# Field Trials of Connected Eco-Driving System for Heavy-Duty Trucks

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## *Introduction*

Connected vehicle (CV) technologies have potential to significantly enhance road safety, environmental sustainability, and commute experiences. As one of the widely studied CV applications, connected eco-driving wirelessly obtains real-time traffic signal phase and timing (SPaT) data and then provides audio and/or visual feedback to the driver, allowing the driver to regulate and optimize the vehicle's speed profile. This can result in reductions in travel time, fuel consumption, and tailpipe emissions. The majority of connected eco-driving studies to date have primarily focused on numerical and microscopic traffic simulations, and mainly for light-duty vehicles. This poster presents early findings from field trials of a connected eco-driving system (called "Eco-Drive") on a heavy-duty truck in real-world settings.

Eco-Drive consists of communication, localization, perception, planning, and control modules ***[Figure 1]***. The communication module facilitates real-time vehicle-to-network (V2N) and infrastructure-to-network (I2N) communications through 4G-LTE. The Eco-Drive system is implemented on a 2015 Volvo VNL heavy-duty truck with 13L diesel engine ***[Figure 2]***. The system provides visual feedback to the driver via a driver-vehicle interface (DVI) that displays SPaT, recommended driving speed range, speed limit, and presence of preceding vehicle ***[Figure 3]***. Field trials of Eco-Drive were conducted in the City of Carson, California, along two corridors with six "connected" signalized intersections that are capable of broadcasting SPaT data ***[Figure 4]***. Video clips from the field trials are available at https://www.youtube.com/watch?v=1CR4vMh8ufE .

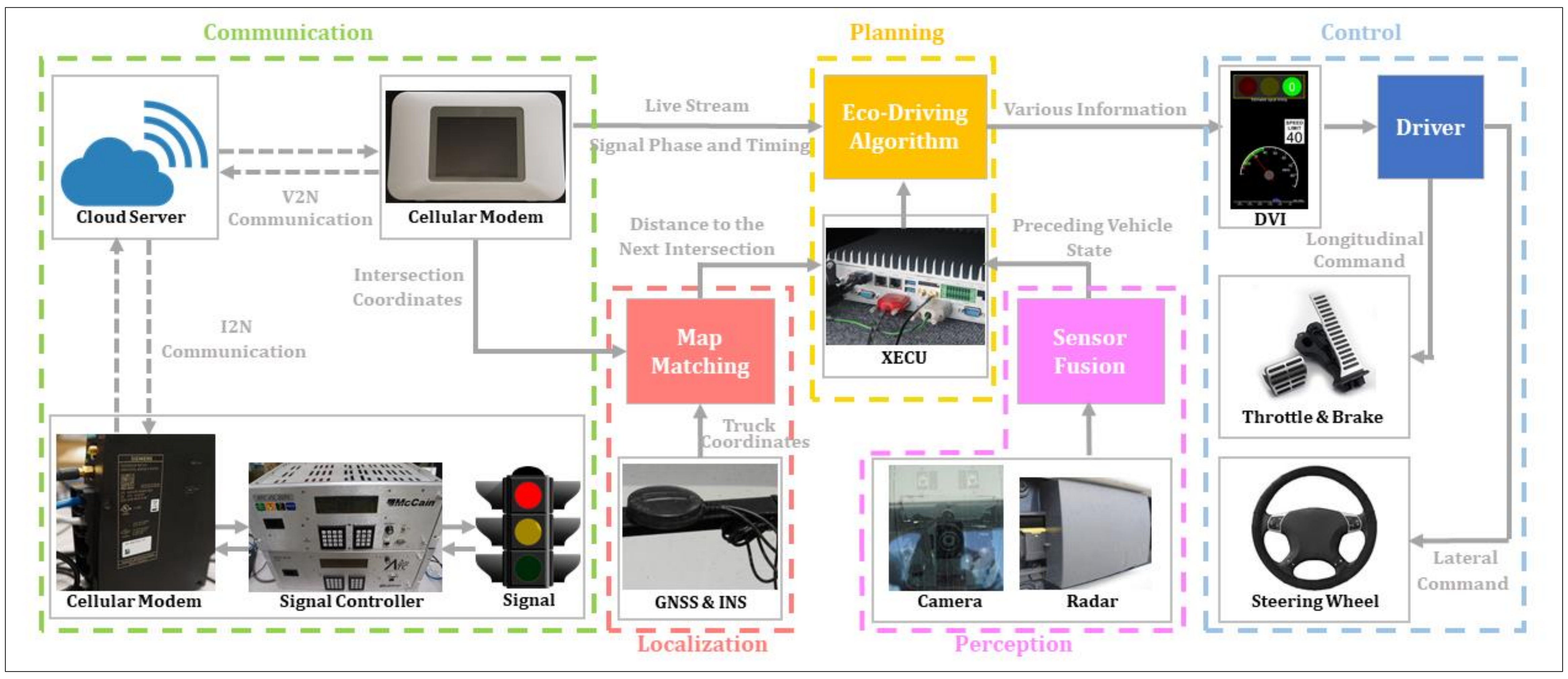


**Figure 1. Architecture of the connected eco-driving system for heavy-duty trucks**

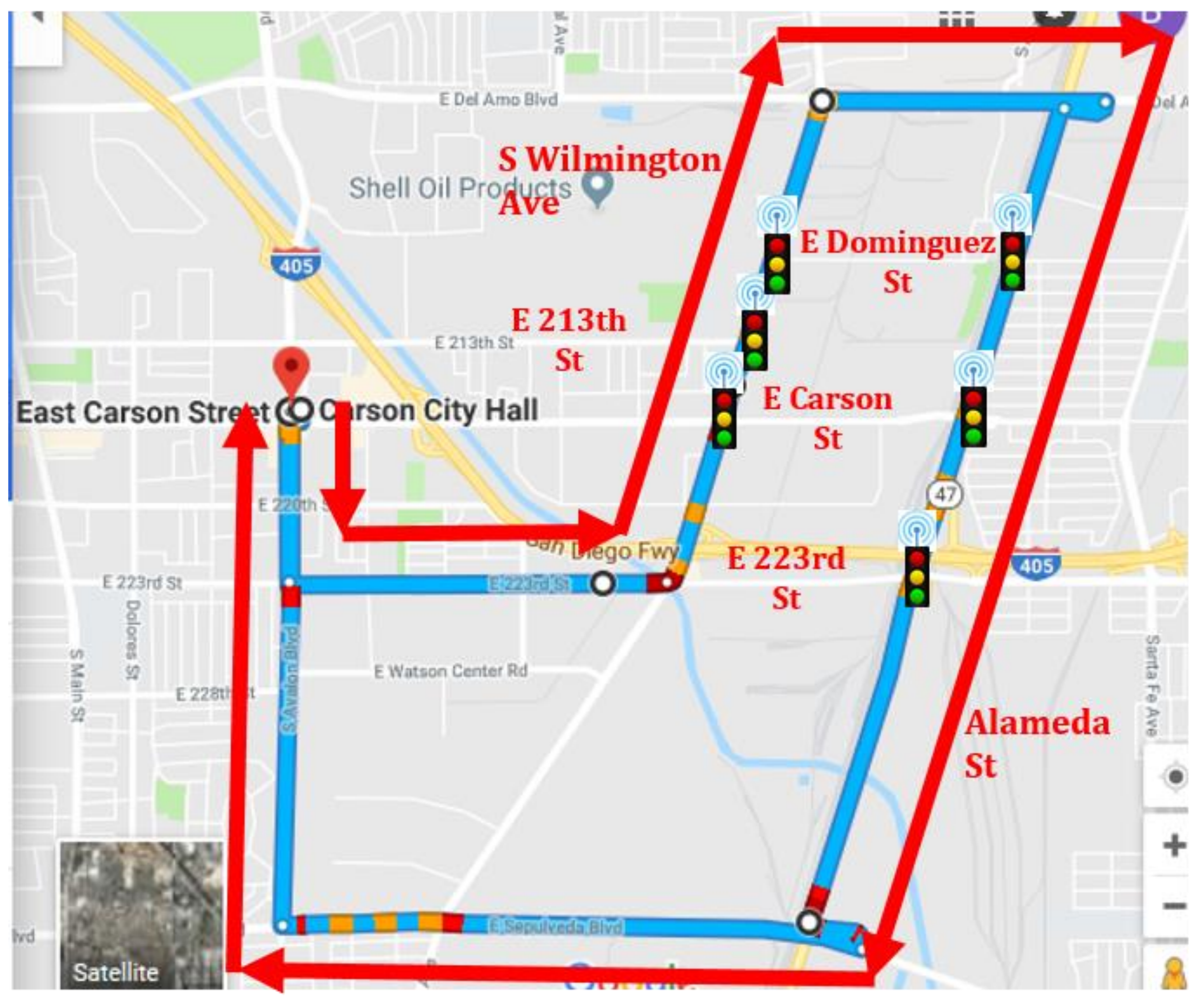


**Figure 4. Test route with six connected intersections**


**Figure 2. Test vehicle during field trial in Carson, California**

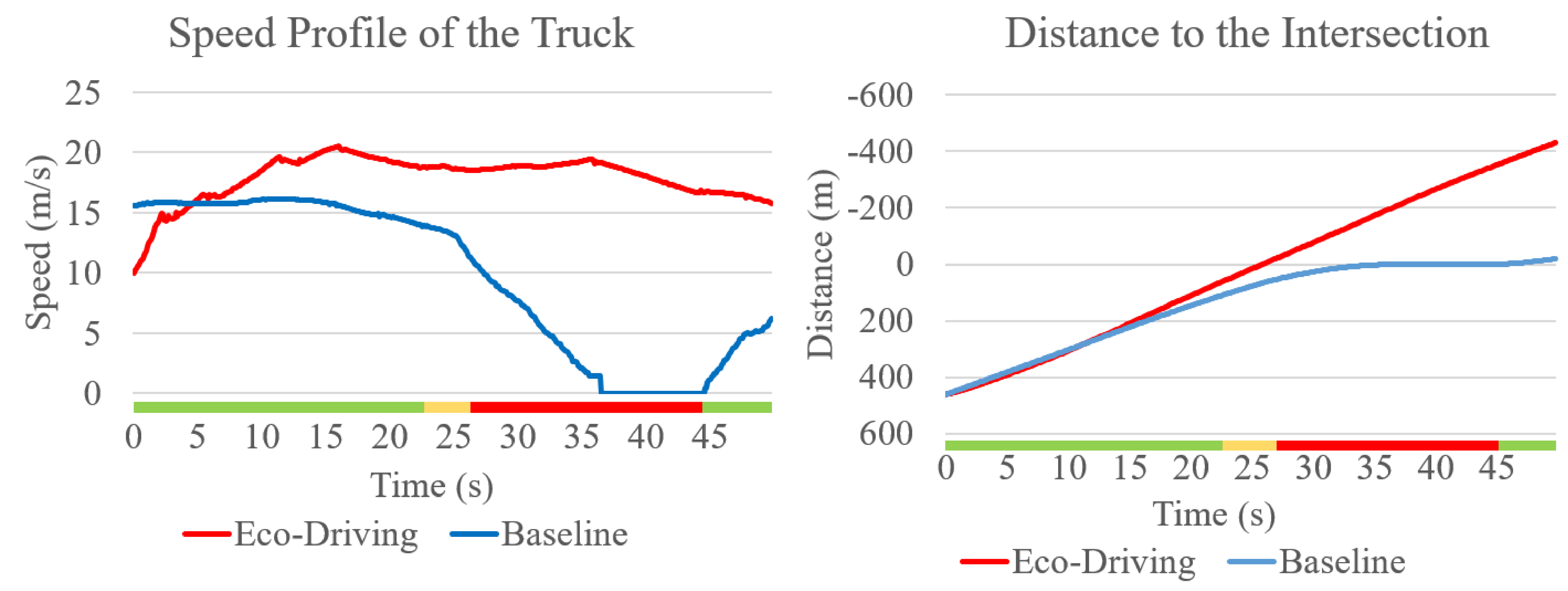


**Figure 5. Real-world data for acceleration scenario**

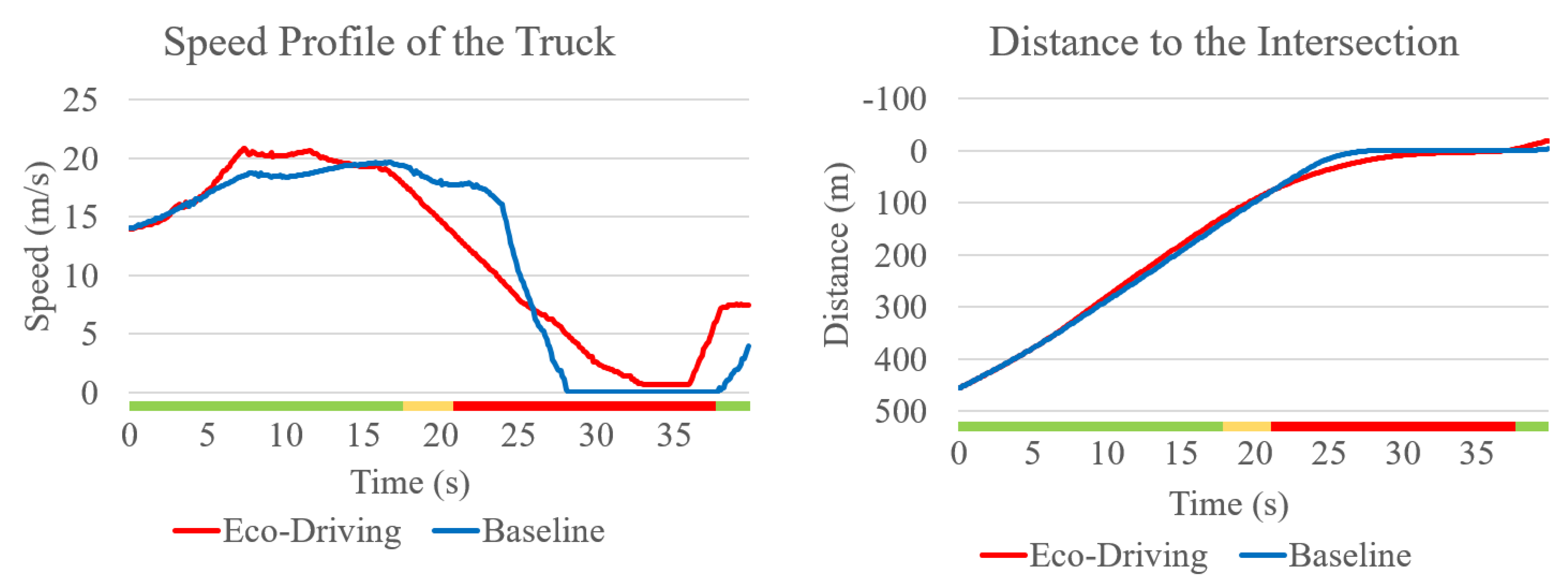


**Figure 6. Real-world data for deceleration scenario**


**Figure 3. Driver vehicle interface in different situations**

## *Early Findings*

- It took strong partnerships between stakeholders from both public and private sectors to make the field trials possible.
- Data from the field trials with Eco-Drive and without Eco-Drive (baseline) were screened to identify segments where the truck approached the same intersection from the same distance at the same SPaT status. The comparison results show 9% fuel savings for the acceleration scenario ***[Figure 5]***, and 4% for the deceleration scenario ***[Figure 6]***.
- More data are being collected to further evaluate the benefits of Eco-Drive.

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