



Caltrans Division of Research,
Innovation and System Information

Research

Notes

Advanced
Research

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Project Title:
Enhancing Safety, Mobility, and
Sustainability Performance of
Urban Freight Corridors through
Connected Vehicle Technology

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Enhancing Safety, Mobility, and Sustainability Performance of Urban Freight Corridors through Connected Vehicle Technology

Improving three intersections with roadside equipment and developing the Eco Approach and Departure for heavy vehicles

WHAT IS THE NEED?

Vehicle-infrastructure connectivity has emerged as a way to enhance safety, mobility and sustainability of transportation systems via information sharing and better cooperation, especially on urban arterials where vehicles interact frequently with traffic signals. Deploying vehicle-to-infrastructure (V2I) communication-based technologies to urban freight corridors would benefit both passenger cars and freight trucks. The University of California at Riverside (UCR) has been working with local agencies to deploy 15 connected traffic signals on three urban freight corridors near the Port of Los Angeles to support a variety of Connected Vehicle (CV) applications such as Eco-Approach and Departure (EAD), which uses Signal Phase and Timing (SPaT) information from the upcoming traffic signals to determine an eco-friendly speed trajectory for the host vehicle to pass through the intersections. On two of those corridors, three traffic signals operated and maintained by Caltrans, are not currently connected. These Caltrans traffic signals are located in the middle of the corridors, causing discontinuity in an otherwise fully connected corridor. This prevents CV applications such as EAD from taking advantage of CV technology at the corridor level. In this project, the research team aim to enable connectivity at those three traffic signals to support enhanced CV applications at the corridor-level.



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WHAT ARE WE DOING?

Based on the research gaps identified above, we propose that this task consists of the following activities:

- a. Enabling connectivity at Caltrans traffic signals: We will work with Caltrans District 7 to instrument traffic controllers at the three Caltrans intersection with necessary equipment to enable them to send SPaT information to UCR's Traffic Signal Information System server via cellular communication. We will consider LTE or 5G technology and use the best available technology at the time of instrumentation.
- b. Development of the enhanced EAD application: We will enhance the EAD application by taking advantage of the newly connected Caltrans traffic signals to optimize vehicle speed profile at the corridor level. Based on the SPaT data collected from all the connected signals, we will develop corridor-based EAD algorithms, which leverage the predictive SPaT information from multiple downstream intersections to design vehicle trajectories that would minimize the fuel consumption of the host vehicle. The EAD app, called Eco-Drive, will be upgraded to adopt the corridor-based EAD algorithms.
- c. Testing and evaluation of enhanced EAD application: We will test the enhanced EAD application via the use of the Eco-Drive app in both passenger cars and trucks. We will then evaluate the effectiveness of the enhanced EAD application as compared to the existing EAD application that optimizes vehicle speed profile for one intersection at a time.

WHAT IS OUR GOAL?

The primary goal of this research is to advance CV technology research, development, and deployment in the state of California. This research will also improve the performance of urban freight corridors in term of safety, mobility, and sustainability.

WHAT IS THE BENEFIT?

This research will augment the existing Southern California CV testbed, which can then be used to test, evaluate, and demonstrate a variety of CV applications, such as the enhanced EAD application, for improving the performance of urban freight corridors. It will also improve traffic safety on the testbed by increasing drivers' compliance with the speed limit and decreasing the likelihood of drivers being caught in dilemma zones when using the EAD application. The traffic energy and emission reduction benefits from this research will improve sustainability, livability, and equity in communities along the testbed.

WHAT IS THE PROGRESS TO DATE?

The project is in contract stage.