Truck Platooning Research in Canada

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Fuel economy testing of a three-vehicle, truck-platooning system.

Résumé

Des recherches menées au Canada et aux États-Unis ont pour but d'identifier des économies potentielles de carburant découlant de l'utilisation de « pelotons » de semi-remorques. Le véhicule principal est conduit normalement, alors que chaque véhicule suivant utilise un régulateur de vitesse adaptatif coopératif pour maintenir un intervalle de temps spécifique entre lui-même et le camion devant lui. En limitant les distances inter-véhicules on réduit la traînée aérodynamique sur les véhicules qui se trouvent dans le peloton, ce qui se traduit par des économies de carburant pour l'ensemble du peloton.

For many years racing car drivers have appreciated the benefits of slipstreaming, or drafting, behind an opponent's vehicle in order to reduce aerodynamic drag on their own race car and provide a potential speed advantage in a subsequent overtaking manoeuvre. In the field of commercial transportation, recent advances in electronic sensors and vehicle control systems, seem poised to provide further aerodynamic efficiencies for heavy trucks. However, the goal here is not to have trucks travel faster, rather it is to reduce their fuel consumption.

The concept is to use a "platoon" of tractor-trailers where the lead vehicle is driven normally, and each following vehicle uses cooperative adaptive cruise control (CACC) to maintain a specific headway between itself and the truck ahead. Limiting the inter-vehicle gaps reduces the aerodynamic drag on the trailing vehicles in the platoon thus resulting in fuel savings for the platoon as a whole.

Research on a three-truck platoon is being conducted as part of the US Federal Highway Administration's Exploratory Advanced Research Project. The Partners for Advanced Transportation Technology (PATH) research group at the University of California (Berkeley) is undertaking this work in collaboration with Volvo Trucks.

A Canadian research consortium, that includes Transport Canada and the National Research Council, have partnered with PATH to investigate the fuel-saving benefits of platooning for various tractor-trailer configurations. In particular, parameters examined included separation distance, vehicle speed, vehicle weight, and trailer configuration (standard vs. aerodynamic treatment).

The study found that fuel savings of at least 5% for the full platoon were achievable for the range of separation distances examined (17 m to 43 m). The combined effect of platooning and aerodynamic trailer devices (side-skirts and boat-tail) was measured to be up to 14.2% at the shortest separation distance. In general, a decrease in fuel savings was observed with increasing inter-vehicle following distance; however, beyond a certain gap (22 m for the standard configuration, and 34 m for the aerodynamic setup), no significant change was observed. The lead vehicle showed no significant fuel savings for the tested separation distances. The trailing vehicle experienced the highest fuel savings of the three vehicles (approximately 3% greater than the middle vehicle). No significant effect was observed on fuel savings between the tested speeds (89 km/h and 105 km/h), and only a moderate increase in fuel savings (1.6%) resulted from using an empty trailer compared to a loaded trailer.

The results demonstrated some of the potential fuel-savings benefits of vehicle platooning for a range of test conditions. Recommendations for further research included investigating the effects of shorter separation distances and lateral offsets in the platoon (where not all trucks are aligned axially), and the inclusion of differing trailer types (e.g. tankers, flatbeds) in the platoon.

Truck platoons offer potential safety benefits through a reduction in reliance on human drivers. Trucks in a platoon keep to the right and do not overtake each other. Speed is much more consistent and inter-vehicle spacing is closely maintained. Automatic braking, applied instantaneously throughout the platoon, is likely to prevent or at least mitigate chain-reaction rear-end crashes. The automated systems relieve driver workload in monotonous driving situations, improving concentration, and ensuring a high level of safety on an on-going basis.

Possible downsides include the length of truck platoons that may affect the ability of other traffic to overtake. In addition, the length of platoons must be limited to avoid bottlenecks at highway entrances and exits. And, should the inter-vehicle gap become too large for any reason, non-connected vehicles cutting into the platoon will have a disruptive effect.

Issues requiring consideration include: the need for regulations to authorize and control platooning, equipment specifications, driver qualifications, and inspecting agency certification. Liability concerns related to the responsibilities for the operation of a platoon between the lead driver, the following drivers, and the automatic system manufacturers, must also be addressed.

As the underlying technologies evolve, and are improved, truck platoons may well provide an efficient – and safe – mode of commercial transportation. However, it is clear that there is some distance yet to go along this particular road.

Some of the material presented above has been extracted from Fuel Economy Testing of a Three-Vehicle Truck Platooning System, Transport Canada (https://tinyurl.com/TruckPlatooningSystem); however, this article has not been produced in affiliation with, or with the endorsement of, Transport Canada.