



Direct Monitoring and Measuring of Vehicle Utilization and Efficiency

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Presentation by Transport Canada

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Outline

- Objective and background - Canadian Vehicle Use Study (CVUS)
- Methodology
- Budget and financing
- Illustrative results
- Challenges
- Lesson learned

Objective and background - CVUS

- The CVUS aims to monitor how Canadian make use of their vehicles. Its results inform transportation policy in a number of areas:
 - ❖ Road safety, fuel efficiency, air emissions, traffic congestion, infrastructure planning.
- The CVUS has two components:
 - ❖ Light-duty vehicles: Cars and light trucks/vans with a gross vehicle weight rating (GVWR) less than 4.5 metric tonnes (t) – launched in 2011.
 - ❖ Heavy-duty vehicles: GVWR of 4.5 tonnes or more, split between Medium trucks (4.5t-15t) and Heavy trucks (15t+) – launched in 2013.
- As of April 2015, 80% of the Canadian vehicle fleet is covered, with six out of ten provinces part of the survey.

Methodology – collection tool

- The CVUS is the world's first survey to collect activity information directly from the vehicle using electronic collection methods exclusively.
- Canadian-made OttoView data logger collects:
 - ❖ Performance data from the Engine Control Unit via the onboard data port (one-second collection interval).
 - ❖ Geographic coordinates from an integrated GPS (one-second collection interval).
 - ❖ Trip-related information (purpose, age and number of passengers, fuel purchase) from a touch screen.



A short intake questionnaire administered during the recruitment process (online or by phone) collects vehicle and user characteristics :

Light vehicles: Vehicle status, number of vehicles at address, number, age and gender of drivers, fuel type, transmission type.

Heavy vehicles: Vehicle status, principal contact, business type, body style, fuel type, number of axles, cab type, roof height, vehicle accessories.

Methodology – collection tool (cont'd)

- Survey participants self-install the logger by connecting it to the Engine Control Unit of their vehicle via one of three cables: 1) a 16-pin OBD-II cable (SAE J1979), 2) a 9-pin truck cable (SAE J1939) and 3) a legacy 6-pin truck cable (SAE J1708).
 - Vehicles with no data port can still collect GPS and questionnaire data.
- Logger stays in the vehicle for 21 days.



Methodology – sampling

- Each participating province provides a quarterly list of vehicles from their motor vehicle registry.
- Stratified random samples of 6,350 light-duty vehicles and 3,150 heavy-duty vehicles are generated each quarter. Stratification is based on province, type, and vehicle age.
 - ❖ Consent rates have averaged 30% since inception.
 - ❖ The effective response rate after completion of the study is around 25%.
- Raw data are weighted to the population totals to produce quarterly and rolling annual average estimates, representative at the provincial level.

Methodology – collection process

- The stratified sample is returned to provinces to match vehicles with owners' contact information.
- Vehicle owners are contacted by mail. Once owners consent, they complete the intake questionnaire and are then mailed an OttoView data logger.
 - ❖ Respondents who complete the study receive a detailed summary report of their vehicle use during the three-week study period.
 - ❖ Light-duty vehicle owners are eligible to win two cash draws if they complete the study and send the logger back promptly.
- From first contact to the return of the logger, the collection cycle takes nearly 60 days.
- All the retrieved information is processed by Transport Canada.
- Estimates are available two months after the end of a quarter.

Methodology – data management

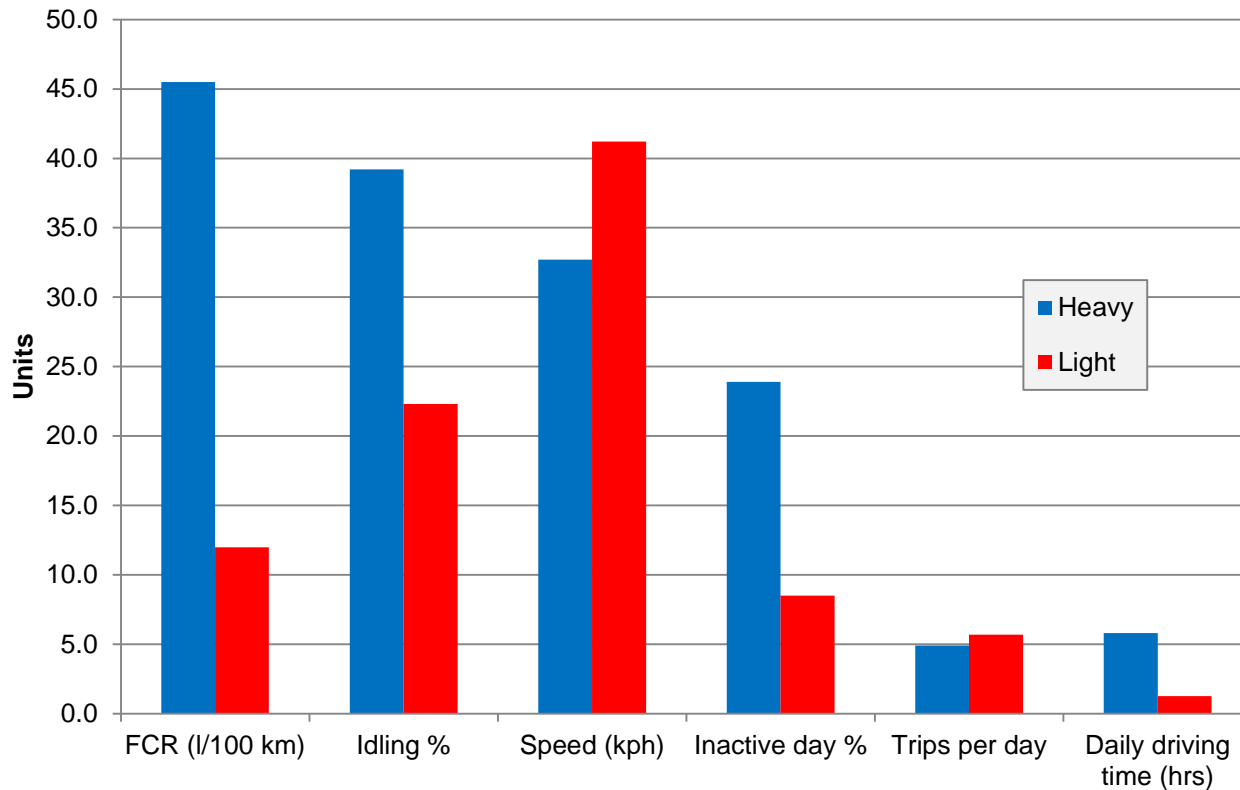
- Microdata are extracted, validated and added to a relational database for estimation and analysis.
- On average 32 GB of data is collected per quarter.
- Each components of the survey (light-duty, heavy-duty vehicles) has its own data model (see annex for further details).

Budget and financing

- Total annual cost of the CVUS is around CAD\$1.1 million.
 - ❖ Cost of OttoView data logger is CAD\$800 per unit.
- The CVUS is funded by Transport Canada, with contributions from Natural Resources Canada and Environment Canada.
 - ❖ A third party firm is hired to manage the contact with the owners of the selected vehicle, to collect the initial information, and to distribute and retrieve data loggers.

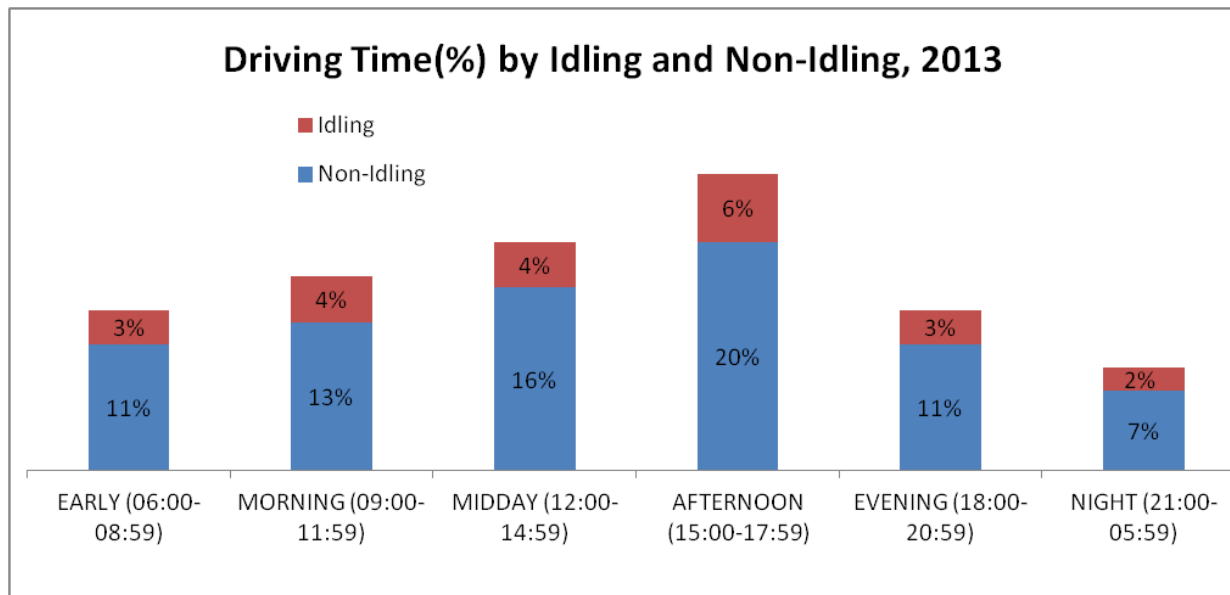
Illustrative results – vehicle performance

- A glimpse at what we learn from vehicle performance and utilization metrics...



Illustrative results - driving and idle time

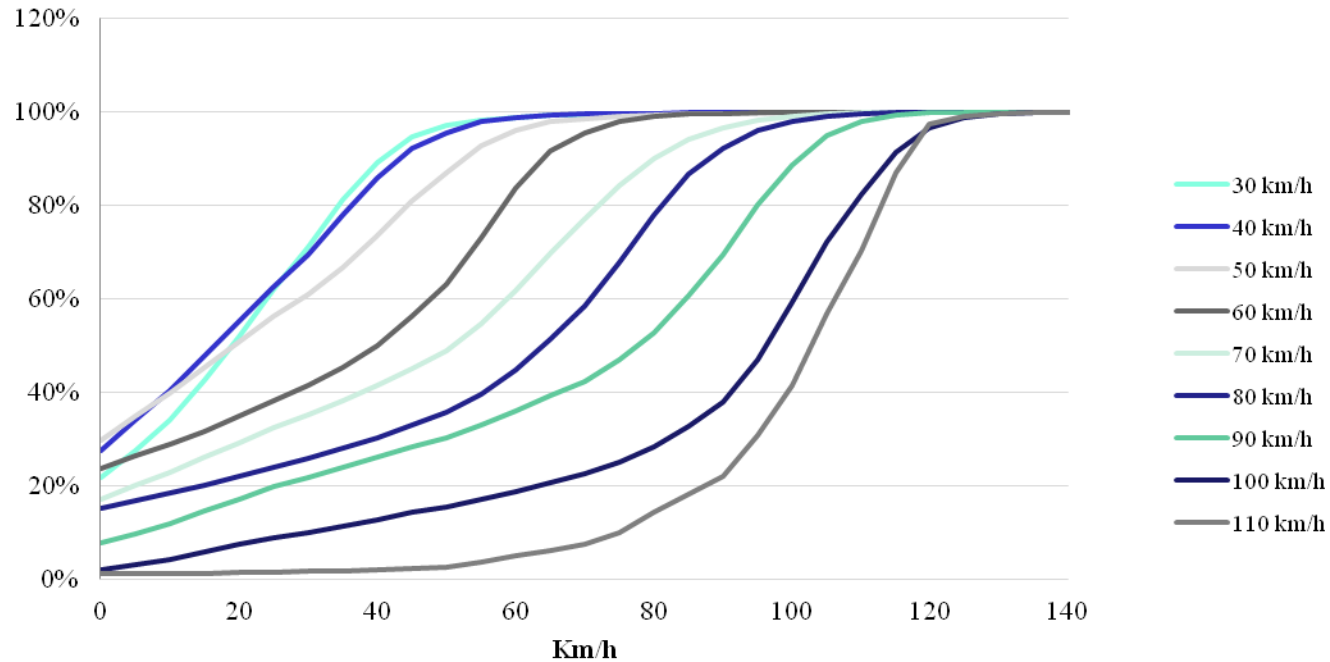
- A major advantage of data logging is that driving time can be precisely divided between idling and non-idling periods as well as by time of day.



Illustrative results – speed behaviour and speed limits

- Compliance with speed limits can also be directly examined.

**Distribution of Speed by Speed Limit Class
Excluding Start and End Trip Idling
2013**



Illustrative results – traffic congestion in Canada’s capital



Challenges – heavy-duty vehicles

- Recruitment process more challenging for heavy truck operators compared with light-duty vehicle owners.
 - ❖ Sending a recruitment letter in advance is helpful but not always effective (letter either ignored or not sent to the person in charge of the vehicle fleet).
 - ❖ Difficult to identify the person responsible for doing the study in a large organisation.
 - ❖ Requires considerable lead time and frequent calls in order to get consent.
 - ❖ Vitally important that a valid phone number be found for each case.
- Respondent burden
 - ❖ Sometimes multiple vehicles are sampled in the same organisation.
 - ❖ Large firms may be surveyed each quarter.
- Challenge to get the drivers to enter trip information and provide consistent, accurate information (e.g. cargo weight onboard).
- Data port may not always be available (firms using it for other purposes).
- High variability in the activity patterns – very diverse population with a large proportion (close to 50%) of inactive vehicles.

Lessons learned – benefits of electronic collection

- Accurate and coherent information through direct information recording.
- Lower respondent burden.
- Collects critical characteristics that are impossible to obtain from the driver.
 - ❖ Speed, operating temperature, location, time, fuel use.
- Unprecedented quantities of data (second-by-second versus trip-by-trip).
- Location of vehicle activity via GPS an intrinsic part of the collection task.
- Electronic collection reduces time spent in the data input process, leading to timely results.
 - ❖ 60 day turnaround for analysis as opposed to 6 months.

For further information

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- **Further results are accessible through the CVUS website: www.tc.gc.ca/cvus**

CVUS – Heavy-duty vehicle data model

