Transport Canada's Evaluation of Cooperative Truck Platooning Systems (CTPS)

CENTRE D'INNOVATION CENTRE

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Transport Canada's Innovation Centre

In January 2018, Transport Canada launched the Innovation Centre (IC) …

… a transportation innovation Research, Development & Deployment (RD&D) organization tasked with:

- driving an integrated departmental approach to transportation innovation;
- partnering in new ways with government, industry and academia; and
- leveraging emerging technologies for the benefit of all Canadians.

… with a vision: *"To enable bold and innovative transportation solutions that enhance the safety, security, accessibility, and environmental performance of transportation in Canada."*

Image Source: Peleton Safety Report 2019

On-Road RD&D (ecoTECHNOLOGY for Vehicles Program)

The **ecoTECHNOLOGY for Vehicles Program (eTV)** tests and evaluates the safety and environmental performance of advanced vehicle technologies, with the goal of advancing key Government of Canada Priorities.

In 2019-20 the eTV Program is undertaking 27 projects to test and evaluate advanced technologies for vehicles.

The following **five broad themes** were identified as key areas of research for FY 2018-21:

a) Emerging Light Duty Vehicle (LDV) Technologies

b) Emerging Heavy Duty Vehicle (HDV) Technologies

c) Connected and Automated Vehicles (such as V2V, V2I, V2X communication and various driver aids)

d) Off-Road Sector (vehicles not intended for travel on public roads such as agriculture, construction, forestry, mining)

e) Green Transit (motorized public transit such as school buses, municipal transit buses, inter-city buses)

Image Source: Peleton Safety Report 2019

Transport Canada Platooning Activities 2014-2020

Review of Cooperative Truck Platoon Systems - Literature Survey
2014

3-Truck Track Testing with California PATH, Phase 1
Oct 2016

2-Truck Wind Tunnel Testing
Jan 2017

3-Truck Track Testing with PATH, Phase 2
Aug 2017

Platooning Workshop with Stakeholders
Oct 2018

2-Truck Track Testing with Auburn U.
Jun 2019

Considerations for On-Road Trials Report
Sept 2020

Test Methodology for Assessing Driver Fatigue Report
Sept 2020

Platoon Energy Savings Simulations
2021 (work in progress)

Next Steps

Platoon On-Road Trial (and track testing)
2021-2022

RFP currently active on BuyAndSell.gc.ca

TC Reports available online at tcdocs.ingeniumcanada.org

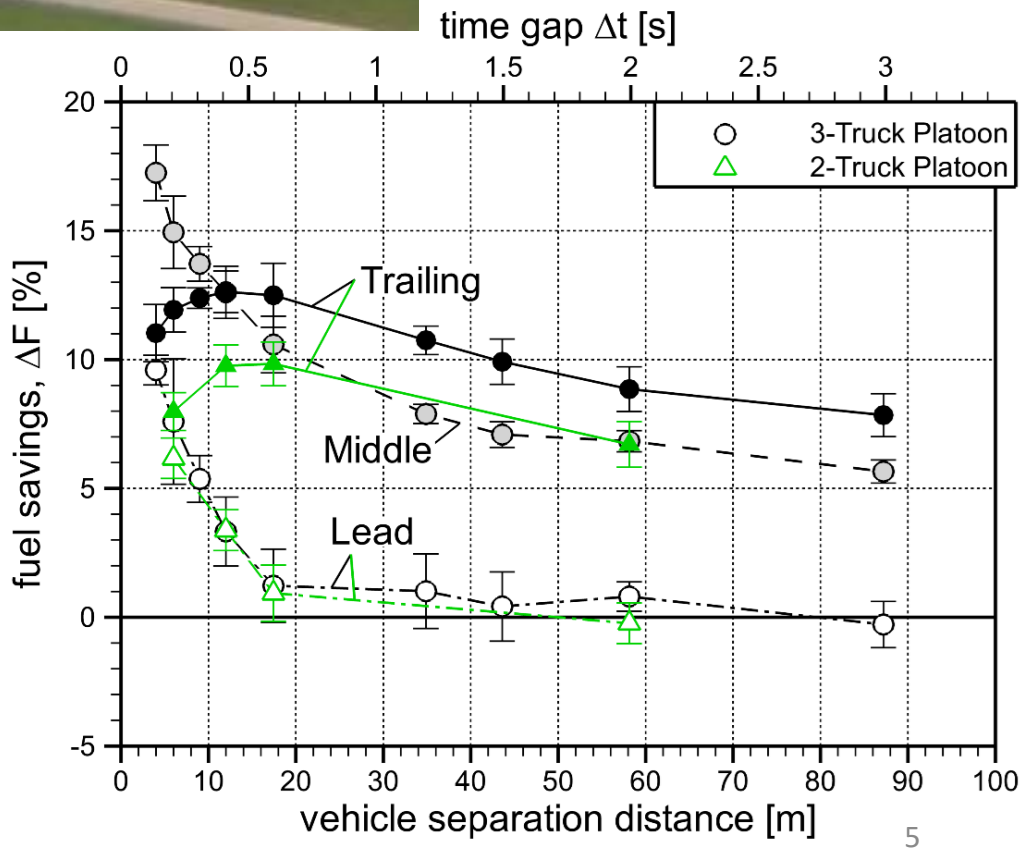
Highlights: 2- & 3-Truck Fuel Savings

Up to 17% individual Savings at 4 m

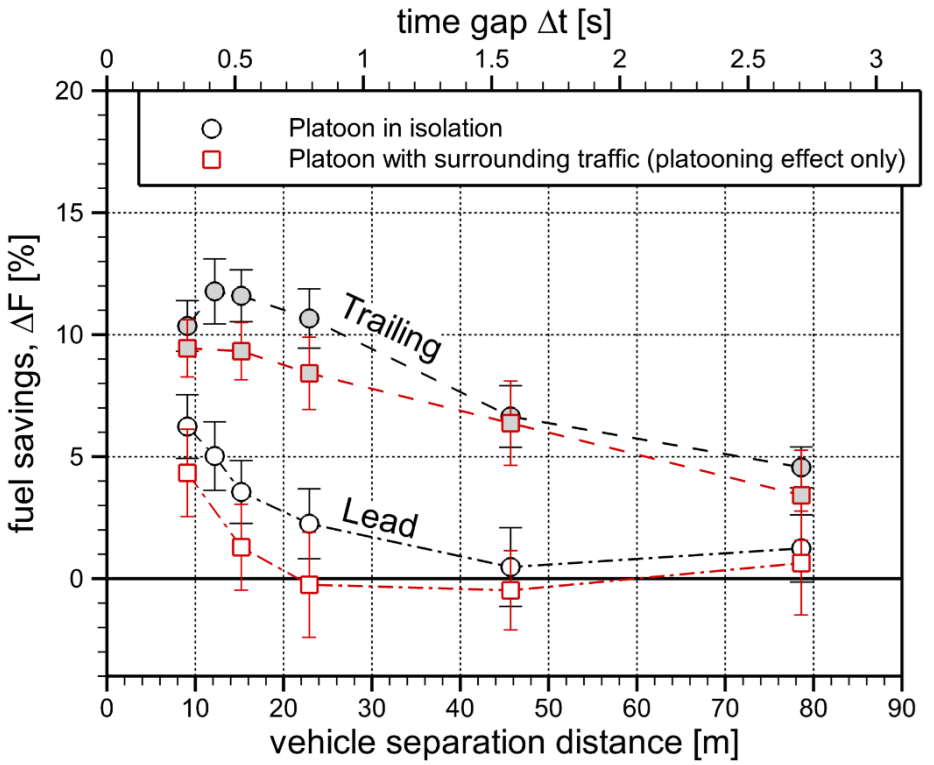
Significant savings at large separations (>5%)

Cut-ins and speed variations reduce savings by 1-2%

Up to 3% individual-truck savings when following an SUV



Highlights: 2-Truck Fuel Savings (Auburn U.)



Up to 5% reduction in saving with lateral offset up to 1.3 m

Up to 7% individual-truck savings with staged 3-vehicle traffic

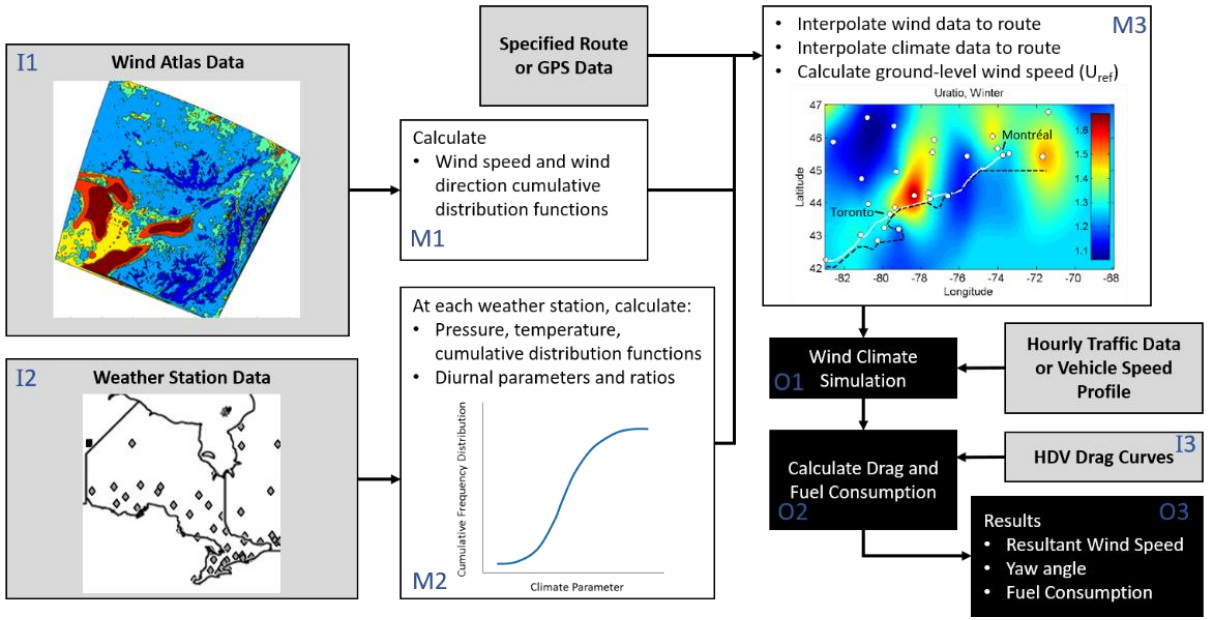
Marginal reduction in % fuel savings when platooning in traffic

Platoon Energy Savings Project

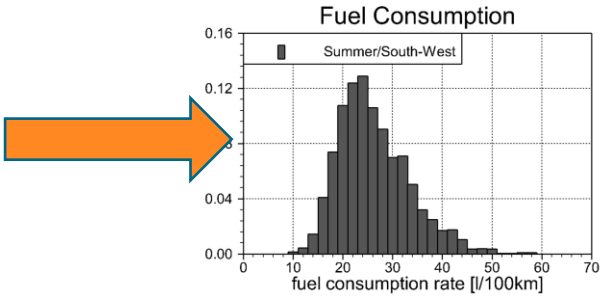
NRC Fleet Aerodynamic Performance Assessment Simulation Software

Predict potential fuel savings for different CTPS technology-penetration levels

- Assess current “background platooning” benefit as a reference
- Predict incremental benefit from CTPS
- Use aerodynamic modeling with advanced road-wind-climate predictions



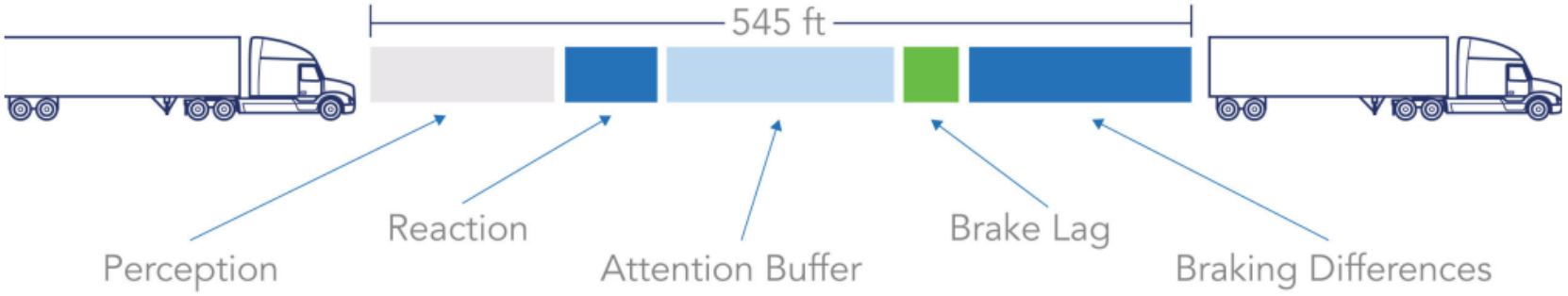
stochastic predictions



Platoon Dynamics

Closing the Gap…

Typical manual braking safety gap:



Potential Cooperative and Automated System:

May improve further by:

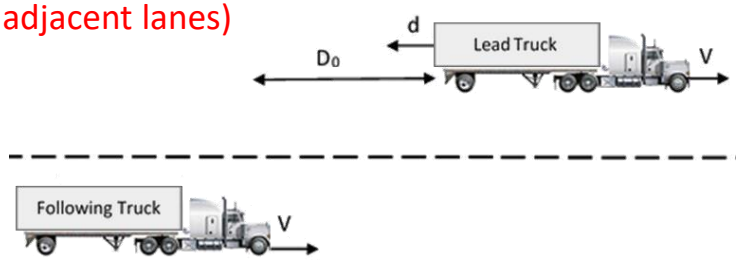
- Monitoring/estimating and accounting for differing braking performance
- Adjust to real-time factors (weather, traffic)
- Anticipate braking events (e.g. lead truck detects obstacles and gap widens)

Image Source: Peleton Safety Report 2019

2019 Dynamic Testing

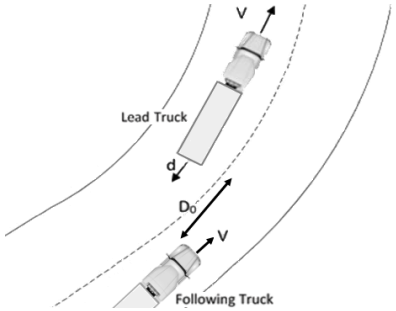
Platoon braking

(trucks tested were able to platoon in adjacent lanes)

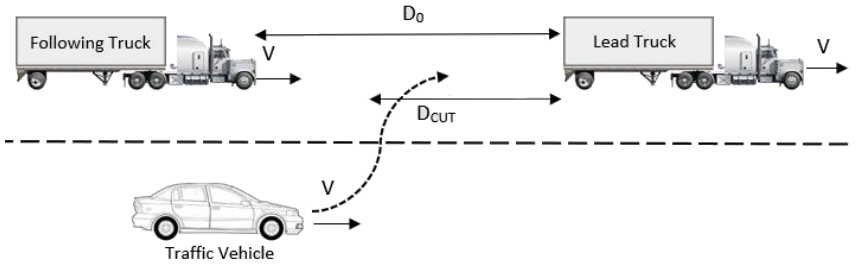


Variables:

- Separation distance of 150 ft and 75 ft
- Constant speed of 50mph, 60mph
- Gradual acceleration (45-60mph) interrupted by hard braking
- Gradual deceleration (70-60mph) interrupted by hard braking
- Straight and curved road



Vehicle Cut-in between Platoon Trucks



Variables:

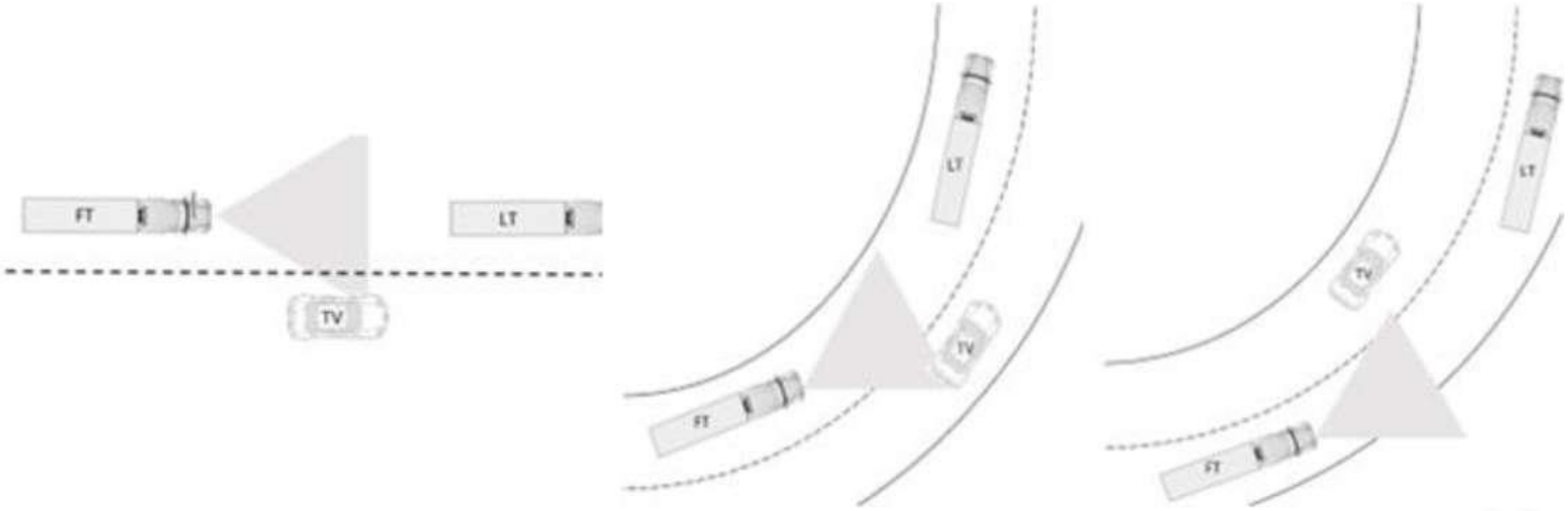
- Separation distance of 150 ft
- Constant speed of 60mph
- Cut-in vehicle at same speed as platoon, cuts-in at different distances ahead of the following truck
- Cut-in vehicle at higher speed then decelerates at various rates after cut-in
- vehicle cuts-in while at lower speed than platoon
- Straight and curved road

Dynamic Testing - Lessons

Braking executed by CTPS did NOT apply trailer brakes! Retrofitting/integrating automated systems is a challenge.

- Test max braking capability of driver-activated braking and system-activated braking. Maybe possible to do this stand-alone, not in platoon.
- Monitor trailer brake airline pressure (or brake temps)

Did not test vehicle cut-in from inner lane of a curve:



Actual test configurations

Proposed test configuration

2019 Dynamic Testing - Lessons

Developing improved test methodology:

- Use of soft target vehicles (pictured)
- Equip a LDV (e.g. a pickup truck with soft target trailer) with V2V system so that it can behave as a lead truck in the platoon. This vehicle offers much better maneuverability, decreasing risks of some test scenarios
- Test unloaded/lightly loaded following truck and correlate dynamic performance to heavier loads.

Thank You

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