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2008 Canadian Vehicle Survey

Update Report

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Canada

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Executive summary

The Canadian Vehicle Survey (CVS) is a quarterly survey of vehicle transportation activities in Canada, providing both quarterly and annual data. The *2008 Canadian Vehicle Survey Update Report* offers an abridged review and analysis of selected annual data from 2000 to 2008, describing Canada's vehicle fleet, patterns in vehicle use and fuel consumption. More detailed information and anaylsis can be found in last year's *2007 Canadian Vehilce Survey Summary Report*.

The following are some of the principal findings from the *2008 Canadian Vehicle Survey Update Report*:

- **The number of vehicles on Canadian roads continued to increase between 2007 and 2008 (from 19.7 to 20.2 million), although the total distance driven decreased by 6.7 billion kilometres (km)**. The decrease in distance driven between 2007 and 2008 represents the largest recorded drop (2 percent) since annual CVS records began in 2000. However, total distance travelled in 2008 was still almost 6 percent higher than in 2000.
- **Ontario and Quebec accounted for almost 60 percent of the Canadian vehicle fleet in 2008, although the Albertan vehicle fleet has grown the fastest since 2000**. During this period, the Albertan vehicle fleet increased by an average annual rate of 3.6 percent per year. Growth in most of the remaining provinces was between 1 and 2 percent per year.
- **The average fuel consumption rate of gasoline-powered light vehicles in Canada was 10.6 litres per 100 kilometres (L/100 km) in 2008, and has not changed since 2005**. Fuel consumption was below the Canadian average in all of eastern Canada, while it was above average for all provinces west of Ontario.
- **From 2000 to 2008, the share of vans, sport utility vehicles (SUVs) and pickup trucks increased substantially relative to that of cars**. The number of SUVs more than doubled while the share of cars in the light vehicle fleet decreased by close to 10 percent. These changes have implications for fuel consumption because vans, SUVs and pickup trucks tend to consume more fuel than do cars and station wagons.
- **The average Canadian light vehicle ownership rate was slightly less than 1.5 vehicles per household in 2008**. Vehicle ownership was highest in Alberta (1.9 vehicles per household) and lowest in Quebec (1.3 vehicles per household).
- **Canadians drove their light vehicles an average of 15 200 km in 2008, down from almost 17 000 km in 2000**. Light vehicles were driven the furthest in Newfoundland and Labrador (18 100 km) and the least in British Columbia (13 100 km), in 2008.
- **The decrease in average annual distance travelled between 2000 and 2008 coincides with rising vehicle ownership and lower occupancy rates**. Between 2000 and 2008, light vehicle ownership rates increased from 1.43 to 1.48 vehicles per household. Canadians also relied on each vehicle to carry fewer passengers, on average, with occupancy rates decreasing from 1.68 to 1.62 passengers per vehicle over the period.

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Introduction

The Canadian Vehicle Survey (CVS) is a quarterly survey of vehicle transportation activities in Canada. Prior to the CVS, few empirically-based estimates existed for the number of vehicle-kilometres and passenger-kilometres travelled on Canadian roads.

Since 2004, Natural Resources Canada (NRCan) has co-sponsored the CVS in collaboration with Transport Canada and Statistics Canada. Through the analysis of these data, NRCan attempts to shed light on the characteristics of Canada's vehicle fleet, patterns in vehicle use and fuel consumption.

This update report was prepared by Noel Melton of the Demand Policy and Analysis Division of the Office of Energy Efficiency (OEE). Samuel Blais supervised the project while overall direction was provided by Andrew Kormylo.

For more information on programs and for tools, financial incentives, free publications and other resources to help conserve energy and reduce greenhouse gas emissions (GHG), visit NRCan's OEE Web site at oee.nrcan.gc.ca.

Contents of this report

The *2008 Canadian Vehicle Survey Update Report* offers an abridged review and analysis of selected annual data from 2000 to 2008, describing Canada's vehicle fleet, patterns in vehicle use and fuel consumption. More detailed information and analysis can be found in last year's *2007 Canadian Vehicle Survey Summary Report*.

Chapter 1 describes the key characteristics of Canada's on-road vehicle fleet and Chapter 2 highlights the regional differences of the fleet across Canada. Chapters 3 and 4 present data on the light vehicle fleet and the medium and heavy truck fleet, respectively.

Annex A and B describe the methodology employed by the CVS. The data used to create the figures in this report are summarized in Annex C, and Annex D contains a glossary.

Chapter 1. Canada's on-road vehicle fleet

Canada's transportation sector includes activities related to transporting passengers and goods by road, rail, water and air. In 2007, this sector's energy consumption accounted for 29 percent of total secondary energy use in Canada.[1] Road transportation, the subject of the Canadian Vehicle Survey (CVS), consumes more than three quarters of this energy. Total greenhouse gas (GHG) emissions in the transportation sector – almost 180 megatonnes of carbon dioxide equivalent emissions – accounted for almost half of direct end-use GHG emissions.[2] In fact, the transportation sector emits more GHGs than any other end-use sector in Canada.

This chapter describes the key characteristics of Canada's on-road vehicle fleet according to CVS data. These data encompass the entire on-road vehicle fleet, with certain exceptions such as buses and motorcycles. For a description of the methodology employed by the CVS, refer to Annex B.

1.1 Number and age of vehicles

Table 1 shows the number of vehicles in Canada in 2000 and 2008, as well as the growth rates during this period. Vehicles are divided into three categories according to weight:

- light vehicles – gross vehicle weight less than 4.5 tonnes (t)
- medium trucks – gross vehicle weight between 4.5 and 15 t
- heavy trucks – gross vehicle weight of 15 t or more

In 2008, the number of in-scope vehicles totalled 20.2 million according to the CVS.[3] Light vehicles represented 96 percent of the total, with medium and heavy trucks each accounting for about 2 percent. As can be seen in Table 1, the growth rate of medium and heavy trucks exceeded that of light vehicles over the period. While light vehicles increased by nearly 17 percent, medium and heavy trucks grew by close to 30 percent.

Table 1 – Vehicles in Canada by vehicle type, 2000 and 2008, and the growth rate

Vehicles	Growth rate			
	2000	**2008**	**Total**	**Average annual rate**
Light vehicles	16 642 140 A	19 426 504 A	16.7%	2.0%
Medium trucks	319 500 A	412 811 B	29.2%	3.3%
Heavy trucks	255 503 A	327 106 B	28.0%	3.1%
Total	**17 217 143 A**	**20 166 421 A**	**17.1%**	**2.0%**

The letter to the right of each estimate indicates its quality: A – Excellent, B – Very good, C – Good, D – Acceptable, E – Use with caution and F – Too unreliable to be published.

Due to rounding, the numbers in the tables may not add up, and some data may differ slightly from one table to the next.

[1] Office of Energy Efficiency, *2009, Energy Use Data Handbook*, 1990 to 2007.
[2] Direct emissions exclude emissions from the electricity generation sector.
[3] See the glossary in Annex D for a definition of in-scope vehicles.

Figure 1 – Age of vehicle fleet by vehicle type, 2008

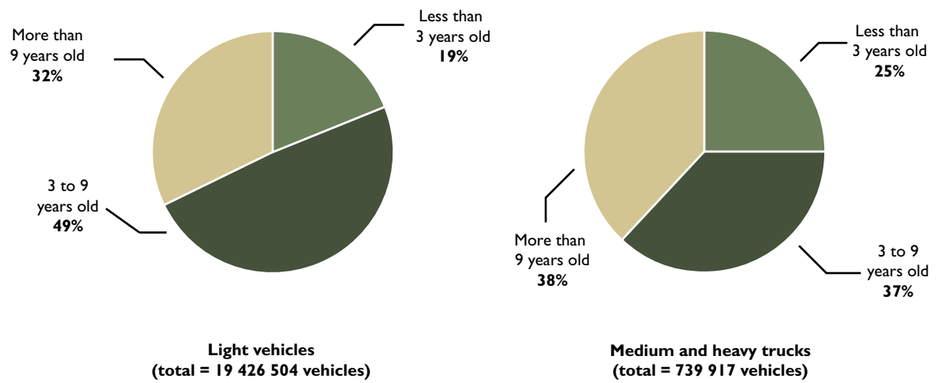


Figure 1 shows the age distribution of vehicles in 2008. About one fifth (19 percent) of light vehicles were less than three years old and nearly half (49 percent) were between three and nine years old. The high growth of medium and heavy trucks has meant that one quarter of the fleet was less than three years old in 2008. However, the fleet also retained a large number of older vehicles, with almost 40 percent of the fleet being more than nine years old in 2008.

1.2 Vehicle-kilometres

In 2008, Canadian vehicles travelled almost 326 billion kilometres (km) (see Figure 2). Light vehicles accounted for slightly more than 90 percent of vehicle-kilometres (VKM) travelled. Although medium and heavy trucks comprised less than 4 percent of the vehicle stock, they accounted for the remaining 10 percent of VKM, indicating that they were driven further than light vehicles on average.

VKM increased at an average rate of 0.7 percent per year from 2000 to 2008, although decreases in total VKM were observed in 2001, 2003 and 2008. The largest drop was in 2008 when VKM decreased by 2.0 percent, coinciding with a peak in gasoline and diesel prices.[4] Over the entire period, average annual growth rates of VKM have been highest for medium trucks (4.5 percent), followed by heavy trucks (1.2 percent) and light vehicles (0.5 percent).

1.3 Fuel consumption

Table 2 lists the number of vehicles according to fuel type consumed in 2008. Virtually all vehicles (more than 99 percent) consumed either gasoline (including up to 10 percent ethanol blends) or diesel. Light vehicles primarily used gasoline (about 97 percent) while heavy vehicles primarily used diesel (also about 97 percent). Meanwhile, medium trucks were more varied in their fuel consumption, with about 75 percent running on diesel and the remainder running on gasoline.

Other types of fuel used by Canadians included electricity, propane, natural gas and 85 percent ethanol/gasoline blends.[5] These fuels were used by less than 1 percent of all vehicles.

[4] Natural Resources Canada, 2010, *The Fuel Focus Report*, www.nrcan.gc.ca/eneene/sources/pripri/latder-eng.php.
[5] For more information on alternative fuels, visit oee.nrcan.gc.ca/transportation/vehicle-fuels.cfm.

Chapter 1. Canada's on-road vehicle fleet

Figure 2 – Vehicle-kilometres travelled by vehicle type, 2000 to 2008

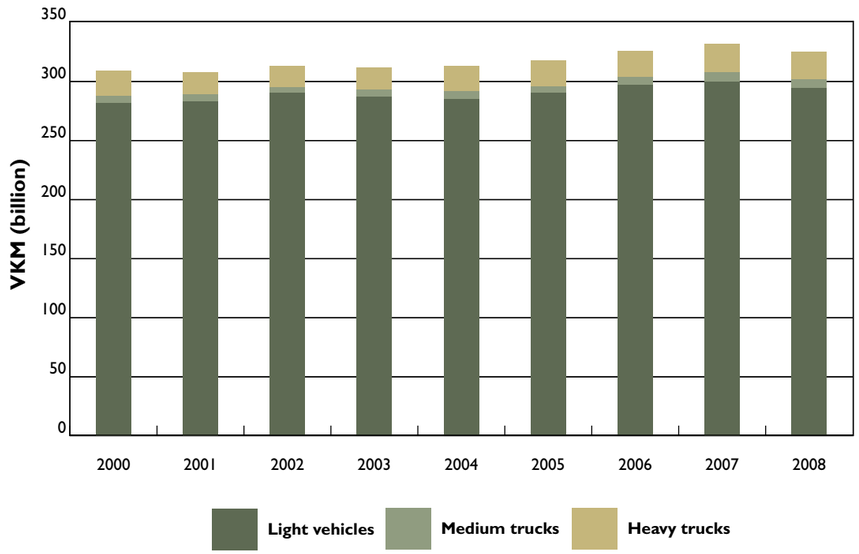


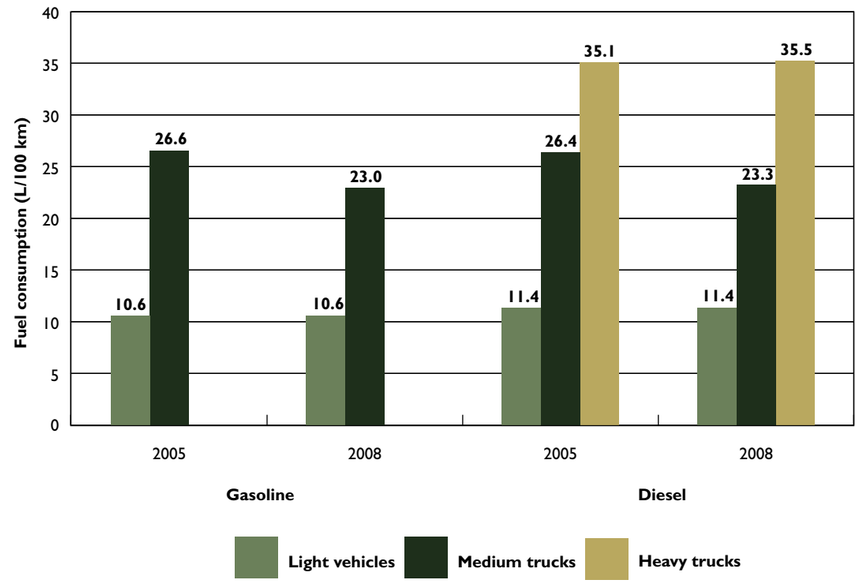
Table 2 – Vehicles in Canada by vehicle type and fuel type, 2008

Fuel	Vehicles			Total
	Light vehicles	Medium trucks	Heavy trucks	
Gasoline	18 808 773 A	107 160 E	- F	18 923 790 A
Diesel	542 224 E	299 648 C	318 528 B	1 160 400 C
Other	- F	- F	- F	- F
Total	**19 426 504 A**	**412 811 B**	**327 106 B**	**20 166 421 A**

Chapter 1. Canada's on-road vehicle fleet

Figure 3 shows gasoline and diesel consumption rates in 2005 and 2008 for each vehicle type.[6] Fuel consumption remained constant for light vehicles (10.6 and 11.4 L/100 km for gasoline and diesel, respectively). Fuel consumption rates decreased for medium trucks (from 26.6 to 23.0 L/100 km for gasoline-powered trucks and 26.4 to 23.3 L/100 km for diesel-powered trucks). However, fuel consumption rates for heavy trucks fluctuated between 2005 and 2008 and ended the period at 35.3 L/100 km, up marginally from 35.1 L/100 km in 2005.

Figure 3 – Fuel consumption rate by vehicle type and fuel type, 2005 and 2008



[6] This year is used because prior to 2005 a different methodology was employed for estimating fuel consumption.

Chapter 2. Geographic analysis

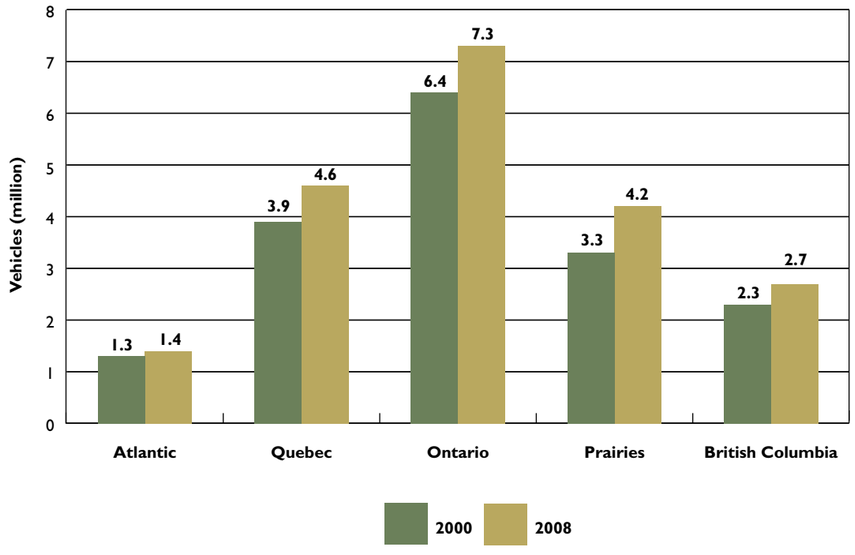
This chapter highlights regional variations in the characteristics of the vehicle fleet across Canada.

2.1 Composition of the on-road vehicle fleet in Canada's provinces and territories

Growth in vehicles from 2000 to 2008 was highest in Alberta (an average annual growth rate of 3.6 percent). Growth in the remaining provinces was around 1.5 to 2 percent per year except for most of the Atlantic Region, where growth was around 1 percent per year.

Figure 4 shows the number of vehicles in Canada for 2000 and 2008, by region. Vehicle distribution is highly correlated with population: together, Ontario and Quebec accounted for almost 60 percent of the Canadian fleet in 2008, with more than 7 million vehicles in Ontario and 4.6 million in Quebec. The Prairies accounted for an additional 4.2 million vehicles (19 percent), British Columbia, 2.7 million (13 percent) and the Atlantic provinces, 1.4 million (7 percent).

Figure 4 – Vehicles in Canada by region, 2000 and 2008*



* This figure excludes the territories because their vehicle fleet is small and accounted for only 58 000 vehicles in 2008.

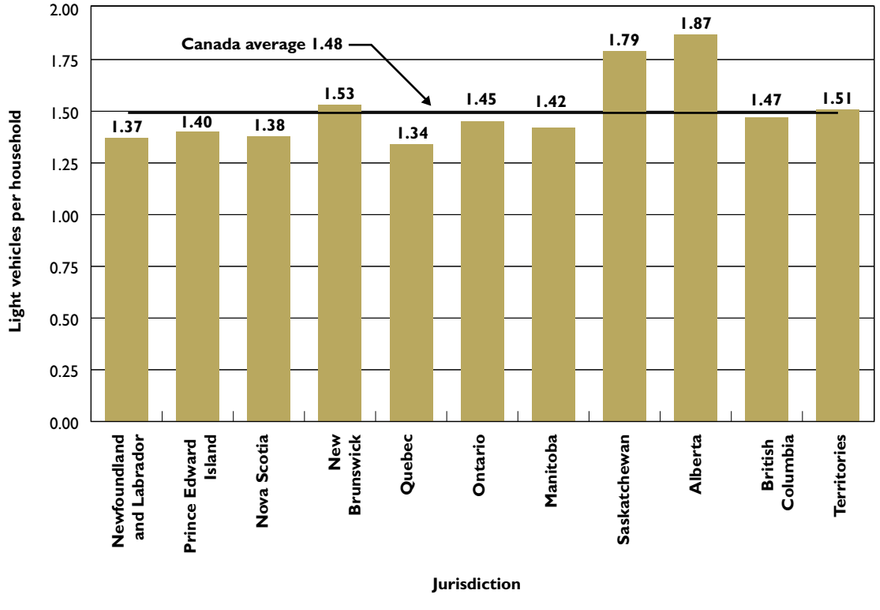
Figure 5 shows the average number of light vehicles per household for each region in Canada. Vehicle ownership was highest in Alberta and Saskatchewan, with an average of 1.87 and 1.79 vehicles per household, respectively. Quebec had the lowest vehicle ownership rate of 1.34 vehicles per household. The Canadian average was just fewer than 1.5 vehicles per household.

2.2 Variation in distance travelled among regions

Figure 6 shows the average annual distance travelled by light vehicles in each jurisdiction. In 2008, light vehicles were driven an average of 15 200 kilometres (km) in Canada. Light vehicles were driven the furthest in Newfoundland and Labrador (18 100 km) and the least in British Columbia (13 100 km). Some of the factors which may contribute to these differences include access to and density of the road network, alternative transportation options, vehicle ownership rate and climate.

The average annual distance travelled by medium trucks was greatest in Quebec (25 500 km) and was also more than 20 000 km in New Brunswick, Ontario and Alberta (see Figure 7). It was only 13 200 km in Saskatchewan.

Figure 5 – Light vehicles per household by jurisdiction, 2008



The CVS data show that heavy trucks were generally driven much further than other vehicle types (Figure 8). Average annual distances exceeded 90 000 km in Quebec, and 80 000 km in Ontario and Manitoba. Heavy trucks travelled much shorter distances in New Brunswick, Saskatchewan and British Columbia.

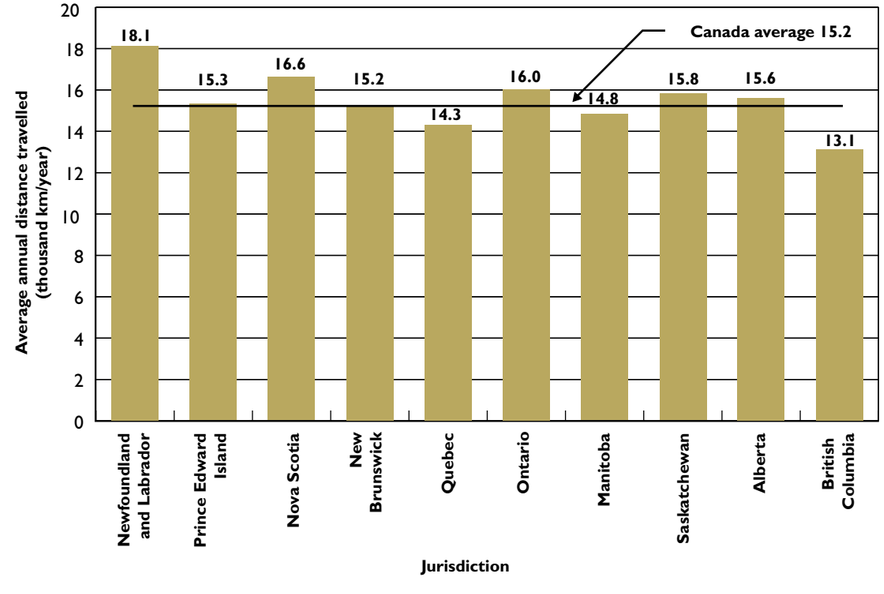
Numerous factors likely contribute to the observed variation in distance travelled among regions for medium and heavy trucks, including structure of the economy, geographic size, geographic range of trucking operations and vehicle ownership rate.

2.3 Provincial fuel consumption rates

Substantial regional variation exists in the fuel consumption rates of light vehicles (Figure 9).

In 2008, the average fuel consumption rate of gasoline-powered light vehicles in Canada was 10.6 L/100 km.[7,8] Fuel consumption was below the Canadian average in all of Eastern Canada, while it was above average for all provinces west of Ontario. Numerous factors may influence these variations, including the composition and age of the vehicle fleet, fuel prices and patterns of vehicle use. In British Columbia and the Prairies, the vehicle fleet contained a greater proportion of vans, sport utility vehicles and pickup trucks than in the rest of Canada. The vehicle fleet in these regions also had a higher proportion of older vehicles.

Figure 6 – Average annual distance travelled by light vehicles by jurisdiction, 2008



[7] The fuel consumption rate for diesel-powered light vehicles is not shown because the data are of too poor quality to publish.
[8] Fuel consumption data are not available for the territories.

Figure 7 – Average annual distance travelled by medium trucks by jurisdiction, 2008

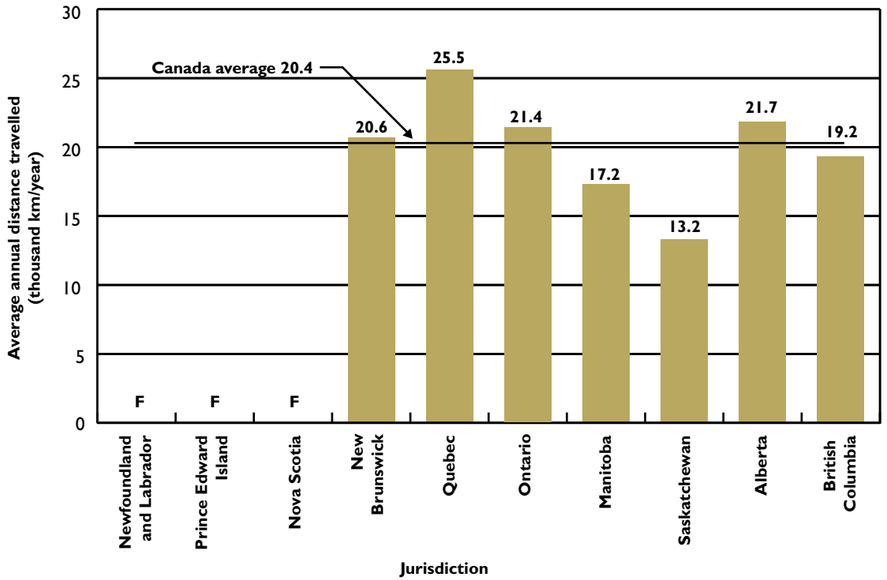


Figure 8 – Average annual distance travelled by heavy trucks by jurisdiction, 2008

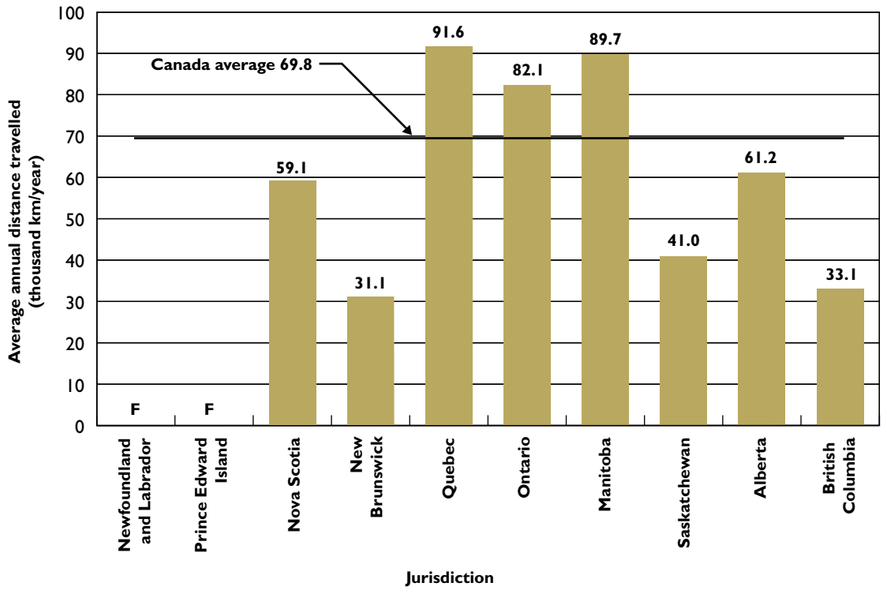


Figure 9 – Fuel consumption rate of gasoline-powered light vehicles by jurisdiction, 2008

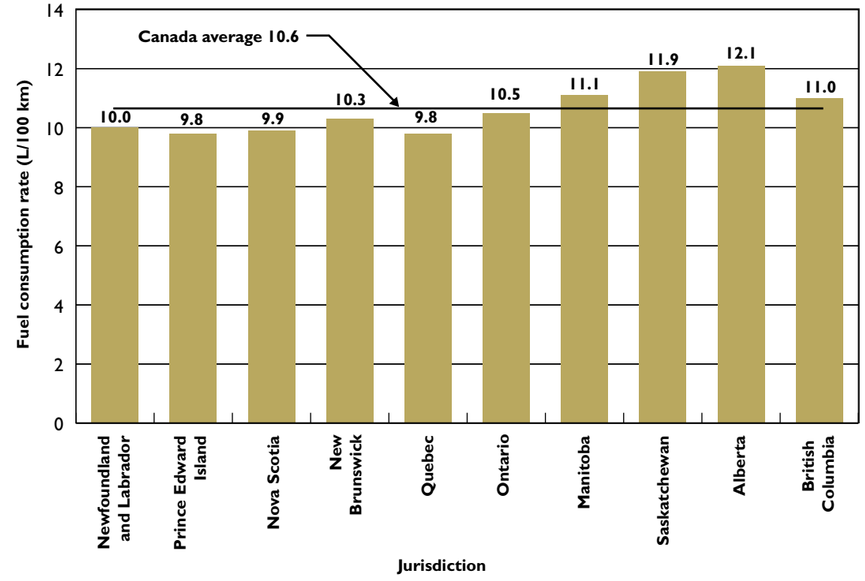


Figure 10 and Figure 11 show the diesel consumption rate of medium and heavy trucks, respectively. Medium truck fuel consumption ranged from 22.2 to 25.7 L/100 km and heavy truck fuel consumption ranged from 33.1 to 39.5 L/100 km.

New Brunswick, Saskatchewan and British Columbia heavy truck fleets had the highest consumption rates (more than 38 L/100 km). As shown in the previous section, heavy trucks also travelled less distance on average in these provinces than in the rest of the country. Therefore, their higher fuel consumption rates could be partly explained by a lower ratio of highway driving relative to city driving (fuel economy tends to be greater for highway driving than for city driving). Most of the other provinces had fuel consumption rates of 34 to 35 L/100 km, with the exception of Manitoba (33.1 L/100 km).

Figure 10 – Diesel consumption rate of medium trucks by jurisdiction, 2008

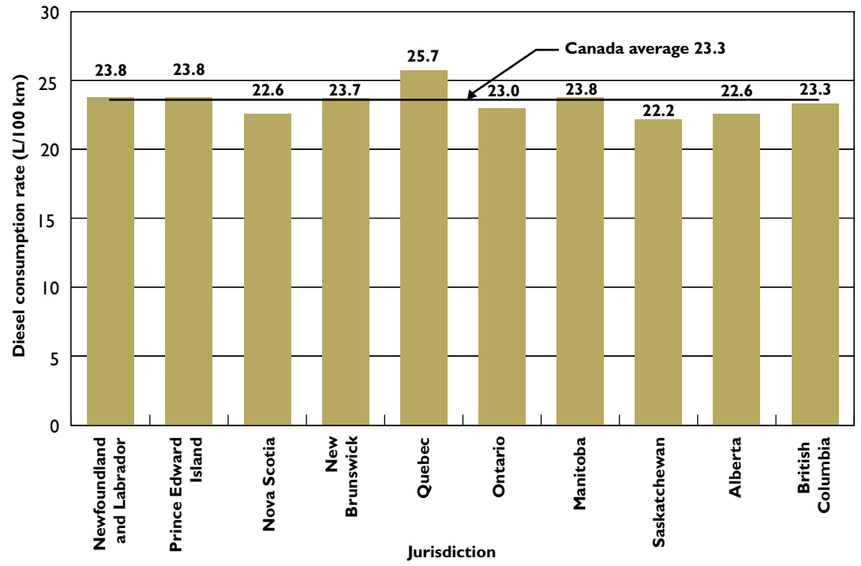
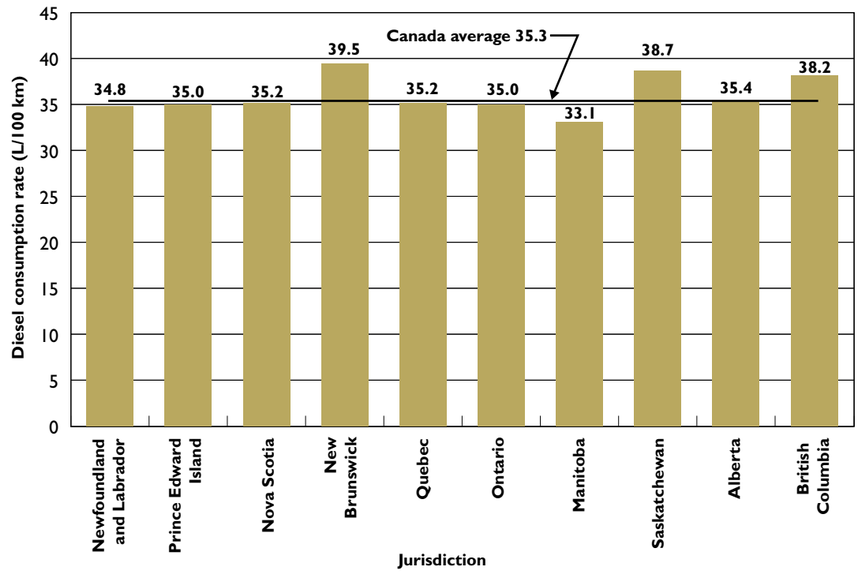


Figure 11 – Diesel consumption rate of heavy trucks by jurisdiction, 2008



Chapter 3. Light vehicles

The light vehicle fleet includes vehicles weighing less than 4.5 tonnes and accounts for more than 96 percent of vehicles in Canada. These vehicles are primarily used for private purposes and include cars, station wagons, vans, sport utility vehicles (SUVs) and pickup trucks.

3.1 Light vehicle body type

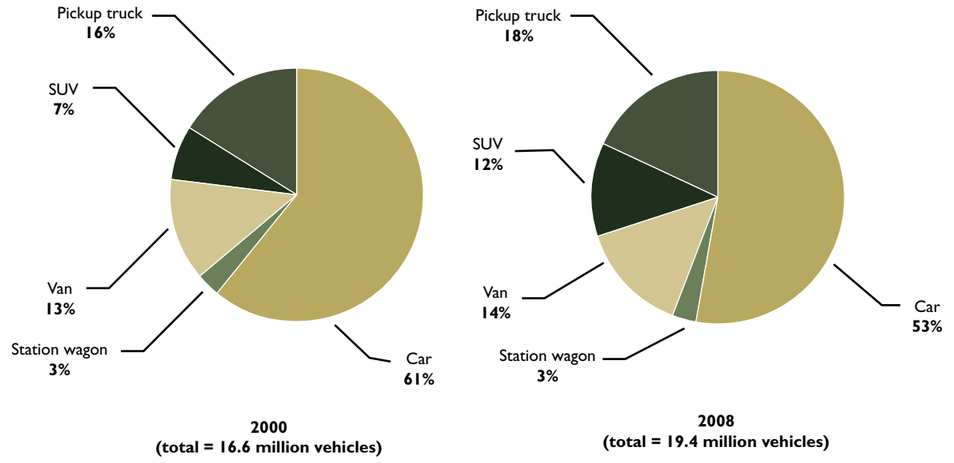
Figure 12 highlights the changes in composition of the light vehicle fleet that occurred between 2000 and 2008. During this period, the share of vans, SUVs and pickup trucks increased substantially relative to the share of cars. Most notably, the number of SUVs more than doubled, and their share of the light vehicle fleet increased from 7 to 12 percent. Meanwhile, the share of cars decreased from 61 to 53 percent. Although the number of station wagons increased by nearly half over the period, its share of the total fleet remained at around 3 percent.

3.2 Passenger-kilometres

Passenger-kilometres (PKM) travelled in light vehicles were 475 billion in 2000 and peaked at 497 billion PKM in 2005. By 2008, PKM had lowered to 477 billion, just 0.4 percent higher than in 2000. The trend in PKM can be partly related to that of vehicle-kilometres (VKM), which experienced a significant decrease from 2007 to 2008 (see Section 1.2).

Figure 13 shows a breakdown of PKM by vehicle body type, which reflects the changing composition of the

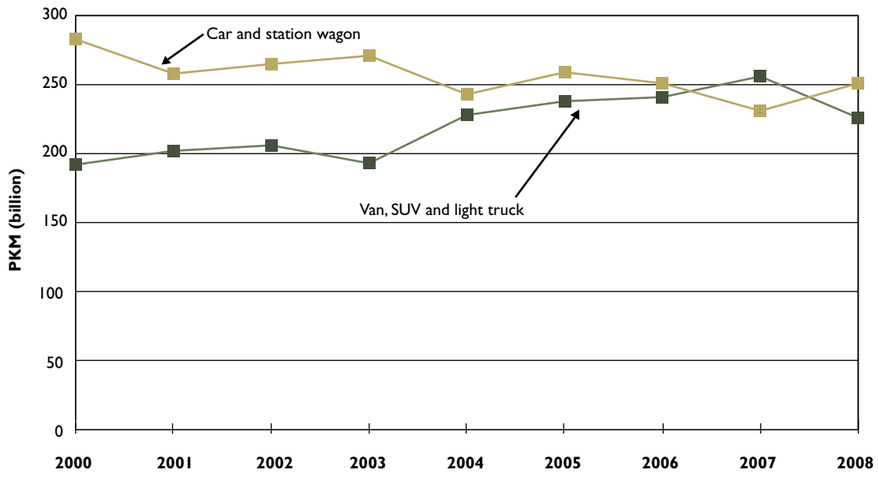
Figure 12 – Light vehicles by vehicle body type, 2000 and 2008



light vehicle fleet. Since 2000, PKM from cars and station wagons generally decreased, while those from vans, SUVs and pickup trucks increased. In 2000, vans, SUVs and pickup trucks accounted for about 40 percent of total PKM, but by 2008 they accounted for approximately half. Note that between 2007 and 2008, this trend was reversed, with PKM from cars and station wagons increasing and PKM from vans, SUVs and light trucks decreasing.

The changes in composition of the light vehicle fleet have implications for fuel consumption because vans, SUVs and pickup trucks tend to consume more fuel than do cars and station wagons. In 2008, the average gasoline-powered car and station wagon consumed 8.8 L/100 km, while the average van, SUV and light truck consumed 12.8 L/100 km. As discussed in Section 2.3, the provinces that have higher fuel consumption rates also have a higher share of vans, SUVs and pickup trucks in their light vehicle fleet.

Figure 13 – Passenger-kilometres travelled in Canada by vehicle body type of light vehicles, 2000 to 2008

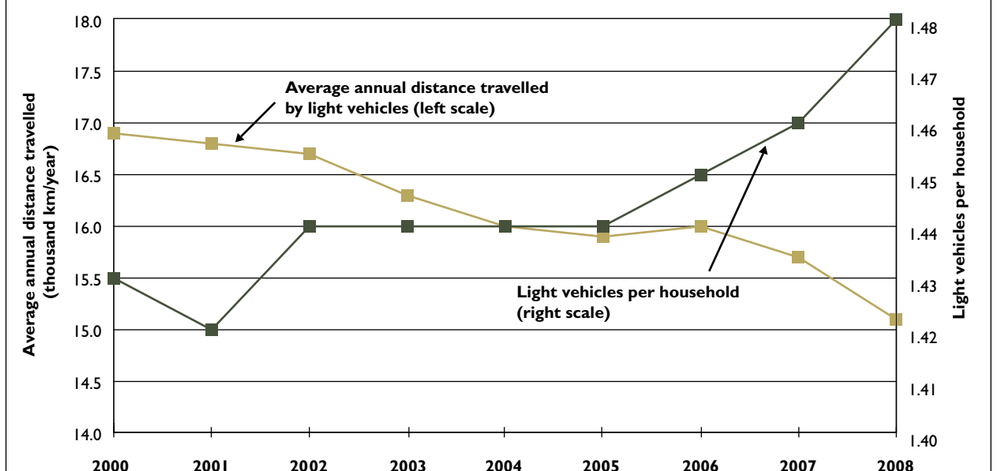


3.3 Vehicle-kilometres

VKM in the light vehicle fleet increased at an average annual rate of 0.5 percent between 2000 and 2008. This increase is well below the growth of light vehicles, which averaged 2.0 percent per year during this period.

Figure 14 shows that the average light vehicle in Canada was driven slightly more than 15 000 km in 2008, down from almost 17 000 km in 2000. During this same period, vehicle ownership increased from 1.43 to more than 1.47 vehicles per household. In other words, while the number of light vehicles in Canada increased since 2000, Canadians have relied on each vehicle to travel less distance. In addition, the occupancy rate of light vehicles decreased from 1.68 to 1.62 persons per vehicle over this period.

Figure 14 – Average distance travelled and light vehicles per household, 2000 to 2008

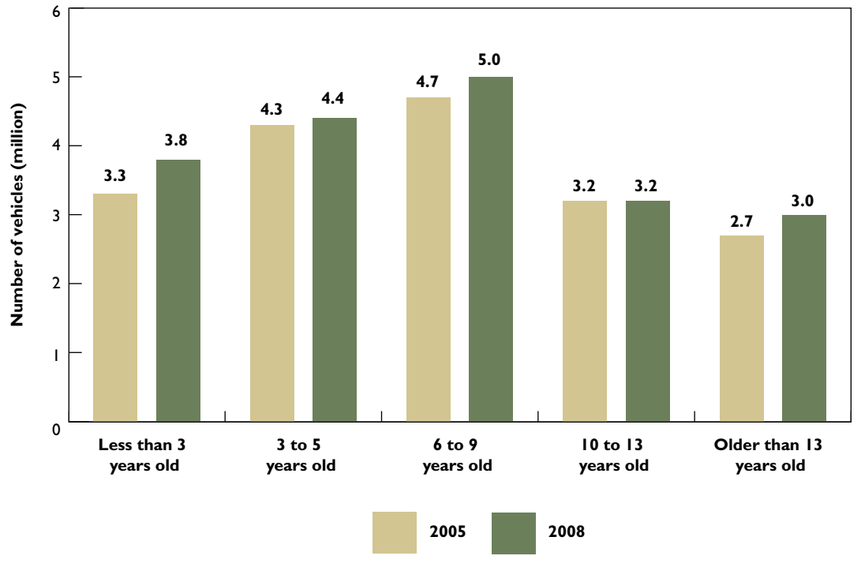


3.4 Age of light vehicles

Figure 15 shows Canada's light vehicle fleet in 2005 and 2008 by vehicle age. Over this period, the number of vehicles in all age categories increased, except for vehicles between 10 and 13 years. The age distribution of light vehicles did not exhibit much change between 2005 and 2008, reflecting the steady growth rate of the vehicle fleet during this period. In 2008, one in five vehicles was two years old or younger and two thirds of vehicles were nine years old or younger. The average vehicle age was about seven years.

Vehicle age is an important determinant of fuel consumption. Newer vehicles tend to be more fuel efficient, although the increasing popularity of vans, SUVs and pickups may somewhat counteract fleet-wide improvements in fuel efficiency.

Figure 15 – Light vehicles by vehicle age, 2005 and 2008



Chapter 4. Medium and heavy trucks

This chapter examines medium and heavy trucks, which are defined according to weight:

- medium trucks – gross vehicle weight between 4.5 and 15 tonnes (t)
- heavy trucks – gross vehicle weight of 15 t or more

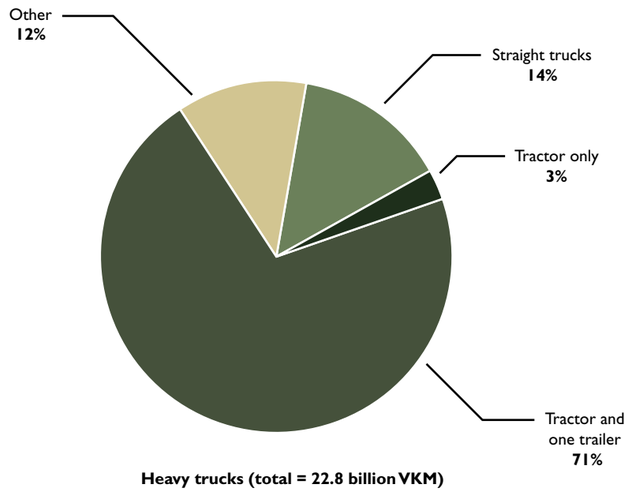
4.1 Medium and heavy truck configuration

Medium and heavy trucks can be configured in different ways. A straight truck is a complete unit (i.e. a power unit and a box or flat bed that cannot be detached). A tractor/trailer, on the other hand, is composed of a cab accompanied by one or more detachable trailers. Tractor/trailer combinations are typically used for long-distance hauling.

In the medium truck category, the majority of vehicle-kilometres (VKM) (about 70 percent) were travelled by straight trucks in 2008. This share of distance decreased from around 80 percent in 2000, indicating increased use of medium trucks with configurations other than straight trucks. Unfortunately, Canadian Vehicle Survey data do not allow us to make any observations about these other configuration types.

Data quality is better for heavy trucks. Figure 16 shows the shares of VKM by configuration type in 2008. The majority of VKM (71 percent) were travelled by tractors with one trailer. Fourteen percent of the distance was travelled by straight trucks, and another 12 percent was travelled by other configurations (which include configurations such

Figure 16 – Distance travelled by heavy trucks by configuration, 2008



as tractors with more than one trailer and straight trucks with trailers). The shares of distance travelled for each configuration of heavy truck have not changed significantly since 2000.

4.2 Medium and heavy truck trip purpose

Figure 17 shows the distance travelled by medium and heavy trucks for different purposes. Medium trucks were generally used for a greater variety of purposes than heavy trucks.

For medium trucks, carrying goods or equipment accounted for a little less than half of VKM in 2008, down from 50 percent in 2000. Travel for non-work purposes remained relatively constant during the period, accounting for 26 percent of VKM in 2008, while driving to or from service calls accounted for 19 percent of distance travelled, up from 12 percent in 2000.

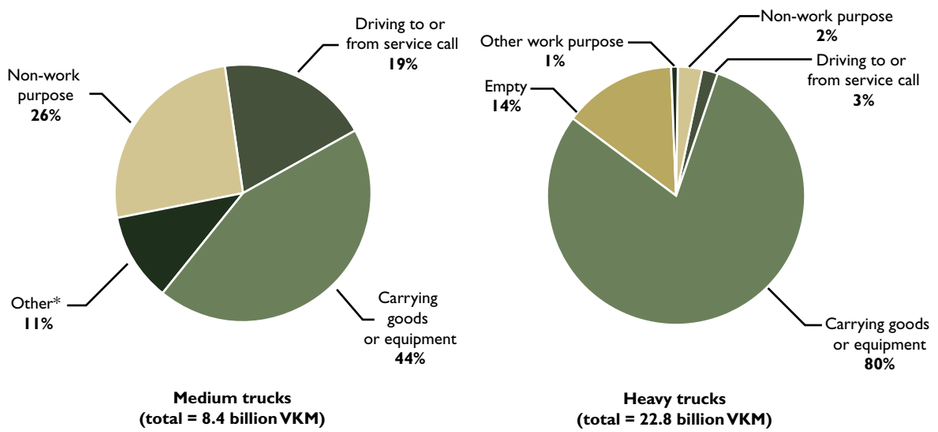
The main purpose for travel by heavy trucks in 2008 was to carry goods or equipment (80 percent), up from 75 percent in 2000. Another 14 percent of distance was travelled by empty vehicles, the same as in 2000. Trucks may travel empty for a variety of reasons, including the inability to find cargo on the way to or from a haul.

4.3 Medium and heavy truck activity

Most truck traffic on Canadian roads is related to one of the following activities:

- for-hire trucking – a company transports goods as its principal activity;
- private trucking – a company transports goods as a secondary activity that is part of the distribution process of its primary output; and
- owner-operators – individuals transport goods either independently or for one of the above-mentioned companies.

Figure 17 – Distance travelled by medium and heavy trucks by trip purpose, 2008



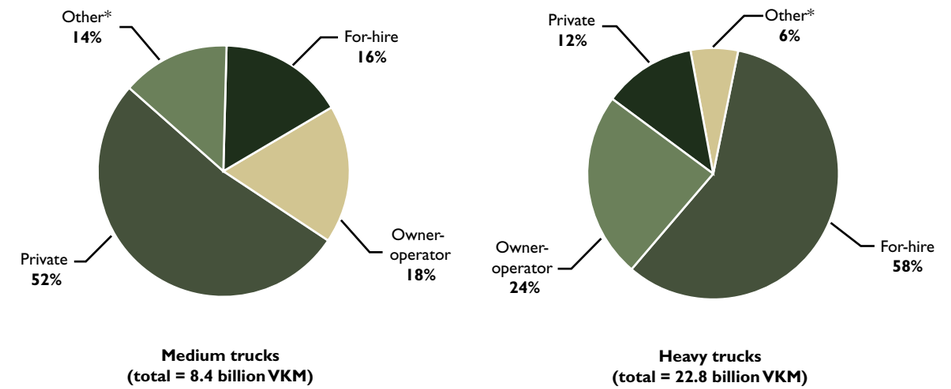
** The "other" category for medium trucks includes "empty" and "other work purpose." These data cannot be disaggregated due to quality.*

Figure 18 shows the distance travelled by medium and heavy trucks according to activity type in 2008. Approximately half of VKM travelled by medium trucks were by private operators, with the other half split about evenly among for-hire truckers, owner-operators and the "other" category. The majority of distance travelled by heavy trucks was by for-hire truckers (58 percent), followed by owner-operators (24 percent) and private truckers (12 percent). The ratios for both medium and heavy trucks have not changed significantly since 2000.

4.4 Age of medium and heavy trucks

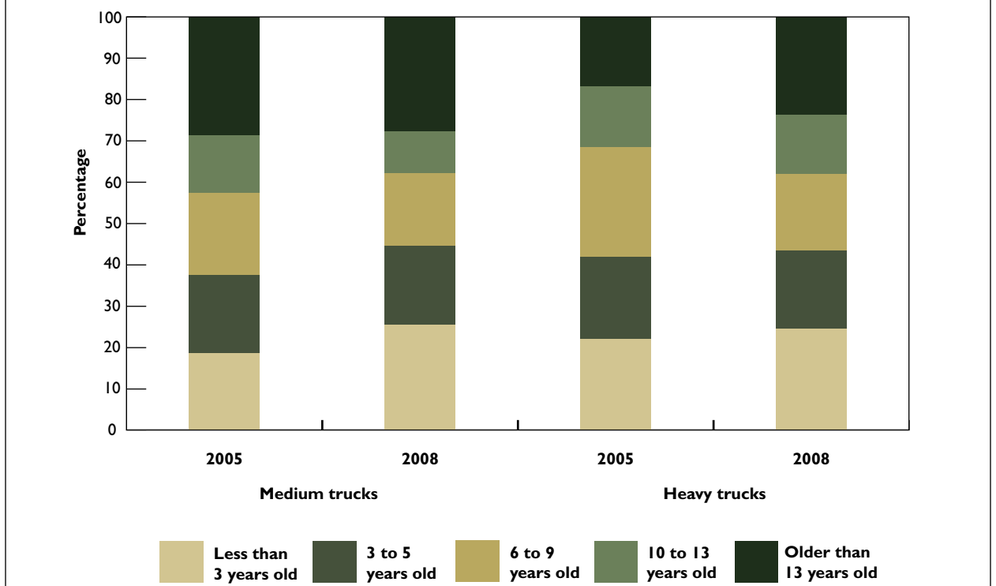
Figure 19 shows the age distribution of medium and heavy trucks in 2005 and 2008. In 2008, the average medium and heavy truck was between eight and nine years old, with medium trucks being slightly older than heavy trucks. One quarter of medium and heavy trucks was less than three years old in 2008, and another quarter was more than 13 years old. Overall, the medium and heavy truck fleet contain a greater proportion of both newer and older vehicles than the light vehicle fleet.

Figure 18 – Distance travelled by medium and heavy trucks by activity type, 2008



** The "other" category is defined by Statistics Canada as when a respondent does not consider his or her operation to be related to for-hire, owner-operator or private activities.*

Figure 19 – Distribution of medium and heavy trucks by vehicle age, 2005 and 2008



ANNEX

Annex A.

Notes about data quality and the interpretation of results

The Canadian Vehicle Survey (CVS) is a quarterly vehicle-based survey. It provides quarterly and annual estimates of the distance travelled by on-road vehicles in Canada and their fuel consumption.[9] In 2008, there were 21 495 vehicles in the sample from the provinces and 12 060 in the sample from the territories. Since participation is voluntary, a certain percentage of these samples included non-respondents. The response rate was about 59 percent for the provinces and 15 percent for the territories.

While considerable effort is exerted to ensure that high standards are maintained throughout all survey operations, the resulting estimates are inevitably subject to a certain degree of error. The total survey error is defined as the difference between the survey estimate and the true value for the population. The total survey error consists of two types of errors: sampling and non-sampling.

Sampling errors occur because the CVS examines only a segment of the population, rather than the entire population. Factors such as sample size, sample design and estimation method affect the sampling error. If the population is heterogeneous, which is the case for the CVS, a large sample size is needed to reduce sampling errors. In addition, the CVS relies on a stratified sample design to divide the population into similar groups, thereby reducing sampling errors by producing estimates for homogeneous groups. These estimates are then aggregated to produce estimates for the entire population. Each estimate in the report is associated with a coefficient of variation (CV), which is the basis for determining an all-encompassing quality indicator. CVs measure the sampling error of the estimates and take into account variability due to non-response and imputation.

CVs are also used to establish confidence intervals (*I*), which express the accuracy of an estimate in concrete terms. The *I* indicates the level of confidence that the true value of a characteristic occurs within certain limits. For example, an *I* of 95 percent, *I(0.95)*, implies that if the sampling were repeated indefinitely, with each sample providing a different *I*, 95 percent of the intervals would contain the true value.[10]

To illustrate how all of these concepts are linked, use an example of a CVS estimate that states on-road vehicles travelled 325.6 billion vehicle-kilometres (VKM) in Canada in 2008. This is an excellent estimate because it has a CV of 0.025 and, therefore, a quality indicator of "A." To determine the *I* of 95 percent attributed to this estimate, the following calculation is performed:[11]

I(0.95) = [325.6 billion × (1 - 1.96 × CV), 325.6 billion × (1 + 1.96 × CV)]

I(0.95) = [325.6 billion × (1 - 1.96 × 0.025), 325.6 billion × (1 + 1.96 × 0.025)]

I(0.95) = [309.6 billion, 341.6 billion]

Based on this *I*, it can be stated with a 95 percent degree of confidence that the distance travelled in Canada in 2008 was between 309.6 billion and 341.6 billion VKM. The smaller the *I*, the greater the chances that the survey estimate is close to the true value. Figure A-1 shows the *I* for the preceding example.

[9] Annex B provides more information on the scope and methodology of the CVS.
[10] Satin, A. and W. Shastry, Statistics Canada, *Survey Sampling: A Non-mathematical Guide*, 2nd edition, Catalogue No. 12-602E, Ottawa, 1993, p. 14.
[11] If a normal distribution is assumed, the *I* of 95 percent corresponds with the estimate plus or minus about two times the standard error. The standard error is equal to the square root of the variance, which corresponds to the product of the estimate and the CV.

Figure A-1 – 95 percent confidence interval for the CVS estimate of VKM travelled in Canada, 2008

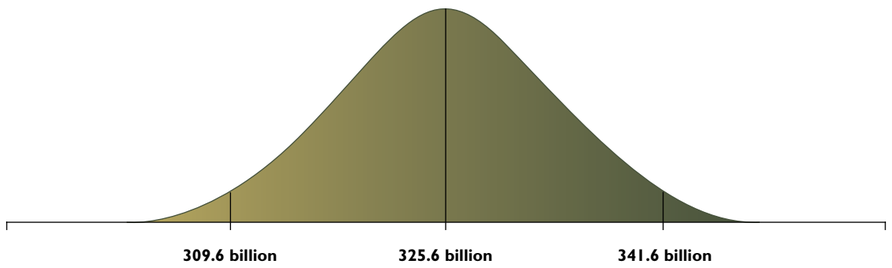


Table A-1 – Range of the confidence intervals attributed to CVS estimates

Quality indicator	Quality of the estimate	Coefficient of variation	Range of the confidence intervals
A	Excellent	Less than 5%	Estimate ± 0% to 9.9%
B	Very good	5% to 9.9%	Estimate ± 10% to 19.9%
C	Good	10% to 14.9%	Estimate ± 20% to 29.9%
D	Acceptable	15% to 19.9%	Estimate ± 30% to 39.9%
E	Use with caution	20% to 34.9%	Estimate ± 40% to 69.9%
F	Too unreliable to be published	35% or more	Estimate ± 70% and over

It is important to remember the confidence interval when analysing survey results. Table A-1 is a reference for readers who want to assess the *I* attributed to an estimate based on the quality indicators in this report.

Non-sampling errors can also contribute to the total survey error. This second type of error can occur at almost any stage of the survey. In particular, errors can arise when a respondent provides incorrect information, does not answer a question or misinterprets a question. Non-sampling errors can also arise when data are being processed. Some of these errors will be cancelled over a large number of observations, but systematically occurring errors will contribute to a bias in the estimates.

For example, if people demonstrating similar characteristics consistently tend not to respond to the survey, a bias may result in the estimates. Some non-sampling errors are difficult to quantify and are not reflected by quality indicators. However, the CVS quality indicators take into account variance due to non-response and imputation and, therefore, account for some of the non-sampling errors. Other measures, such as survey response rate and imputation rate, can also serve as indicators for non-sampling errors.

Annex B.

Scope and methodology of the Canadian Vehicle Survey

This section summarizes the methodology used in the Canadian Vehicle Survey (CVS), conducted by Statistics Canada on behalf of Transport Canada and Natural Resources Canada (NRCan) in 2008. More information is available in the *Canadian Vehicle Survey: Annual 2008*, produced by the Transport Division of Statistics Canada.[12]

General description

The CVS is a voluntary survey of vehicles that is conducted quarterly. The survey design allows for calculation of annual estimates based on the data collected during the four quarters. The survey population consists of all motor vehicles registered in Canada at any time in 2008 that have not been scrapped or salvaged. Buses (since 2004), motorcycles, off-road vehicles (e.g. snowmobiles) and special equipment (e.g. cranes, snowploughs) are excluded from the registration lists used in the sample.

The survey population is derived from the vehicle registration lists sent by the 10 provincial and three territorial governments to Statistics Canada three months before the reference period. This population differs slightly from the population of interest because vehicles that were registered during the quarter or fewer than three months before the quarter began are not included in that quarter's sample (the sample for each quarter is derived from the population of the preceding quarter).

The registration lists received by Statistics Canada undergo a rigorous preparation procedure:

- Out-of-scope vehicles are removed.
- Vehicles with expired registration are removed.
- Records with duplicate vehicle identification numbers within a given list are removed, leaving the record that was updated most recently.
- Records with irregular data are verified.

The most recent set of prepared lists is used to select the sample for each quarter. These sets of vehicle lists and the days within the respective quarter constitute the survey population.

Survey design

The CVS uses a two-stage sample design. A sample of vehicles is selected in the first stage, and a sample of consecutive days within the quarter is selected in the second stage. All vehicles from the survey population are stratified into 78 strata according to vehicle type, jurisdiction and vehicle age. Then a systematic sample of vehicles (first-stage sample) is selected from the survey population to spread the sample over all regions.

In the second stage, a first reporting day within the quarter is randomly assigned to each vehicle that was selected in the first stage. Within each stratum, the first reporting day is spread evenly over the quarter to ensure a uniform number of responses over time and for each day of the week. This step is not applied to the vehicles registered in the three territories because only odometer readings are collected.[13]

The sample consisted of 33 555 vehicles for the four quarters of 2008, with 21 495 vehicles from the provinces and 12 060 from the territories.[14] Table B-1 shows the number of vehicles sampled in the provinces and territories in 2008 by type of vehicle.

[12] Statistics Canada, 2009, *Canadian Vehicle Survey: Annual 2008*, Catalogue No. 53-223-X, www.statcan.ca/bsolc/english/bsolc?catno=53-223-X.
[13] Less information is collected in the territories because respondents there are asked to participate in several surveys a year.
[14] A larger sample in the territories enables Statistics Canada to compensate for a lower response rate in these jurisdictions.

Table B-1 – Vehicles in the sample by jurisdiction and vehicle type

Jurisdiction	Vehicles			Total
	Light vehicles	Medium trucks	Heavy trucks	
Newfoundland and Labrador	877	204	221	1 302
Prince Edward Island	544	179	146	869
Nova Scotia	1 072	264	272	1 608
New Brunswick	1 067	224	270	1 561
Quebec	2 277	466	539	3 282
Ontario	2 554	654	621	3 829
Manitoba	1 112	333	293	1 738
Saskatchewan	1 049	363	401	1 813
Alberta	1 626	536	596	2 758
British Colombia	1 755	340	640	2 735
Total for provinces	*13 933*	*3 563*	*3 999*	*21 495*
Yukon	1 580	784	1 571	3 935
Northwest Territories	3 348	1 041	789	5 178
Nunavut	2 549	160	238	2 947
Total for territories	*7 477*	*1 985*	*2 598*	*12 060*
Total for Canada	**21 410**	**5 548**	**6 597**	**33 555**

Data collection

Data collection for the vehicles sampled is conducted differently in the provinces than in the territories. In the provinces, the registered owners of the sampled vehicles are contacted for a Computer-Assisted Telephone Interview (CATI). During the CATI, the following information is collected about each sampled vehicle:

- vehicle type
- fuel type used
- distance driven the previous week
- anticipated vehicle use during the following six weeks
- current odometer reading
- vehicle maintenance
- household characteristics

Respondents are asked to complete a trip log. If they agree, the trip log is mailed to them. There are two types of logs: one for light vehicles and one for medium and heavy trucks. Respondents receiving a light-vehicle log are requested to record information for 20 consecutive trips made in the selected vehicle, beginning on the assigned first reporting day. Respondents have to record a new trip each time the driver enters the vehicle or a passenger enters or exits the vehicle.[15]

Respondents receiving a heavy-vehicle log (medium and heavy trucks) are requested to record information for all the trips made in the selected vehicle over the assigned seven days. A new trip begins if there is a stop that lasts more than 30 minutes, if the driver changes, if the reason for the trip or the use of the vehicle changes, if the truck configuration is modified or if the truck goes from full to empty or the reverse.

The following information is recorded for each trip:

- start-and-stop dates and times
- start-and-stop odometer readings
- starting point and destination (light vehicles) or trip purpose (heavy vehicles)
- number and age group of passengers (light vehicles) or number of passengers at the start and end of the trip (heavy vehicles)
- gender and age group of the driver
- total cost, per unit cost and amount of fuel purchased
- distance travelled on roads with posted speed limit of 80 kilometres per hour or higher
- truck configuration (heavy vehicles)
- dangerous goods (heavy vehicles)

Since 2004, when NRCan became co-sponsor of the CVS, respondents have been asked to continue recording fuel purchases until they reported two fill-ups or five purchases or until the 28-day reporting period ended.

Less information is collected in the territories. Statistics Canada sends a questionnaire that asks for an odometer reading at the beginning of the quarter and another at the end, so the distance travelled during the quarter can be identified. Information is also collected on the vehicle's ownership status (still owned, sold or scrapped), body style and type of fuel used.

Data edit and imputation

After all the information for the survey has been collected, Statistics Canada conducts a series of computerized and manual verifications to ensure that the records are consistent and that there are no errors as a result of data capture.

Missing values and data found to be in error are imputed by another automated system using different imputation rules depending on the vehicle, available information and type of data to be imputed. For example, data can be imputed based on responses to other questions or by using data from similar vehicles. The imputed data are examined again for completeness and consistency.

Response rate

Statistics Canada defines the CVS response rate as the number of vehicles for which the respondents have provided full or partial answers to the questions concerning vehicle-kilometres only, divided by the number of vehicles in the sample. Table B-2a and Table B-2b show the response rates obtained for each quarter by vehicle type.

[15] This definition has been used as of the first quarter of 2004 and is different from that used in previous versions of the CVS.

Table B-2a – CVS response rate – Provinces

2008 (Quarter)	CVS response rate – Provinces (percent)		
	Light vehicles	Medium trucks	Heavy trucks
Quarter 1	58.2	60.7	62.4
Quarter 2	59.1	60.3	57.9
Quarter 3	58.2	62.3	62.7
Quarter 4	60.9	65.7	66.8
Annual	**59.1**	**62.3**	**62.4**

Table B-2b – CVS response rate – Territories

2008 (Quarter)	CVS response rate – Territories (percent)		
	Light vehicles	Medium trucks	Heavy trucks
Quarter 1	14.6	10.8	12.1
Quarter 2	16.9	11.2	9.7
Quarter 3	15.9	10.9	13.0
Quarter 4	12.9	10.4	9.1
Annual	**15.1**	**10.8**	**10.9**

The response rate for the fuel component of the CVS is lower than the response rates in the preceding tables. Therefore, the data on fuel consumption has a high imputation rate, which helps explain the lower quality of fuel consumption estimates in this report.

Estimates and quality indicators

Estimates are based on the principle that each vehicle in the sample represents a certain number of vehicles in the population of interest. A sample weight is assigned to each vehicle in the sample, and the purpose of the final set of weights is to reflect as closely as possible the characteristics of the vehicle population during the reference period.

All estimates for 2008 presented in this report were produced by using an estimate module developed by Statistics Canada. This module also calculates the coefficient of variation (CV) that reflects the quality of each estimate. The CV takes into account variability due to sampling and variability due to non-response and imputation.

For example, a variance due to relatively high imputation has a negative effect on the quality of fuel consumption estimates. Estimates with a CV of more than 35 percent are not reliable enough to be published. Table A-1 in Annex A describes the indicators used in this report to describe the quality of estimates.

For more information on the methodology used in the CVS, contact the Transport Division, Statistics Canada, at

Transportation Division
Statistics Canada
150 Tunney's Pasture Driveway
Ottawa ON K1A 0T6
Tel.: 1-866-500-8400

E-mail: transportationstatistics@statcan.gc.ca

Annex C.

Data tables of figures from the 2008 Canadian Vehicle Survey

Several figures from the chapters of this report have been converted to the following data tables for statistical purposes. Note that the letter to the right of each estimate indicates its quality: A – Excellent, B – Very good, C – Good, D – Acceptable, E – Use with caution and F – Too unreliable to be published.

Due to rounding, the numbers in the tables may not add up, and some data may differ slightly from one table to the next.

Figure 1 – Age of vehicle fleet by vehicle type, 2008

Vehicle age	Vehicles – 2008		
	Light vehicles	Medium trucks	Heavy trucks
Less than 3 years old	3 757 038 C	105 114 E	80 159 D
3 to 5 years old	4 400 905 B	79 080 E	61 988 E
6 to 9 years old	5 042 142 B	72 013 E	60 745 E
10 to 13 years old	3 187 534 C	- F	46 450 E
More than 13 years old	3 038 885 C	114 474 D	77 763 E

Figure 2 – VKM travelled by vehicle type, 2000 to 2008

Year	VKM, 2000 to 2008 (million)			
	Light vehicles	Medium trucks	Heavy trucks	Total
2000	281 985 A	5 930 A	20 716 A	308 631 A
2001	283 380 A	6 476 A	18 577 A	308 434 A
2002	290 320 A	5 440 A	18 167 A	313 927 A
2003	286 618 A	6 173 A	18 606 A	311 397 A
2004	285 164 A	7 001 B	20 829 A	312 994 A
2005	289 717 A	6 195 B	21 601 A	317 512 A
2006	296 871 A	7 438 B	21 836 A	326 145 A
2007	300 203 A	8 150 B	23 922 A	332 275 A
2008	294 361 A	8 416 B	22 834 A	325 611 A

ANNEX

Figure 3 – Fuel consumption rate by vehicle type and fuel type, 2005 and 2008

Year	Light vehicles	Medium trucks	Heavy trucks
Gasoline consumption rate (L/100 km)			
2005	10.6 B	26.6 C	- F
2008	10.6 B	23.0 C	- F
Diesel consumption rate (L/100 km)			
2005	11.4 D	26.4 A	35.1 A
2008	11.4 E	23.3 A	35.3 A

Figure 4 – Vehicles in Canada by region, 2000 and 2008

Province/territory	Vehicles	
	2000	2008
Newfoundland and Labrador	246 674 A	286 058 B
Prince Edward Island	75 920 A	82 015 C
Nova Scotia	516 296 A	552 505 B
New Brunswick	434 605 A	480 730 B
Quebec	3 856 820 A	4 560 974 A
Ontario	6 435 278 A	7 285 377 A
Manitoba	601 515 A	685 881 B
Saskatchewan	682 228 A	771 651 B
Alberta	2 052 922 A	2 727 151 B
British Columbia	2 269 107 A	2 675 964 B
Yukon	23 410 A	30 087 A
Northwest Territories	19 518 A	24 473 A
Nunavut	2 851 A	3 555 B
Canada	**17 217 143 A**	**20 166 421 A**

Figure 5 – Light vehicles per household by jurisdiction, 2008*

Province/territory	Vehicles per household
Newfoundland and Labrador	1.37
Prince Edward Island	1.40
Nova Scotia	1.38
New Brunswick	1.53
Quebec	1.34
Ontario	1.45
Manitoba	1.42
Saskatchewan	1.79
Alberta	1.87
British Columbia	1.47
Territories	1.51
Canada	**1.48**

* Data quality estimates are not provided because the CVS data were combined with Statistics Canada data on households (*Dwelling Characteristics and Household Equipment for Canada, Provinces/Territories and Selected Metropolitan Areas*, Catalogue No. 62F0041XDB).

ANNEX

Figures 6, 7 and 8 – Average annual distance travelled by light vehicles, medium trucks and heavy trucks by jurisdiction, 2008

Province/territory	Average annual distance travelled (km)		
	Light vehicles	Medium trucks	Heavy trucks
Newfoundland and Labrador	18 052 C	- F	- F
Prince Edward Island	15 288 C	- F	- F
Nova Scotia	16 551 C	- F	59 053 E
New Brunswick	15 221 C	20 633 E	31 063 E
Quebec	14 296 B	25 475 E	91 639 D
Ontario	16 027 B	21 447 D	82 055 C
Manitoba	14 753 C	17 198 E	89 696 E
Saskatchewan	15 810 C	13 220 E	40 999 E
Alberta	15 633 B	21 708 D	61 216 D
British Columbia	13 086 B	19 221 E	33 139 E
Canada	**15 153 A**	**20 386 B**	**69 806 B**

Figures 9, 10 and 11 – Fuel consumption rate of light vehicles, medium trucks and heavy trucks by jurisdiction, 2008

Province	Fuel consumption (L/100 km)		
	Light vehicles (gasoline)	Medium trucks (diesel)	Heavy trucks (diesel)
Newfoundland and Labrador	10.0 E	23.8 C	34.8 B
Prince Edward Island	9.8 E	23.8 D	35.0 C
Nova Scotia	9.9 E	22.6 B	35.2 A
New Brunswick	10.3 E	23.7 C	39.5 B
Quebec	9.8 D	25.7 B	35.2 A
Ontario	10.5 C	23.0 B	35.0 A
Manitoba	11.1 D	23.8 B	33.1 A
Saskatchewan	11.9 E	22.2 B	38.7 A
Alberta	12.1 D	22.6 B	35.4 A
British Columbia	11.0 E	23.3 B	38.2 B
Canada	**10.6 B**	**23.3 A**	**35.3 A**

Figure 12 – Light vehicles by vehicle body type, 2000 and 2008

Body type	Vehicles	
	2000	2008
Car	9 616 617 A	10 362 959 B
Station wagon	421 166 B	623 672 E
Van	2 116 998 A	2 684 401 C
SUV	1 086 770 A	2 295 665 C
Pickup truck	2 579 587 A	3 497 151 C

Figure 13 – PKM travelled in Canada by vehicle body type of light vehicles, 2000 to 2008

Year	PKM travelled, 2000 to 2008 (million)	
	Car and station wagon	Van, SUV, pickup and other light vehicles
2000	282 608 A	192 466 A
2001	258 405 B	202 219 B
2002	264 511 B	206 068 B
2003	270 513 B	192 643 E
2004	243 012 A	228 152 A
2005	259 216 A	237 746 B
2006	251 057 A	240 699 A
2007	231 313 A	255 619 A
2008	251 091 A	225 706 A

Figure 14 – Average distance travelled and light vehicles per household, 2000 to 2008

Year	Average annual distance travelled by light vehicles (km)	Light vehicles per household*
2000	16 944 A	1.43
2001	16 877 A	1.42
2002	16 782 A	1.44
2003	16 334 A	1.44
2004	16 036 A	1.44
2005	15 976 A	1.44
2006	16 015 A	1.45
2007	15 794 A	1.46
2008	15 153 A	1.48

* Data quality estimates are not provided because the CVS data were combined with Statistics Canada data on households (*Dwelling Characteristics and Household Equipment for Canada, Provinces/Territories and Selected Metropolitan Areas*, Catalogue No. 62F0041XDB).

Figure 15 – Light vehicles by vehicle age, 2005 and 2008

Age	Vehicles	
	2005	2008
Less than 3 years old	3 302 281 C	3 757 038 C
3 to 5 years old	4 288 089 B	4 400 905 B
6 to 9 years old	4 656 862 B	5 042 142 B
10 to 13 years old	3 221 021 C	3 187 534 C
More than 13 years old	2 666 485 C	3 038 885 C

Figure 16 – Distance travelled by heavy trucks by configuration, 2008

Configuration	VKM (million)
Straight truck	3 247 C
Tractor only	774 E
Tractor and one trailer	15 991 B
Straight truck and trailer	525 E
Tractor and 2 trailers	1 854 D
Tractor and 3 trailers	- F
Other	221 E

Figure 17 – Distance travelled by medium and heavy trucks by trip purpose, 2008

Trip purpose	VKM (million)	
	Medium trucks	Heavy trucks
Driving to or from a service call	1 606 E	590 E
Carrying goods or equipment	3 613 D	18 257 B
Empty	- F	3 081 C
Other work purpose	- F	- F
Non-work purpose	2 206 D	483 E

Figure 18 – Distance travelled by medium and heavy trucks by activity type, 2008

Activity type	VKM (million)	
	Medium trucks	Heavy trucks
For-hire	1 304 D	13 299 B
Owner-operator	1 525 D	5 402 B
Private	4 343 B	2 649 C
Other	1 197 D	1 269 D

Figure 19 – Distribution of medium and heavy trucks by vehicle age, 2005 and 2008

Year	Vehicles			
	Medium trucks		Heavy trucks	
	2005	2008	2005	2008
Less than 3 years old	61 087 E	105 114 E	65 104 D	80 159 D
3 to 5 years old	61 314 E	79 080 E	58 717 D	61 988 E
6 to 9 years old	64 444 E	72 013 E	78 450 E	60 745 E
10 to 13 years old	45 872 E	- F	43 431 E	46 450 E
More than 13 years old	93 222 E	114 474 D	49 761 E	77 763 E

Annex D.

Glossary

Alternative fuel

Alternative fuels include all fuels other than standard fuels (gasoline and diesel) used in road transportation, such as propane, compressed natural gas and ethanol.

Fuel consumed

In the Canadian Vehicle Survey (CVS), fuel consumed is the fuel used to operate a vehicle. This variable is determined for each vehicle based on declared fuel purchases and distance travelled.

Fuel consumption rate

The fuel consumption rate is the amount of fuel (in litres) used by a vehicle to travel 100 kilometres. This rate is expressed in L/100 km and can be calculated based on actual road conditions or in the laboratory.

Fuel type

The fuel type is based on the information provided by the respondent or from the registration lists. All vehicles are divided into three classes: vehicles powered by gasoline, by diesel and by other energy sources (e.g. natural gas, liquid petroleum gas, propane).

Heavy trucks

In the CVS, the heavy truck category includes all heavy vehicles with a gross vehicle weight of 15 tonnes (t) or more.

In-scope vehicles

In-scope vehicles include all motor vehicles – except buses, motorcycles, off-road vehicles (e.g. snowmobiles, dune buggies, amphibious vehicles) and special equipment (e.g. cranes, street cleaners and backhoes) – registered in Canada during the survey reference period that have not been scrapped or salvaged. For more details, visit www.statcan.ca/bsolc/english/bsolc?catno=53-223-X.

Light trucks

In the CVS, light trucks is a subcategory of light vehicles and includes pickup trucks, vans and sport utility vehicles.

Light vehicles

In the CVS, the light vehicle category includes all vehicles with a gross vehicle weight of less than 4.5 t.

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Glossary

Medium trucks

In the CVS, the medium truck category includes all heavy vehicles with a gross vehicle weight between 4.5 and 15 t.

Number of in-scope vehicles in the CVS

The number of in-scope vehicles is an estimate of the average number of vehicles registered during the quarter based on the registration lists from jurisdictions and survey responses. This estimate may differ slightly from the number of vehicles on the registration lists because it includes all survey findings. The number of in-scope vehicles includes both vehicles used and those not used on the roads during the reference period.

Passenger-kilometre

Passenger-kilometres (PKM) are the sum of the distances travelled by individual passengers, the driver being considered one of the passengers (e.g. total PKM for a specific vehicle would be the sum of the distances travelled by individual passengers in that vehicle). For light vehicles, respondents must report the number of passengers for each trip. For heavy vehicles, the number of passengers is calculated as the average of the number of passengers at the beginning of each trip and the number of passengers at the end of each trip. PKM can also be abbreviated PKT for passenger-kilometres *travelled*.

Straight truck

A straight truck is a complete unit, comprising a power unit and a box that cannot be detached.

Tractor

The tractor is the cab where the driver is located. A road tractor is designed to pull a trailer containing freight. If a truck comes apart, the road tractor is the front end (the engine).

Vehicle-kilometre

A vehicle-kilometre (VKM) is the distance travelled by vehicles on roads (e.g. total VKM for a specific vehicle would be the distance travelled by that vehicle on the road). VKM can also be abbreviated VKT for vehicle-kilometres *travelled*.

Vehicle type

Vehicle type is the weight classification created for the CVS and is based on the information on the vehicle registration lists. The vehicles are divided into three weight types: light vehicles with gross vehicle weights of less than 4.5 t, medium trucks with gross vehicle weights between 4.5 and 15 t and heavy trucks with gross vehicle weights of 15 t or more.