Transport Canada Transports Canada

Transport Canada
ecoTECHNOLOGY for Vehicles Program Update

Task Force on Vehicle Weights & Dimensions Policy
Government/Industry Meeting
November 29, 2017

Canada

Transport Canada's ecoTECHNOLOGY for Vehicles (eTV) Program

- eTV tests, evaluates and provides expert technical information on advanced light-duty vehicle (LDV) and heavy-duty vehicle (HDV) technologies.

- eTV program testing and evaluation results:
  - guide the proactive development of codes, standards, and regulations;
  - support the development of non-regulatory industry codes and standards that anchor industry efforts to integrate new vehicle technologies.

- eTV testing priorities are focused on addressing knowledge gaps, particularly where new innovations have potential environmental or safety implications.

- A few eTV HDV projects related to assessing technologies for improving HDV efficiency include:
  - Cooperative truck platooning systems **(update today)**
  - Extensive wind-tunnel aerodynamic testing of tractor-trailer aerodynamic technologies
  - Investigation of 6x2 tractor drivetrain technology **(update today)**
  - HDV tire market study

eTV Cooperative Truck Platoon Work

Began CTP work in 2014 with a literature review of CTPS and past testing (report), which informed eTV's Current CTPS Work Plan, consisting of 3 primary activities:

1) Early Engagement:

- 2016 Media / Ministerial Demo Day: Minister and media overview and demonstrations
- 2017 Stakeholder Demo Day: Brought together 50+ industry, enforcement and regulatory stakeholders for discussion and demonstrations

2) Track Testing:

- 2016 Phase I Track Testing: Examine impact of separation distances, speeds, weights and tractor configurations on fuel economy
- 2017 Phase II Track Testing: Measure effect of: non-platoon traffic (ambient and cut-ins); Canadian configurations (longer and heavier trucks); and separation distances (4 to 50m)

3) Pol/Reg Study:

- 2017-18 Commissioning Policy, Regulatory, Operational Considerations Study to advance understanding of CTPS impacts and the necessary considerations to support pilot deployments in Canada (CTPS manufacturers inquiring about deployment requirements)

CTPS Track Testing 2017 – Project Participants

- Transport Canada (TC)
- U.S. Federal Highway Administration (FHWA)
- U.S. Department of Energy (DOE)
- Partners for Advanced Transportation Technology (PATH) at U.C. Berkeley
- University of California, Berkeley
- Berkeley Lab
- Volvo Trucks
- National Research Council Canada (NRC)
- FPInnovations PIT Group
- PMG Technologies
- Centre de Formation du Transport Routiers de Saint-Jerome (CFTR)
- National Renewable Energy Lab (NREL)

CTPS Summer 2017 - Overview

- Majority at 65 mph, 65 000 lbs, with aero trailer
- Shorter and longer separation distances
- 0.14seconds/4metres to 3.0seconds/87metres
- 2-truck versus 3-truck platoon
- Mismatched vehicle/trailer configurations
- Speed changes, interruptions, other traffic
- Platooning vs long-combination vehicles
- Other measurements
  - *Wind effects with on-board anemometry*
  - *Driveshaft torque for aero-drag measurements*
  - *Vehicle computer data for detailed investigations*
  - *Engine cooling evaluations*

Video of 2017 CTPS Testing:
English version:
https://vimeo.com/229586964/89b66a1127

Version française:
https://vimeo.com/229589072/3c2d6f030f

CTPS Track Testing 2017 – Initial Observations

- Significant fuel savings at variety of platoon speeds & separation distances (4-50m)
- Trailer aerodynamic treatments (side skirts & boat-tails) may further enhance the platoon's effectiveness at reducing fuel use beyond the efficiency benefits that aerodynamic trailers provide over standard trailers alone
- Platoon system responded appropriately to cut-ins by passenger vehicles (only a small penalty to fuel savings in test scenario with frequent cut-ins)
- The final report detailing this year's findings will be published by spring 2018 and shared publicly on eTV's website

eTV Pol / Reg Study – 2017-18

As a complement to the Program's engagement and track testing work, we are commissioning a study that will advance the understanding of the necessary considerations to support pilot deployments in Canada based on policy, regulatory and operational considerations.

Goals:

- To assemble in one document, core deployment considerations & approaches considered & adopted elsewhere (e.g., EU, US, Japan)
- Review existing Pan-Canadian regs to see where they mirror or differ from each other and how that could influence interprovincial deployments
- Continue Engagement on CTPS (workshops, share findings)

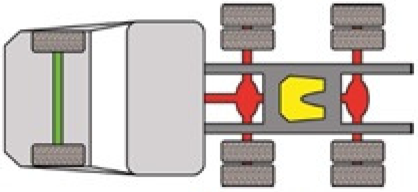
eTV Pol / Reg Study – 2017-18

Potential Considerations:

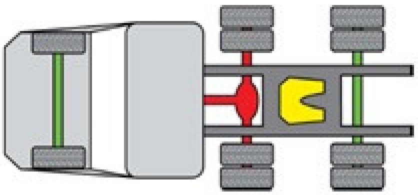
i. **Operational Considerations** (signage, speeds, appropriate highways, permits)
ii. **Driver and Fleet Considerations** (training, optimal routes/loads, hours)
iii. **Technical Considerations** (certification, testing, equipment)
iv. **Education and Awareness** (public campaigns, outreach)
v. **Comparison of Regulatory Frameworks** (variability b/t Cdn jurisdictions)
vi. **Canadian Specific Combinations** (relation to LCV, B-Trains)

HDV 6x2 Axle Technology – Background Information

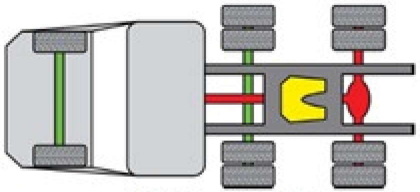
- Traditional highway tractors employ a 6x4 drive configuration which uses a non-powered steer axle and two powered rear axles.
- Recent innovations have resulted in increased availability of 6x2 configurations in North America -- which employ only one powered rear axle in one of two configurations:
    - Tandem tag – forward most drive axle is powered (Kenworth, Freightliner); and,
    - Tandem pusher – rear most drive axle is powered (Volvo).
- OEMS can have different load shifting (biasing) strategies during:
    - Low speed operation (i.e. load is transferred to the drive axle to gain traction); and,
    - High speed operation (i.e. load is transferred to the dead (LRR) axle for fuel economy).
- Increase in individual axle loads could have implications on:
    - Infrastructure (i.e. loading that is higher than the current allowable axle limits); and,
    - Vehicle dynamic stability (i.e. high speed maneuvering after load shifting has occurred).



6x4 arrangement



6x2 tag tandem 6x2 architecture



6x2 pusher 6x2 architecture

Potential Benefits	Potential Challenges
• fuel economy • reduced emissions • reduced maintenance • mass reduction	• loading on infrastructure • vehicle dynamic stability • traction • tire wear

HDV 6x2 Axle Technology – Project Approach

The eTV Program technical assessment has three planned phases.

Phase 1 – Technical Literature Review – Completed August 2016

- Review available OEM technical documents, peer-reviewed publications, consult OEMs and suppliers, and other available material to characterize different 6x2 architectures and performance.
- Posted to TC's website (http://www.tc.gc.ca/eTV).

Phase 2A – Track Test Plan Development – Completed September 2016

- Development of track testing procedure to measure how much load is transferred to the drive axles in various loading configurations.

Phase 2B – Winter Track Testing (Two vehicle pairs) – Completed February 2017

- Equip the vehicles with wheel force transducers to measure the loads and moments at each wheel Complete track testing at TC's Motor Vehicle Test Center (MVTC) to measure axle loads and moments during accelerations from a dead stop on a low µ (ice) surface.

Phase 2B – Winter Track Testing (all vehicle pairs) – Winter 2018

- Starting on a low µ (ice) surface, accelerating to higher speeds on dry pavement, recording the magnitude and duration of load shift events.
- A third vehicle pair is added.
- Testing at lighter weights: more challenging situation for traction
- Results can be used for dynamic simulation and infrastructure impacts analysis.

HDV 6x2 Axle Technology – Project Approach

Phase 2E – Dynamic Simulation – Expected Completion Spring 2018
Use empirical data derived from testing to simulate dynamic performance in various scenarios

Phase 3A – Infrastructure Impact Analysis/ Test Plan Development – Completion December 2017

- Susan Tighe, Ph.D., Centre for Pavement and Transportation Technology (University of Waterloo) assisting with the development of a detailed test plan and statement of work (SOW).
- Identify the instruments and methodologies to analyze the impact of 6x2 technologies on infrastructure.

Phase 3B – Infrastructure Impact Data Analysis – Spring 2018 (Tentative)
Facilitate an RFP and award contract to firm capable of performing the work recommended in the test plan established from 3A.

Stakeholder Engagement

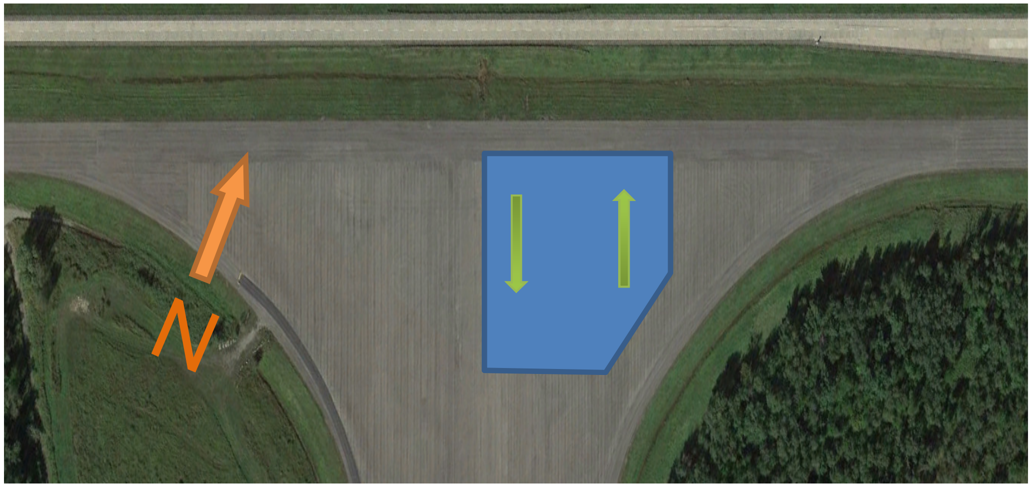
Technical working group is comprised of:

Transport Canada – ecoTECHNOLOGY for Vehicles (eTV)
Infratech Solutions Inc. (Susan Tighe)
Environment and Climate Change Canada – Transportation Division (TD)
Provincial and territorial weights & dimensions regulators
Canadian Trucking Alliance (CTA)
Private Motor Truck Council of Canada (PMTC)
Truck and Engine Manufacturers Association (EMA)

Phase 2A: FY16-17 Dynamic Testing (2 vehicle pairs only)

Track testing conducted January 16 – February 28th, 2017

- Testing at TC Motor Vehicle Test Centre on an ice surface
- Determine tractive capability of each tractor (startability, acceleration)
- Open deck trailer with range of ballast amounts and distributions
- Evaluating the effects of the traction control system, and the magnitude and duration of load shifting events



Test Vehicles: 6x2 Axle Technology Vehicle Pairs

Kenworth T680	VNM62T 200	* Freightliner Cascadia Evolution 125 *
		
PACCAR MX-13 HD, 12.9L 455 hp @1700 rpm, 1650 lb.-ft.@1000 rpm Governed RPM: 2,200 rpm Automated Eaton 10 spd **6x2: tandem tag** G.C.W, 80,000 lbs Fr Axle: 12,000 lbs Rr Axle: 6x4 40,000 lbs, 6x2 34,000 lbs Trailer Load (lbs): 40,000 Emission controls: LRRA, IRTE, ATS, TGR	Volvo D11 425V/1550, 11L 425 hp @ 1600 rpm 1550 lb-ft @1000 rpm Governed RPM: 2,200 rpm I-Shift ATO2612D, **6x2: tandem pusher** G.C.W, 80,000 lbs Volvo VF12 12,500 lbs Meritor RS23-160 23,000 lbs 40K; 20K Volvo Air Suspension, W 20K Liftable Aux Axle 50" Meritor ABS with VEST	Detroit DD15, 14.8L 400 hp @ 1,625 rpm, 1,750 lb-ft @1,075 rpm Governed RPM: 2,200 rpm DT12-OA-1550 automatic **6x2: tandem tag** GCW: 80,000 lbs (36,300 kg) 6x4: 40,000 lbs tandem 6x2: 20,000 lbs single 20,000 lbs tag 2.28 rear axle ratio ABA, ACC and LDW technologies

* New acquisition

6x2 Axle Technology – Next Steps

- Track testing – Winter 2018
- Complete dynamic simulation – Spring 2018
- Finalize SOW infrastructure impacts analysis – Dec 2017
- Post RFP and award contract for infrastructure impacts analysis – Spring 2018

THANK YOU

MERCI

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BACK-UP SLIDES

Prototype CACC System

- Starts with Volvo's adaptive cruise control (ACC) using radar/video sensing of forward vehicle
- Adds 5.9 GHz DSRC radio for V2V communication
- Enables faster response to speed changes, with more stable vehicle following
    - Driver-selectable time gaps of 1.5, 1.2, 0.9 or 0.6 s
    - (SAE) Level 1 Automation
    - Saves energy, emissions