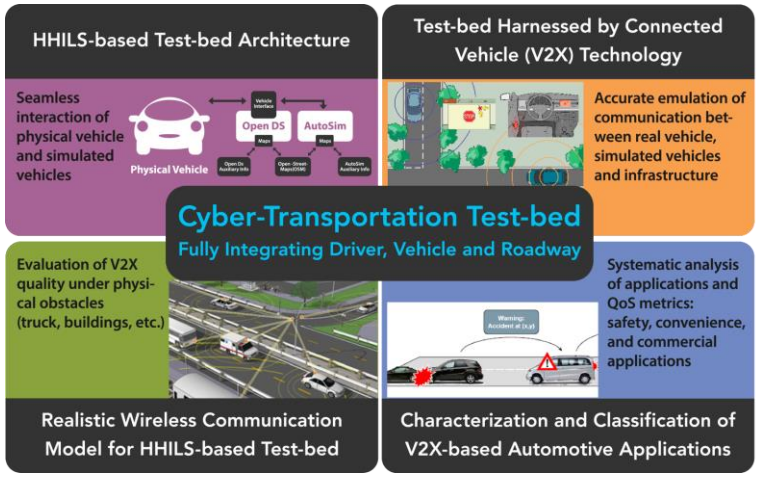
Traffic Operations Laboratory



The Traffic Operations Laboratory was established to support research in the area of traffic operations with the state-of-the-art systems including a driving simulator, microscopic traffic simulation models, wireless communications simulators, traffic signal timing optimization programs and a hardware-in-the-loop simulation.

The laboratory's main research focus has been shifted to information and communications technology applications with the goal of improving transportation system mobility, achieving sustainable transportation, and enhancing safety.

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"Using very high-fidelity microscopic traffic simulation tools to model and optimize transportation."

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Connection Vehicle Technology Applications

With recent information and communications technology (ICT) advancement, the transportation system has begun taking advantage of the ICT called "connected vehicle technology." The laboratory has been focusing on the connected vehicle technology applications research including a development and evaluation of cooperative vehicle intersection control algorithm, a development of integrated vehicular dynamics and traffic simulation modeling for assessing real-time safety, a design and evaluation of route guidance system utilizing turning movement based travel times, a design and evaluation of roadway reservation system, etc.

Traffic Signal Control Algorithms and Eco-Driving

The CTR algorithm intended to implement adaptive control. A key innovation to this algorithm was using directly measured/estimated cumulative travel times. A main purpose was to identify the minimum market penetration rate to outperform existing actuated signal control. In a CVI/UTC funded project, we developed a hardware-in-the-loop simulation environment that is ready to be deployed in the field. The study found that 30% market penetration would outperform actuated control.

We have developed an eco-driving algorithm and evaluated its performance using a driving simulator that considers communications latencies. A PreScan program by TAAS international was used as a platform to develop a driving simulator, to explicitly model connected vehicle communications and to test eco-driving guidance.

Surrogate Safety Assessment under Connected Vehicles

One of challenges in assessing safety for connected vehicle applications is that traditional safety modeling approach based on post-crash data analyses is not applicable. No studies ever considered impacts of GPS and inertial navigation unit (INU) accuracy and communications latency for traffic safety. A project funded by US DOT's exploratory advanced research project allowed us to develop a framework that considers vehicle dynamics model (CarSim), traffic simulation (VISSIM), GPS/INU, communication latencies. Furthermore, we validated the enhanced surrogate safety assessment model (that considers lateral vehicle movements using a vehicle dynamics model) using actual crash data.

RECENT RESEARCH DEVELOPMENTS

- Eco-Traffic Signal System that considers both eco-driving and eco-adaptive signal control under connected and automated vehicle environment
- Cooperative Vehicle Intersection Control (CVIC) algorithm allowing vehicles go through the intersection without stopping
- Enhanced safety assessment tool integrating traffic simulation model, vehicle dynamics model, GPS/INU simulator, and connected vehicle simulator.

RECENT GRANTS

- Oak Ridge National Laboratory (UT-Battelle) – Improving Energy Efficiency by Leveraging Connected Vehicle Technology
- Virginia Transportation Research Council – Mesoscopic Traffic Simulation Modeling Guidance
- KOTI - Development and Verification of Signal Operation Algorithms in Local Intersection Network utilizing V2X Communication Infrastructure

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