



Caltrans Division of Research,
Innovation and System Information

Research

Notes

Transportation
Safety and
Mobility

FEBRUARY 2022

Project Title:
Connected and Automated
Vehicles (CAV) Planning and Policy
Development

Task Number: 3712

Start Date: January 1, 2020

Completion Date: December 31, 2021

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System Impact Of Connected And Automated Vehicles: An Application To The I-210 Connected Corridors Pilot

A research project by UC Berkeley PATH program to model Connected Automated Vehicles (CAV) in to the current ICM systems.

WHAT IS THE NEED?

In current Integrated Corridor Management (ICM), the control targets are ordinary objects of vehicles, buses, pedestrians, etc. However, in recent years, a great amount of effort has been devoted to the field of connected and automated vehicles (CAVs), which may be implemented in the future and become one of the dominant travel modes.

Given that this important piece is missing from current ICM systems, it will become a serious problem for public agencies like Caltrans and local Traffic Management Centers (TMCs) to manage traffic properly and efficiently once CAVs are deployed in the field.

Unfortunately, at the current moment it is impossible to evaluate the system impact of CAVs on transportation networks in the field, and insights from existing CAV studies are very limited since they were applied to small networks. Instead, a more appropriate way is to build a well-calibrated large-scale traffic network in microsimulation and add the CAV components for testing purposes.

WHAT ARE WE DOING?

This research aims to fill this gap by developing an integrated platform in microsimulation that allows the modeling of CAVs in current ICM systems. For demonstration purposes, the I-210 Connected Corridor Pilot model developed in the microsimulation software, Aimsun, will be used as a test site.



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The proposed platform will incorporate the most appropriate CAV models/applications into Aimsun using the available Software Development Kits (SDKs) and allow public agencies to play with different scenarios in microsimulation and understand potential impacts of CAVs on their proposed ICM strategies.

WHAT IS OUR GOAL?

The primary goal of this project is to develop an integrated platform to incorporate CAVs into microsimulation and evaluate their system-impacts on large-scale transportation networks.

WHAT IS THE BENEFIT?

The outcome from this project will provide public agencies useful tools to better understand the system impact of CAVs and help them perform long-term planning.

WHAT IS THE PROGRESS TO DATE?

This project aims to build a mixed traffic platform in microsimulation to help evaluate the network-level impacts of CAV applications. The platform is built based on the newly developed Adaptive Cruise Control/ Cooperative Adaptive Cruise Control (ACC/CACC) and vehicle-to-everything (V2X) features in Aimsun and is the first microsimulation platform that can replicate mixed traffic in the real world. For the demonstration purposes three applications have been selected which are mentioned below:

1. Freeway Speed Harmonization
2. Route Guidance (For Traffic Incident Management)
3. Traffic Signal Optimal Speed Advisory

Various simulations were conducted to assess the performance of the proposed framework. For traffic light optimal speed advisory, the SPaT and MAP messages were constructed and implemented. Various simulations were conducted in the test network. The technical memo "Simulation results of CAV applications in small networks" was submitted. The technical memo "Network-level impacts of Adaptive Cruise Control (ACC) and Cooperative Adaptive Cruise Control (CACC)" was revised and submitted. The "Technical memo: Simulation results of CAV applications in large-scale networks" has been completed. The draft Final report has been submitted and is being updated to include comments received from Caltrans. The research outcomes were presented to Caltrans.

IMAGES

Network	Time Period	Demand Level	Delay Reduction (100% CAVs)	Speed Improvement (100% CAVs)
Freeway Only	7AM—9AM	100%	38.7%	22.3%
	7AM—9AM	110%	40.5%	28.8%
	12PM—2PM	100%	35.0%	14.2%
	12PM—2PM	110%	25.9%	12.9%
	4PM—6PM	100%	52.4%	25.1%
	4PM—6PM	110%	46.0%	28.7%
Arterial Only	7AM—9AM	100%	14.3%	5.9%
	7AM—9AM	110%	19.1%	8.5%
	12PM—2PM	100%	12.5%	4.7%
	12PM—2PM	110%	13.9%	5.4%
	4PM—6PM	100%	13.8%	5.8%
	4PM—6PM	110%	16.4%	7.2%
Freeway and Arterial Subnetwork	7AM—9AM	100%	28.4%	18.0%
	1PM—3PM	100%	24.5%	13.0%
	4PM—6PM	100%	26.9%	16.0%
I-210 Pilot	7AM—9AM	100%	15.3%	9.4%
	12PM—2PM	100%	13.9%	7.2%

Image 1: Summary of reports