

JOINT TRANSPORTATION RESEARCH PROGRAM

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Develop and Deploy a Safe Truck Platoon Testing Protocol for the Purdue ARPA-E Project in Indiana

Introduction

Class 8 truck platooning will improve the safety and fuel efficiency of freight transportation. New control strategies are required for platooning on roads with hilly terrain. This work focused on filling the research gap by comparing different control strategies to improve platooning on a route with hilly terrain, specifically road grade up to $\pm 4.5\%$.

Findings

- Hilly terrain poses challenges to truck platoons using fixed set speed cruise control.
- Driving the front truck efficiently on hilly terrain improves both trucks fuel economies and improves gap maintenance between the trucks.
- Fuel savings for the platoon is 12.3% when the front truck uses long horizon predictive cruise control (LH-PCC), 8.7% when the front truck uses flexible set speed cruise control, and only 1.2% when the front truck uses fixed set speed cruise control.

Implementation

Purdue, Peloton & Cummins have jointly configured two Peterbilt 579 trucks for relevant combinations of (1) coordinated shifting, (2) constant or variable platoon gap controls, (3) flexible or constant speed setpoint cruise control of the front trucks, and (4) long-horizon predictive cruise control (LHPCC) of the front truck. Confirmation of this functionality during platooning was demonstrated at the Continental Test track in Uvalde, Texas. In Indiana, on-road experiments were limited to single truck operations with flexible and constant setpoint cruise control. Data from all of the above was used to improve the fidelity of simulations used to arrive at

the fuel savings and gap control findings for hilly terrain per what is summarized above in the findings section. In addition, in the early summer of 2020, Purdue submitted to, and received approval from, INDOT a safe truck platoon testing protocol, which could not be implemented in Indiana before the end of the project because of COVID-19.

Recommended Citation for Report

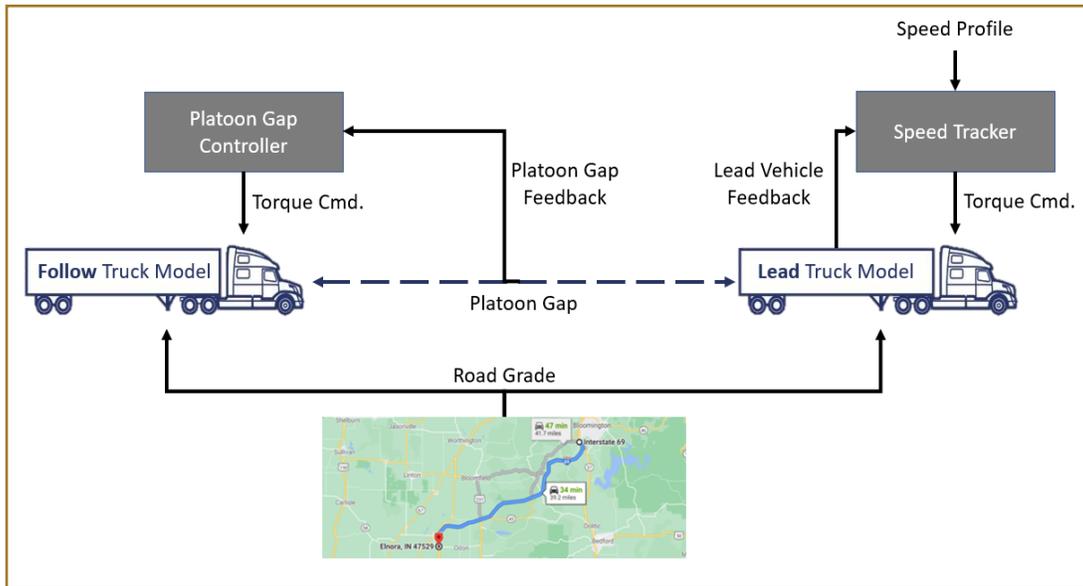
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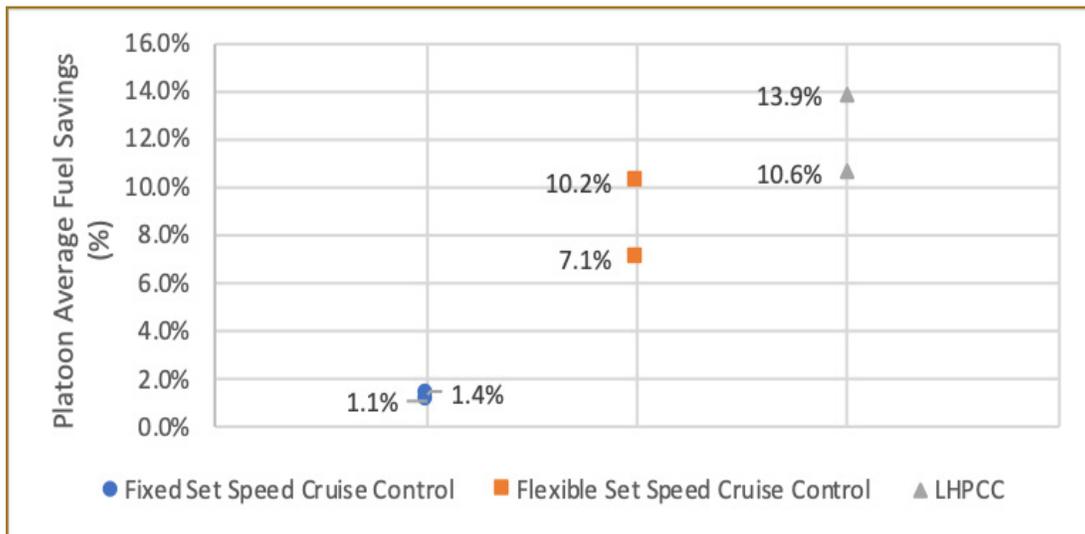
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Peterbilt 579 Trucks Used for Study (Cummins engine/transmission and Wabash National Trailers)



Control System for Improved Platooning on Hilly Terrain in Indiana



North and south bound fuel savings taken in comparison to a single truck using a fixed set speed cruise controller (based on experimentally-validated simulations).

