

*Keynote Speaking #4*

## **Testbed Simulator for Evaluating Vehicle-to-Infrastructure Communication and Applications Architectures for Communications and Sensor Systems**

**Speaker: Dr. Francois Dion, University of Michigan, Ann Arbor**



**Highlight:** This paper presents the results of initial efforts to develop a virtual VII simulation testbed within the Paramics microscopic traffic simulation environment. This simulator is being developed to help mitigate limitations of real-world testbeds. VII simulation capabilities are implemented through the development of a portable plug-in module using Paramics' Applications Programming Interface (API). This module simulates the generation of VII snapshots by individual vehicles, the uploading of these snapshots to roadside units, and some probe data post-processing. While some temporary simplifying assumptions are made, the simulation generally follows operational concepts described in the SAE J2735 Surface Vehicle Standard and used by the U.S. Department of Transportation (USDOT) in its Proof-of-Concept test program. Potential use of the model is demonstrated by simulating VII probe data collection over the USDOT's Michigan Proof-of-Concept testbed. Simulation results show the sensitivity of VII probe data collection to communication range, market penetration, number of active RSEs, interval between snapshots, and snapshot buffer size. These preliminary results already demonstrate the utility of the simulator in conducting evaluations and sensitivity analyses for scenarios hard to execute in existing testbeds. They also highlight the value of using such a simulator to complement real-world VII testing activities.

Dr. François Dion is currently an assistant research scientist at the University of Michigan Transportation Research Institute (UMTRI), where he is affiliated with Office of ITS Integration within the Transportation Systems Group. Dr. Dion is responsible for projects related to intelligent transportation systems (ITS) and vehicle-infrastructure integration (VII). His current research interests focus on the modeling of VII applications within traffic simulation models, evaluation of new mobility and transportation system management applications enabled by VII probe vehicle data, driver responses to in-vehicle traveler information systems, advanced traffic signal control systems, and systems integrating transit signal priority within traffic signal optimization functions. Dr. Dion was also recently awarded a National Science Foundation grant to look at data latency issues and prioritization needs associated with vehicle-to-vehicle communications. This work, to be done in collaboration with Michigan State University, will involve the development of a hybrid simulator for transportation application evaluations based on the integration of the NS-2 communication simulator with the Paramics microscopic traffic simulation model.

Prior to joining UMTRI, Dr. Dion held a position of assistant professor at Michigan State University (2003-2007), with a primary research focus on ITS applications and traffic operations. While working there, he developed a microscopic traffic simulation model providing a basic modeling of vehicle-to-infrastructure and vehicle-to-vehicle wireless communications, evaluated the impacts of wireless communication delays on the performance of automated vehicle control systems, and developed a vehicle control model considering potential delays in wireless communications. He also developed a methodology to assess the potential benefits of transit signal priority deployments along urban arterials for a urban planning agency in Canada and contributed to the development of a traffic signal control logic using

genetic algorithms and neural networks to consider potential transit priority options. Dr. Dion also taught introductory undergraduate courses on transportation engineering, as well as graduate courses on transportation policies and decision-making, Intelligent Transportation Systems, environmental considerations in transportation engineering, and the simulation and optimization of urban transportation networks.

Further back, Dr. Dion worked as a researcher for the Virginia Tech Transportation Institute (1999-2003). There, he conducted research on real-time traffic signal control systems, transit signal preemption systems, real-time transportation data collection systems, modeling and simulation of urban transportation networks, and modeling of vehicle fuel consumption and emissions.

Dr. Dion possesses a Ph.D. in civil engineering from the University of Waterloo, in Canada, and both an M.A.Sc. and B.Eng. in civil engineering (transportation) from the École Polytechnique in Montréal, Canada. He is a licensed professional engineer in both Michigan and Québec, and is a member of the Institute of Transportation Engineers (ITE) and the Transportation Research Board (TRB), with an active membership in the TRB committee on Vehicle-Highway Automation (AHB30).