PROJECT BRIEF

UF Transportation Institute UNIVERSITY of FLORIDA STRIDE

Simulation Extension to Evaluate the Impact of CAVs on Traffic Congestion & Emissions

(STRIDE Project D: Evaluation of Advanced Vehicle & Communication Technologies through Traffic Microsimulation)

PROJECT OVERVIEW

As connected and autonomous vehicles (CAVs) begin operating alongside conventional vehicles on roads, there are many "what if" scenarios that need to be considered. Specifically, how do CAVs impact traffic management and emissions? Researchers developed an extension to be used with the traffic simulation software VISSIM that would test the impact of potential "what if" scenarios.

GOAL

The goal of this project was to develop a robust microscopic simulation extension for VISSIM that evaluates traffic operational quality and emissions considering the presence of CAVs.

FINDINGS

In this project, the researchers developed and tested a simulation extension with CAV functionality. This extension was integrated with emissions modeling.

Several traffic scenarios were simulated using different demand and CAV penetration levels. The results showed a net improvement in traffic operational measures (travel time and speed) when CAVs were in the traffic stream.

However, emissions did not follow the same trend. While increasing AV penetration rates resulted in emissions reductions, increasing CV and CAV penetration rates resulted in higher emissions. A deeper analysis showed that while VISSIM's CV logic seeks to maximize the likelihood of vehicle arrival-on-green, the algorithm likely results in oscillation of the second-by-second speeds leading to overall higher emissions. The results are based on a small and relatively simple network, and operations may be different for larger and more complex networks.

PRODUCT

A **simulation extension with CAV functionality** was developed for VISSIM. The extension evaluates how CAVs may impact traffic management and emissions when operating alongside conventional vehicles.

IMPACTS

Adoption of the simulation extension would enable wide-scale assessment of how CAVs impact traffic congestion and emissions.

CLIMATE CHANGE IMPACTS

The simulation extension is helpful in evaluating the impact on CAVs emissions. When suitably integrated with an optimization algorithm with a goal to reduce emissions, this extension can have significant impact on mitigating climate change impacts.

WHO BENEFITS?

- CAV research community
- Simulation modeling research groups
- State Departments of Transportation (DOTs)
- Federal Highway Administration (FHWA)

RESEARCH TEAM

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PRODUCT

Simulation Extension with CAV functionality for VISSIM (Version 10.0)

The simulation extension evaluates the impact of CAVs on traffic management and emissions.

The extension was developed by leveraging the strengths of both the internal and external interfaces in VISSIM. The research team used the Component Object Model (COM) Application Programming Interface (API) to access network elements and the External Driver Model (EDM) to maintain the longitudinal control of vehicles.

The trajectory data from VISSIM were used to estimate energy, fuel consumption, and greenhouse gas emissions. The calculations follow the Motor Vehicle Emission Simulator (MOVES) methods developed and mandated by the US Environmental Protection Agency (USEPA).

The extension could be used to evaluate CAV strategies for a variety of networks and scenarios. Future work includes incorporating a CAV-based signal optimization algorithm developed by the University of Florida into the extension, enhancing the optimization to include emissions, and applying the tool developed to large-scale transportation challenges.

The extension is available upon request from the researchers.

For more information on Project D (Evaluation of Advanced Vehicle and Communication Technologies through Traffic Microsimulation), visit the STRIDE Project page.

About STRIDE

The Southeastern Transportation Research, Innovation, Development & Education Center (STRIDE) is the 2016 Region 4 (Southeast) U.S. Department of Transportation University Transportation Center headquartered at the University of Florida Transportation Institute (UFTI).

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