



# Truck Platooning

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This document is a technical summary of the FHWA Research and Technology Evaluation: Truck Platooning Final Report (FHWA-HRT-20-071).

## Introduction

This brief summarizes an evaluation of the Federal Highway Administration's (FHWA's) investment in the truck platooning research project titled "Assessing the Feasibility of Deploying Partial Automation for Truck Platooning." This research project included two complementary subprojects, titled "Partial Automation for Truck Platooning" (PATP) and "Driver-Assistive Truck Platooning" (DATP).

The purpose of the evaluation was to assess how the FHWA's Office of Operations Research and Development's work on truck-platooning research affected truck-platooning knowledge, the availability and quality of data, and the deployment of truck-platooning technology.<sup>(1)</sup>

## Background

The research project "Assessing the Feasibility of Deploying Partial Automation for Truck Platooning" consisted of two complementary projects, PATP and DATP, which aimed to develop prototype trucks capable of platooning in a realistic setting outside of the laboratory.<sup>(2)</sup> The projects addressed several technical and operational challenges, including implementing cooperative adaptive cruise control (CACC) in trucks, following distance thresholds, maintaining platoons in an operational environment, and facilitating driver and stakeholder acceptance.<sup>(3)</sup> The focus of the PATP and DATP projects was to decrease the costs of freight travel by improving fuel efficiency and highway mobility and allowing long-haul trucks to travel together as efficiently as possible.

The PATP research was conducted under the University of California at Berkeley's (UC Berkeley's) California Partners for Advanced Transportation Technology (PATH) Program with support from the California Department of Transportation (Caltrans), Volvo Group North America, Cambridge Systematics, and the Los Angeles Metro Gateway Cities Council of Governments.<sup>(4)</sup> PATH developed a three-truck platooning system for extensive aerodynamic and fuel-efficiency testing as well as operational environment (i.e., highway) testing and demonstrations.

PATH publicly demonstrated truck platooning technology as an outreach component of PATP in the following three instances:

- June 2016 at Intelligent Transportation System (ITS) America 2016 in San Jose, CA.
- March 2017 on I-110 near the Port of Los Angeles.
- September 2017 on I-66 in Northern Virginia.

The DATP research was conducted under Auburn University in partnership with Peterbilt, American Transportation Research Institute, Peloton Technology, and Meritor. In phase one, Auburn examined the business case for truck platooning technology.<sup>(4)</sup> In phase two, Auburn conducted aerodynamic simulations, developed a prototype two-truck platoon, and tested fuel efficiency.<sup>(3)</sup>

## FHWA Research and Technology Evaluation TechBrief



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Researchers for both the PATP and DATP projects developed CACC systems for commercial trucks that used dedicated short-range communication systems for vehicle-to-vehicle communication, which allowed the trucks to safely maintain a constant time gap in the PATP project and a constant following distance in the DATP project. When engaged, a following truck's acceleration and braking were controlled by the CACC system, while the vehicle operator—consistent with SAE Level 1 automation—maintained control of steering. Developing a human-machine interface and analyzing driver responses to close following distances were significant components of both the PATP and DATP projects. Truck platooning requires active supervision and steering by each vehicle operator.

## Findings

By evaluation area, the overall findings are as follows:

### Truck Platooning Knowledge

Prior research by PATH, as well as European and Japanese truck-platooning projects, had previously demonstrated the aerodynamic and fuel efficiency benefits of truck platooning, but they were not demonstrated in an operational environment using U.S. equipment. FHWA identified gaps in technical knowledge, human factors, safety benefits, and expected market impacts prior to the PATP and DATP projects. Truck-platooning research received support from FHWA leadership, and the associated positive benefits were a key factor in its inclusion in the Exploratory Advanced Research (EAR) program.

Previous work on truck platooning and partnerships on related projects played significant roles in shaping partnerships for this truck platooning research. PATP and DATP project partnerships between public, private, and academic entities enabled the pooling of resources and expertise (e.g., technical, management, outreach) to achieve project objectives. The ability to leverage resources from allied partners contributed significantly to the overall research. The partnerships were effective; the only issues noted were project delays due to lags in the execution of agreements and unforeseen challenges that arose during innovative collaborations with private-sector startups. Specific to DATP, researchers turned the challenges of partnership into benefits.

FHWA project teams coordinated PATP and DATP activities, with FHWA staff playing a key supporting role. The FHWA Office of Operations Research and Development was involved with demonstrations at ITS America 2016 in San Jose, CA; on I-110 near the Port of Los Angeles; and on I-66 in Northern Virginia and played an active role in the Virginia demonstration.

### Availability and Quality of Data

The PATP and DATP project outputs addressed previously identified research gaps in technical knowledge, human factors, safety benefits, and expected market impacts. FHWA focused efforts on disseminating findings internally for follow-up research. With support from FHWA, researchers disseminated findings internally and externally through publications, presentations, and demonstrations. The effectiveness of these disseminations was unclear, and the opinions of stakeholders appeared mixed.

### Deployment of Truck Platooning Technology

The PATP and DATP projects directly influenced further FHWA-sponsored truck platooning research on human factors, commercial deployment, and bridge impacts. The PATP and DATP projects encouraged additional research by Federal agencies, academia, and private industry.

The impact of the PATP and DATP projects on commercial development was mixed or limited. Several stakeholders interviewed noted that, while policy implications were unclear, the PATP and DATP projects impacted awareness about and general knowledge of truck platooning technology. Original equipment manufacturers noted concerns over the economic viability of deploying truck platooning technology.

Federal funding for the PATP and DATP programs combined was over \$3.4 million; project partners committed to cost matching up to 20 percent (approximately \$340,000). Having partners commit some funding showed potential payback that could make truck platooning research viable. All stakeholders interviewed agreed the benefits outweighed the costs, and all but one—who was unsure—had a positive impression of qualitative return on investment.

## RECOMMENDATIONS

Based on this evaluation of these two EAR Program-funded projects, the Research and Technology Evaluation Program team offers the following recommendations for FHWA research:

- Continue fostering partnerships and seeking future opportunities for collaboration with a range of partners, both within and outside the U.S. Department of Transportation.
- Conduct periodic market forecasting or industry needs assessments to determine whether a future deployment of truck-platooning technology would be economically viable.
- Consider ways to incentivize the speedy execution of agreements to avoid project delays.
- Continue disseminating FHWA knowledge and expertise when engaging stakeholders, particularly at public outreach events and technology demonstrations.

- Collect data on resources committed to project success, including those from FHWA, project partners, and other stakeholders.
- Ensure research findings are broadly disseminated.

## References

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