The Traffic Operations Laboratory was established to support research in the area of traffic operations with the state-of-the-art systems including 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.

“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 “connection 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.

Stochastic Optimization of Traffic Signal Timing Plan
The traffic signal system is one of the most common facilities being operated by traffic engineers to control traffic in an orderly manner. Traffic signal timing optimization has been recognized as one of the most cost-effective methods for improving accessibility and mobility at urban networks. Existing state-of-the-practice traffic signal timing-optimization programs rely on macroscopic and deterministic models to represent traffic flow, including actuated traffic signal systems. One distinct shortcoming of such an approach is its inability to account for the stochastic nature of traffic, such as the variability in traffic demand, driver behavior, vehicular interarrival times, and vehicle mix. We developed a stochastic optimization approach that explicitly considers random variabilities in traffic and optimized traffic signal timing plans for sustainability (i.e., minimizing fuel consumption and emissions).

ITS Evaluation Using Simulation Model
Vehicle-to-vehicle and vehicle-to-infrastructure communications, made possible by connected vehicle technology, will enable new transportation applications and services. To understand and quantify potential benefits from connected vehicle technology applications, these applications must be evaluated before field deployment. We have integrated wireless communications simulator and microscopic traffic simulations to assess the potential benefits of ITS applications.

RECENT RESEARCH DEVELOPMENTS
• Integrated Traffic Simulation and Wireless Communications Simulators for assessing algorithm and benefits of the Connected Vehicle Technology Applications
• 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
• Ohio St. University – Integrates GPS/INU Simulator for Enhanced Traffic Safety
• SAIC – Transportation Operations Research & Development
• SAIC – Development of Weather Module for the Traffic Analysis Tools Program

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