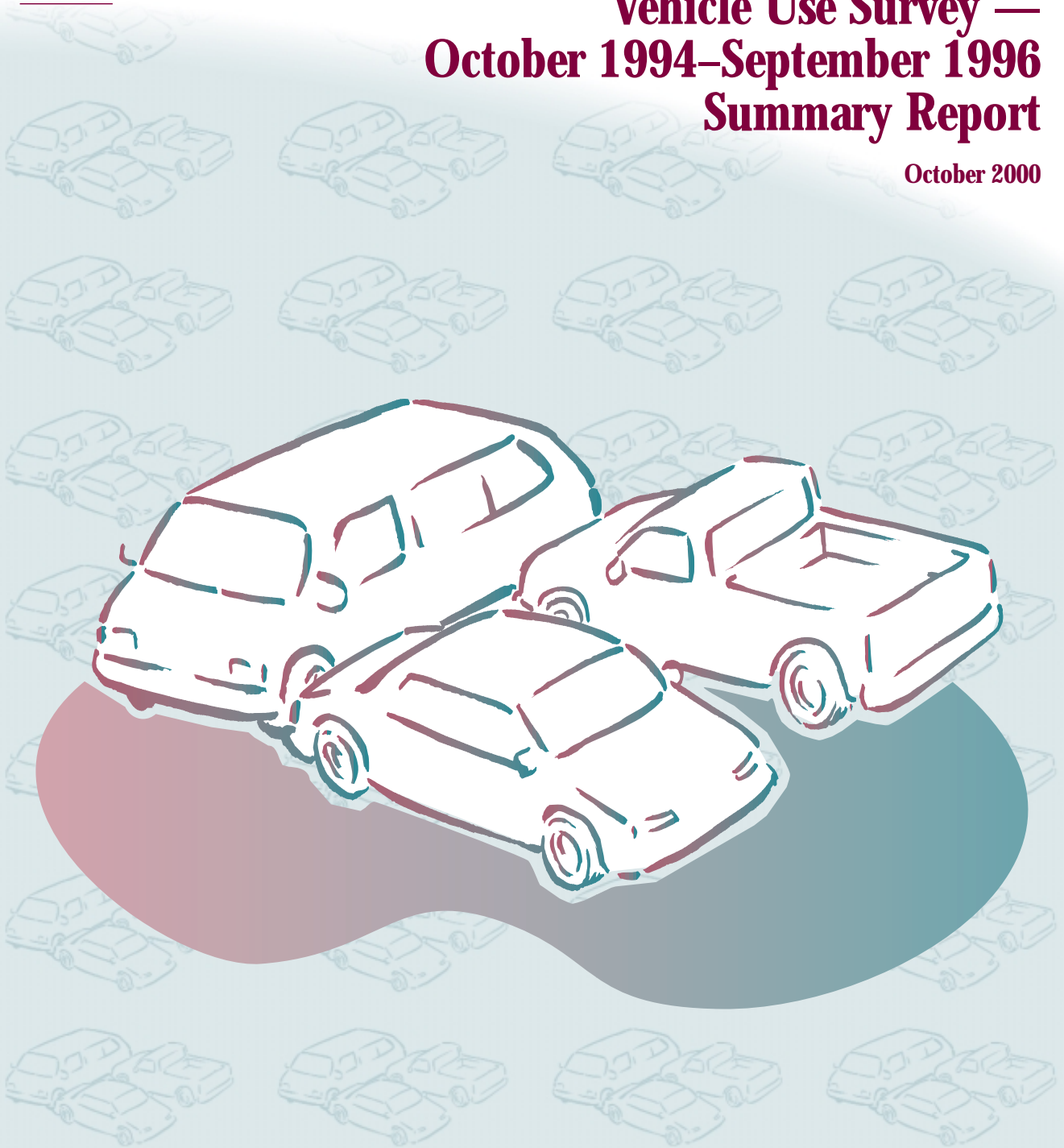




Office of Energy Efficiency
National Energy Use Database

National Private Vehicle Use Survey — October 1994–September 1996 Summary Report

October 2000



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**National Private Vehicle Use Survey –
October 1994 to September 1996
Summary Report**

October 2000

Foreword

This report presents the results of the *National Private Vehicle Use Survey – October 1994 to September 1996* (NaPVUS) in Canada. The purpose of this survey is to provide further data on the transportation sector for the National Energy Use Database (NEUD), an initiative launched by Natural Resources Canada's (NRCan's) Efficiency and Alternative Energy Branch, now known as the Office of Energy Efficiency (OEE).

Statistics Canada conducted NaPVUS on behalf of the OEE and collected monthly data for a period of two years (eight quarters) between October 1994 and September 1996. This summary report, based on the data collected during the entire survey period, is the third in a series. The first, a detailed statistical report based on the data collected during the fourth quarter of 1994, was released in December 1999. The second, similar to the first, is a detailed statistical report based on the data collected during the entire survey period. This third report summarizes the highlights of NaPVUS. For further information, see Appendix A for the list of reports produced by NEUD.

NaPVUS measured factors that affected fuel consumption and the distance driven by members of Canadian households. It also described the characteristics of the motor vehicle fleet used by members of households for personal reasons (with the exception of motorcycles, mopeds, scooters, recreational vehicles, vehicles rented for a short period, vehicles used only for commercial purposes and trucks used solely for camping).

For the first time in Canada, a coherent data set was developed to study household fuel consumption. This was done by grouping data collected from drivers and households to determine driver and household profiles. The data included general patterns of use of private vehicles within the household, patterns of use by drivers for a specific vehicle (chosen at random from the household's vehicles) within the household, and factors that influence vehicle purchase decisions and current vehicle maintenance behaviour.

The objectives of the study were inspired by the paper entitled *Mind the Gap: The Vicious Circle of Measuring Automobile Fuel Use* by Lee Schipper *et al.* (1993). In his paper, a vicious circle was identified in the evaluation of the four basic parameters for the study of vehicle fuel consumption: the number of vehicles, fuel consumption, the distance driven per vehicle and the consumption rate per vehicle. The paper concluded that only a survey that groups the data from the four basic parameters with the characteristics and driving behaviour of vehicle users could permit the coherent study of fuel consumption.

NaPVUS will enable the OEE and other interested parties to monitor and assess trends in fuel consumption and greenhouse gas emissions from the personal use of vehicles by Canadian households. The results of NaPVUS will also help bridge the information gap that has existed since Statistics Canada stopped conducting the *Fuel Consumption Survey* in the late 1980s on behalf of Transport Canada.

Victor Tremblay, of STATPLUS, participated, under the supervision of Linda Yuen, of the OEE, in preparing this report. Stephen Arrowsmith, of Statistics Canada's Special Surveys Division, managed the survey. The following people also contributed to this undertaking: André Bourbeau, Scott Buchanan, Dave Côté, Jesse Coull, Maryse Courchesne, Hugette Demers, Eileen Dumbrell, Michel Francoeur, Suzelle Giroux, Paul Labelle, Jean-Pierre Moisan, Lori Reedman, Peter Reilly-Roe, Pascal Tanguay, Brian Warbanski and Gabrielle Zboril.

The development of NaPVUS was the product of extensive discussions among the OEE, Statistics Canada and the Automobile Mobility Data Compendium at Université Laval. Based on discussions with NRCan outlining the project parameters, Statistics Canada presented design options in the report entitled *Feasibility Study for the National Private Vehicle Use Survey*. The various designs were tested through a pilot study and two series of qualitative studies that made use of focus groups. To obtain further information on the design of NaPVUS and its data, please refer to the document on micro-data for the *National Private Vehicle Use Survey*.

The OEE would like to thank Martin Lee-Gosselin and Sylvie Bonin, managers of the Automobile Mobility Data Compendium, for their valuable advice throughout the development of the survey and the analysis of the results. The Compendium, whose mandate is to provide advice to the OEE on transportation data collection initiatives, is one of the centres supported by NEUD.

To obtain an electronic version of this publication, please consult the OEE's Web site at <http://oee.nrcan.gc.ca>. For further information on NEUD surveys and the subjects addressed in this document or to obtain copies of the reports, please contact the following:

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To obtain a copy of the electronic micro-data file or further information on the data and their use, please contact the following:

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Executive Summary

This report presents the summarized results of the *National Private Vehicle Use Survey – October 1994 to September 1996* (NaPVUS) for Canada. The purpose of this survey is to provide further data on the transportation sector for the National Energy Use Database (NEUD).

Statistics Canada conducted NaPVUS on behalf of Natural Resources Canada's Office of Energy Efficiency (OEE) and collected monthly data for a period of two years between October 1994 and September 1996. The sample comprises households selected from Statistics Canada's *Labour Force Survey* (LFS) sampling frame. Most of the information was obtained by telephone interviews that collected data on the characteristics of all private vehicles used by households. For each household, one vehicle was selected at random in order to obtain more precise information on its usage, the driver's profile and vehicle-maintenance behaviour. With regard to fuel consumption and distance travelled, the respondents were asked to record information in a fuel purchase diary for the selected vehicle for one month. A total of 22 231 households with one or more vehicles participated in the survey and provided information on 35 918 vehicles. Finally, 9 391 diaries with usable information were returned to Statistics Canada for processing.

Between October 1994 and September 1996, there were, on average, 14.2 million private vehicles operated for personal use in Canada. Each vehicle travelled, on average, 4 364 km and consumed 494 litres of fuel per quarter and its fuel consumption ratio was estimated at 11.3 litres per 100 km. The result is that, on average, private vehicles in Canada travelled 247.6 billion kilometres and consumed 28 billion litres of fuel annually.

Among the 11.3 million households in Canada, 88 percent had at least one licensed driver, and 81 percent used at least one vehicle for personal reasons. On average, there were 1.3 vehicles per Canadian household. On a quarterly basis, households with at least one private vehicle travelled 6 734 km and consumed 763 litres of fuel. On an annual basis, these figures are 26 936 km travelled and 3 052 litres of fuel consumed per household.

Of the randomly selected household vehicles, 19 vehicles out of 20 were used all year round, and seven vehicles out of 10 were used every day of the week. Half of them were driven by only one person. One vehicle out of five was used occasionally for business purposes (excluding commuting to and from work).

Nearly three quarters of all light vehicles were passenger cars as opposed to light trucks and vans. Almost half of the vehicles (47 percent) were equipped with three- or four-cylinder engines and more than half had front-wheel drive (59 percent). In general, three vehicles out of four (76 percent) were equipped with automatic transmissions. Slightly more than half (55 percent) had air conditioning.

Private vehicles were seven years old on average; at the time of the survey, one third of them were older than 1987 models. For the vehicle stock, at the time of the survey, nearly half (46 percent) of these vehicles had been purchased as new by their owners. Of the factors that influenced the decision to purchase a vehicle, whether new or used, fuel efficiency ranked fourth after price (the most important factor) the design or performance, and the reputation. Fuel efficiency was ranked more important than safety.

During the six months preceding the interview, 92 percent of vehicle owners had changed the oil of the selected vehicle at least once and 41 percent had this done twice or more. A full tune-up had been carried out on three out of four (75 percent) vehicles during the previous 12 months. Most tune-ups were performed at a dealership (34 percent of the time) or at a certified service station (45 percent of the time). Others were done by the owner of the vehicle, a parent or a friend. Three out of five vehicles (57 percent) had the air pressure in their tires checked during the previous month.

Although light trucks and vans travelled, on average, approximately the same distance per quarter as passenger cars, they tended to consume 40 percent more fuel. The fuel consumption ratios were 14.1 L/100 km for light trucks and vans and 10.2 L/100 km for passenger cars.

Older models were found to have a higher fuel consumption ratio, but on average, they tended to be driven less. Generally, each additional year of vehicle age means an increase in the fuel consumption ratio of 0.3 L/100 km, a reduction of 936 km driven per year (234 km per quarter) and a corresponding reduction of 62 litres of fuel per year (15.5 litres of fuel per quarter). Factors such as vehicle usage pattern and vehicle design contributed to this result.

Household composition had a clear impact on the private vehicle uses. For example, nearly half of the persons living alone (45 percent) did not have a private vehicle.

Household income played an important role in the possession and usage of private vehicles. Half of the households (46 percent) earning less than \$20 000 per annum owned a private vehicle. On average, the low-income households owned 0.6 vehicles, travelled 2 313 km and consumed 262 litres of fuel per quarter. In contrast, households earning more than \$60 000 annually owned 1.9 vehicles, travelled 8 752 km and consumed 960 litres of fuel per quarter.

Analysis by province shows that the average fuel consumption per vehicle, the average kilometres driven per vehicle and the fuel consumption ratio in Quebec, Ontario and Newfoundland are very close to the national average. The number of kilometres driven per vehicle is the highest in Nova Scotia (5 011 km or 15 percent above the national average of 4 364 km) and in New Brunswick (4 705 km). However, in these provinces, the fuel consumption ratio is the lowest among all provinces. The reverse situation is observed in the western provinces where the average number of kilometres driven per vehicle tends to be lower than the national average while the fuel consumption ratio is higher. These compensating factors result in a moderate variation in the average fuel consumption per vehicle among provinces, the highest estimates being in Saskatchewan (532 litres per quarter) and in Nova Scotia (528 litres).

Total fuel consumption was strongly affected by seasonal fluctuations in the average number of kilometres travelled. For example, in winter, the average distance travelled per vehicle (3 744 km) was 14 percent below the annual average but, in summer, it climbed to 22 percent (5 312 km) above it. The fuel consumption ratio was also slightly affected by the season, being ten percent lower in summer than in winter.

Trends were established from the *Fuel Consumption Survey (FCS)* of 1979 to 1988 and *NaPVUS* 1994 to 1996. The total fuel consumption of private vehicles increased, on average, 1.3 percent per year in Canada. This was the net result of an annual average increase of 3.5 percent in the vehicle fleet, an annual average decrease of 0.6 percent in the distance

travelled per vehicle and an annual average decrease of 1.4 percent in the fuel consumption ratio.

NaPVUS provides on-road fuel consumption information that is based on a sample of vehicles. To provide some context and perspective, NaPVUS on-road fuel consumption ratios were compared to the combined city/highway laboratory-tested results (assumes 55 percent driving in the city and 45 percent driving on the highway) obtained from the vehicle manufacturers. When the comparisons were made for the same set of vehicles, the analysis found that the on-road estimates of fuel consumption were 28 percent higher for light trucks and vans, 23 percent higher for passenger cars and 25 percent higher for the overall light duty vehicles than the results produced under laboratory conditions for the same vehicles.

The laboratory-tested fuel consumption results are submitted by the vehicle manufacturers to the government of Canada. These data, obtained under the Joint Government-Industry Voluntary Fuel Consumption Program, are used to produce the fuel consumption labels for new vehicles and to produce the government's Fuel Consumption Guide (FCG). The data are also used to verify that vehicle manufacturers meet the Company Average Fuel Consumption goals.

The laboratory-tested data are different from the figures provided in the FCG. The laboratory tests are based on a federal testing procedure that ensures all vehicles are tested under identical conditions. They do not reflect the real on-road driving conditions. Therefore, the fuel consumption ratios obtained from the laboratory-tested results are adjusted upward for the FCG to reflect more realistic on-road driving conditions. These adjustment factors add 11.1 percent to the laboratory-tested city fuel consumption ratio (in litres per 100 km), 17.6 percent to the laboratory-tested highway fuel consumption ratio, and 14.1 percent to the city/highway combined fuel consumption ratio. These adjustment factors are currently under review to ensure that the fuel consumption ratios presented in the FCG reflect average Canadian on-road driving conditions.

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Introduction

From October 1994 to September 1996, Natural Resources Canada (NRCan) sponsored the *National Private Vehicle Use Survey* (NaPVUS) in Canada. The main purpose of the survey was to collect information on kilometres driven and on-road fuel use of private vehicles at the household level in all ten provinces.

This report contains the summarized results of all data collected from the households during the survey period on the personal use of light vehicles (passenger cars, minivans, pickup trucks, vans and other types of light trucks such as utility vehicles) in Canada.

The survey sought to determine the following:

- the number of vehicles used for personal reasons;
- distances travelled by these vehicles;
- fuel consumption;
- vehicle fleet characteristics;
- household vehicle use;
- vehicle maintenance behaviour;
- driver profile;
- the key factors affecting the decision to purchase a vehicle;
- on-road fuel consumption ratio; and
- comparison of on-road versus laboratory-tested fuel consumption ratios.

NaPVUS' universe comprises households excluded from the sample rotation within the scope of Statistics Canada's *Labour Force Survey* (LFS). Most of the information was obtained by telephone. If they agreed, the respondents were asked to record information on fuel consumption and distance travelled in a fuel purchase diary for one month.

1 Methodology

Sampling

For each month from October 1994 to September 1996, NaPVUS' sample was taken from the rotated-out households from the previous cycle of Statistics Canada's LFS sample. The sample was not proportional to the population of each province, but a sufficient sample size was chosen to ensure that relatively precise estimates could be made for each province.

During this 24-month period, a total of 39 287 households were selected to participate in NaPVUS. Among these, 25 572 accepted the telephone interview, for a response rate of 65 percent. Among these participating households, 3 341 (13 percent) declared that they did not own any private vehicles. In the remaining 22 231 households, we enumerated a total of 35 918 vehicles, for which information on the uses and characteristics was collected. In each of the 22 231 households with private vehicles, one vehicle was randomly selected and specific questions were addressed: number and characteristics of the drivers, the usage of this specific vehicle and the maintenance habits. Drivers of these selected vehicles were then asked to fill out a fuel purchase diary for a period of one month and to return it to Statistics Canada. A total of 9 391 (42 percent) diaries with usable information were returned. Among these, 898 vehicles (ten percent) were declared as not having been used during the one-month diary period; these were considered as nil distance travelled and nil fuel consumption. Among the remaining 8 493 vehicles, 7 178 cases had at least two fill-ups recorded in the diaries, allowing the estimation of the fuel consumption rate. For the 1 315 remaining usable cases, the availability of at least two fuel purchases made it possible to derive, through statistical modelling, an estimate of their fuel consumption rate. The final sample does not contain any vehicles with only one fuel purchase; these cases were discarded due to the lack of distance and fuel consumption estimation.

Given the large sample size, the majority of the estimates presented in this report have a small sampling error.

Survey Methods

Data collection consisted of a two-step process. First, a computer-assisted telephone interview was conducted. If the respondents agreed, one of the household vehicles was randomly selected and the respondents were sent a fuel purchase diary and asked to record information on this selected vehicle for a period of one month. The completed fuel purchase diary was returned to Statistics Canada in a prepaid envelope.

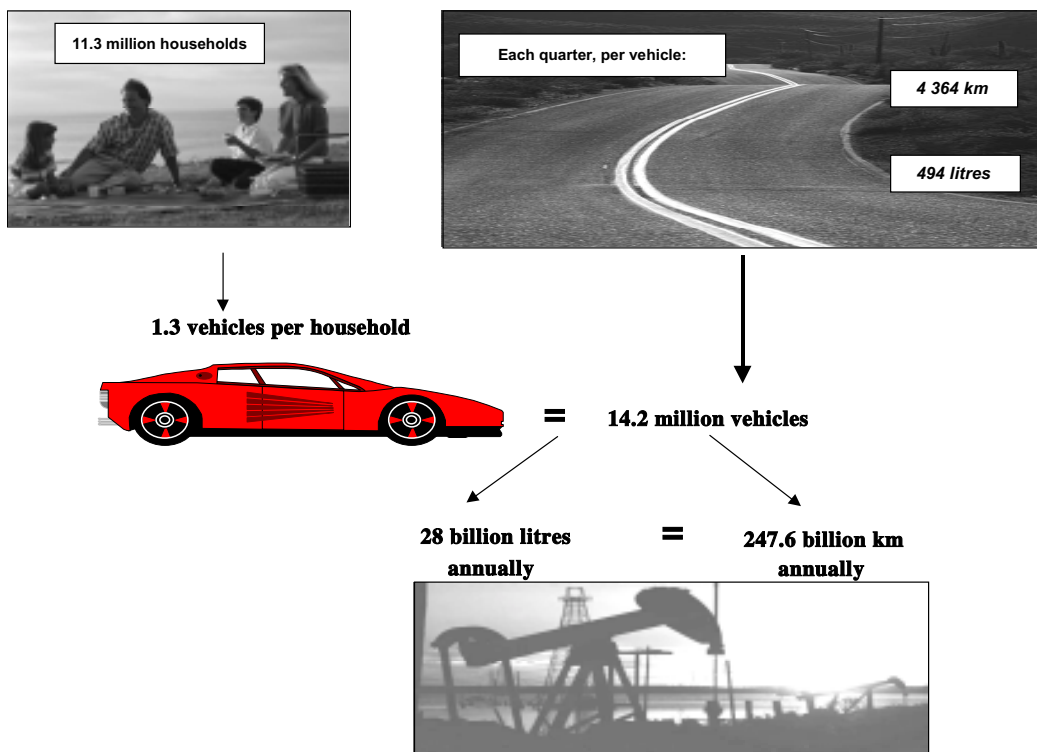
All of the returned diaries were manually checked. Diaries were rejected if respondents recorded only one fuel purchase or if the respondent had switched the chosen vehicle for another. To accurately calculate the fuel consumption rate, at least two fill-ups had to have been made during the month. An imputation of this rate was made for vehicles for which two fuel purchases were made that were not fill-ups.

Details of the methodology and survey instruments are presented in the *National Private Vehicle Use Survey – October 1994 to September 1996 – Detailed Statistical Report*, Catalogue No. M92-191/2000E.

2 Overview

In the period from October 1994 to September 1996, there were approximately 14.2 million light vehicles being operated for personal use in Canada. Annually, these vehicles travelled 247.6 billion kilometres and consumed 28 billion litres of fuel. The average fuel consumption ratio per vehicle was about 11.3 litres per 100 km travelled.

The average distance travelled per quarter per vehicle between October 1994 and September 1996 was 4 364 km and the average fuel consumption was 494 litres. The ten percent of vehicles not used during the given survey period were included in the calculation of these averages.



During the survey period, 88 percent of the 11.3 million Canadian households had at least one licensed driver, and 81 percent of households used at least one vehicle for personal reasons. On average, there were 1.3 vehicles per Canadian household. This average would be 1.5 if households without private vehicles are excluded from the calculation.

On a quarterly basis, households with at least one private vehicle travelled 6 734 km during the survey period and consumed 763 litres of fuel. On an annual basis, these figures are 26 936 km per household and 3 052 litres of fuel.

Other analyses in this report present the following averages for the period between October 1994 and September 1996.

Characteristics of the Private Vehicles

- ◆ Nearly one out of five private vehicles (18 percent) was a 1993 model or newer (less than three years old during the survey period). However, one third of the private vehicles (33 percent) were older than 1987 models (more than nine years old during the survey period).
- ◆ Most of the private vehicles (73 percent) were passenger cars. The rest were classified in the light trucks and vans category and comprised pickup trucks (14 percent), minivans (eight percent), utility vehicles or other pickup trucks (five percent) and vans (two percent).
- ◆ Almost half of the private vehicles (47 percent) were equipped with three- or four-cylinder engines and more than half had front-wheel drive (59 percent).
- ◆ There were some four-wheel drive vehicles (11 percent) and a few with turbochargers (five percent).
- ◆ Three out of four private vehicles (76 percent) were equipped with automatic transmissions; slightly more than half (55 percent) had air conditioning.

Vehicle Ownership and Purchase

- ◆ Private vehicles were usually owned by a member of the household (96 percent). A very small portion of the vehicles were leased on a long-term basis (three percent) or supplied by the employer of a household member (one percent).
- ◆ One third of the private vehicles had been purchased during the 24 months preceding the survey (31 percent); however, more than one third (35 percent) had been purchased more than five years earlier.
- ◆ At the time of the survey, nearly half (46 percent) of the private vehicles in Canada were purchased as new by their owners.
- ◆ Of the factors that influenced the decision to purchase a private vehicle, price was the most important for 39 percent of users, followed by design or performance (26 percent), reputation (16 percent), fuel efficiency (10 percent) and safety (six percent). Even when we looked at the factors ranked second in importance, the order remained the same, and fuel efficiency still came in fourth.

Vehicle Usage

- ◆ Nineteen out of 20 private vehicles (95 percent) were used throughout the year. Seven out of ten vehicles (70 percent) were used every day of the week.

- ◆ During the month preceding the interview, a large proportion of the vehicles had been used for shopping (89 percent), making personal or family visits (82 percent) or attending social activities (77 percent). Three out of five private vehicles (62 percent) were used to commute to and from work.
- ◆ During the reference period, 49 percent of the private vehicles were driven by single drivers and 44 percent of the vehicles were driven by multiple drivers, often with one principal driver.

Vehicle Maintenance

- ◆ During the six months preceding the interview, 92 percent of vehicle owners had changed the oil at least once. A small portion (nine percent) of the vehicle owners had changed the oil three times or more.
- ◆ A full tune-up had been performed on three out of four private vehicles (75 percent) during the previous 12 months, and one out of three vehicles (31 percent) had this done at least every six months.
- ◆ Most tune-ups were performed at a dealership (34 percent) or at a certified service station (45 percent). One out of five tune-ups (21 percent) was done by the owner of the vehicle, a parent or a friend.
- ◆ The tire air pressure had been checked in three out of five vehicles (57 percent) during the previous month.

Fuel Purchase

- ◆ On average, private vehicles in Canadian households travelled 342 km between fuel purchases. The average amount of fuel purchased each time was 39.6 litres. More than two-thirds (69 percent) of the fuel purchased for the vehicles was regular unleaded gasoline, the rest was premium (12 percent), mid-grade gasoline (six percent) or other (four percent) types of fuel. Ten percent of the vehicles were not used during the diary period.

Trend Analysis

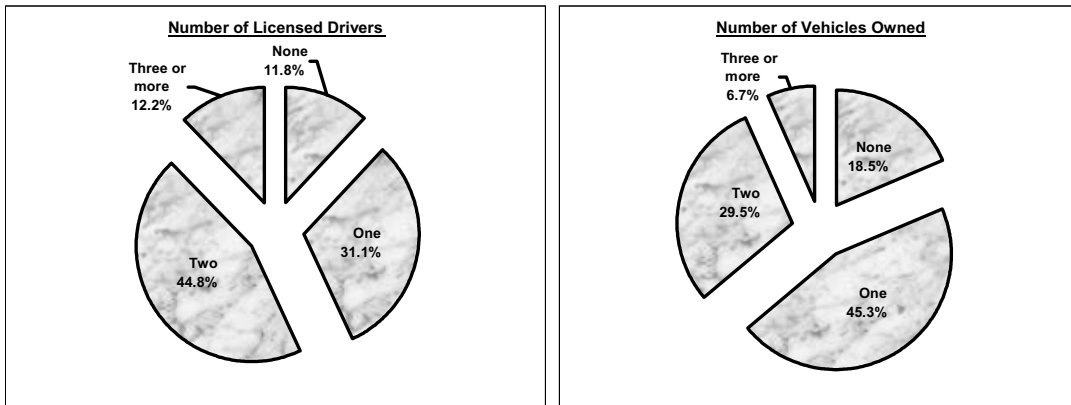
- ◆ The analysis of the average distance travelled per vehicle, by model year, showed a reduction in annual distance travelled as the vehicles become older. Each year of age added to a vehicle meant a reduction of 936 km driven per year, a corresponding reduction of 62 litres of fuel and an increase in the fuel consumption ratio of 0.3 litre of fuel per 100 km driven.
- ◆ The seasonal effects had significant influence on the average kilometres driven and the resultant total fuel consumption by all private vehicles. For example, for the first quarter of the year, winter, the average number of kilometres driven was 14.2 percent lower than the annual average while, for the third quarter, summer, it was 21.7 percent higher than the annual average.

- ◆ Comparing data from the *Fuel Consumption Survey (FCS)* (a vehicle use survey sponsored by Transport Canada and conducted by Statistics Canada from 1979 to 1988) to NaPVUS, it was observed that the total fuel consumption of private vehicles in Canada has increased an average of 1.3 percent per year since 1988. This was the net result of an annual average increase of 3.5 percent in the vehicle fleet, an annual average decrease of 0.6 percent in the distance travelled by the vehicles and an annual average decrease of 1.4 percent in the fuel consumption ratio.
- ◆ When comparing the on-road (NaPVUS) fuel consumption ratios to those based on the unadjusted laboratory conditions for the same set of vehicles, the analysis found that the on-road estimates of fuel consumption were 28 percent higher for light trucks and vans, 23 percent higher for passenger cars and 25 percent higher for the overall light duty vehicles than the results produced under laboratory conditions for the same vehicles. These data confirm the results of analyses performed ten years ago based on the FCS.

3 Private Vehicles in Canadian Households

In the period from October 1994 to September 1996, 88 percent of the 11.3 million Canadian households had at least one person with a driver's licence and 81 percent of the households used at least one vehicle for personal reasons. The total fleet was estimated at 14.2 million private vehicles for an average of 1.3 vehicles per household, including the households that did not own a vehicle (18.5 percent).

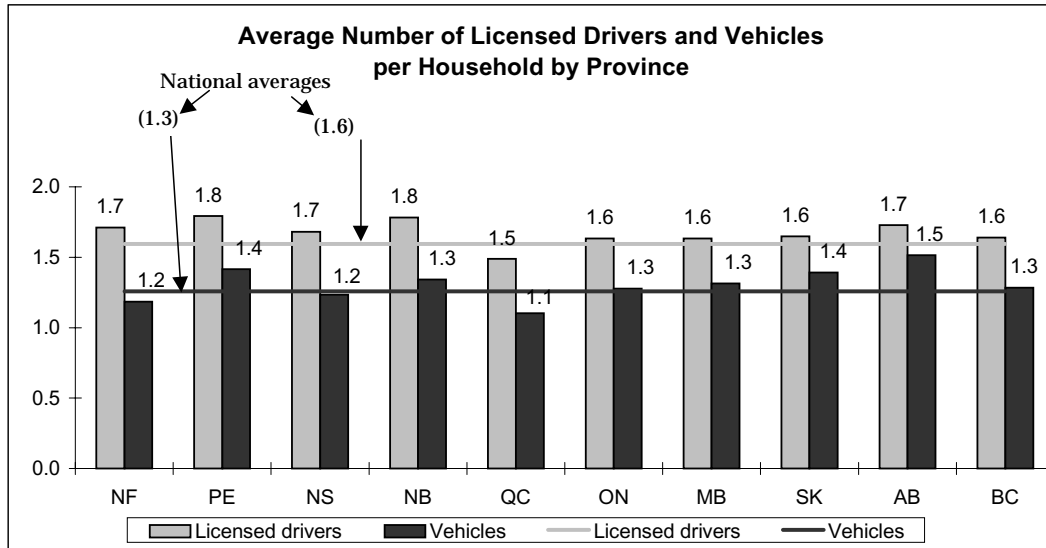
Figure 3 Distribution of Households by Number of Licensed Drivers and by Number of Vehicles Owned



Vehicle Ownership by Household Profile

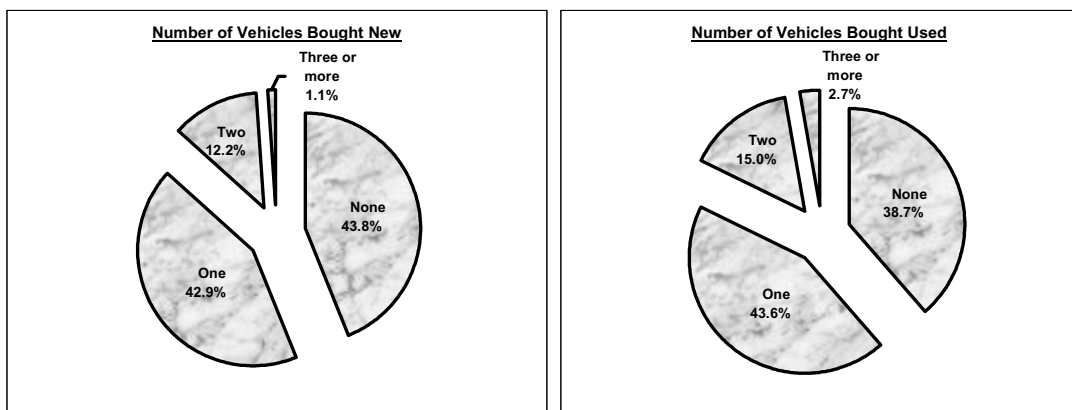
The average number of vehicles per household was the highest in Alberta (1.5) and Saskatchewan (1.4). In the province of Quebec, approximately one quarter of households did not own a private vehicle, resulting in a provincial average of 1.1 vehicles per household. Households in rural areas across the country tended to own more vehicles per household (1.5) than those in the three largest metropolitan areas – Montréal, Toronto and Vancouver (1.1).

Figure 3.1.1



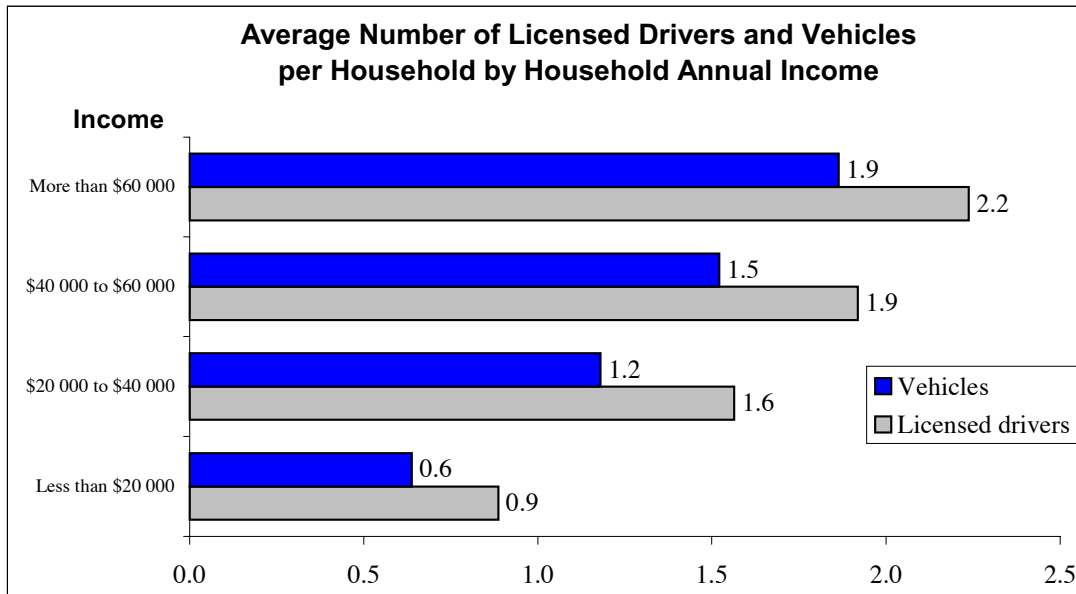
More than half (56 percent) of Canadian households that owned vehicles had purchased at least one new vehicle. The percentage was highest in Quebec (60 percent) and lowest in the Prairie Provinces (53 percent) where households were most likely to purchase at least one used vehicle (67 percent).

Figure 3.1.2 Distribution of Households by Number of Vehicle Bought New or Used



Household composition greatly affected vehicle ownership. Only slightly more than half (55 percent) of the single-member households owned a private vehicle compared to 90 percent of the multiple-member households owning private vehicles. Household income also had a great influence on owning private vehicles: the average number of vehicles per household varied from 0.6 for low-income households with an annual income less than \$20 000 to 1.9 for more affluent households with an annual income greater than \$60 000. Nearly all households (98 percent) in this high-income category owned at least one vehicle and three out of four had bought at least one new vehicle.

Figure 3.1.3

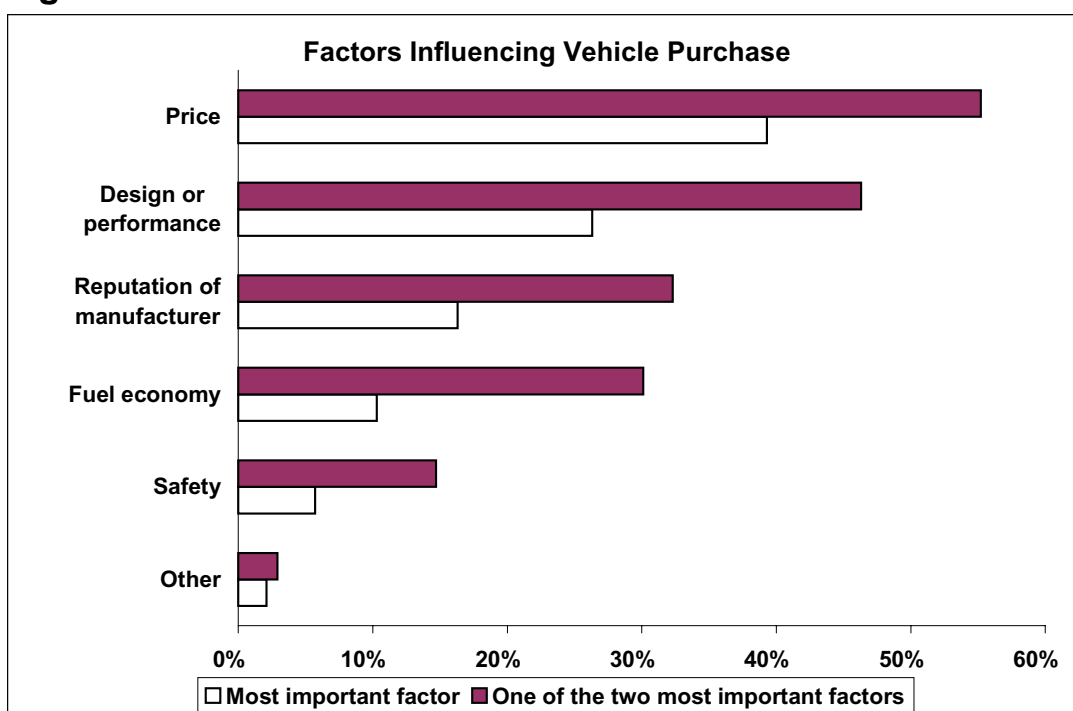


Factors Affecting Vehicle Purchase Behaviour

At the time of the survey, the existing vehicle ownership showed that about half (46 percent) of the private vehicles in Canada were purchased as new. This percentage was the highest in Quebec (52 percent) and the lowest in the Prairie Provinces (40 percent).

Whether a vehicle was bought new or used, price was identified as the most influential factor in purchasing a vehicle (39 percent). The other factors of influence are design or performance (26 percent), the reputation of the manufacturer (16 percent), fuel economy (10 percent) and safety (6 percent). When survey respondents were asked to identify the top two factors that influenced their purchase decision, the order remained the same, with fuel economy ranking fourth.

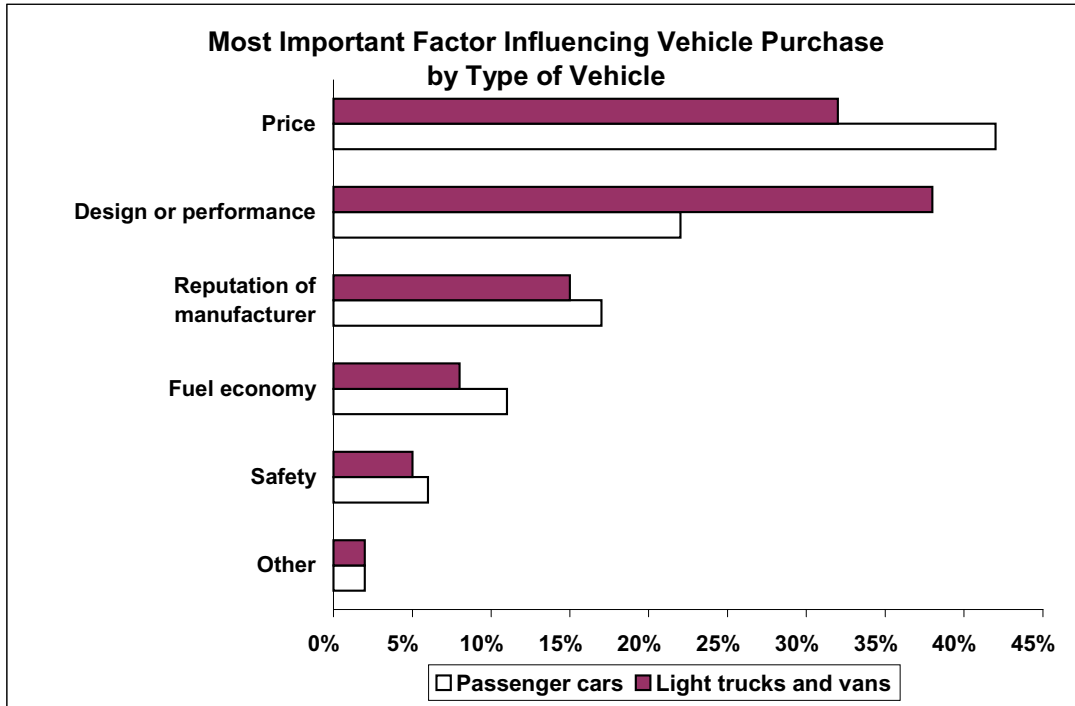
Figure 3.2.1



Further analysis of the data showed that fuel economy ranked no better than fourth regardless of the household profile, except for income. Among the households with an annual income lower than \$20 000, 15 percent considered fuel economy as the most important factor in their choice of vehicle. When survey respondents were asked to identify the top two factors that influenced their purchase decision, 36 percent from this low-income group chose fuel economy, preceded by price (53 percent) and design or performance (39 percent) as one of the top two factors. Respondents with more than \$20 000 annual household income were less likely to consider fuel economy as one of the top two factors in influencing their vehicle purchase decision.

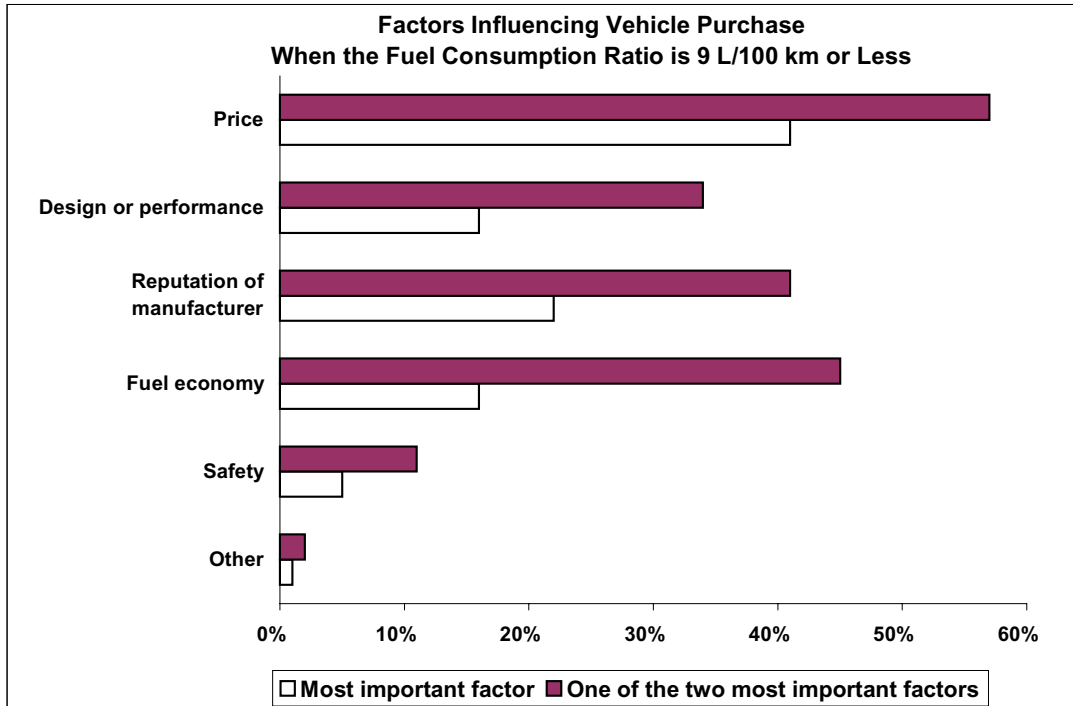
Design and performance ranked as the most important factor (38 percent) that influenced the purchase of a light truck or van. In these cases, price ranked second with 32 percent. This clearly contrasts with the priority given when purchasing a passenger car, where price (42 percent) dominated design and performance (22 percent).

Figure 3.2.2



When the analyses examined the vehicles by their fuel consumption rates using 9 L/100 km as the separator, the survey results showed that among owners of vehicles with fuel consumption rates below 9 L/100 km, fuel economy (16 percent) was considered the most important factor. Of these owners, 45 percent considered fuel economy as one of the top two most important factors affecting their decision in selecting the vehicle.

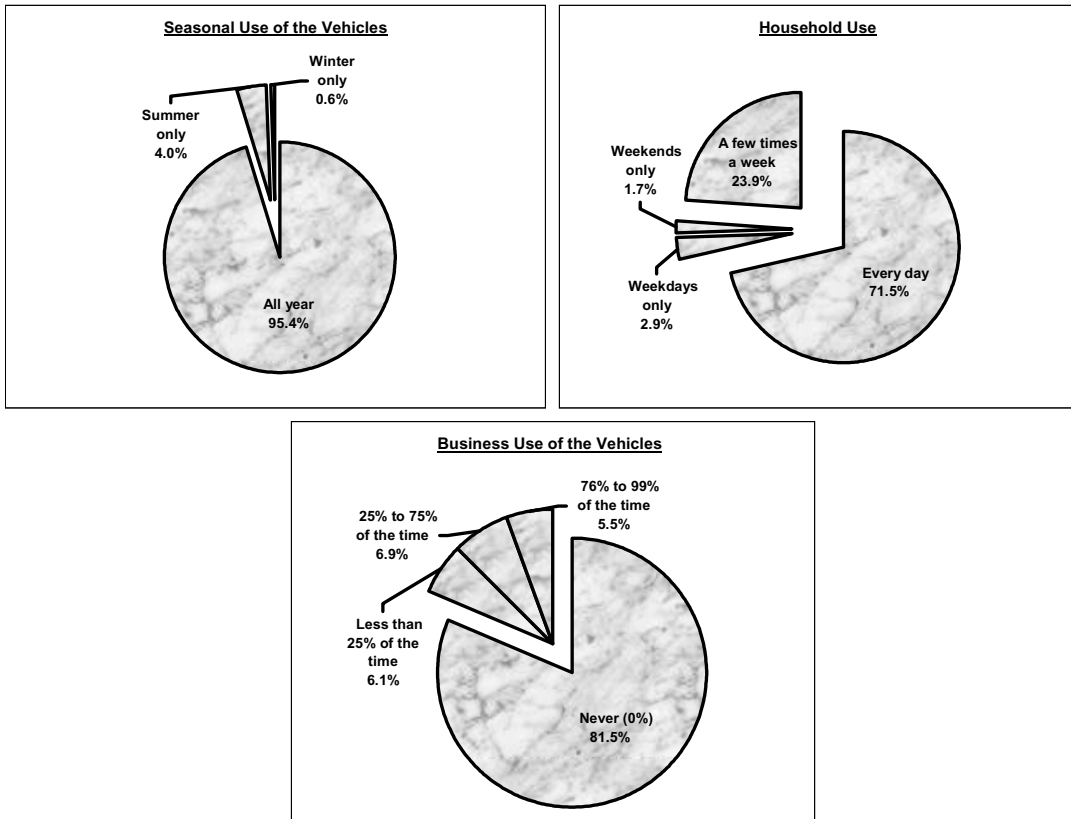
Figure 3.2.3



Reasons for Usage of Private Vehicles

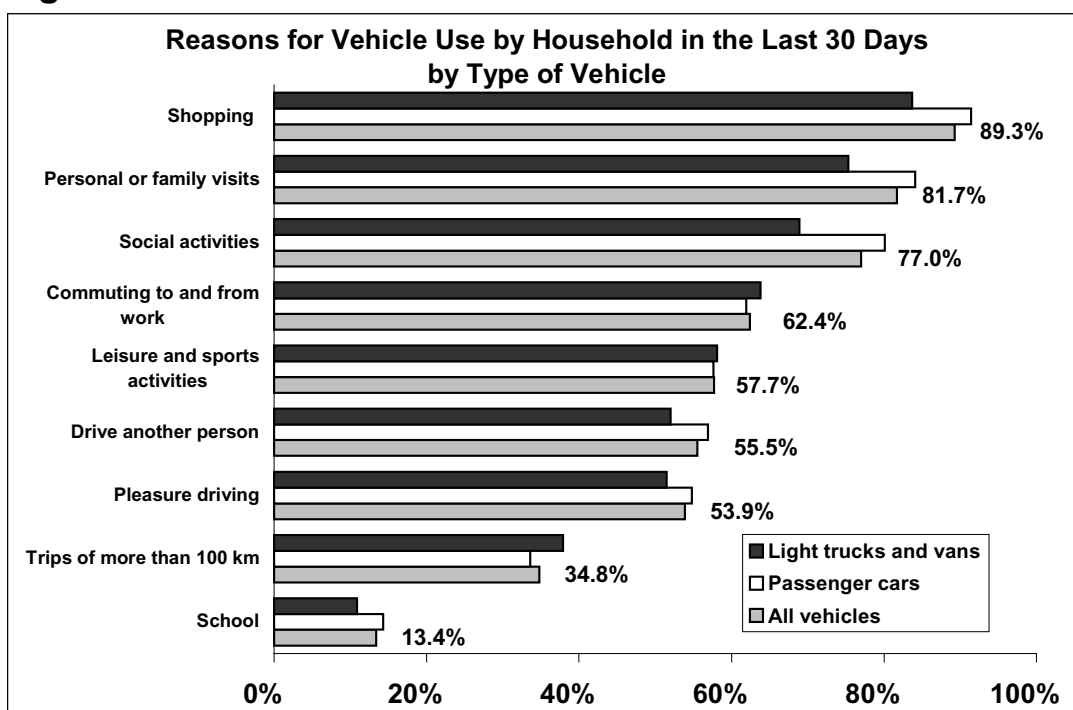
Nineteen out of 20 private vehicles were used year-round and seven vehicles out of ten were used every day of the week. This last proportion was found to be slightly higher in the Atlantic Provinces (74 percent) than in the Prairie Provinces (65 percent). Four vehicles out of five were never used for business, except for commuting to and from work. This proportion falls to three vehicles out of four in rural areas or when the vehicle is a recent model or a light truck or van.

Figure 3.3.1 Distribution of the Vehicles According to Household Use



When asked to identify the uses of a particular vehicle by the household members, the most frequent reasons provided were shopping, personal and family visits, and social activities. Commuting to and from work was mentioned in nearly two thirds of the cases, slightly more than for leisure and sports activities and driving another person. The different types of vehicles were generally used for the same purposes, although light trucks and vans were used relatively less often than passenger cars for shopping, personal and family visits and social activities.

Figure 3.3.2

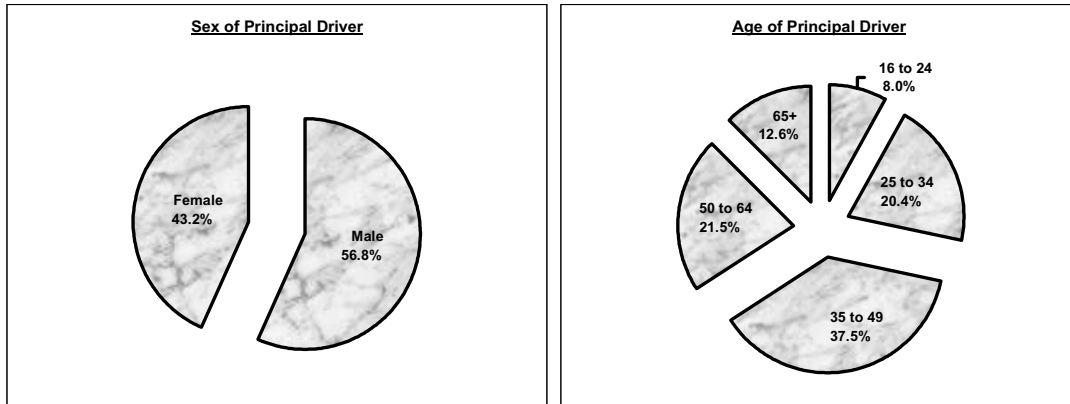


Other analyses showed that the three major activities (shopping, personal or family visits and social activities) were conducted more frequently when the principal driver was a woman. The age of the principal driver of the vehicle also clearly influenced the reasons for its use; for example, as might be expected, senior drivers were less likely to use the vehicle to go to work or to school.

Driver Profile

During the survey period, half of the vehicles were driven by single drivers. When multiple drivers shared a vehicle, it usually had a principal driver, defined as the person who drove the vehicle more often than anyone else in the household. As a consequence, 94 percent of the vehicles, including single-driver vehicles, had a principal driver, who was most often a male. Three out of five principal drivers were in the 35- to 64-year-old category. There were no significant differences in driver profile by region, province or type of area.

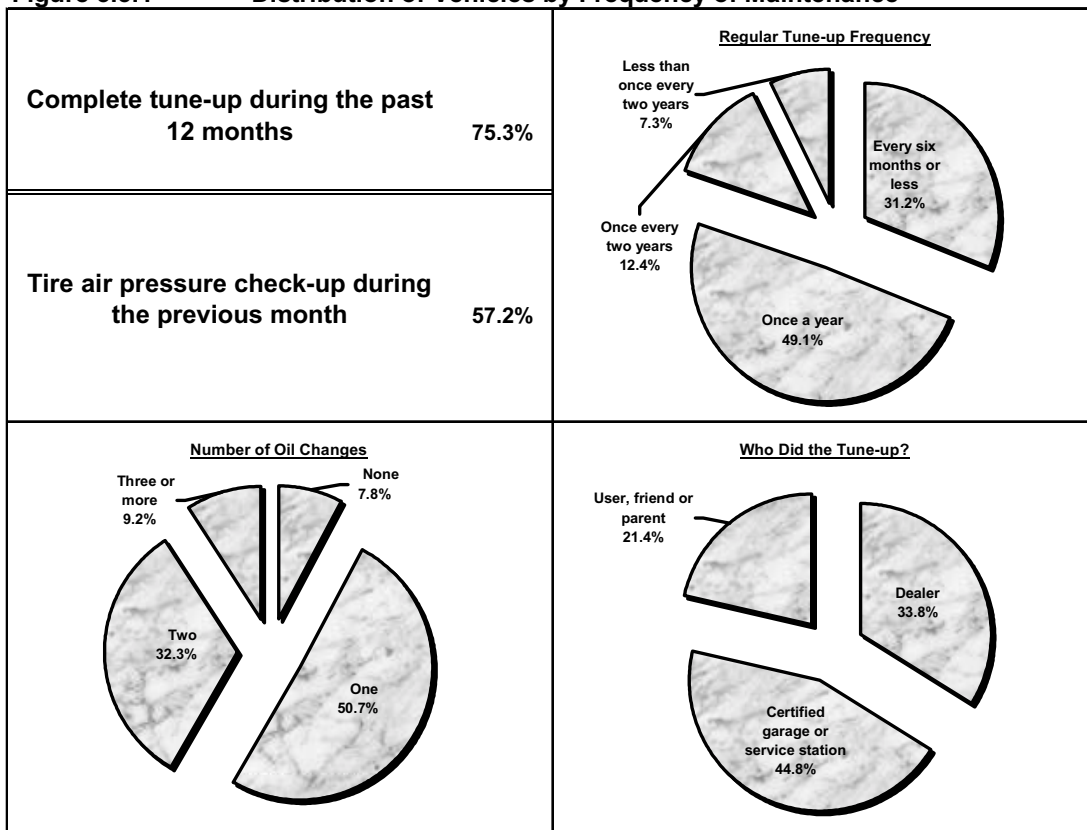
Figure 3.4 Distribution of the Vehicles by Age and Sex of the Principal Driver



Vehicle Maintenance

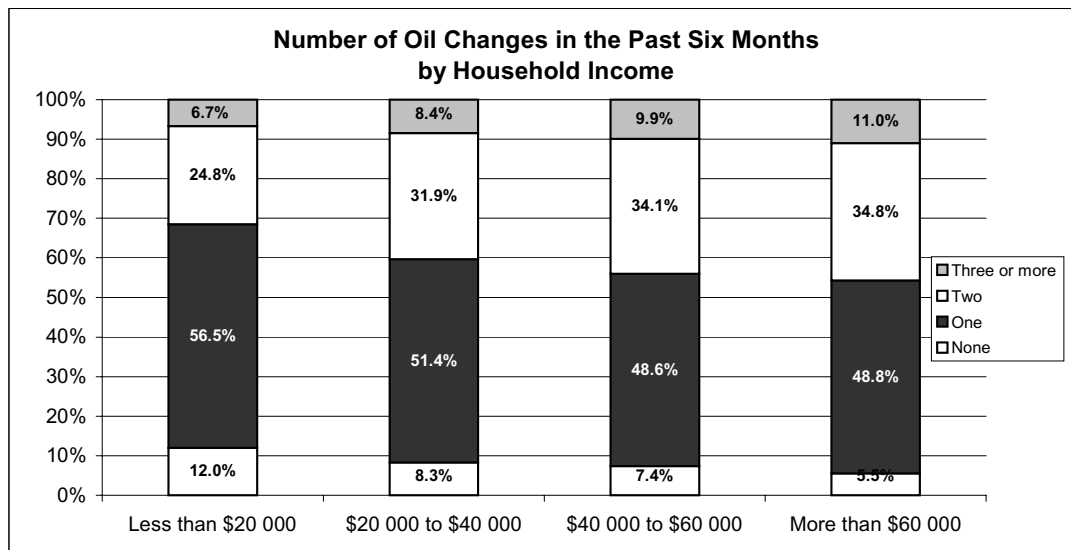
In most vehicles (92 percent), the oil had been changed at least once during the six months prior to the interview and for two out of five vehicles this had been done at least twice. Three out of four vehicles had undergone a complete tune-up at least once during the previous 12 months and one vehicle out of three usually had had a complete tune-up at least every six months. Tune-ups were performed at a certified garage or service station nearly half of the time and at the dealership one third of the time. For 20 percent of the private vehicles, this task was done by the driver, a parent or a friend. The tire air pressure had been checked on nearly three vehicles out of five during the previous month.

Figure 3.5.1 Distribution of Vehicles by Frequency of Maintenance



Analysis by region showed that during the previous 12 months, complete tune-ups had been performed less frequently in the Prairie Provinces (65 percent) than in Quebec (84 percent) and in the three major metropolitan areas of Montréal, Toronto and Vancouver (83 percent). Tune-ups were more frequently performed by the driver, a parent or a friend in the Prairie Provinces (26 percent) than in Quebec (18 percent). There was no significant regional variation in the frequency of checking tire air pressure.

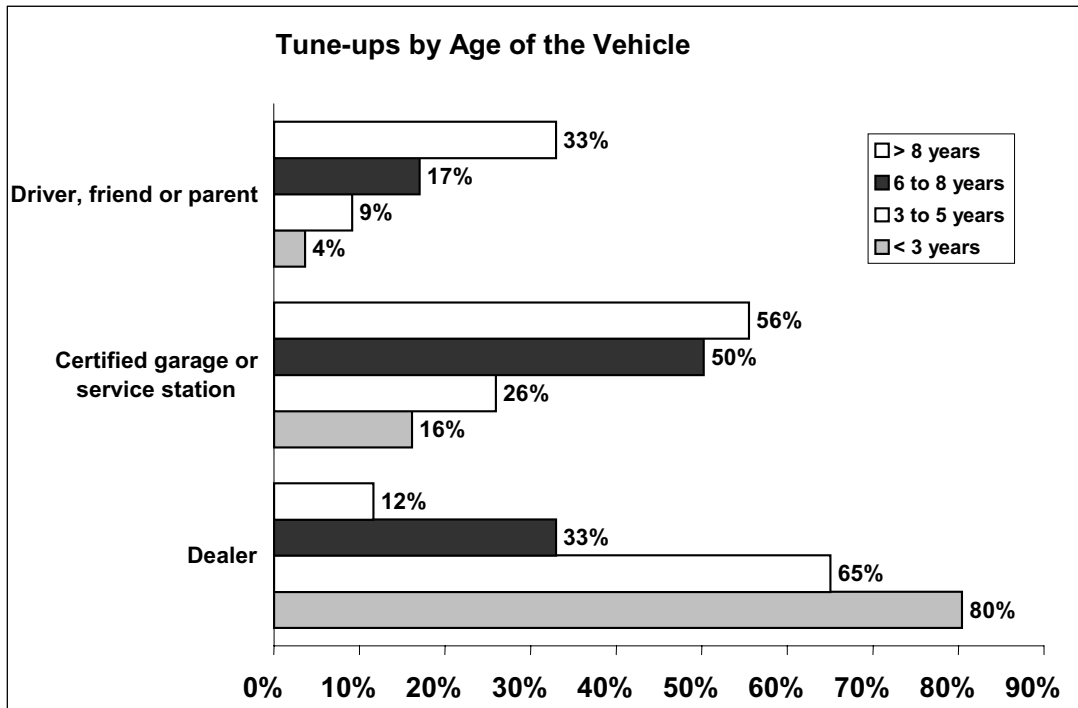
Figure 3.5.2



The priority given to vehicle maintenance increased with household income. Figure 3.5.2 shows that the percentage of vehicles in which the oil had been changed at least twice during the past six months was 46 percent for households with an annual income greater than \$60 000, compared with 32 percent for households earning \$20 000 or less annually. With regard to complete tune-ups the trend is not as clear: 77 percent of vehicles used by households with a higher income had had a tune-up during the previous 12 months compared with 71 percent for households earning less than \$20 000 per year. The higher-income households were less likely to have the tune-up performed by the driver, a parent or a friend.

The decision as to who performed the tune-up clearly depended upon the age of the vehicle. For example, 80 percent of the tune-ups for newer vehicles were done at the dealership compared with 12 percent for vehicles over eight years old. This may have reflected service being carried out under new vehicle warranty.

Figure 3.5.3

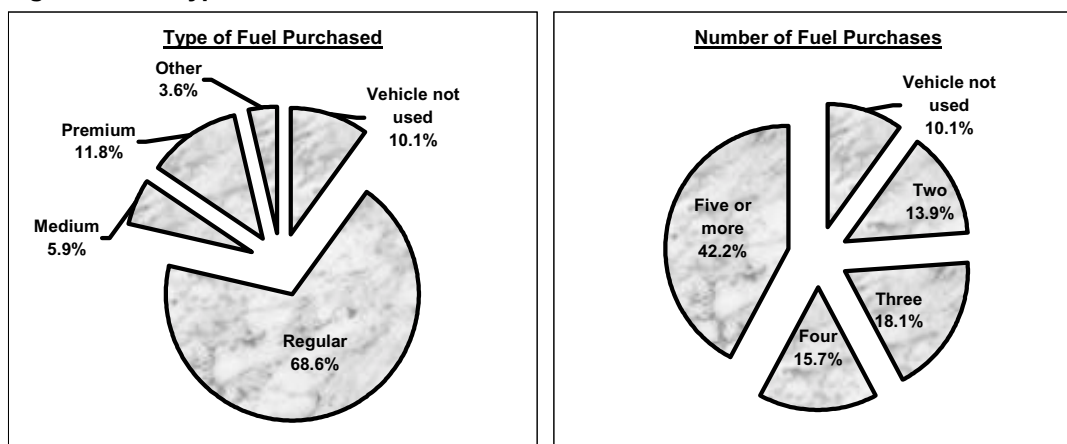


Distance Travelled Between Fuel Purchases

On average, from October 1994 to September 1996, Canadian households travelled 342 km between fuel purchases. The average amount of fuel purchased was 39.6 litres per purchase.

Overall, ten percent of private vehicles were not in use during the one-month survey period and, as a result, no fuel purchases were made for them. During the one-month survey period, five fuel purchases or more were required for 42 percent of the vehicles. Regular gasoline was purchased for 69 percent of the vehicles and premium gasoline for 12 percent. The rest purchased other types of fuel such as mid-grade (6 percent) and diesel or others (4 percent). It should be noted that fuel-purchase behaviour was recorded only for vehicles for which at least two fuel purchases were made during the one-month period. This constraint was necessary in order to estimate the fuel consumption rate.

Figure 3.6.1 Type of Fuel Purchased and Number of Fuel Purchases



The amount of fuel purchased on average at each visit to the gas station was highest in Saskatchewan (45.8 litres) and Alberta (45.2 litres) but much lower in the Atlantic Provinces such as in Newfoundland (33.4 litres) and Nova Scotia (35.4 litres). This may be due to the fact that there were more light trucks and vans (which generally are equipped with larger gas tanks) in Saskatchewan (36 percent) and Alberta (35 percent), while there were more passenger cars in Newfoundland (66 percent) and Nova Scotia (72 percent)

Figure 3.6.2

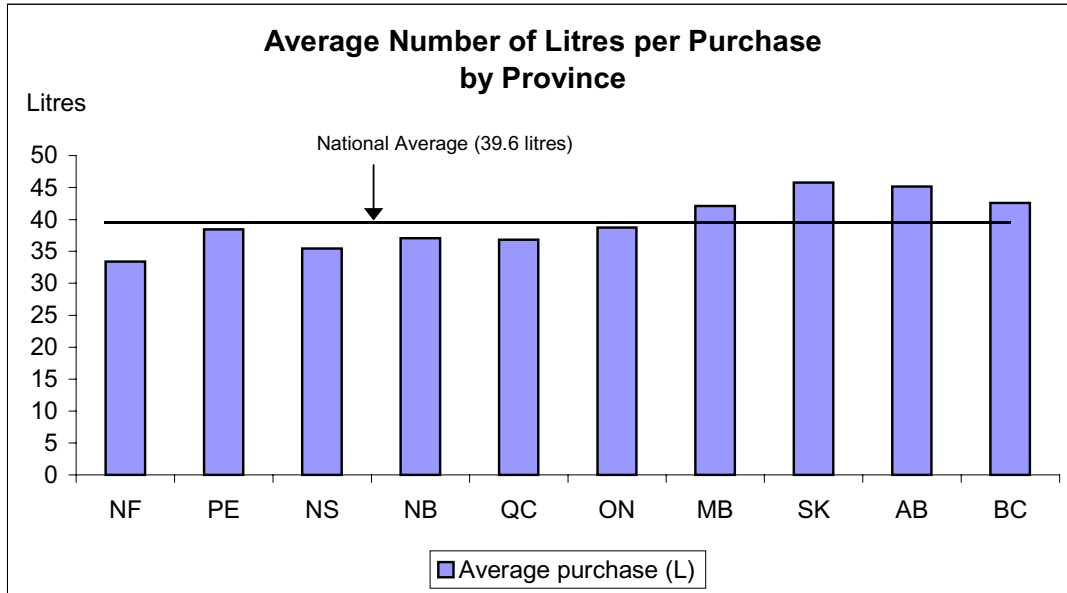
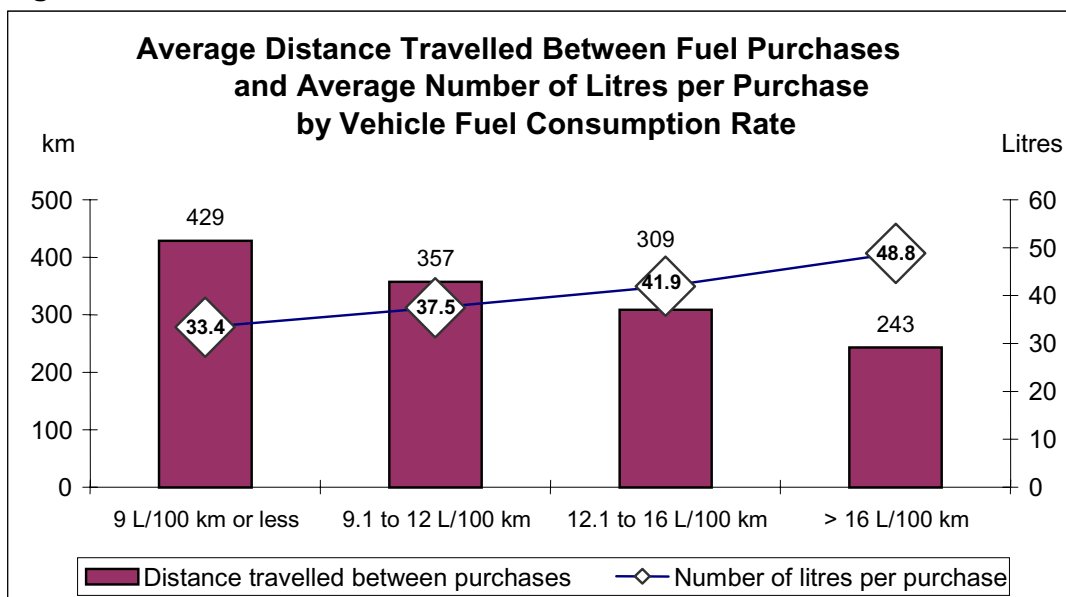


Figure 3.6.3 shows that the more energy-efficient vehicles travelled further between fuel purchases and required less fuel per purchase. When the vehicle fuel consumption rate was 9 L/100 km or less, the average distance travelled between fuel purchases was 429 km and the amount of fuel purchased was only 33.4 litres. At the other extreme, vehicles with a fuel consumption rate exceeding 16 L/100 km needed an average of 48.8 litres of fuel per purchase and travelled only 243 km between fuel purchases.

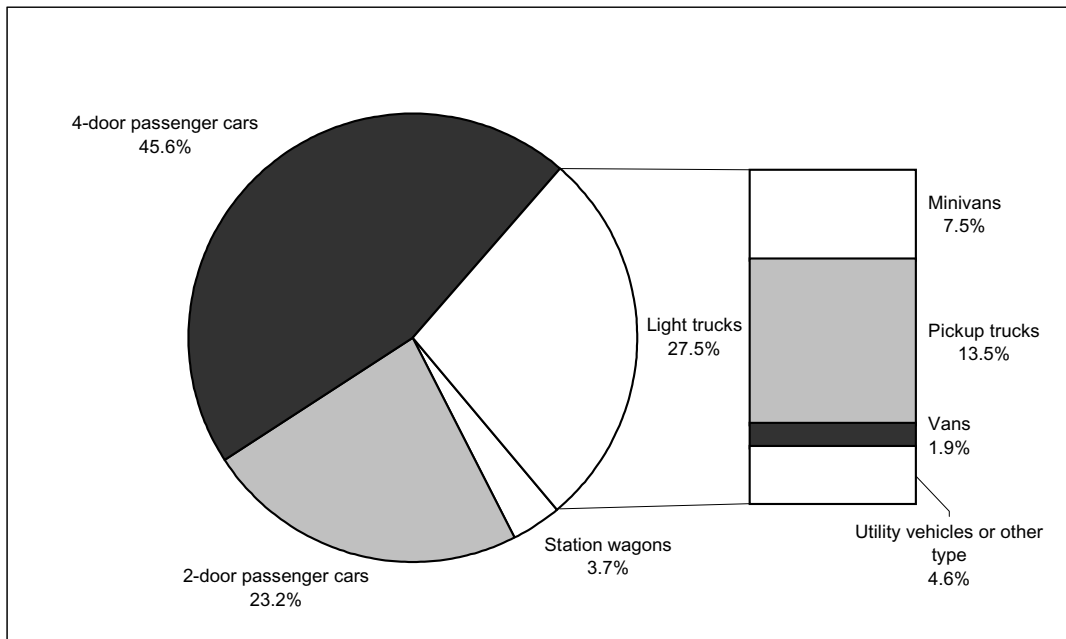
Figure 3.6.3



Vehicle Characteristics

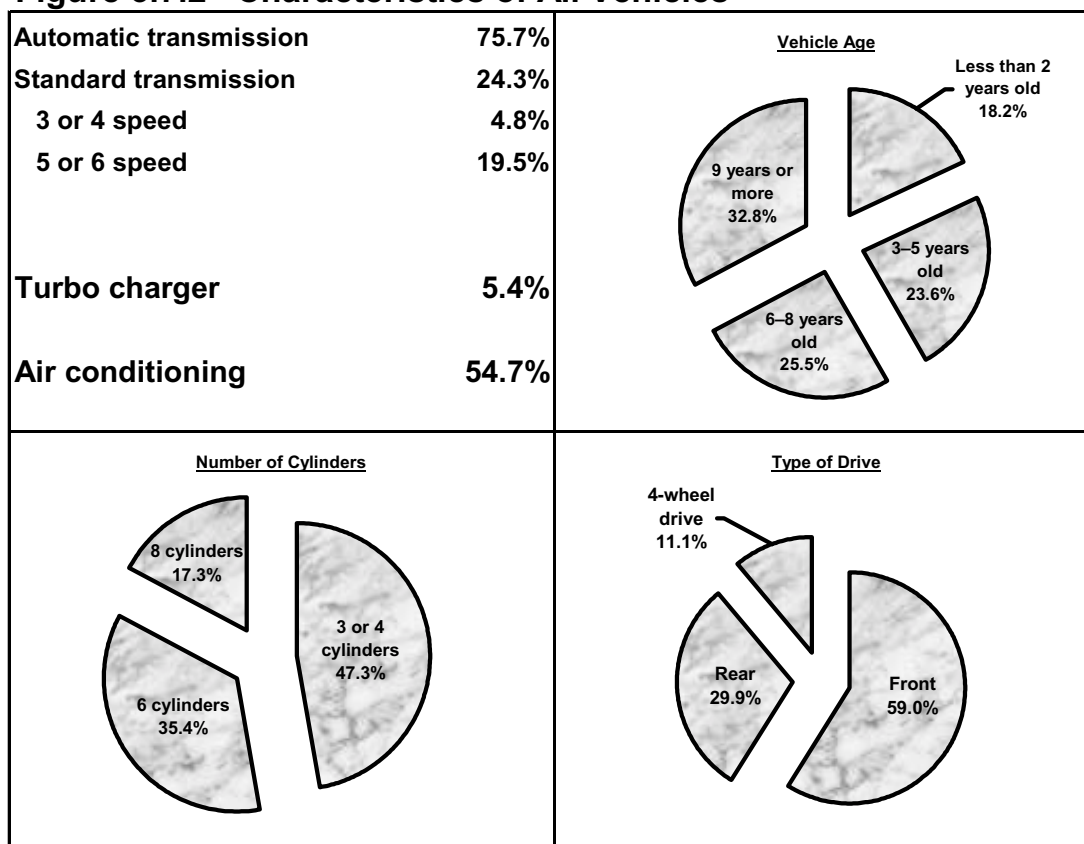
From October 1994 to September 1996, almost three out of ten private vehicles in Canada belonged to the light trucks and vans category. Pickups trucks accounted for 13.5 percent of private vehicles (one half of light trucks and vans), and 7.5 percent of vehicles were minivans. Other vehicles were classified as passenger cars and were mostly 4-door vehicles (45.6 percent) or 2-door vehicles (23.2 percent); station wagons (3.7 percent) were a vanishing category in the passenger car universe, being replaced by minivans in the light trucks and vans category.

Figure 3.7.1 Distribution by Type of Vehicle



During the survey period, 18 percent of the vehicles used by households were 1993 or newer models (i.e. less than three years old). One third of vehicles were pre-1987 models (i.e. over nine years old). Nearly half of all vehicles were equipped with four-cylinder engines. There were few four-wheel drive vehicles (11 percent) and even fewer with turbochargers (5 percent). Three out of five vehicles had front-wheel drive, three vehicles out of four had automatic transmissions and more than half of the vehicles had air conditioning.

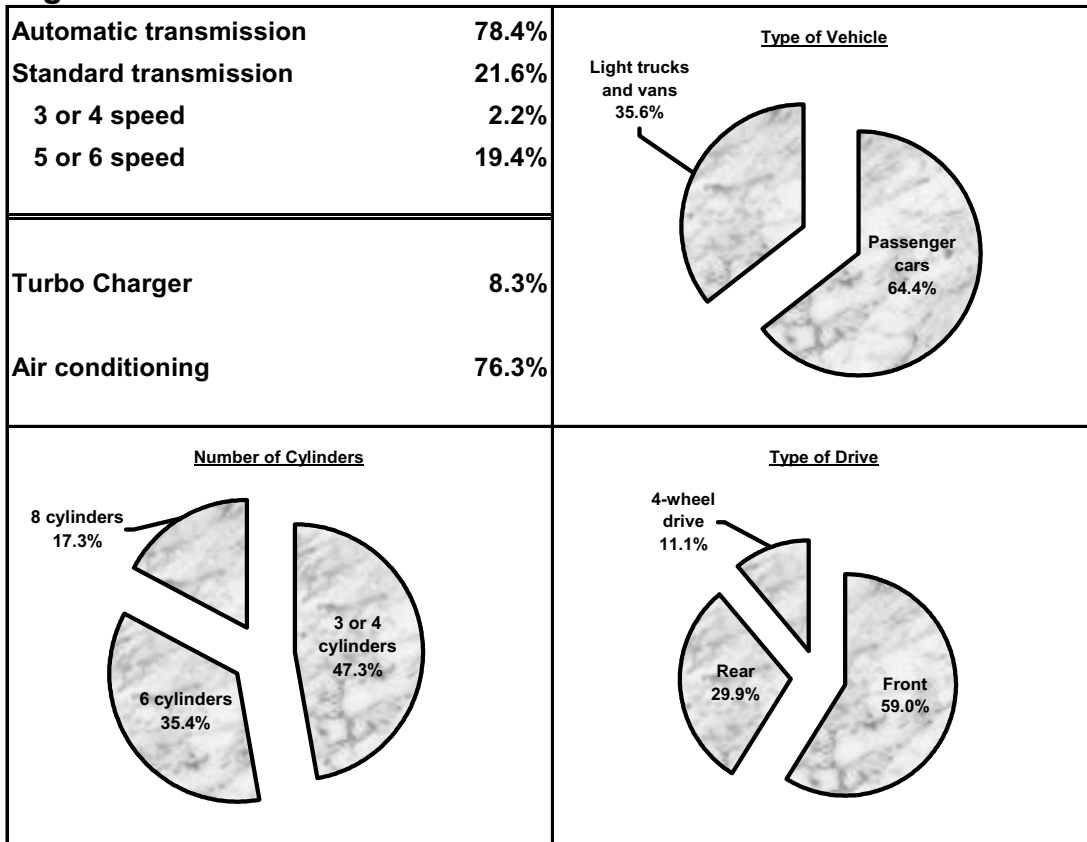
Figure 3.7.2 Characteristics of All Vehicles



In rural areas in general, 41 percent of the vehicles were light trucks and vans (27 percent of all vehicles were pickup trucks). In the four western provinces, one third of the vehicles were light trucks and vans. The Prairie Provinces (45 percent) and British Columbia (39 percent) also had the highest percentage of pre-1987 models. Standard transmissions were more frequently found in Quebec (32 percent) and in British Columbia (31 percent). Air conditioning was more often an option in Ontario (66 percent) and in the Prairie Provinces (63 percent).

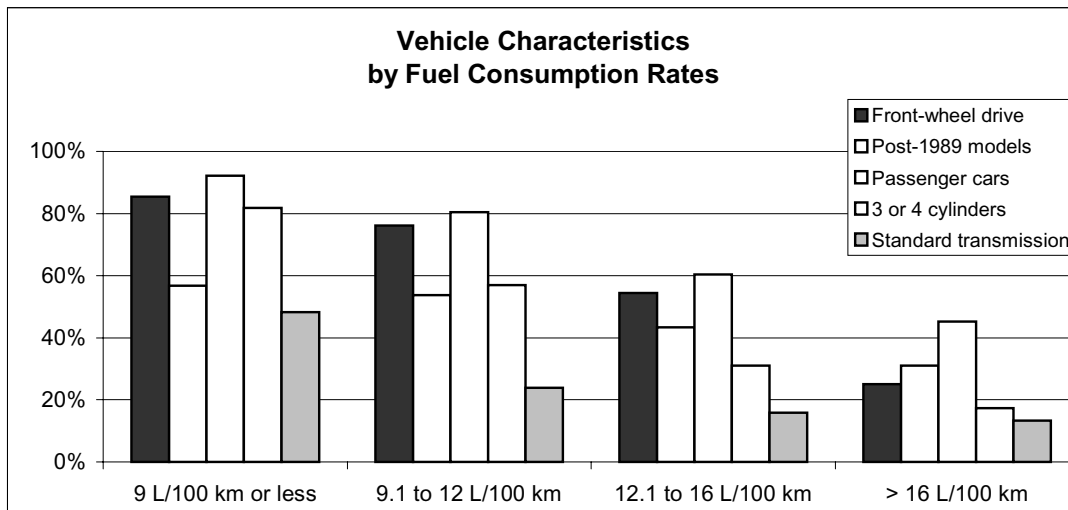
Vehicles that were two years old or less at the time of the survey show a distinct profile. They were more likely to be equipped with air conditioning, front-wheel drive and turbochargers. Eight-cylinder engines were relatively rare in newer models. One third of the newer vehicles belonged to the light trucks and vans category and 14 percent of the newer vehicles were minivans.

Figure 3.7.3 Characteristics of Vehicles Less Than 2 Years Old



The profile of vehicles clearly varied as a function of the fuel consumption rate. Figure 3.7.4 shows a convincing relationship. As expected, most energy-efficient vehicles tended to be passenger cars (92 percent of the vehicles with a fuel consumption rate of 9 L/100 km or less), recent models (57 percent were 1990 or newer), equipped with standard transmissions (48 percent), three- or four-cylinder engines (82 percent) and front-wheel drive (85 percent). These figures dropped rapidly as the fuel consumption rates increased.

Figure 3.7.4

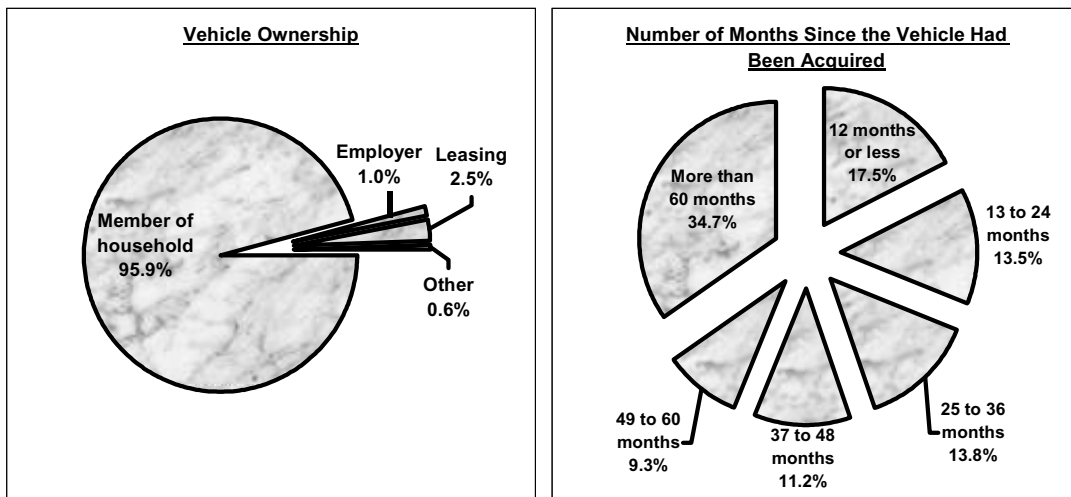


Private Vehicle Ownership

Private vehicles were most likely (96 percent) to be the property of a member of the household. They were rarely leased (3 percent) and, even less frequently, supplied by the employer of a household member (one percent). The pattern was the same regardless of the province, the type of area, the household composition or household income.

Nearly one third of the vehicles were purchased during the 24 months preceding the survey and more than one third were purchased more than five years prior to the survey. This last percentage tends to be smaller in Quebec and the eastern provinces (30 percent or less) than in Manitoba (40 percent).

Figure 3.8.1 Ownership and Numbers of Months Since the Vehicle Had Been Acquired

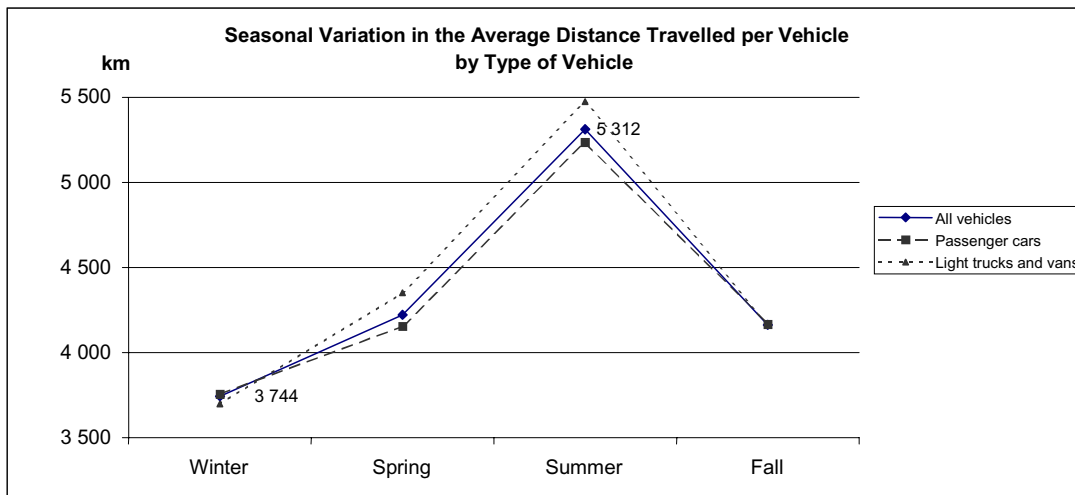


4 Distance Travelled

From October 1994 to September 1996, private vehicles in Canada travelled, on average, 4 364 km per quarter. Considering that households owned an average of 1.3 vehicles, this implied that a typical Canadian household drove an average of 5 488 km in each three-month period. On a yearly basis, this amounted to 17 500 km per vehicle, and 22 000 km per household.

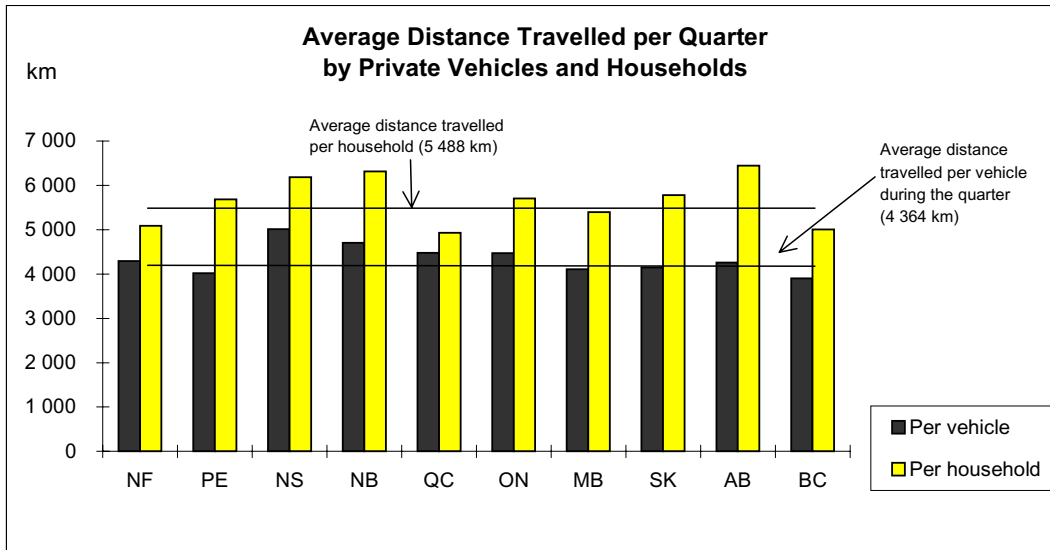
There were significant seasonal variations in the distance travelled by private vehicles, and the pattern is identical for passenger cars and light trucks and vans. Figure 4.1 presents the seasonal averages of distance driven over the two-year survey period. On average, private vehicles travelled 3 744 km during the winter compared to 5 312 km during the summer.

Figure 4.1



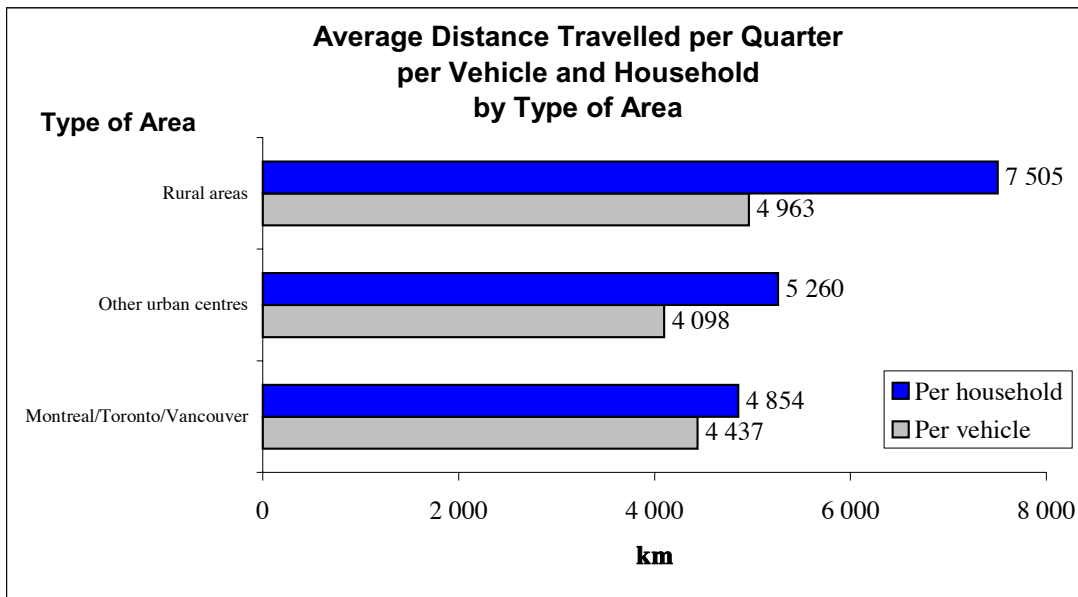
As shown in Figure 4.2, there were provincial variations in the average distance travelled – from a low of 3 901 km per vehicle in British Columbia to a high of 5 011 km in Nova Scotia. The number of vehicles per household and the average distance travelled per household were lowest in Quebec at 4 930 km per quarter and highest in Alberta at 6 442 km. Households in Alberta also owned the highest average number of vehicles, at 1.5 vehicles per household compared to the lowest average of 1.1 private vehicles per household in Quebec. The overall average for Canada was 1.3 vehicles per household.

Figure 4.2



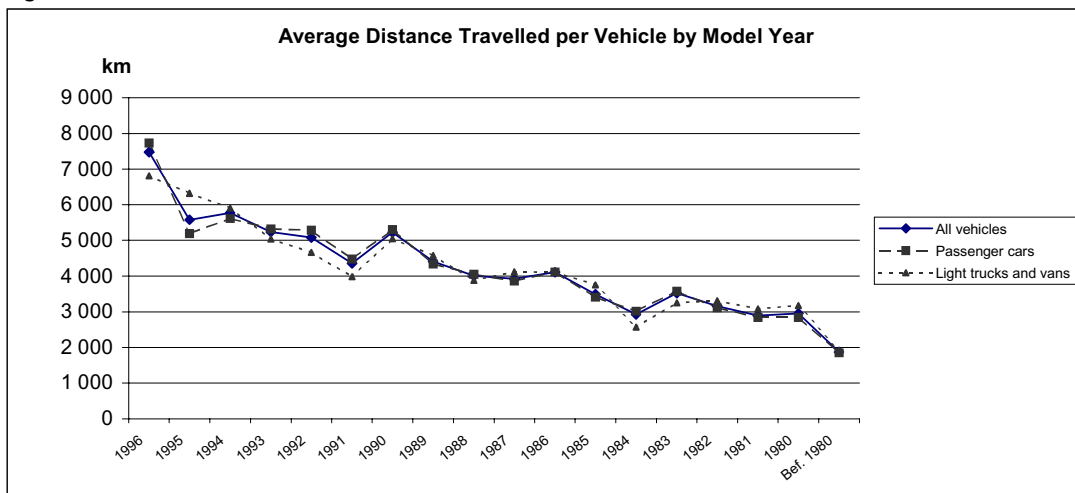
As shown in Figure 4.3, vehicles in rural areas travelled significantly further per quarter than those in urban areas – 4 963 km per vehicle and 7 505 km per household. Vehicles in the major urban areas of Montréal/Toronto/Vancouver travelled 11 percent less per vehicle and 35 percent less per household. The significant differences found in the household distance travelled could be attributed to the average number of 1.5 vehicles per household in the rural areas compared to 1.1 vehicles in the three major centres.

Figure 4.3



The average distance travelled per quarter during the survey period was quite similar for passenger cars (4 336 km) and for light trucks and vans (4 421 km). However, as is clearly shown in Figure 4.4, newer vehicles, both passenger cars and light trucks and vans, travelled further than older ones. A detailed analysis found that each year added to a vehicle's age meant a reduction of 234 km driven per three-month period.

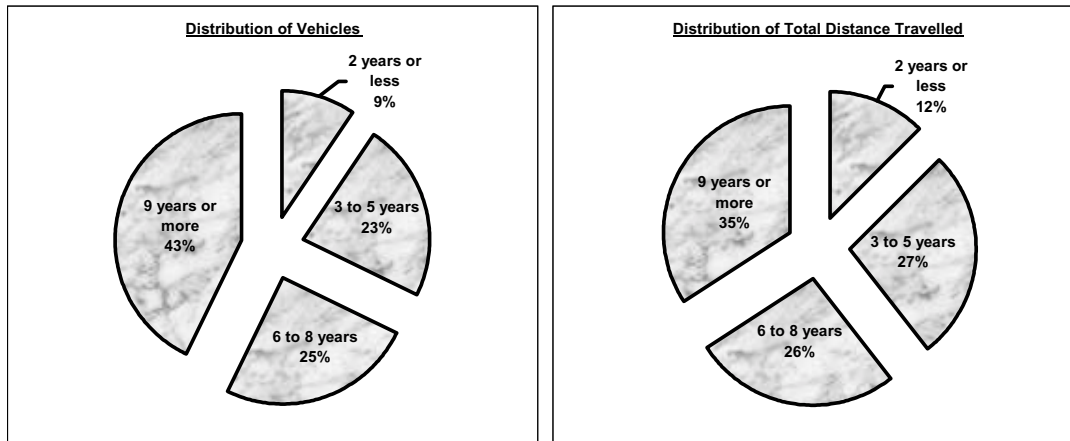
Figure 4.4



Seen from another angle, we observed that vehicles less than six years of age accounted for 32 percent of all private vehicles but they accounted for 39 percent of all the distance travelled. Conversely, vehicles nine years old or more represented 43 percent of the market, but these older vehicles travelled only 35 percent of the distance driven by all private vehicles.

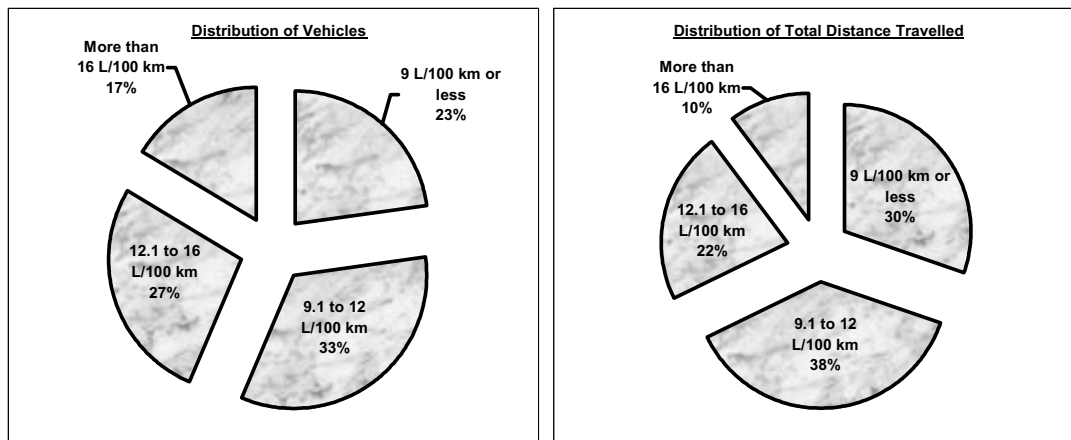
Figure 4.5 compares the distribution of vehicles and the distance travelled.

Figure 4.5 Distribution of Vehicles and of Total Distance Travelled by Vehicle Age



Newer vehicles were deemed more energy efficient than older vehicles. As discussed earlier in this chapter, these newer, more fuel-efficient vehicles travelled further than older vehicles. This is illustrated in Figure 4.6: vehicles with a fuel consumption ratio less than or equal to 9 L/100 km represented 23 percent of the total number of private vehicles, but also accounted for 30 percent of all the distance driven. Another potential explanation of this phenomenon could be that people who drive further tend to buy more fuel-efficient vehicles.

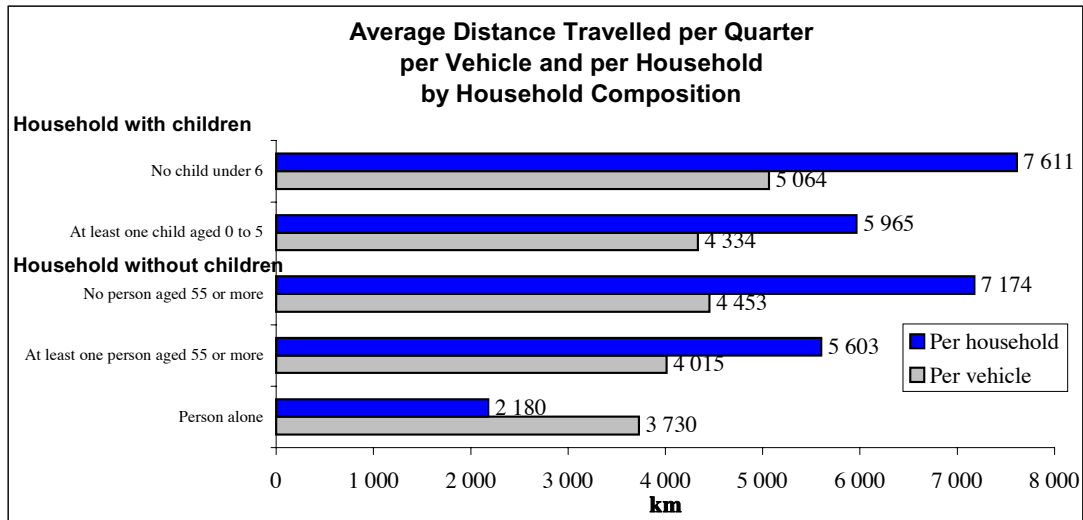
Figure 4.6 Distribution of Vehicles and of Total Distance Travelled by Fuel Consumption Ratio



Household composition was found to have a significant impact on the usage of vehicles. This impact is moderate for the average distance travelled per vehicle, from 3 730 km for persons living alone to 5 064 km for families with children all above pre-school age. However, taking into

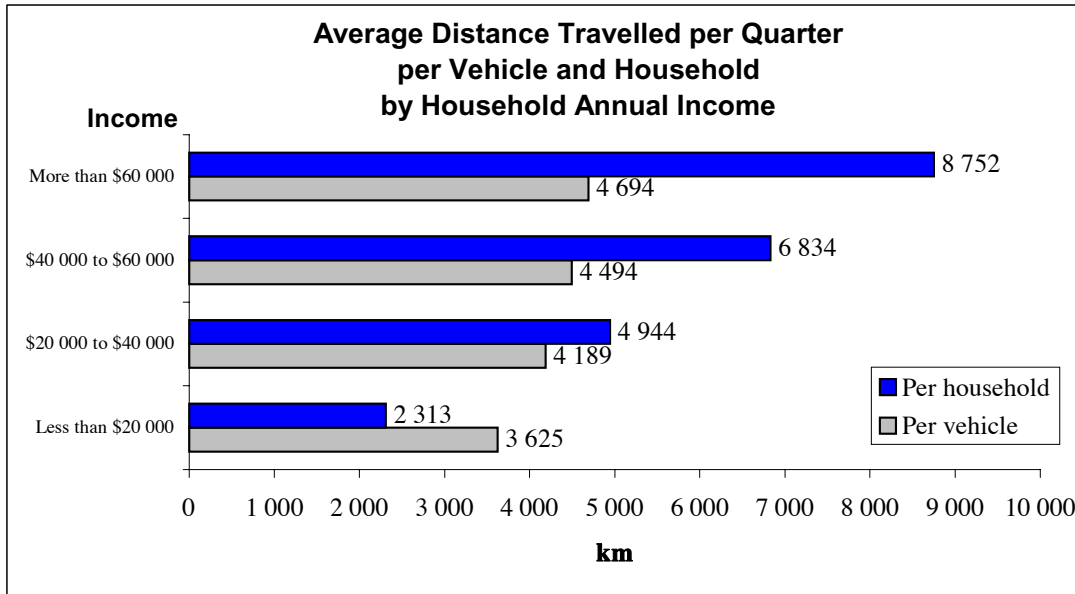
account all vehicles used by the households, the variations were much more significant: single-person households, a large proportion of which did not own a private vehicle, drove 2 180 km per quarter in comparison with 7 611 km for households with children aged six years or above. The differences are shown in Figure 4.7.

Figure 4.7



The annual household income has an even more striking influence, as illustrated in Figure 4.8. Households earning less than \$20 000 annually, including those not owning any private vehicle, travelled only 2 313 km per quarter in their private vehicles, while households earning more than \$60 000 per year averaged 8 752 km, nearly three times more. This was directly associated with the higher number of vehicles owned by more affluent households. Households earning more than \$60 000 per year averaged 1.9 vehicles per household while households with an annual income of less than \$20 000 owned 0.6 vehicle per household.

Figure 4.8



Vehicles with multiple drivers tended to travel further (4 868 km per quarter) than single-driver vehicles (4 054 km). However the age-sex profile of the main driver did not seem to have a significant impact on the distance driven, with the exception that drivers over 65 years of age drove 20 percent less (3 490 km per quarter) than the overall quarterly average (4 362 km).

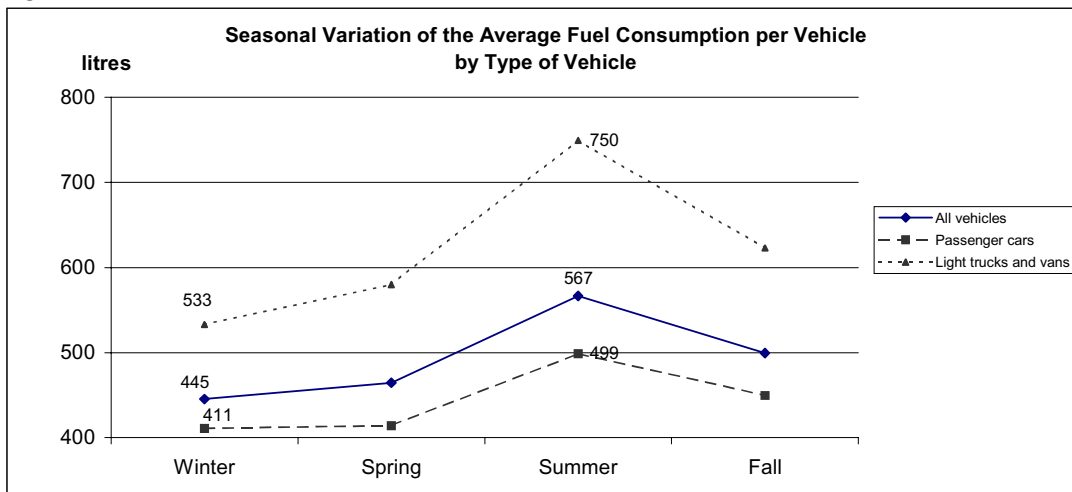
5 Fuel Consumption

From October 1994 to September 1996, private vehicles in Canada consumed, on average, 494 litres of fuel per quarter. For the total 14.2 million vehicles owned by Canadians, this represents seven billion litres of fuel consumed for each three-month period. For a typical Canadian household owning 1.3 vehicles, this indicated a quarterly fuel consumption of 621 litres of fuel. On an annual basis, Canadian private vehicles consumed 28 billion litres of fuel, and each household consumed 2 484 litres of fuel.

Factors Affecting Fuel Consumption

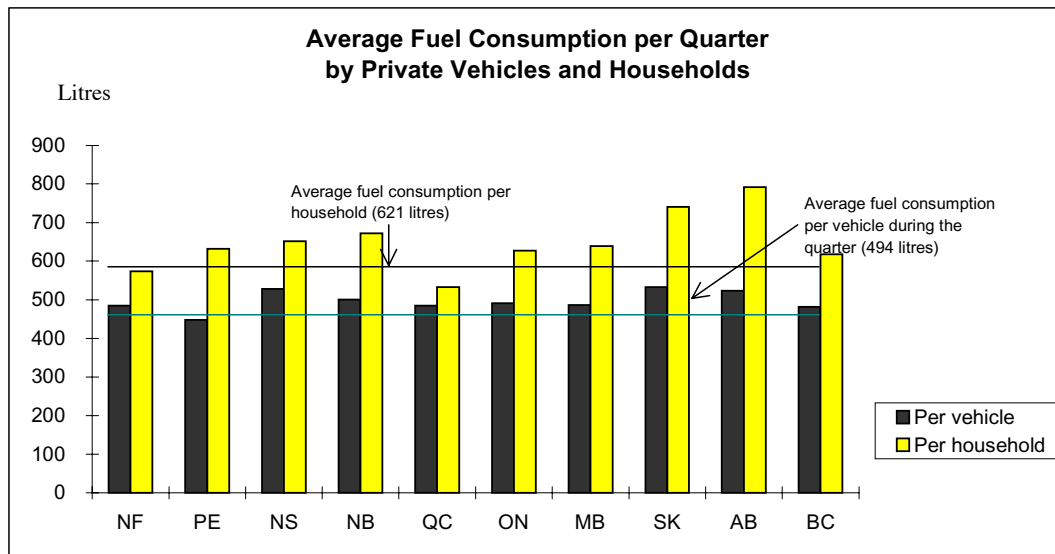
The quarterly average fuel consumption per vehicle shows significant seasonal variations as evidenced in Figure 5.1.1, which presents the seasonal averages over the two-year survey period. On average, private vehicles consumed 445 litres of fuel during winter and this average consumption peaked at 567 litres during the summer. Although the seasonal pattern is quite similar for passenger cars and for light trucks and vans, light trucks and vans show a more pronounced increase in fuel consumption from winter (533 litres) to summer (750 litres).

Figure 5.1.1



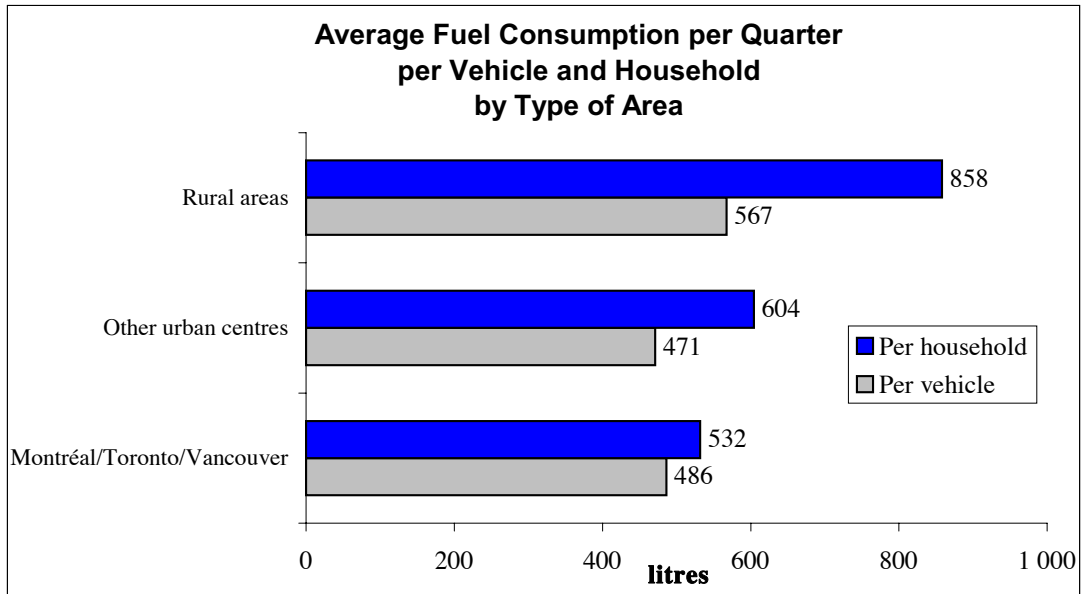
As shown in Figure 5.1.2, three provinces show significantly higher fuel consumption per vehicle than the national average: Saskatchewan (532 litres), Nova Scotia (528 litres) and Alberta (523 litres). Taking all the vehicles owned by households into account, the average fuel consumption per household is clearly above the national average for Saskatchewan (741 litres) and Alberta (792 litres) where the number of vehicles per household is respectively 1.4 and 1.5. Conversely, in the province of Quebec, with a low of 1.1 vehicles per household, the average fuel consumption per household appears significantly below the national average at 533 litres per quarter.

Figure 5.1.2



Given that the average distance travelled per vehicle is higher in rural areas than in urban areas, as shown in Chapter 4, it is not surprising to observe higher average fuel consumption both per vehicle and per household in rural areas. The average number of vehicles per household is 1.5 in rural areas, while it is only 1.1 in the three major metropolitan areas.

Figure 5.1.3



The average distance travelled by light trucks and vans is similar to that of passenger cars and, although light trucks and vans represent 27.5 percent of the private vehicle stock, their share of the total fuel consumption during the survey period was estimated at 34.7 percent. This can be explained by the higher fuel consumption ratio of light trucks and vans compared to passenger cars. Figure 5.1.4 illustrates these differences.

Figure 5.1.4 Distribution of Vehicles, Total Distance Travelled and Total Fuel Consumption by Type of Vehicle

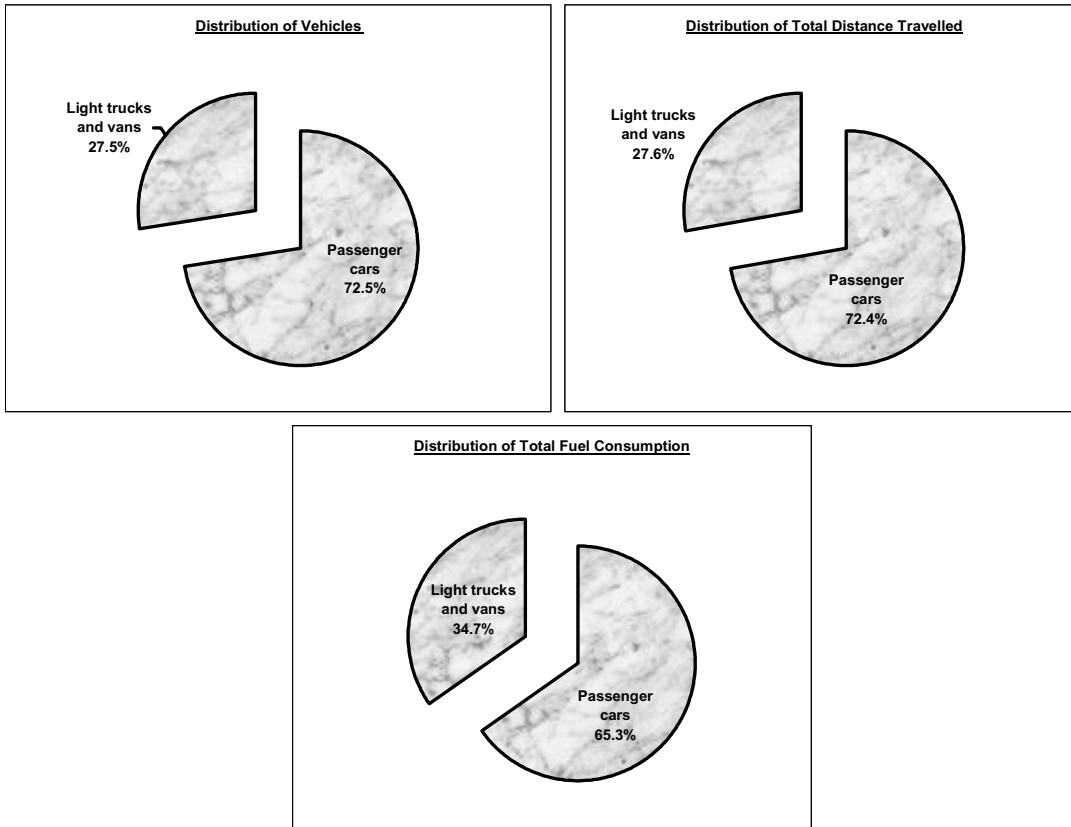
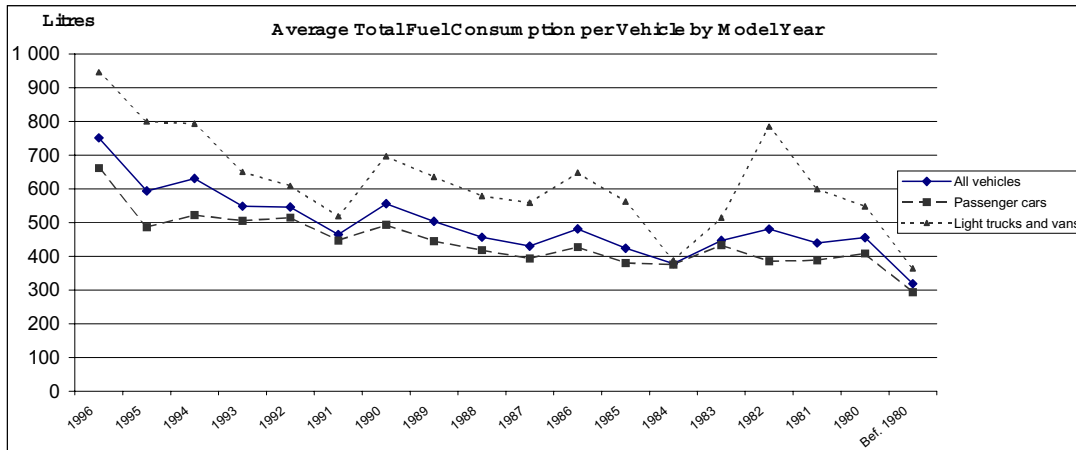


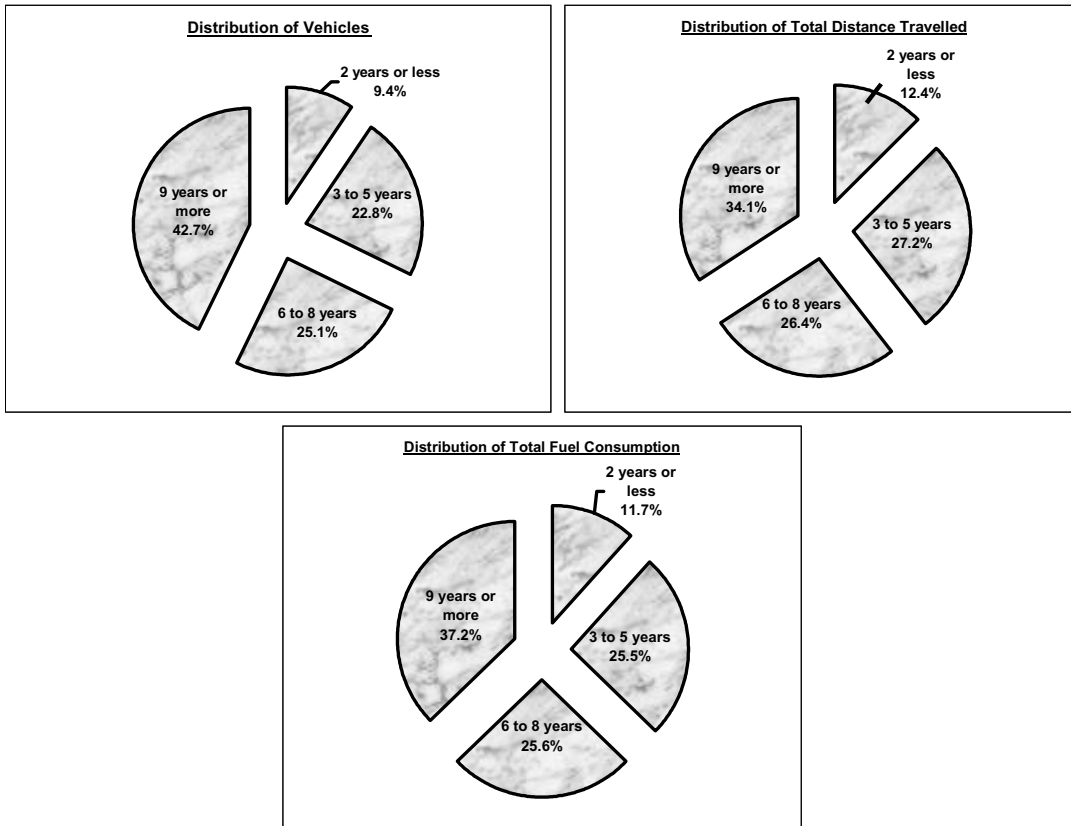
Figure 5.1.5 shows that the average quarterly fuel consumption per private vehicle tends to decrease as the model year gets older. This is due to the fact that older vehicles were driven less during the survey period and therefore travelled smaller average distances per quarter (as shown in Chapter 4). The calculation of a linear trend establishes that each year of age added to a vehicle means a reduction of 15.5 litres of fuel per three-month period. This rate of reduction is much smaller than that of the distance travelled, implying that older vehicles are less energy efficient. The pattern of the curve in Figure 5.1.5 is less smooth for light trucks and vans than for passenger cars due to a smaller sample size for light trucks and vans.

Figure 5.1.5



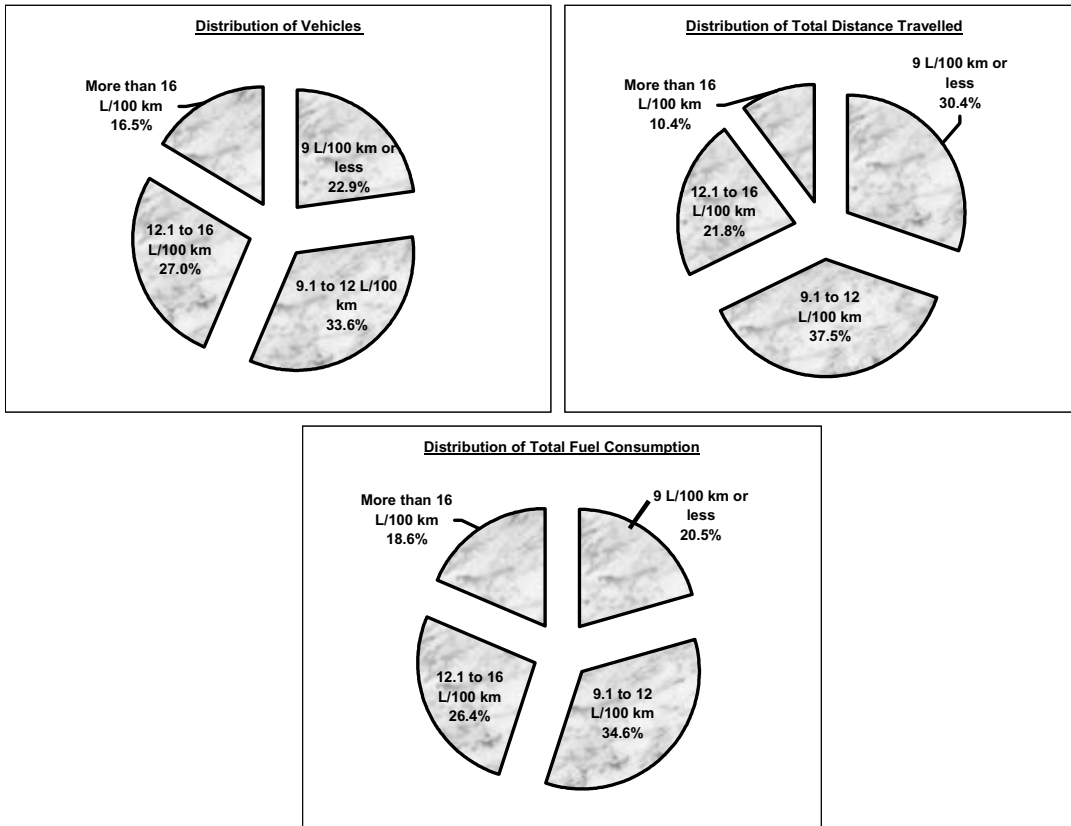
Another way of seeing the trend between the average fuel consumption and the age of the vehicles is shown in Figure 5.1.6. Vehicles less than six years of age accounted for 32 percent of all private use vehicles and nearly 40 percent of all the distance travelled; however, due to their high fuel efficiency, they consumed only 37 percent of all the fuel consumed. Conversely, vehicles nine or more years old represented 43 percent of the market and travelled 34 percent of the total distance. Due to their low fuel efficiency, these older vehicles accounted for 37 percent of the fuel consumed by all private use vehicles.

Figure 5.1.6 Distribution of Vehicles, Total Distance Travelled and Total Fuel Consumption by Vehicle Age



In Chapter 4, we stated that the most fuel-efficient vehicles – those with a fuel consumption rate less than or equal to 9 L/100 km – travelled slightly more than 30 percent of all the distance driven during the survey period and consumed less than 21 percent of all the fuel consumed during the same period. Conversely, the less energy-efficient vehicles – those with a fuel consumption rate greater than 12 L/100 km – travelled only ten percent of all the distance driven during the survey period but consumed nearly 19 percent of all the fuel consumed during the same period by all vehicles.

Figure 5.1.7 Distribution of Vehicles, Total Distance Travelled and Total Fuel Consumption by Fuel Consumption Rate



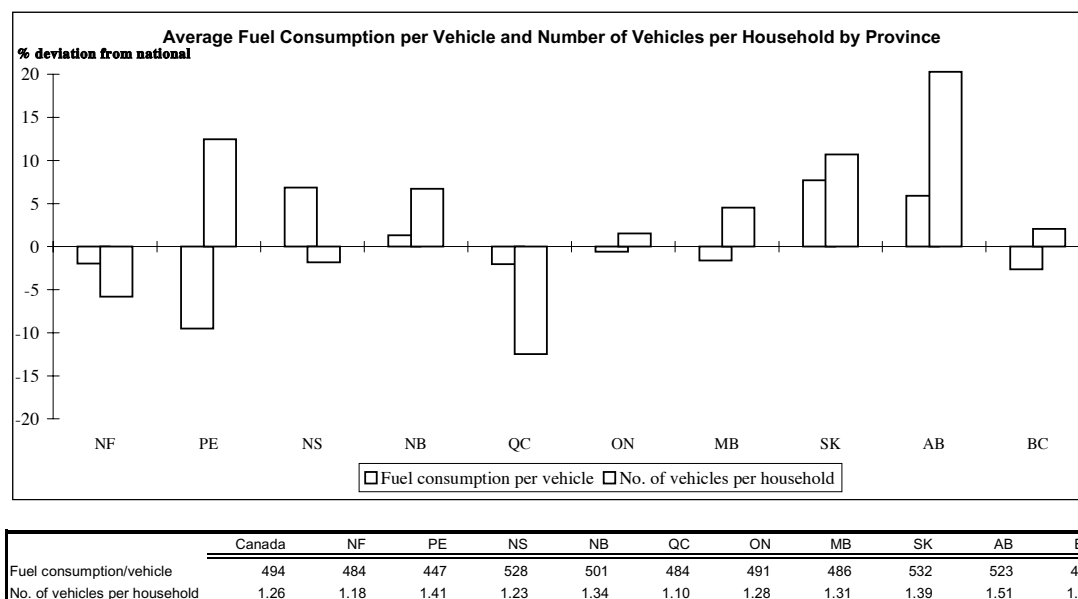
Household Fuel Consumption

To understand the factors affecting household fuel consumption, analyses were conducted through the following two components:

- the average fuel consumption per vehicle; and
- the number of vehicles per household.

Figure 5.2.1 illustrates how these two components vary from the national averages. The variations are expressed as a percentage of the national figure.

Figure 5.2.1 Provincial Variations Relative to the National Averages

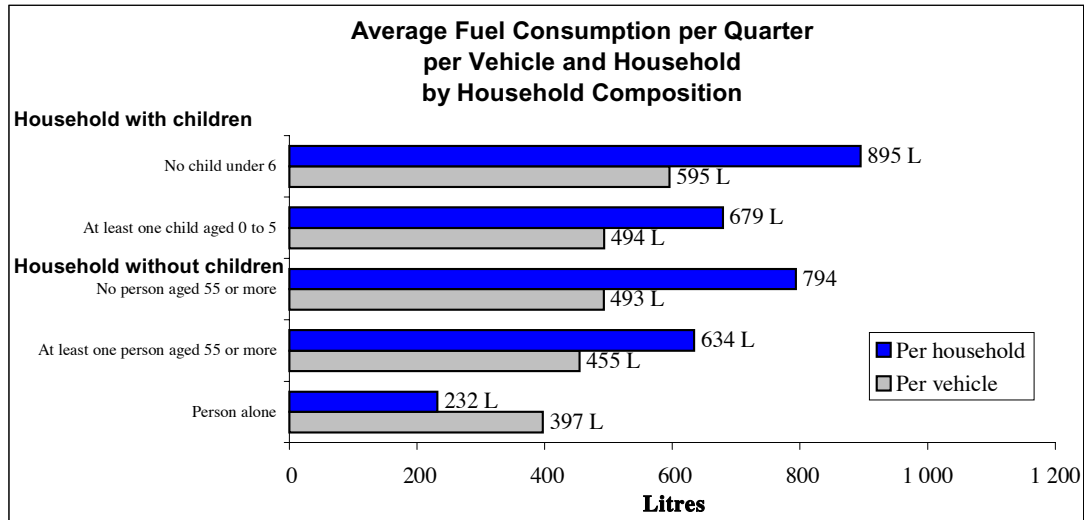


In Ontario, Manitoba and British Columbia, the average fuel consumption per vehicle and the average number of vehicles per household, were close to the national averages, as illustrated in Figure 5.2.1.

Saskatchewan has the highest average fuel consumption per vehicle and per household, likely due to the fact that households in this province had nearly 1.4 vehicles per household, many with high consuming light trucks and vans. In Alberta, we also found more vehicles per household (1.5) and six percent above the national average number of high fuel consumption vehicles.

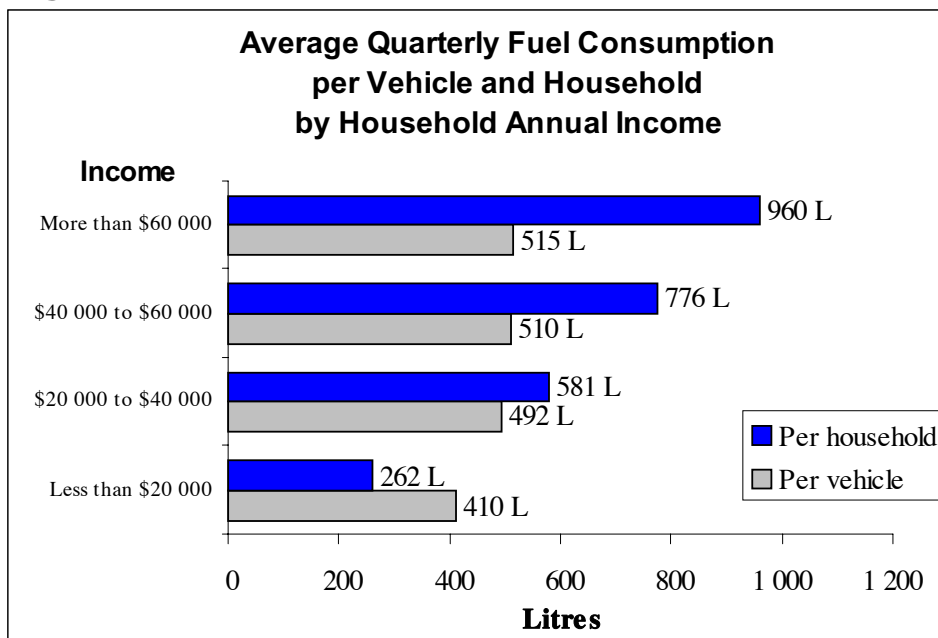
Household composition had, as expected, a significant impact on the vehicle fuel consumption. The average fuel consumption per vehicle varied, for instance, from 397 litres per quarter for persons living alone to 595 litres for families with children aged six years or more. However, taking into consideration the number of vehicles owned by each household, the variation is more noticeable: single-person households, among which a significant proportion do not own a private vehicle, consumed 232 litres of fuel per quarter in comparison with 895 litres for households with children all over pre-school age.

Figure 5.2.2



When annual income was considered, the variation in average fuel consumption was even more noticeable. Including households that do not own any private vehicle, households earning less than \$20 000 annually purchased 262 litres of fuel. In contrast, households earning more than \$60 000 per year purchased 960 litres of fuel during the same period. Such a large difference is mainly due to the number of vehicles possessed by the households in each group.

Figure 5.2.3



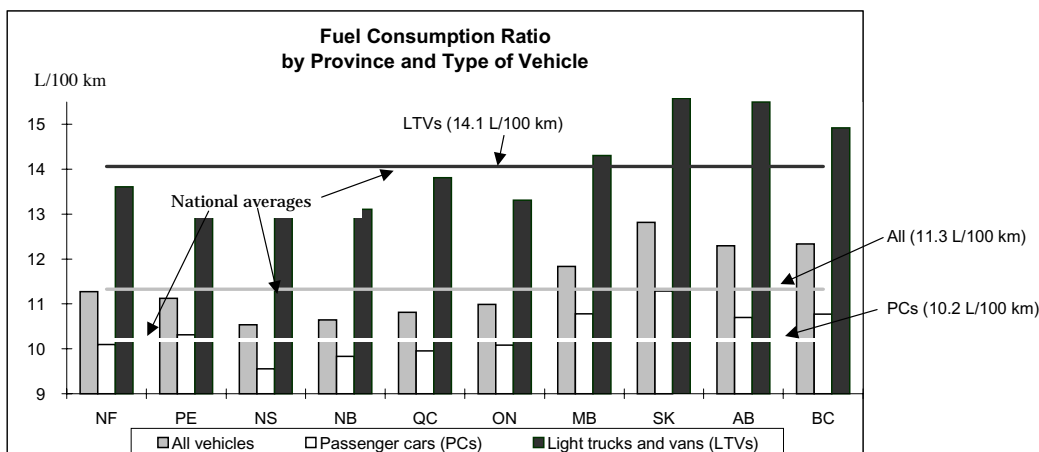
6 Fuel Consumption Ratio

During the survey period, from October 1994 to September 1996, private vehicles in Canada consumed, on average, 494 litres of fuel per quarter while travelling 4 364 km. This corresponds to an overall performance of 11.3 litres of fuel per 100 km. This ratio (L/100 km) is called the fuel consumption ratio (FCR). The survey results revealed that the on-road FCR for passenger cars was 10.2 L/100 km and for light trucks and vans was 14.1 L/100 km.

Regional Variations of the Fuel Consumption Ratio

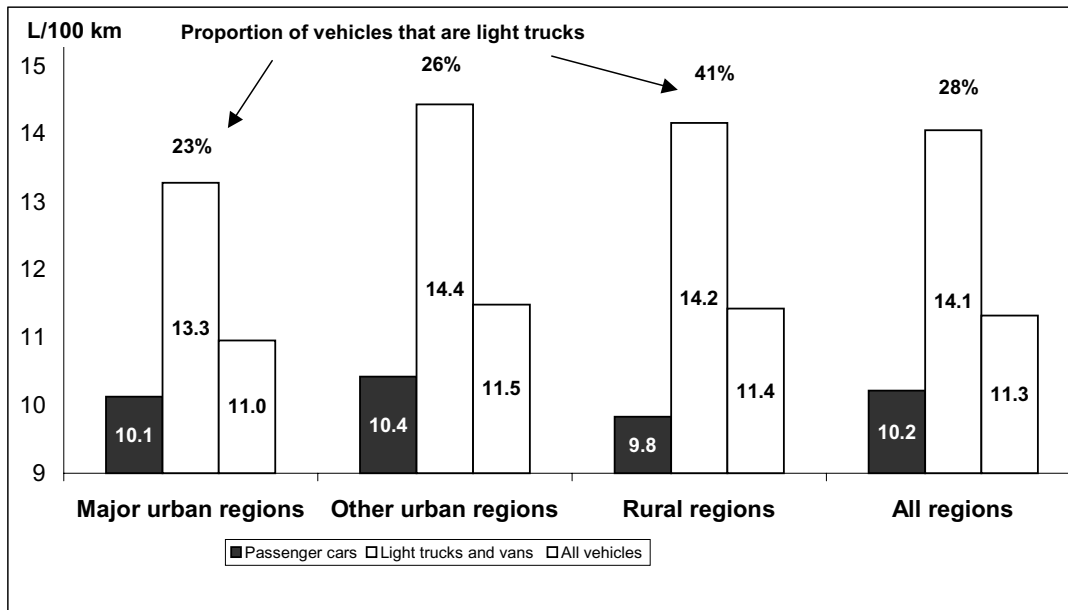
Figure 6.1 compares the FCR between provinces and distinguishes between passenger cars and light trucks and vans. Generally, provinces with an FCR lower than the national average for all vehicles also had an FCR lower than the national average for each type of vehicle separately. New Brunswick (10.5 L/100 km), Nova Scotia (10.6 L/100 km) and Quebec (10.8 L/100 km) had the lowest FCR. Passenger cars in those provinces all had an average FCR below 10 L/100 km. Saskatchewan (12.8 L/100 km), Alberta (12.3 L/100 km) and British Columbia (12.3 L/100 km) had FCRs that significantly exceeded the national average. This is partly due to the fact that about one third of all vehicles in these provinces were light trucks and vans, which had a high FCR, although the FCR for passenger cars also exceeds the national average in those provinces.

Figure 6.1.1



Vehicles used in the three major metropolitan areas show a slightly lower-than-average FCR of 11.0 L/100 km, mainly due to relatively better performance of the light trucks and vans (13.3 L/100 km). In rural areas, the FCR for passenger cars is low at 9.8 L/100 km but the large proportion of light trucks and vans pulls the overall FCR up to 11.4 L/100 km.

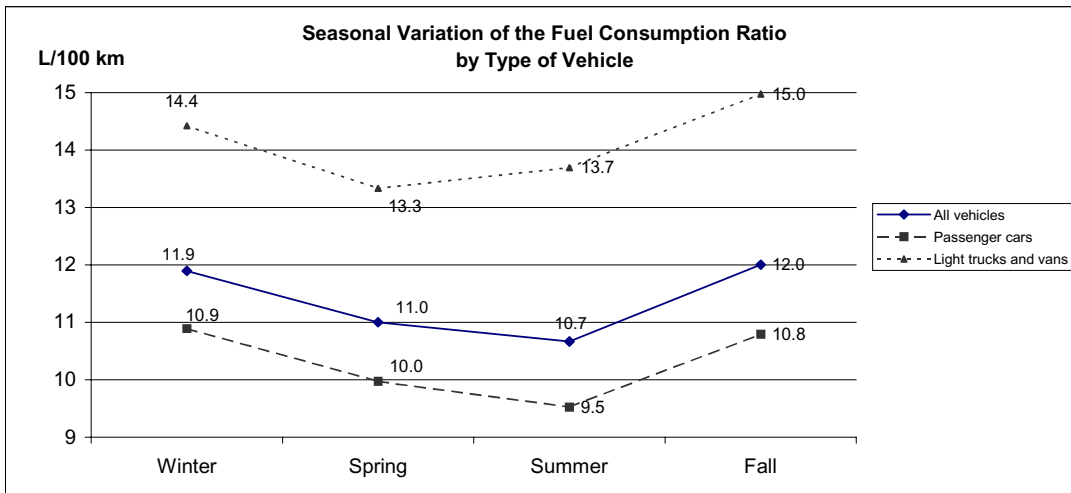
Figure 6.1.2
Fuel Consumption Ratio (L/100 km)
by Vehicle Type and Type of Area



Seasonal Variations in the Fuel Consumption Ratio

The FCR was slightly affected by the season. The overall FCR for all vehicles was ten percent lower in summer than in winter; for passenger cars, the FCR reached its peak at 10.9 L/100 km in winter, then gradually dropped to 9.5 L/100 km in summer. For light trucks and vans, the general pattern was similar; however, the maximum FCR was attained in the fall (15.0 L/100 km) and the minimum in spring (13.3 L/100 km). The seasonal variation of the FCR was much less important than that of the average distance travelled per vehicle, as shown in Chapter 4.

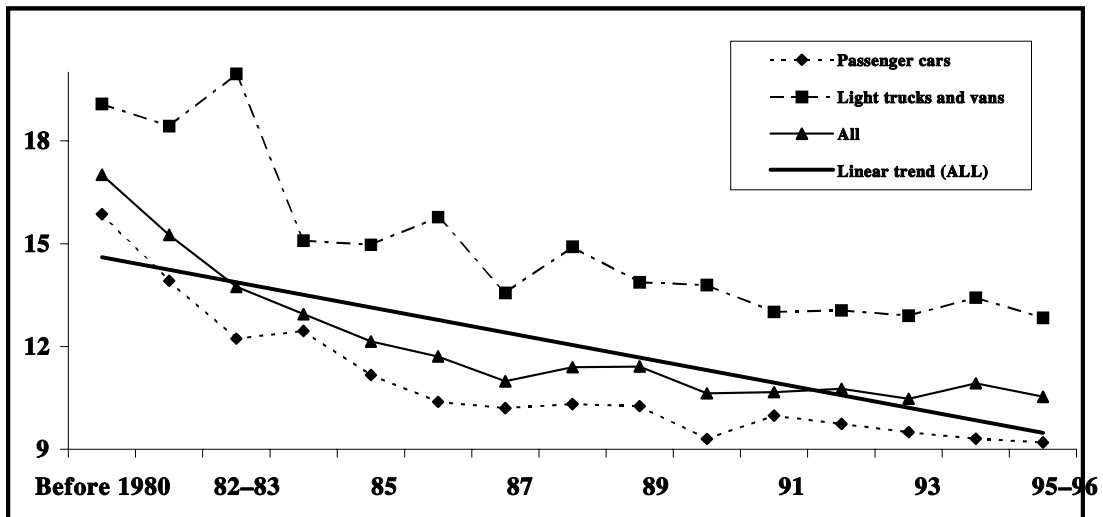
Figure 6.2



Fuel Consumption Ratio by Model Year

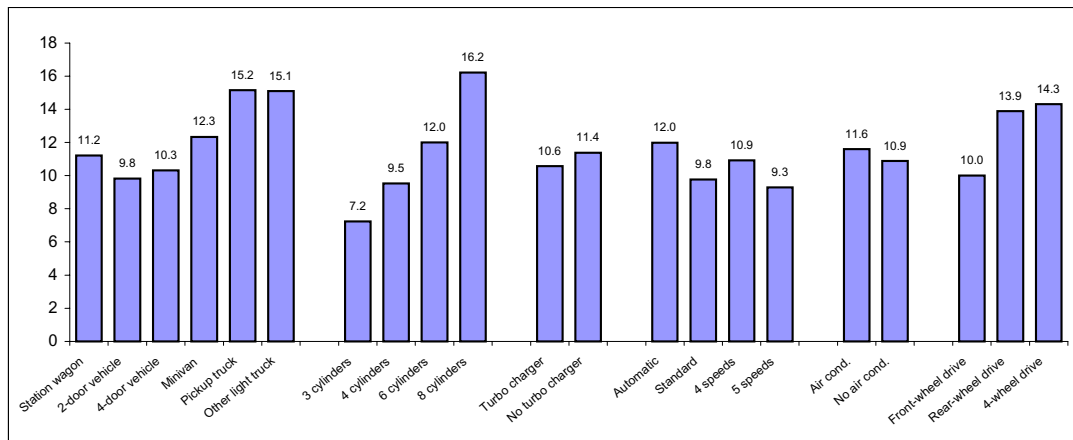
The FCR has been improving over the years. Prior to 1985, the average FCR was 15 L/100 km but it decreased steadily to 10.5 L/100 km by 1996. For light trucks and vans, the FCR dropped from 18 L/100 km in pre-1984 models to 13 L/100 km in post-1990 models. The general trend indicated that the FCR for the overall light duty vehicles improved by 0.3 L/100 km each year.

Figure 6.3.1
Fuel Consumption Ratio (L/100km)
by Model Year and Type of Vehicle



Aside from the model year, the general characteristics of the vehicles also affected the FCR. For example, the FCR was much lower (9.8 L/100 km) for a two-door passenger car than for a pickup truck (15.2 L/100 km). Vehicles with four-cylinder engines also consumed less fuel (9.5 L/100 km) than vehicles with eight-cylinder engines (16.2 L/100 km). There was a difference of 2.2 L/100 km between vehicles with automatic and manual transmissions. Front-wheel drive vehicles fared 3.9 L/100 km better than the rear-wheel drive vehicles.

Figure 6.3.2
Fuel Consumption Ratio (L/100 km)
by Vehicle Characteristics

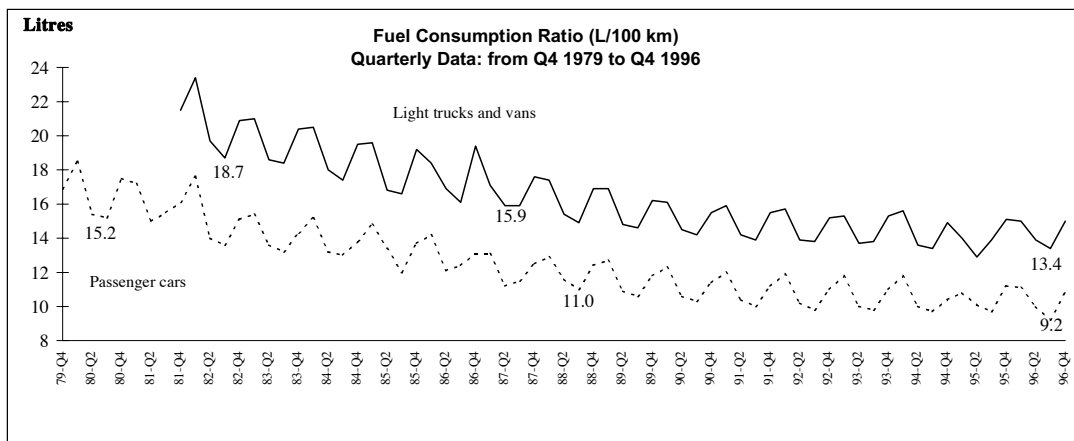


Trend of Fuel Consumption Ratio

NaPVUS October 1994 to September 1996 was, to a certain extent, an opportunity to evaluate the trend in private vehicle use since the 1980s. During the 1980s, Statistics Canada collected similar data with the *Fuel Consumption Survey* (FCS). The FCS collected data on passenger cars between October 1979 and December 1988 and on light trucks and vans between October 1981 and December 1987. Given that the sampling universes were not identical, adjustments to the data were made to make it comparable. However, because the methodologies used to conduct the FCS and NaPVUS were not identical in many aspects, the differences must be taken into consideration when interpreting the results.

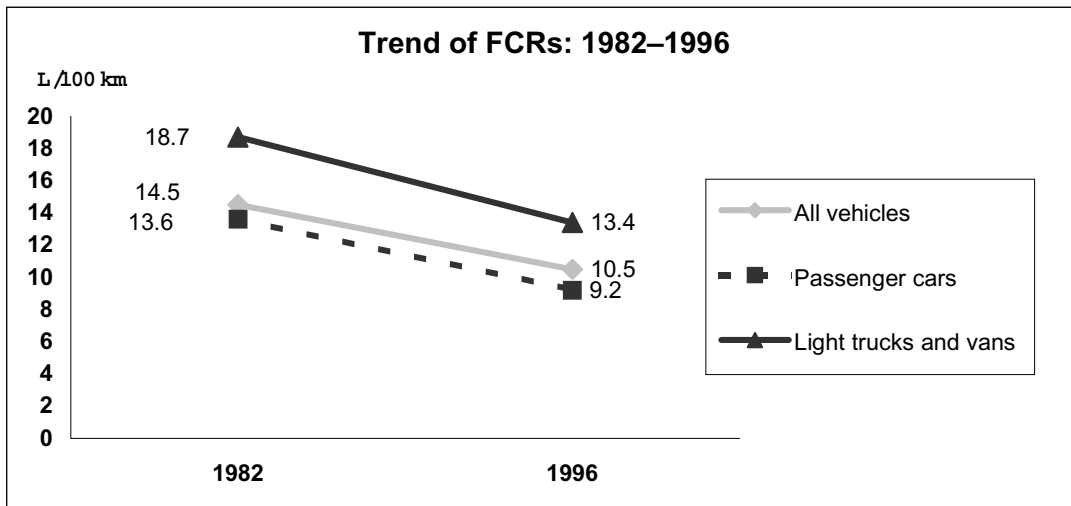
Figure 6.4.1 shows the FCR trend separately for passenger cars and for light trucks and vans from FCS to NaPVUS; data between the FCS years and NaPVUS were interpolated. The trend showed a steady decrease in the FCR through the years. In the early 1980s, the FCS found the average consumption ratios to be 15.2 L/100 km for passenger cars and 18.7 L/100 km for light trucks and vans. By the third quarter of 1996, the fuel consumption ratio dropped to 9.2 L/100 km for passenger cars and 13.4 L/100 km for light trucks and vans.

Figure 6.4.1



In order to make a clearer comparison, data from the third quarter of the 1982 FCS were compared with those of the corresponding quarter of the 1996 NaPVUS, with data being adjusted to reflect the same universe. In 1982, the average FCR of all private vehicles was 14.5 L/100 km while, in 1996, it was 10.5 L/100 km, a 28 percent decrease. The decrease was 32 percent for passenger cars and 28 percent for light trucks and vans. It should be noted that between 1982 and 1996, light trucks and vans increased their market share from 17 percent to 28 percent.

Figure 6.4.2



6.5 Comparison of On-Road Versus Laboratory-Tested Fuel Consumption Ratios

NaPVUS provides on-road fuel consumption information that is based on a sample of vehicles (model years 1979 to 1996). To provide some context and perspective, NaPVUS on-road fuel consumption ratios were compared to the combined city/highway laboratory-tested results (assumes 55 percent driving in city and 45 percent on highway) obtained from the vehicle manufacturers. When the comparisons were made for the same set of vehicles, the analysis found that the on-road estimates of fuel consumption were 28 percent higher for light trucks and vans, 23 percent higher for passenger cars and 25 percent higher for the overall light duty vehicles than the results produced under laboratory conditions for the same vehicles.

The laboratory-tested FCR is based on a federal testing procedure which requires that, after being driven about 6 000 km, the vehicle is mounted on a laboratory chassis dynamometer and run through simulated city and highway courses. This method of testing is used instead of on-road testing because all test conditions can be carefully controlled, ensuring that all vehicles are tested under identical conditions. As a result, the laboratory tests do not reflect real-world driving conditions (specifically, on-road fuel consumption). There are a number of factors that could explain the difference between the two results, including the following:

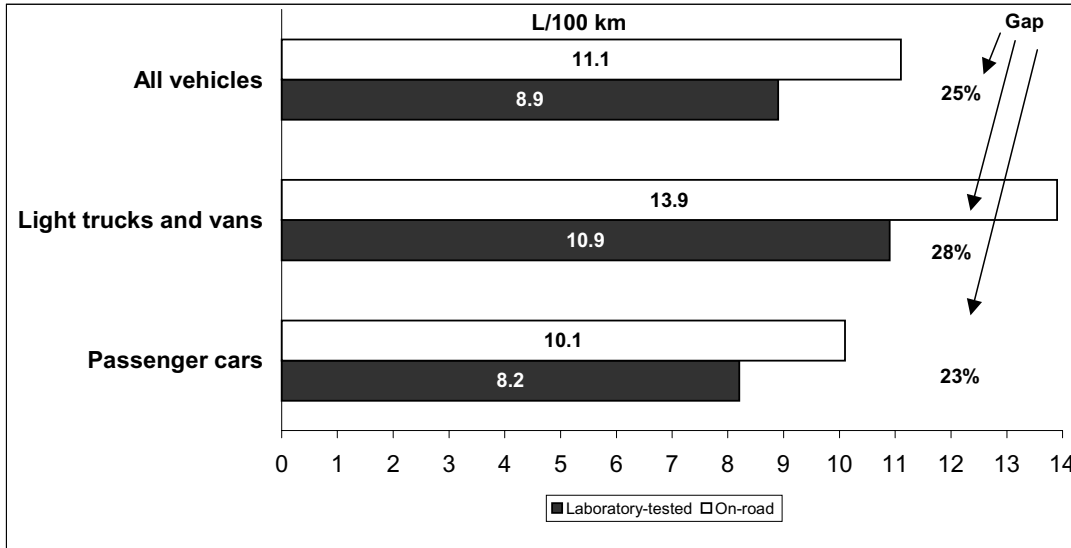
1. **Driving Conditions:** Laboratory-testing conditions may not represent exactly what a driver faces on the road. For example, it does not take into consideration road surface and grade, congested traffic patterns and the frequency of stops, all of which can increase the FCR. It also does not provide seasonal and climatic effects on fuel consumption.
2. **Vehicle Conditions:** Laboratory tests are conducted using new vehicles in perfect mechanical condition. On-road results are obtained from older vehicles whose FCR may have deteriorated over time. Vehicles purchased by consumers may also have optional features that can increase the FCR (e.g. air conditioning, other electric options) that may not have been in use during the laboratory test.
3. **Driving Behaviour:** Laboratory-testing conditions do not include driving behaviour (e.g. excessive speed, sudden acceleration/deceleration, long periods of idling) that can increase fuel consumption.

The laboratory-tested fuel consumption results are submitted by the vehicle manufacturers to the Canadian government under the Joint Government-Industry Voluntary Fuel Consumption Program. The results are used to produce the fuel consumption labels for new vehicles and to produce the government's Fuel Consumption Guide (FCG). The data are also used to verify that vehicle manufacturers meet the Company Average Fuel Consumption goals.

The laboratory-tested data are different from the figures provided in the government's annual FCG. The laboratory tests are based on a federal testing procedure that ensures all vehicles are tested under identical conditions. They do not reflect the real on-road driving conditions. Therefore, the fuel consumption ratios obtained from the laboratory-tested results are adjusted upward for the FCG to reflect more realistic on-road driving conditions. These adjustment factors add 11.1 percent to the laboratory-tested city fuel consumption ratio (L/100 km), 17.6 percent to the laboratory-tested highway fuel consumption ratio (or 14.1 percent to the city/highway combined fuel consumption ratio). These adjustment factors are currently under

review to ensure that the fuel consumption ratios presented in the FCG reflect average Canadian on-road driving conditions.

Figure 6.5
Fuel Consumption Ratio (L/100 km)
Laboratory-Tested Versus On-Road (NaPVUS) Estimates



APPENDIX A

List of NEUD Publications

LIST OF REPORTS NATIONAL ENERGY USE DATABASE OFFICE OF ENERGY EFFICIENCY

These reports are or will soon be viewable and downloadable from the Office of Energy Efficiency Web site at: <http://oee.nrcan.gc.ca/dpa>.

- ◆ *1993 Survey of Household Energy Use – National Results*; Catalogue No. M92-85/1994E; ISBN 0-662-22793-X.
- ◆ *1993 Survey of Household Energy Use – Provincial Results*; Catalogue No. M92-96/1995; ISBN 0-662-61978-1.
- ◆ *Survey of Canadian New Household Equipment Purchases, 1994 & 1995 – Statistical Report*; Catalogue No. M92-133/1997; ISBN 0-662-62902-7.
- ◆ *The Household Equipment of Canadians – Features of the 1993 Stock & the 1994 & 1995 Purchases – Analysis Report*; Catalogue No. M92-131/1997; ISBN 0-662-62806-3.
- ◆ *Survey of Houses Built in Canada in 1994 – Statistical Report*; Catalogue No. M92-136/1994; ISBN 0-662-62970-1.
- ◆ *Trends in Energy Characteristics of Homes in Canada – Analysis Report*; Catalogue No. M92-85/1-1997; ISBN 0-662-63165-X .
- ◆ *The 1994 Home Energy Retrofit Survey – Statistical Report*; Catalogue No. M92-135/1994; ISBN 0-662-62969-8.
- ◆ *The 1995 Home Energy Retrofit Survey – Statistical Report*; Catalogue No. M92-135/1995; ISBN 0-662-64000-4.
- ◆ *Energy Consumption of Major Household Appliances Marketed in Canada – Trends from 1990 to 1997*; Catalogue No. M92-176/1999; ISBN 0-662-64615-0.
- ◆ *National Private Vehicle Use Survey – October–December 1994 – Statistical Report*; Working Paper prepared for the NEUD, OEE.
- ◆ *National Private Vehicle Use Survey – October 1994 to September 1996 – Detailed Statistical Report*; Catalogue No. M92-191/2000E; ISBN 0-662-29031-3.
(available in winter 2000/2001)
- ◆ *National Private Vehicle Use Survey – October 1994 to September 1996 – Summary Report*; Catalogue No. M92-190/2000; ISBN 0-662-65006-9.
- ◆ *1997 Survey of Household Energy Use – Detailed Statistical Report*; Catalogue No. M92-85/1997E; ISBN 0-662-29209-X.
(available in winter 2000/2001)

- ◆ *1997 Survey of Household Energy Use – Summary Report*; Catalogue No. M92-85/1997-1; ISBN 0-662-65123-5.

To obtain a copy of any of these reports, contact:

Energy Publications
c/o DLS
Ottawa ON K1A 0S9
Canada

Fax: (819) 779-2833

When ordering, please use the catalogue number and ISBN associated with each title.



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