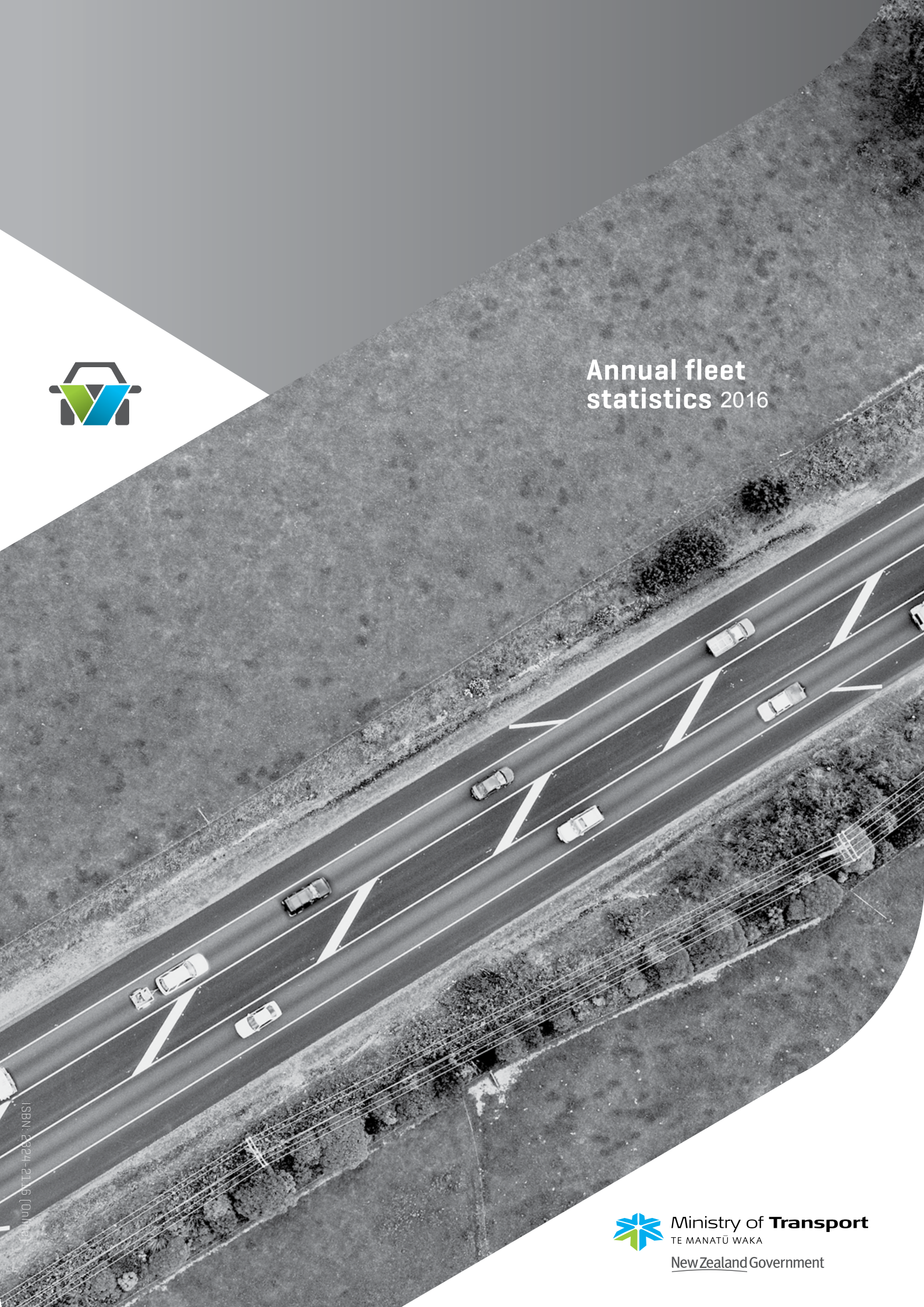
Annual fleet statistics 2016



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Ministry of Transport
TE MANATŪ WAKA
New Zealand Government

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For more information about vehicles and travel check out www.transport.govt.nz/research.

2016 fleet report highlights

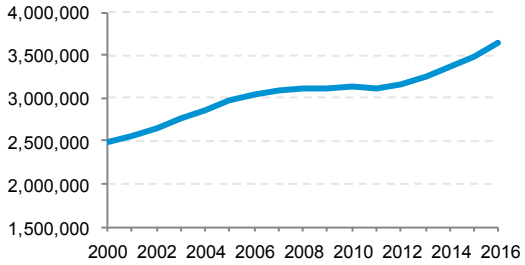
Light vehicle registrations and travel

Light vehicle registrations increased markedly in 2013 and have continued to grow each year since then. New registrations have set record after record, and used registrations have almost reached the previously record levels of 2003-2005.

The key light fleet metrics (fleet size, vehicles per capita, travel, travel per capita) are all rising.

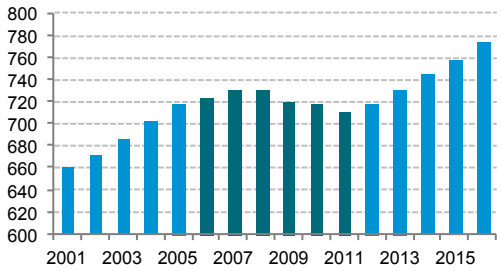
Light fleet size

The light fleet has grown significantly since registrations first picked up in 2013.



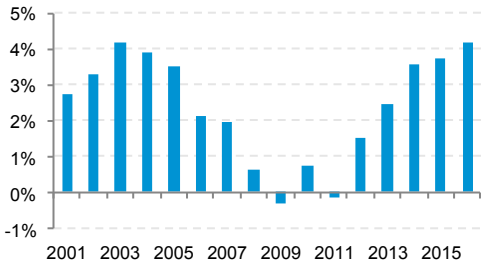
Light vehicles per 1000 people

Vehicle ownership rates started increasing in the second half of 2012 after dropping from 2007 to 2011, and have kept on increasing. They are now at their highest ever level.



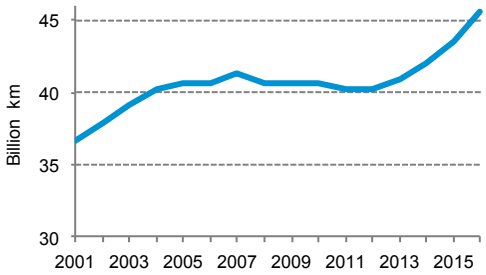
Light fleet growth rate

The rate of fleet growth in 2016 was even higher than the very high growth in 2002-2005.



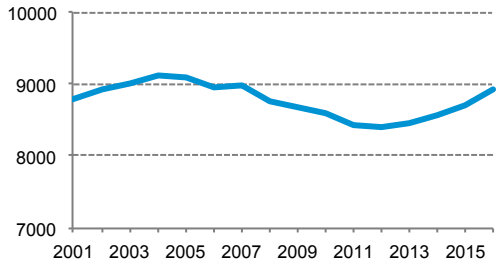
Travel growth

Light fleet growth has resulted in travel growth of 4.6% in 2016.



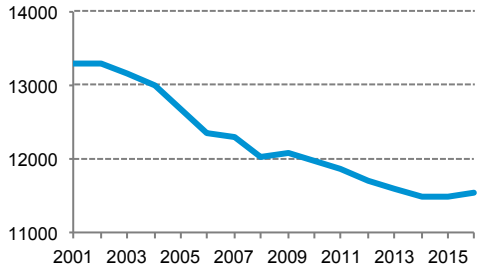
Travel growth per person

The kilometres travelled per person in light vehicles has increased every year since 2013.



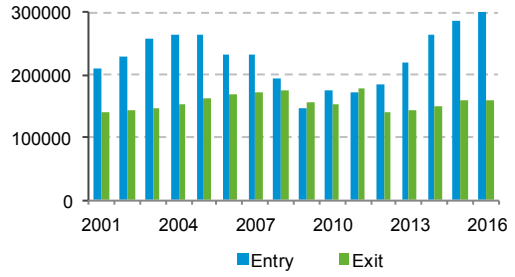
Travel per light vehicle

Annual travel per light vehicle has been declining, as light vehicle numbers have increased by a greater rate than travel.



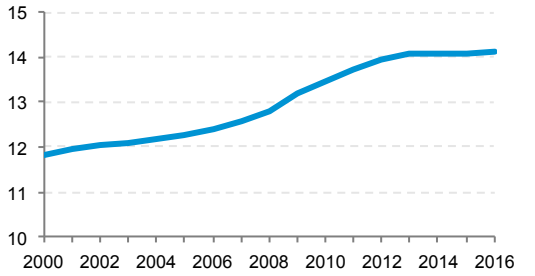
Light vehicle entries and exits

The number of vehicles leaving the fleet in 2016 was low, whereas entries were a record high



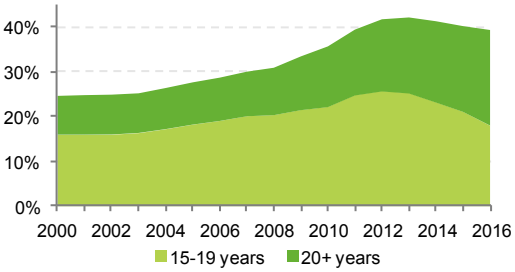
Light fleet average age

Vehicle registrations dropped after 2005, and as a result the average age of the light vehicle fleet started to increase. The increase in age has been arrested by the high levels of registrations, but hasn'lt dropped due to the low levels of scrappage.



Light fleet age structure

The large number of recent vehicle registrations have reduced the proportion of the fleet that is aged 15 years or older. However, the absolute number of these vehicles remains high and many are approaching the end of their life.



Petrol prices

Real regular petrol prices were lower in 2015- 2016 than 2011-14. These prices (cents/litre) have been converted to a December 2011 basis using the consumer price index.

CO_2 emissions of light vehicles registered

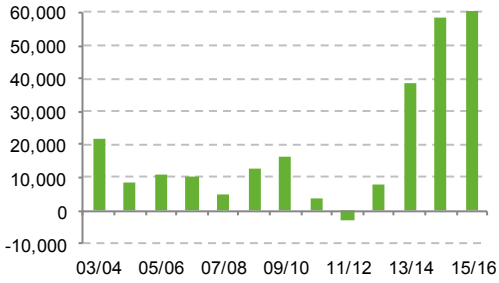
The CO_2 emissions (grams per km driven) of light vehicles entering the fleet dropped in 2011 and 2012 but have remained steady since then.

Light petrol fleet fuel economy

The fuel economy (litres per 100 km) of the light petrol fleet is improving. This is established by comparing travel and the petrol used, less estimated non-road use.

Net migration

One of the causes of the high number of vehicle purchases in 2016 was high net migration (shown below). Fewer New Zealanders are leaving and immigration has increased.



Accessing the graphs and information in this report

The graphs and information presented in this report, and the report itself, are available at www.transport.govt.nz/research. A series of brief quarterly fleet reports is also available there.

The Ministry has developed a set of transport Indicators, which include further information on the vehicle fleet, including some regional breakdowns. They are available on the Ministry of Transport's website (www.transport.govt.nz).

Describing the vehicle fleet

This report is based on data from the Motor Vehicle Register. The statistics presented in this publication have been categorised differently to the traditional motor vehicle statistics produced by the Transport Registry Centre of the New Zealand Transport Agency (NZTA)[1]. The objective was to produce a categorisation better suited to the estimation of fuel use and levels of emissions. Points (1) and (2) below are the significant differences.

1) Vehicle categorisation

The vehicle categories used in this report are:

- Light passenger
- Light commercial
- Truck
- Bus
- Motorcycle

NZTA categorisation	Categorisation used in this report
Passenger car/van	Light passenger
Goods vans/trucks/utilities	Light commercial if under 3500kg Truck if over 3500kg
Buses	Light commercial if under 3500kg Bus if over 3500kg
Motor caravans	Light commercial if under 3500kg Truck if over 3500kg
Motorcycles	Motorcycles
Mopeds	Motorcycles

2) Vehicles leaving the fleet

The second difference is in judging when a vehicle has left the fleet. Unless a vehicle owner actively de-registers it, or the vehicle has not been re-licensed for 12 months, then NZTA's practice has been to include those vehicles in fleet statistics. This over-estimates the size of the active fleet, as some vehicles will become inactive well within the 12 months.

In this report vehicles are considered to have left the fleet when their licence expires and is not renewed within 12 months or they are cancelled, whichever comes first. This provides for better travel estimates

Appendix A and B expand on these approaches.

[1] www.nzta.govt.nz/statistics/motor-vehicle-registration/index.html

3) Travel estimation

The vehicle travel estimates in this report are derived from the odometer readings recorded when vehicles undergo inspection (warrant of fitness and certificate of fitness). These readings were first recorded in this way in 2000 and the estimates derived from them become usable from 2001 onwards.

Although the current method of collecting data generally provides accurate data, a range of matters, discussed below, mean that all figures presented are estimates and may be revised in subsequent years in light of more complete data.

The travel estimates for a year are calculated in July/August the following year, and make use of 6 months of inspections data after the end of that analysis period. This approach results in a high number of vehicles having an inspection after the end of the analysis period, but it is still a compromise.

One reason that travel estimates vary from year to year is the new longer warrant of fitness (WoF) cycles. For instance, a vehicle that entered the fleet in August 2014 will not be inspected for three years. Therefore average travel distances for similar vehicles will be used for that vehicle until it is eventually inspected.

Other vehicles that have had a series of inspections, may not have an inspection in the six months after the analysis period. That means that their travel has to be projected to the end of the analysis period. This is more common now that many vehicles are subject to annual WoF inspections.

Eventually these vehicles are likely to undergo more inspections, and the estimated travel for the analysis period can firmed up. That is why there is a limited degree of change when estimates for previous years are republished.

It also means that similar overall annual travel estimates (for instance 39.9 billion and 40.1 billion) are best regarded as the same, as that level of difference may disappear when extra inspections lead to better estimates.

1. Setting the scene – the vehicle fleet in context

How much is the fleet growing?

Figure 1.1 shows that the light fleet (light passenger and light commercial vehicles) makes up over 90 percent of the total vehicle fleet. The light fleet is made up of cars, vans, utes, four wheel drives, sports utility vehicles (SUVs), buses and motor caravans (camper vans) under 3.5 tonnes. Figure 1.2 shows that the light fleet grew by 21 percent between December 2000 and December 2006 but only by 4.5 percent from December 2006 to December 2012. Growth was 2.5% in 2013, 3.6% in 2014, 3.8% in 2015 and 4.2% in 2016.

The light fleet is not the fastest growing segment of the fleet. Figure 1.2 shows that bus and motorcycle/ mopeds have increased by over 100 percent since December 2000.

Figure 1.1 : Fleet composition

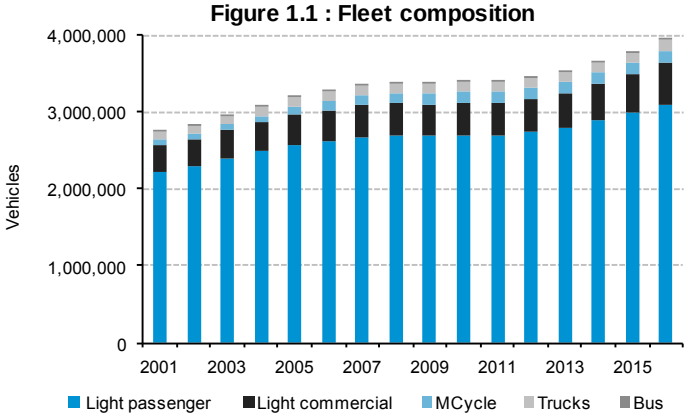
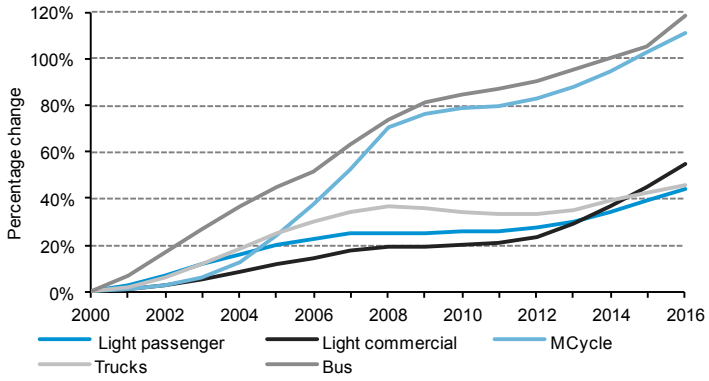


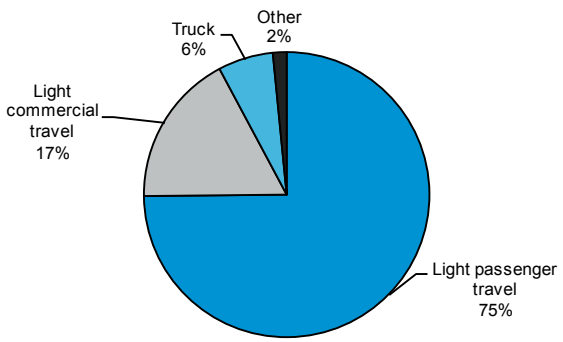
Figure 1.2 : Fleet increase since 2000



What part of the fleet travels the most?

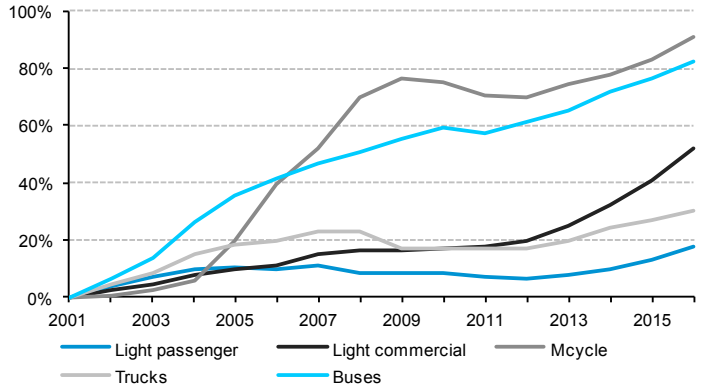
Travel on New Zealand roads is dominated by the light fleet. Light passenger vehicles contributed 75 percent of road travel in 2016 and light commercial vehicles a further 17 percent. Only eight percent of road travel was by other vehicles (motorcycles, heavy trucks and buses).

Figure 1.3a : Travel in 2016



Comparing Figures 1.2 and 1.3b shows that growth in travel and vehicle numbers has been similar, except for light passenger vehicles. Their numbers have increased relatively more than their travel has.

Figure 1.3b: Travel growth

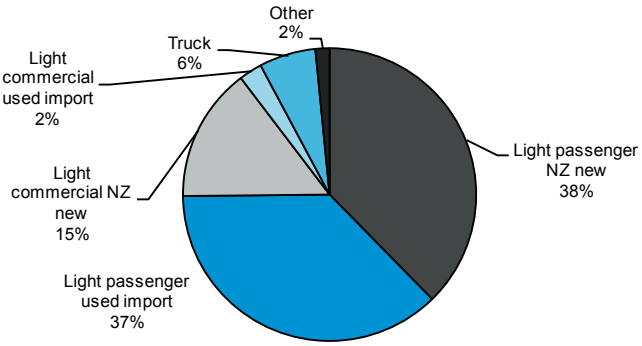


Is the light fleet travel done by New Zealand-new or used imported vehicles?

Breaking the information in 1.3a down further shows that travel by the light passenger and light commercial fleets is significantly different. Light passenger travel[2] is almost equally split between vehicles imported new into New Zealand, and vehicles imported second-hand. Light commercial travel is dominated by New Zealand-new vehicles.

See also Section 8.2, for a diesel/petrol breakdown.

Figure 1.3c : Travel in 2016, new/used import

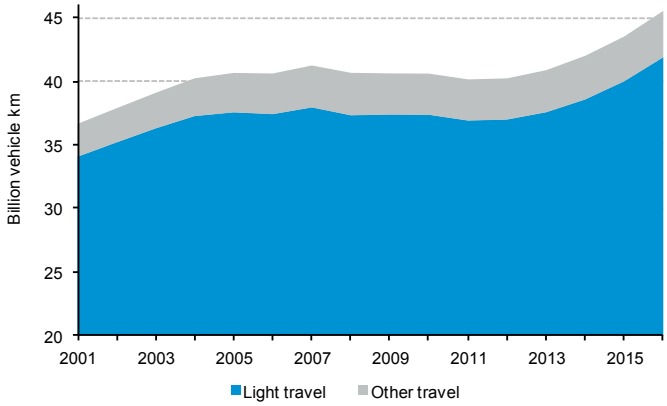


What are the trends in travel?

Total annual travel in New Zealand was increasing until 2007 (up 12.8 percent from 2001 to 2007), but between then and 2012 three periods of high oil prices and the economic downturn saw a slight fall in travel (down 2.1 percent from 2008 to 2012).

Travel was up 1.6 percent in 2013, 2.8% in 2014, 3.6% in 2015 and 4.6% in 2016. The growth in the fleet has been similar to travel growth in recent years - the light fleet size increased by 3.8% in 2015 and 4.2% in 2016..

Figure 1.4 : Travel

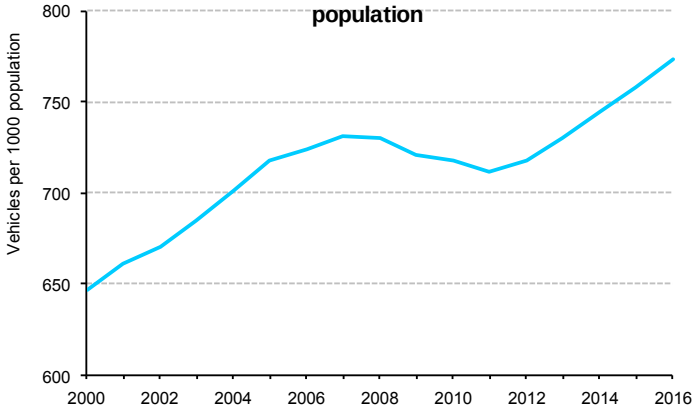


Ownership per capita[3] of light vehicles increased significantly between 2000 and 2005. The increase reflected a number of factors, including the high value of the New Zealand dollar (which made vehicles cheaper), high employment and the positive

[2] Travel has been estimated using the odometer readings from the vehicle inspection system (warrant of fitness and certificate of fitness).

economic outlook that typified that time. Light vehicle ownership per capita declined between 2007 and 2012, but has increased to record levels since then. It is now higher than the previous peak level of 2007. Also see Figure 1.5b. These levels of ownership are among the highest in the world.

Figure 1.5a : Light fleet ownership per 1000 population



Regional light vehicle ownership

Figures 1.5a shows the national trend in light vehicle ownership per capita. However, there is substantial regional variation (see Figures 1.5b and 1.5c). Three of the four regions with the highest ownership rates are in the South Island (Canterbury, Nelson-Marlborough and Southland). Wellington and Auckland have low ownership rates, due in part to the availability of public transport

Figure 1.5b: North Island light vehicle ownership per 1000 people

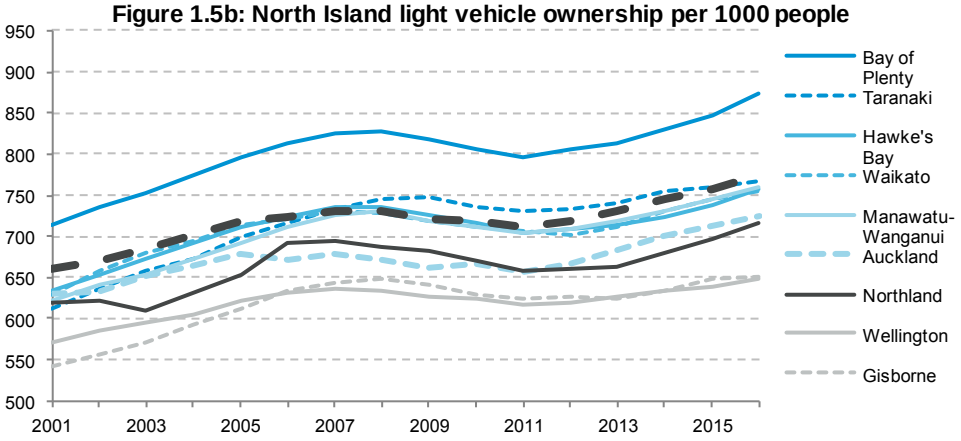
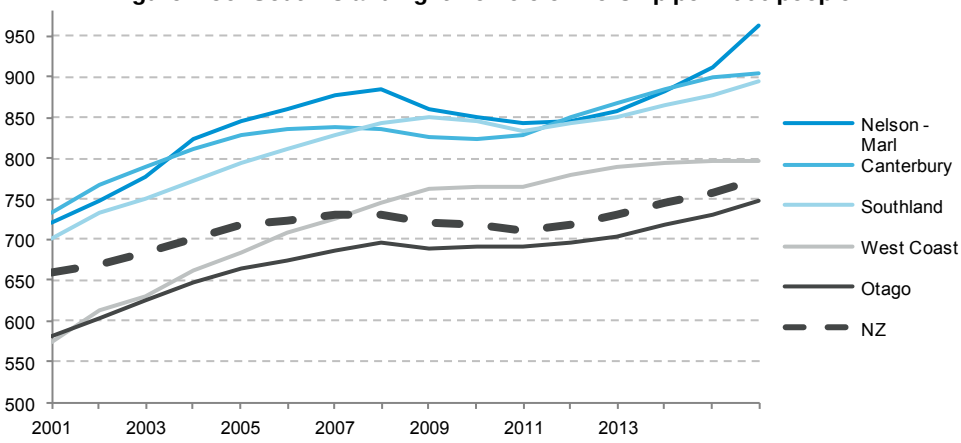


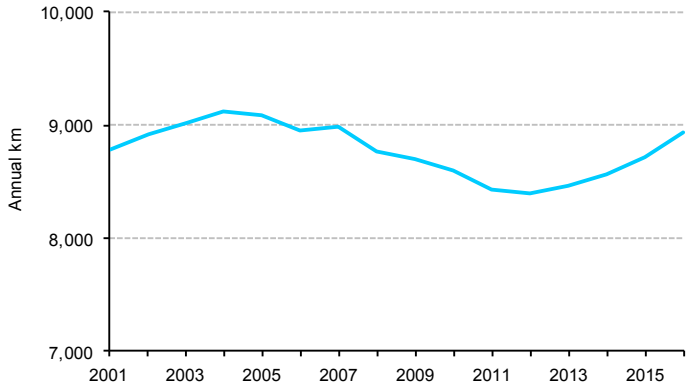
Figure 1.5c: South Island light vehicle ownership per 1000 people



[3] Population data obtained from the Statistics New Zealand website www.stats.govt.nz.

The increased ownership rate was accompanied by increased travel per capita until 2005. Light travel per capita (and fleet travel) dropped in response to the fuel price rises in 2006, rose slightly in 2007 and continued to drop until 2012. Light travel per capita has increased very year since 2013. Figure 1.7 shows that travel per vehicle dropped until 2014. Otherwise, the travel increase would have been far more due to the increase in light vehicles per capita.

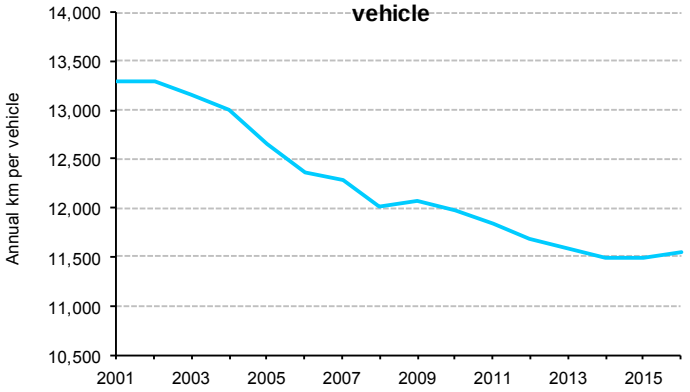
Figure 1.6 : Light fleet travel per capita



Although New Zealand has high levels of vehicle ownership (see Figure 1.5a) this does not translate proportionately into increased travel. The amount of travel per light vehicle declined every year until 2014 (with the exception of 2009) which is why travel has not increased in line with vehicle numbers.

Part of the reason for the decline in travel per light vehicle was the increase in vehicles per capita from 2000 to 2005 (see Figures 1.5 and 1.6) and again more recently.

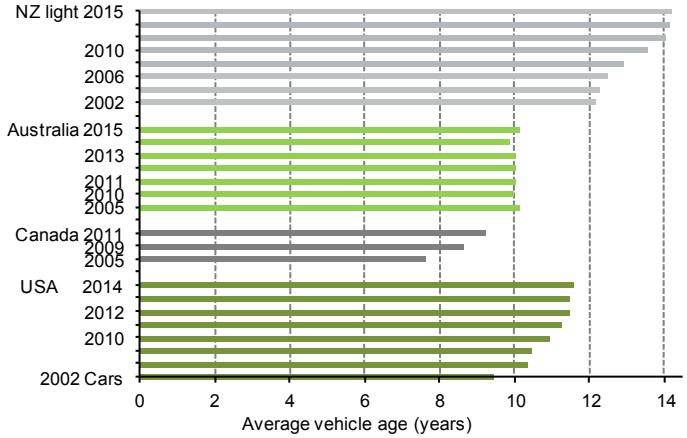
Figure 1.7 : Light fleet average annual travel per vehicle



How does the age of the New Zealand fleet compare internationally?

This comparison has been confined to countries with high levels of motorisation, and with similar patterns of development to New Zealand. The United Kingdom has not been included as its motorisation level is comparatively low. New Zealand has a comparatively old fleet compared with other developed countries.

Figure 1.8 : Average light fleet age



Source : USA Polk, Canada DesRosiers and Automotive Industries Association, Australia Bureau of Statistics

Light petrol fleet fuel economy

The economy of the light petrol fleet has been estimated by comparing the travel of the light petrol fleet with petrol deliveries, less estimated other uses of petrol.

The fuel that has been removed from the calculation is:

- petrol used on-road by other parts of the fleet (motorcycles, heavy goods vehicles and buses
- fuel used off-road (boats and jet skis, lawnmowers, circuit racing, rallying, speedway, off-road motorcycling and agricultural quad bikes), which is estimated as 3.7-4.7 percent of petrol deliveries[4]

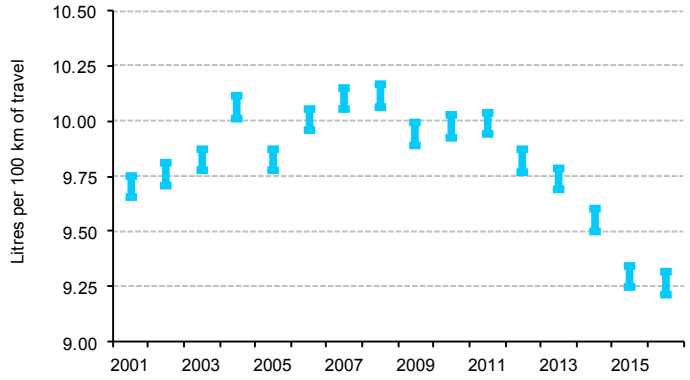
The bars on the chart in Figure 1.9 show petrol economy estimates, which are based on the minimum (4.7 percent) and maximum (5.7 percent) percentage of petrol thought not to be used by the light fleet.

The resulting rates are indicative of what happens on New Zealand roads under New Zealand driving conditions. These values are higher than the vehicle fuel test cycle values shown in Section 9, which are based on European and Japanese regulatory test cycles. There is evidence that real world fuel consumption is higher than the manufacturers laboratory test values, and the gap between them is widening[5].

The graph indicates that real world petrol economy improved only slightly between 2006 and 2011, despite the entry of more fuel-efficient vehicles into the fleet (also see Section 9). It improved by 5% between 2011 and 2015.

The petrol estimates used are Ministry of Business, Innovation and Employment (MBIE) “observed” values, which MBIE collates from fuel company reporting.

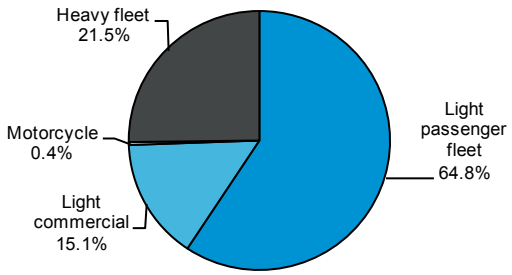
Figure 1.9 : Light petrol fleet fuel economy
Minimum and maximum estimates



Vehicle fleet CO_2 emissions

Vehicles produce CO_2 in direct proportion to the amount of fuel used. Modern vehicles are typically engineered to reduce their harmful emissions, and sometimes this is confused with their CO_2 emissions. CO_2 emissions are purely a product of the fuel consumed, and are not affected by any controls a vehicle has to reduce harmful emissions (such as fine particulates, NOx, carbon monoxide, volatile organics and hydrocarbons).

Figure 1.10 : 2015 CO_2 emissions



Source : VFEM (Vehicle Fleet Emissions Model) 2

[4] Detailed in the accompanying data spreadsheet. Refer www.transport.govt.nz/research.
[5] www.theicct.org/laboratory-road and www.intechopen.com/download/get/type/pdfs/id/41021

Population increase and the light fleet

Growth in the light fleet in the last three years has mirrored population growth. Population growth has increased substantially with positive net migration. In 2011/12 more people left New Zealand than arrived but since then arrivals have outnumbered departures.

Figure 1.11a shows the recent correlation between population and light fleet growth.

Figure 1.11b shows that the turn around in net migration since 2013/14 is due both to a reduction in New Zealanders leaving and an increase in non-New Zealanders arriving.

Figure 1.11a : Net migration and light fleet growth

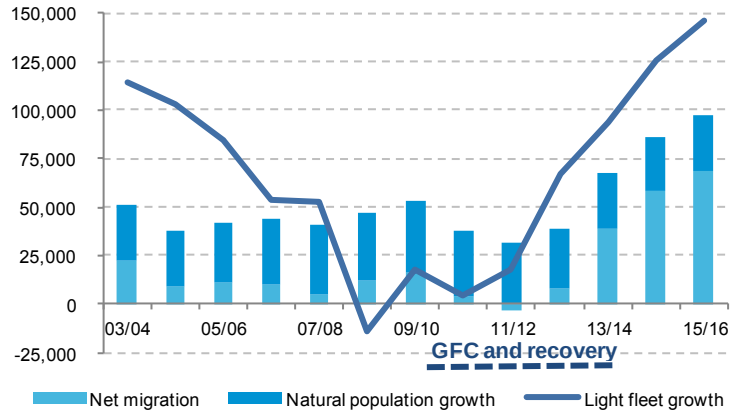
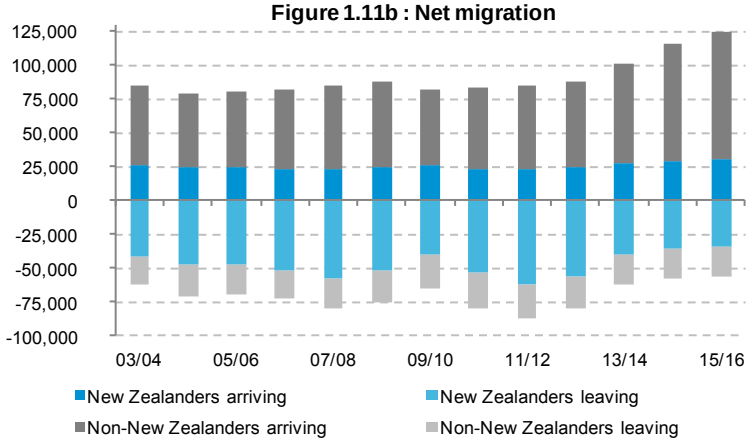


Figure 1.11b : Net migration



2. Composition of the fleet

New Zealand new and used imported vehicles

Used imported vehicles make up a large proportion of the light vehicle fleet. Figure 2.1 shows their share reached almost 50 percent in 2006 before dropping back to 46% recently.

Figure 2.2 shows that the used import share of the bus and truck fleet is also dropping. The used import segment of the bus and truck fleets was growing faster than the used imported segment of the light fleet. This growth has ceased since the 2007 Vehicle Exhaust Emissions Rule effectively prevented the import of older used diesel vehicles. There have also been increased sales of new buses since 2007 (see Figure 5.1d).

Figure 2.1 : Light fleet composition

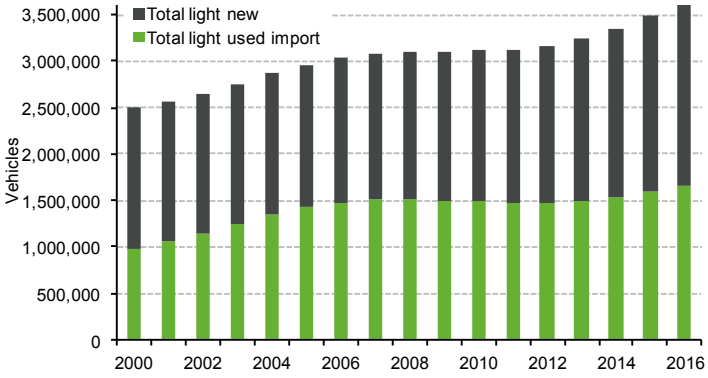
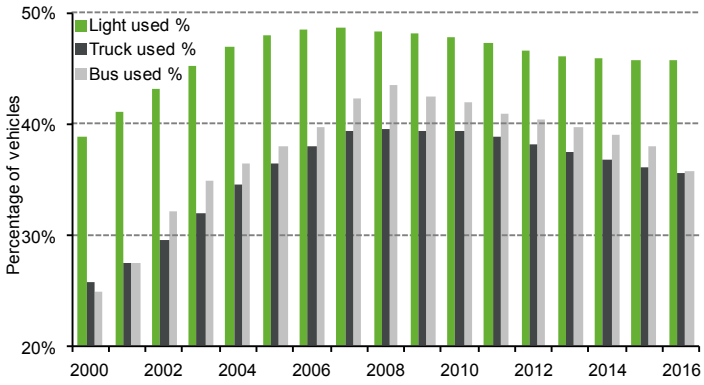


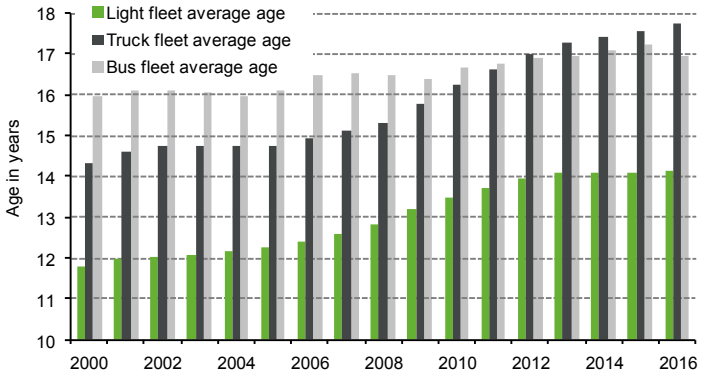
Figure 2.2 : Fleet used import percentage



Average vehicle age

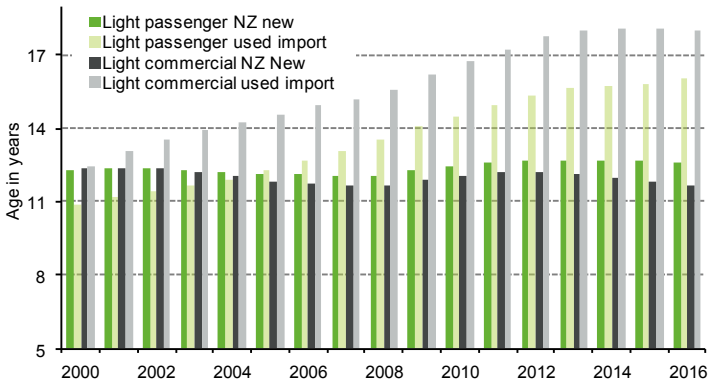
The average age of the light fleet (14.1 years) and the truck fleet (17.7 years) has increased. This is not isolated to New Zealand and one possible influence is improved mechanical reliability, leading to vehicles lasting longer.

Figure 2.3 : Fleet average age



The average age of the vehicles in the light fleet is high by international standards (see Figure 1.8). Figure 2.4 shows that the average age of the used imported light passenger vehicles in the fleet is increasing and that the average age of the NZ new light passenger vehicles is remaining about the same. The aging of the large block of mid 1990s vehicle shown in Figure 2.5a drives this trend.

Figure 2.4 : Light fleet average age



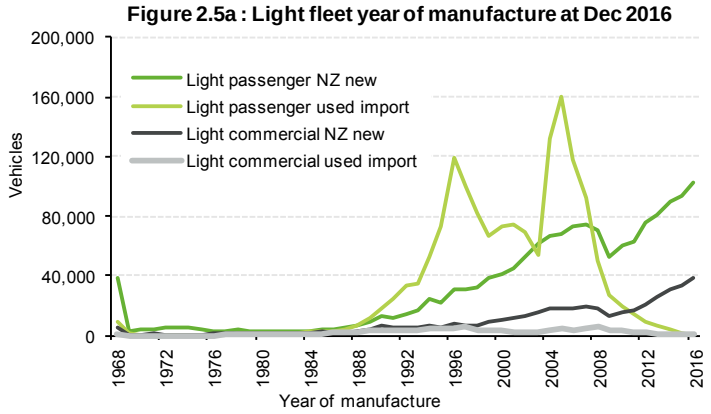
Light fleet year of manufacture

The light vehicle fleet age mix includes a significant number of used imports manufactured in the mid 1990s.

The 1996 year of manufacture peak in the New Zealand fleet is in part a consequence of the Frontal Impact Standard[6], which had the effect of restricting used car imports to those vehicles manufactured during or after 1996 (and some older vehicles that met the standard).

As these mid-1990s vehicles age, we expect a significant effect on the age of the fleet. The actual effect will depend on future vehicle import and scrappage patterns (see also Figures 2.5b, 2.11a- 2.11b, 2.12a-2.12d and Table 2).

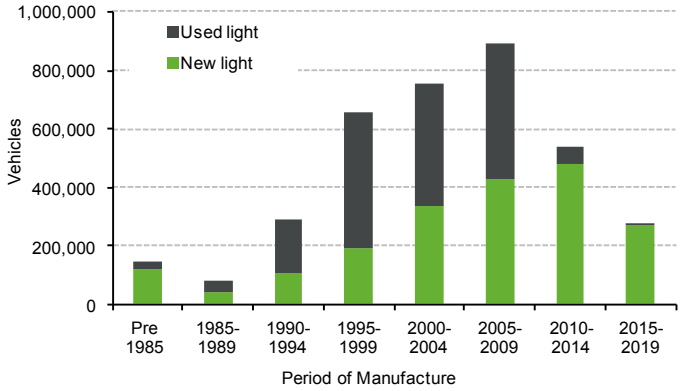
Figure 2.5a : Light fleet year of manufacture at Dec 2016



[6] http://www.nzta.govt.nz/resources/rules/frontal-impact-2001-index.html

Figure 2.5b shows the relative numbers and ages of the vehicles in the light fleet. Mid-1990s vehicles were once the largest single block, but they have been overtaken by 2000-04 and 2005-09 vehicles.

Figure 2.5b : Light fleet composition Dec 2016



Tables 1 and 1a provide a cumulative view of the age structure of the light vehicle fleet at 31 December 2016.

Table 1 December 2016 light fleet age structure

Light vehicle age	Share
Upto 1 year old	3.9%
Upto 2 years old	7.5%
Upto 3 years old	10.9%
Upto 4 years old	14.1%
Upto 6 years old	19.6%
Upto 8 years old	25.0%
Upto 10 years old	34.2%
Upto 15 years old	60.6%
Upto 20 years old	78.4%

Table 1a December 2016 light fleet age structure

Year of manufacture	Vehicles	Cumulative vehicles	Cumulative share
2016	142,337	142,337	3.9%
2015	129,903	272,240	7.5%
2014	124,877	397,117	10.9%
2013	114,585	511,702	14.1%
2012	105,752	617,454	17.0%
2011	95,658	713,112	19.6%
2010	98,911	812,023	22.4%
2009	95,267	907,290	25.0%
2008	144,198	1,051,488	29.0%
2007	191,084	1,242,572	34.2%
2006	212,824	1,455,396	40.1%
2005	251,127	1,706,523	47.0%
2004	219,775	1,926,298	53.1%
2003	134,223	2,060,521	56.7%
2002	138,614	2,199,135	60.6%
2001	134,604	2,333,739	64.3%
2000	128,092	2,461,831	67.8%
1999	117,968	2,579,799	71.0%
1998	124,349	2,704,148	74.5%
1997	143,256	2,847,404	78.4%
1996	162,984	3,010,388	82.9%

1995	104,823	3,115,211	85.8%
1994	87,709	3,202,920	88.2%
1993	60,967	3,263,887	89.9%
1992	56,529	3,320,416	91.4%
1991	45,137	3,365,553	92.7%
1990	42,165	3,407,718	93.8%
1989	28,727	3,436,445	94.6%
1988	17,899	3,454,344	95.1%
1987	13,103	3,467,447	95.5%
1986	10,592	3,478,039	95.8%
1985	9,256	3,487,295	96.0%
1984	7,536	3,494,831	96.2%
1983	5,595	3,500,426	96.4%
1982	5,497	3,505,923	96.6%
1981	4,999	3,510,922	96.7%
1980 and earlier	120,136	3,631,058	100.0%

There is a significant difference between the make-up of the light passenger and light commercial fleets. Light commercial vehicles are typically relatively young New Zealand-new vehicles, whereas the passenger fleet has a far higher proportion of older used imports.

Figure 2.5c : Light passenger fleet composition Dec 2016

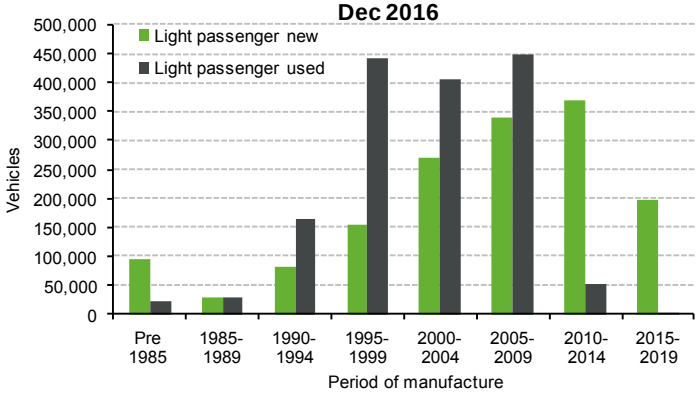
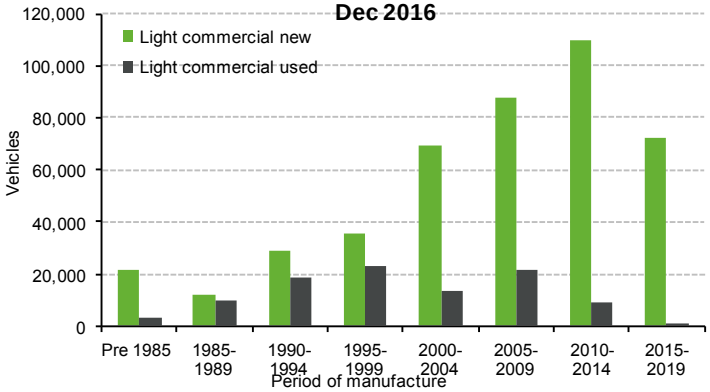


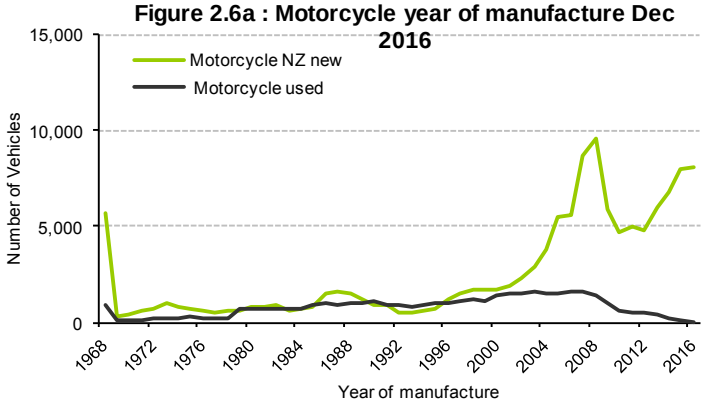
Figure 2.5d : Light commercial fleet composition Dec 2016



Motorcycle and moped year of manufacture

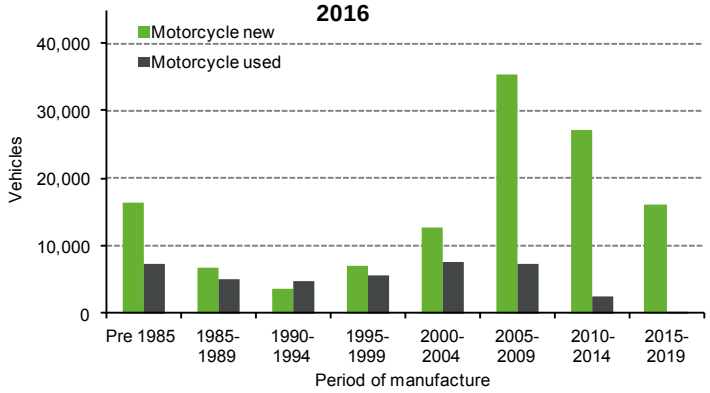
The motorcycle and moped fleet grew rapidly from 2004 to 2008 (see Figure 1.2). The age structure (Figure 2.6a) shows that registrations peaked in 2008, and resurged from 2013 onwards. Used imports only make up a limited share of these registrations. Also see Figure 2.6b.

Figure 2.6a : Motorcycle year of manufacture Dec 2016



Motorcycles and mopeds have typically been purchased new in recent years, although there is a higher proportion of used imports among the older bikes.

Figure 2.6b : Motorcycle fleet composition Dec 2016



Truck year of manufacture

The truck age structure (Figure 2.7a) shows large numbers of 1990s used imports in that fleet, which is a characteristic of the light fleet as well. See also Figure 2.7b.

The peaks in used vehicle models that were made in the mid-1990s reflected the effective banning of these vehicles in many Japanese cities for air quality reasons. This was achieved by a retrospective requirement for vehicles to meet more recent emission standards. Many owners chose to export their vehicles rather than fit aftermarket emission controls. Imports of used diesel trucks fell after 2005 (see Figure 5.1c). Truck registrations have increased significantly since the low point in 2009.

Figure 2.7a : Truck year of manufacture Dec 2016

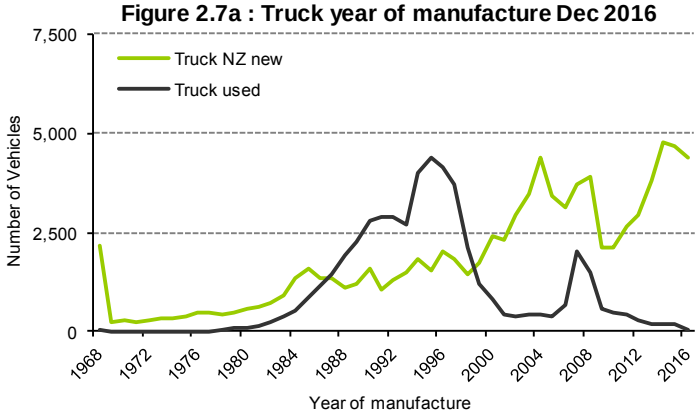
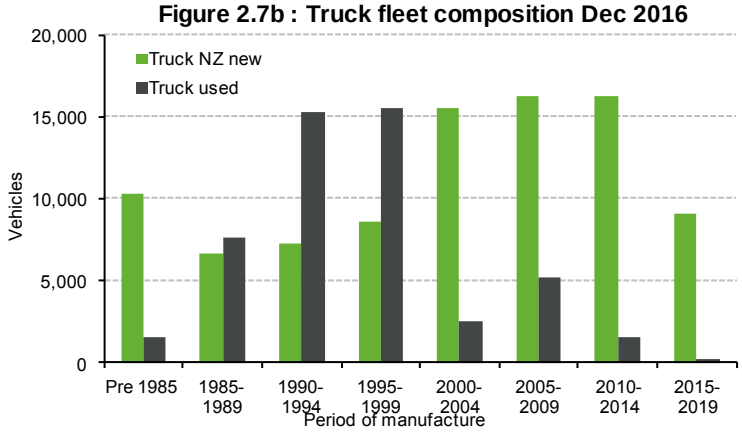


Figure 2.7b : Truck fleet composition Dec 2016



Bus year of manufacture

The bus fleet has a different age profile from that of the truck fleet. It has a larger proportion of recent New Zealand new vehicles.

Figure 2.8a : Bus year of manufacture Dec 2016

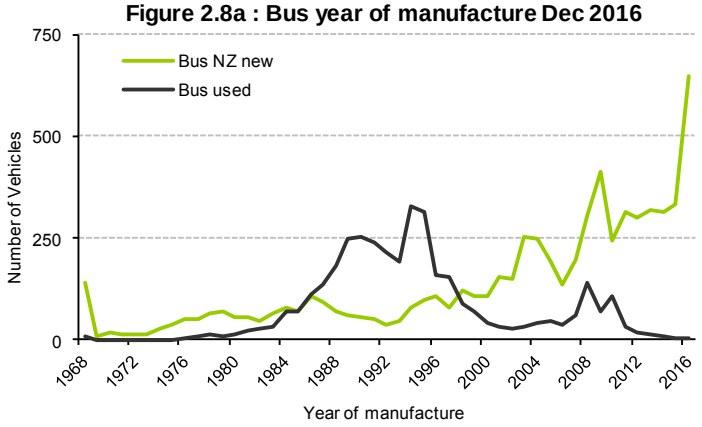
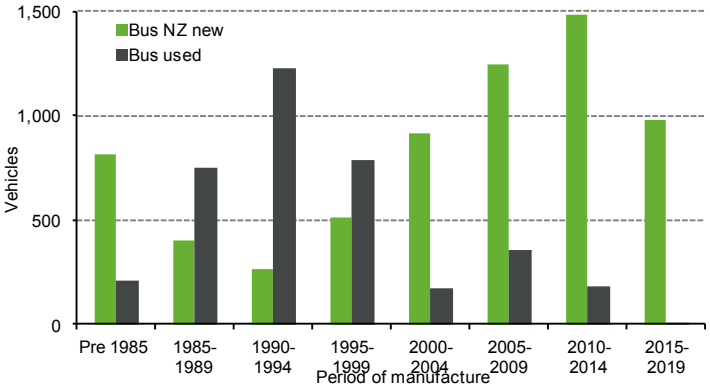


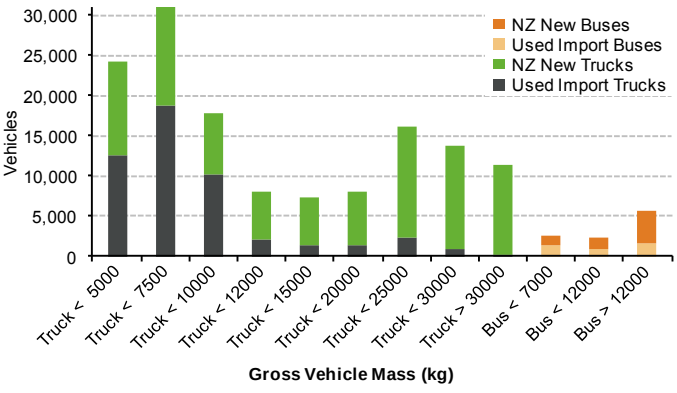
Figure 2.8b : Bus fleet composition Dec 2016



Heavy fleet gross vehicle mass

The used imported vehicles in the heavy fleet are concentrated in the small to medium mass range.

Figure 2.9 : Heavy fleet mass Dec 2016



Light fleet age structure

Figures 2.10a and 2.10b show how the age structure of the light fleet has changed since 2000. In 2000, 23.8% of the light fleet was 15 or more years old, but by 2016 this had increased to 39.4%, down from a peak of 42.3% in 2013.

Vehicle replacement volumes dropped significantly in 2008-2011 and the effect can be seen in the levelling off of the light fleet size (see Figure 2.10a) until the increase in vehicle registrations in 2012.

Figure 2.10a : Light fleet age structure

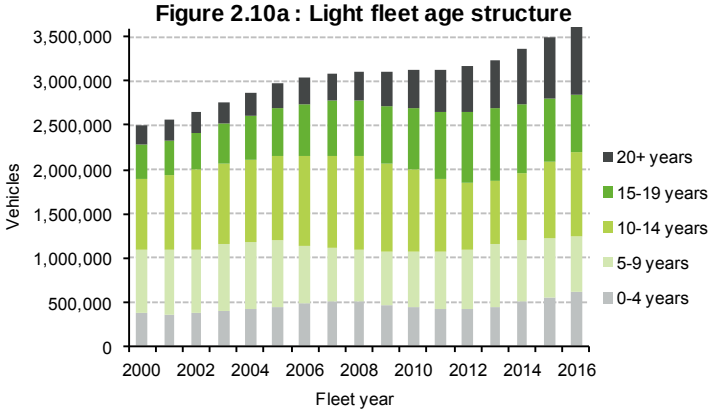
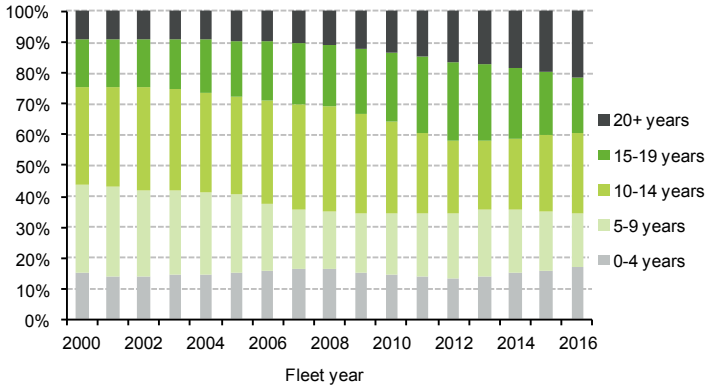


Figure 2.10b : Light fleet age structure



1990s vehicles in the light vehicle fleet

The New Zealand light vehicle fleet has a large number of vehicles built in the mid-1990s (see pages 13-15). These older vehicles tend to have lower levels of crash worthiness (ability to protect their occupants in a crash) and higher levels of harmful emissions than vehicles built more recently, so there is interest in how quickly they are leaving the fleet. This section provides more detailed information on vehicles built in the 1990s.

Figure 2.11a shows that the 1990s vehicles peaked at 1.8 million in the 2006 fleet, and had dropped by 47% to 0.95 million by December 2016.

Figure 2.11a : 1990s light vehicles in the 2000-2016 fleets

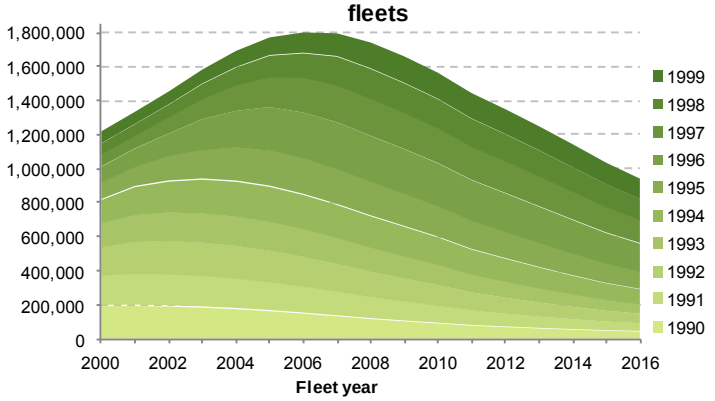


Figure 2.11b shows the entry of large numbers of 1996 year of manufacture vehicles between 2000 and 2008, with 50,000 more of these in the fleet than models of any other year. This remains the largest model year with 163,000 1996 vehicles still in the fleet in 2016.

The graph also shows the lower rate of scrappage of more recent model years (1998 and 1999), which is shown in another way in Figure 2.11c.

Figure 2.11b : 1990s light vehicles in the 2000-2016 fleets

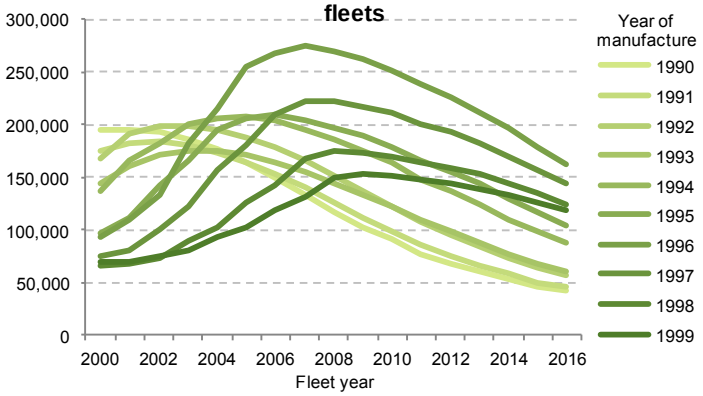


Table 2 shows the rates of entry and exit of 1990s vehicles in the 2001-2016 fleets.

- the average scrappage rate of all 1990s vehicles in 2016 was 8.9% ie 8. 9% of those vehicles in the fleet at the start of 2016 left during the year
- large numbers of 1994-1997 vehicles will be in the fleet for some time (currently 499,000 vehicles, down from 549,000 a year ago or 9%)

Table 2 Percentage change in the number of 1990s vehicles in the fleet

Fleet year	Vehicle year 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	Total
2001	0.5%	4.2%	13.9%	10.8%	21.5%	15.1%	16.0%	5.9%	4.3%	0.8%	9.3%
2002	-1.8%	0.6%	3.8%	7.1%	9.6%	28.3%	21.4%	26.2%	8.0%	6.1%	8.8%
2003	-3.5%	-1.8%	0.4%	1.9%	9.5%	16.6%	37.6%	20.8%	21.3%	8.1%	8.8%
2004	-4.9%	-3.4%	-1.9%	0.2%	3.2%	16.9%	17.5%	28.5%	14.9%	15.6%	6.9%
2005	-6.9%	-5.2%	-3.6%	-2.0%	0.9%	5.9%	19.2%	14.9%	22.7%	9.7%	4.6%
2006	-8.9%	-7.0%	-5.4%	-4.1%	-2.1%	1.2%	5.1%	16.4%	12.9%	15.1%	1.6%
2007	-10.7%	-8.8%	-7.1%	-5.5%	-3.8%	-1.9%	2.3%	6.0%	17.5%	11.8%	-0.3%
2008	-12.5%	-10.5%	-8.8%	-7.1%	-5.2%	-3.7%	-1.6%	0.0%	4.6%	13.8%	-3.0%
2009	-11.8%	-10.4%	-9.1%	-7.5%	-5.7%	-4.1%	-2.9%	-2.2%	-0.9%	2.2%	-4.7%
2010	-12.2%	-11.4%	-10.3%	-8.5%	-6.8%	-5.1%	-3.8%	-3.1%	-2.3%	-1.4%	-5.7%
2011	-14.6%	-14.0%	-13.0%	-11.2%	-9.2%	-7.3%	-5.5%	-4.6%	-3.5%	-2.4%	-7.6%
2012	-11.8%	-11.8%	-11.3%	-9.6%	-8.1%	-6.5%	-5.0%	-4.1%	-3.1%	-2.4%	-6.5%
2013	-11.8%	-12.0%	-11.9%	-10.7%	-9.4%	-7.8%	-6.3%	-5.2%	-4.2%	-3.2%	-7.4%
2014	-11.7%	-12.5%	-12.6%	-11.5%	-10.5%	-9.3%	-7.4%	-6.6%	-5.5%	-4.3%	-8.4%
2015	-12.0%	-12.9%	-13.1%	-12.1%	-11.4%	-10.6%	-9.0%	-8.2%	-6.8%	-5.6%	-9.4%
2016	-9.8%	-10.6%	-10.9%	-10.7%	-10.4%	-9.8%	-8.8%	-8.4%	-7.4%	-6.3%	-8.9%

Scrappage rates: vehicle age and when the vehicle was manufactured

The information in Table 2 shows that the survivability of vehicles of a given age is higher if they were manufactured more recently (ie the percentage scrapped is lower). While the 2008 global financial crisis may have influenced that, scrappage rates have continued to drop after 2008 so improvement in mechanical longevity must also be part of that picture.

For instance consider the scrappage rates for 18 year old vehicles made in 1991-1997 (these vehicles reached 18 years old after 2008). Figure 2.11c shows that the scrappage rates are lower for these vehicles if they were made more recently.

Figure 2.11c : Vehicle scrappage - same age, different year of manufacture

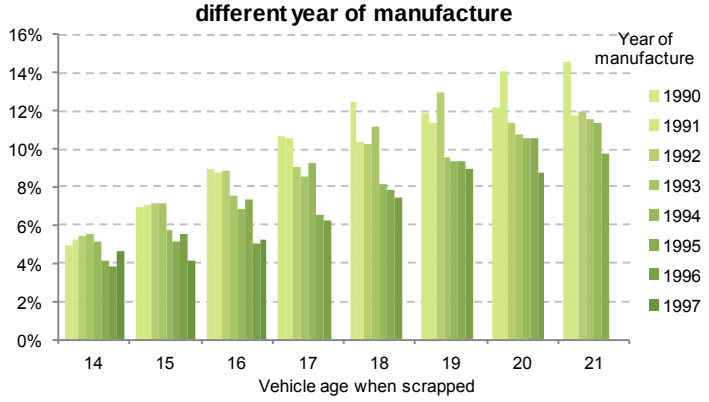
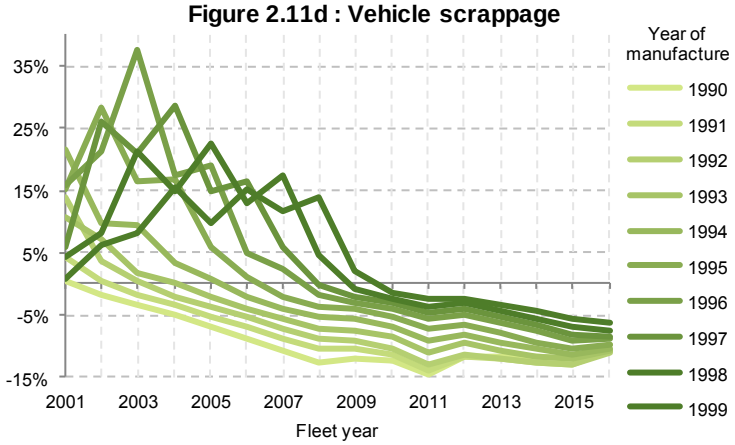


Figure 2.11d tracks the percentage change in the numbers of 1990-1999 vehicles in the 2001-2015 fleets. Positive numbers on the vertical axis show the rate of increase in numbers of that year of manufacture, and negative numbers show the rate of decrease (scrappage).

Figure 2.11d : Vehicle scrappage



Diesel light fleet age distribution

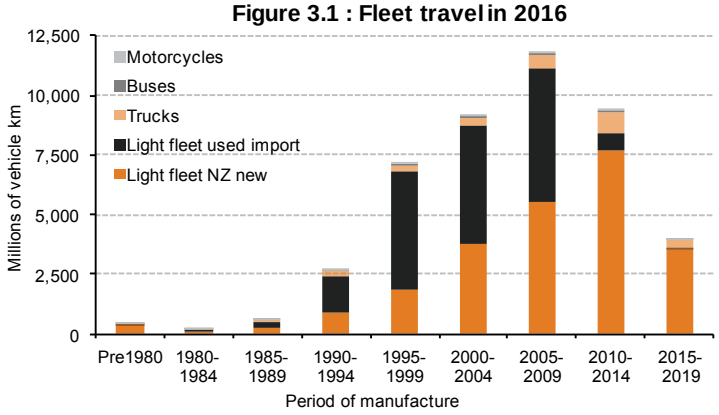
The age of the light diesel fleet is related to the emissions controls in those vehicles, and their health impacts. The older diesels have less effective emissions controls.

See tab 2.13 in the accompanying spreadsheet for the age distribution of the light diesel fleet, and tab 9.11 for a breakdown of the emissions standards to which the light fleet was built.

3. Vehicle travel and age

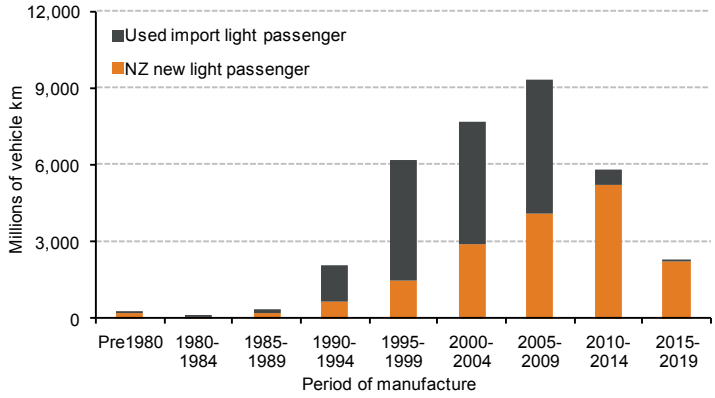
The breakdown of travel is shown in Figure 3.1.

Figure 3.1 : Fleet travel in 2016



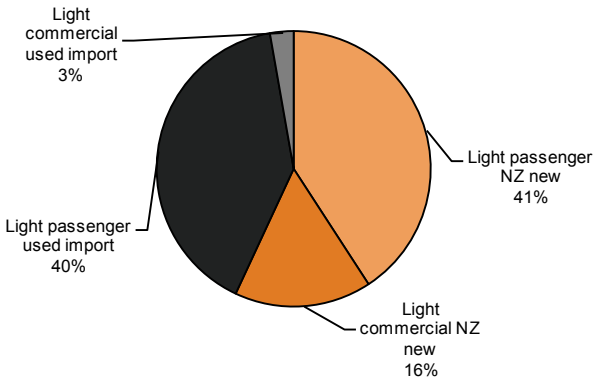
Light passenger vehicle travel makes up the majority of travel. 24% of this travel is done by vehicles manufactured during the 1990s.

Figure 3.2a : Light passenger fleet travel in 2016



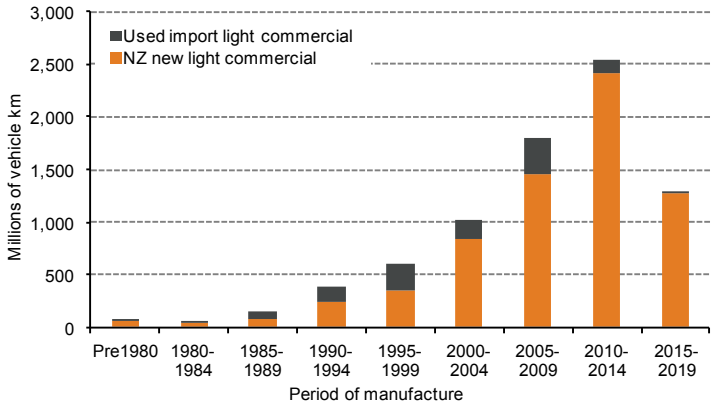
New Zealand-new light vehicles do more travel overall than used imported light vehicles. New and used light passenger vehicles do about the same amount of overall travel but new light commercials do far more than used light commercials (see Figures 3.1, 3.2b and 3.2c).

Figure 3.2b : Light fleet travel 2016



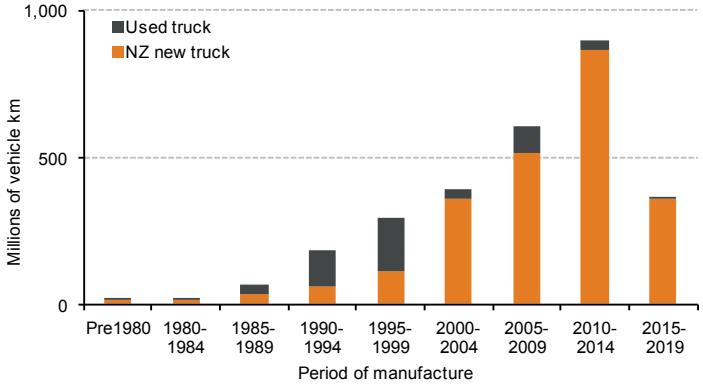
Light commercial fleet travel is different from light passenger fleet travel. A higher proportion of travel is done by recently purchased New Zealand-new vehicles (also see Figure 2.5c).

Figure 3.2c : Light commercial fleet travel in 2016



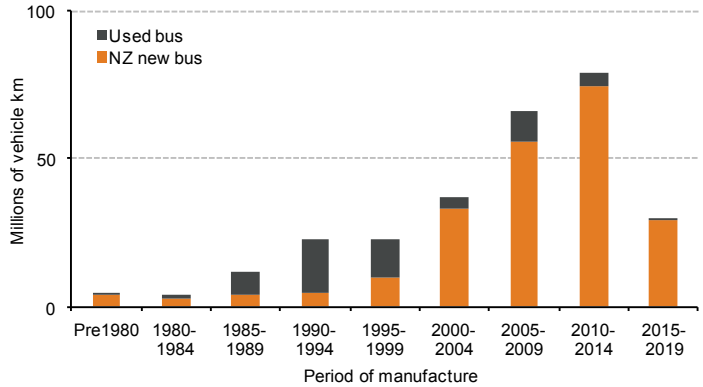
44% of travel by trucks is by vehicles built from 2010 onwards, although they make up a much smaller part of the fleet than that (20%, see Figure 2.7b).

Figure 3.2d : Truck travel in 2016



As with trucks, buses built from 2010 do 39% of travel even though they only make up 26% of the bus fleet.

Figure 3.2e : Bus travel in 2016



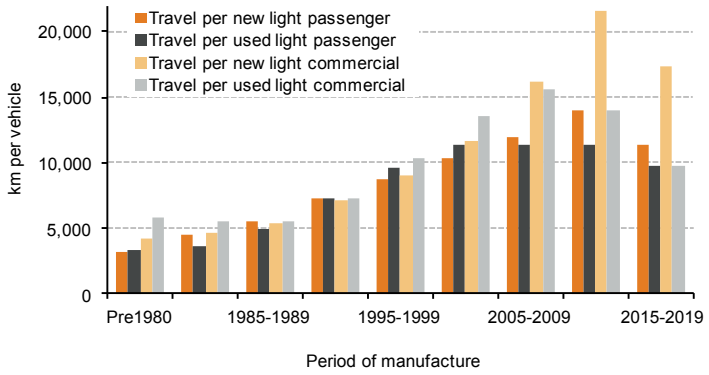
Average vehicle travel by vehicle age

There is a clear relationship between vehicle age and travel - older vehicles are not driven as far each year. The patterns of used and new light vehicle travel also vary with vehicle age.

There is a difference in travel patterns between light commercial and light passenger vehicles. Light commercial vehicles are driven further each year than passenger vehicles until they reach an age of about 15 years, after which the annual distances are similar.

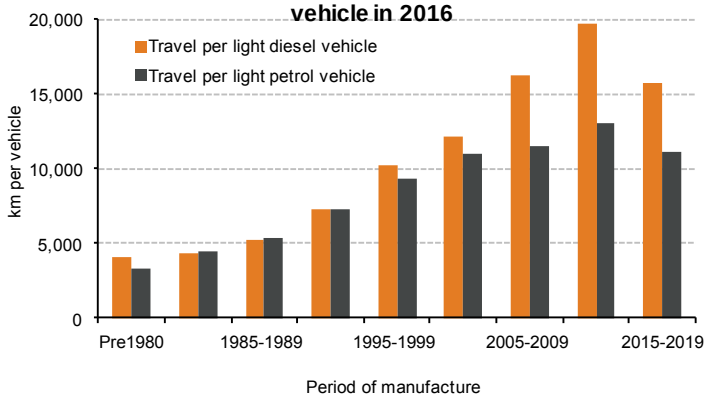
The travel by vehicles manufactured in 2015-19 appears low, but that is because on average new vehicles purchased in 2016 were only in the fleet for 6 months.

Figure 3.4a : Travel per light vehicle in 2016



On average diesel vehicles travel further than petrol vehicles of the same age. Many light diesel vehicles are light commercials (utes and vans) though diesel SUVs are classed as light passenger vehicles in this report.

Figure 3.4b : Light petrol and diesel travel per vehicle in 2016



Figures 3.4c and 3.4d show that newer buses travel similar distances to trucks of the same age per vehicle per year, and older buses travel further than similarly aged trucks. Both travel more than light vehicles. Total travel by heavy vehicles is much less than that by light vehicles (see Figures 3.4c, 3.4d and 3.4e) as they are only a small part of the fleet (see Figure 1.1).

Travel by used imported trucks is different as they tend to be smaller vehicles (see Figure 2.9) which are not usually used for long-distance freight.

Travel by vehicles manufactured in 2015-19 appears low, but that is because on average new vehicles purchased in 2016 were only in the fleet for six months.

Figure 3.4c : Truck travel per vehicle in 2016

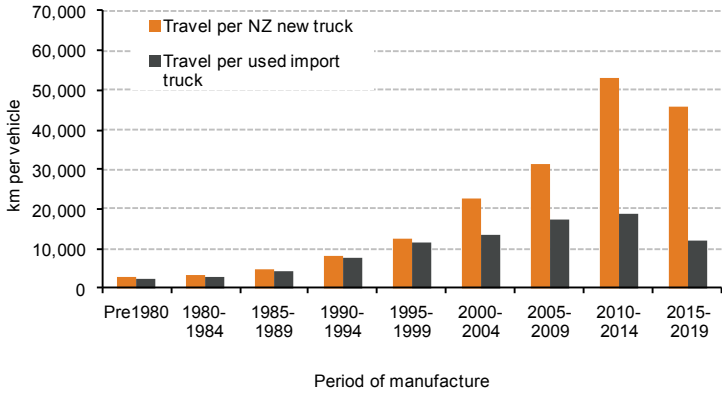
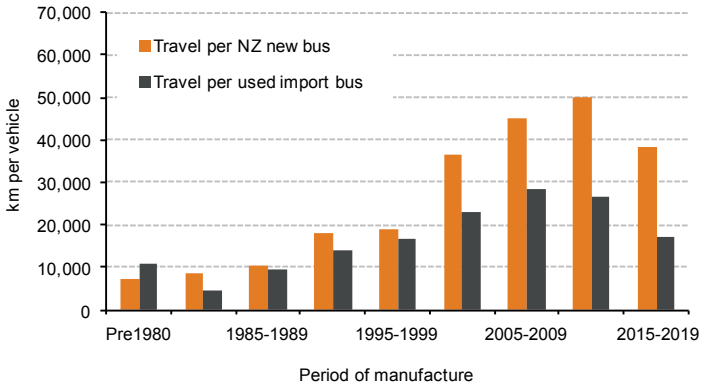
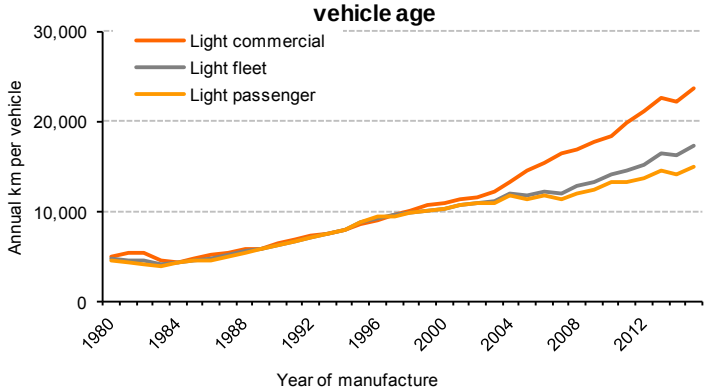


Figure 3.4d : Bus travel per vehicle in 2016



Light commercial vehicles are typically driven further than light passenger vehicles early in their life. This effect starts to diminish as the vehicles age, and has disappeared by the time they are 20 years old. There has been little change in this pattern since 2001.

Figure 3.5 Light fleet average travel in 2015, by vehicle age



4. Light fleet engine capacity trends

These graphs show the average engine capacity for the light vehicle fleet from January 2000 through to December 2016. The average engine capacity of the fleet grew between 2000 and 2011. Since then the average engine size of New Zealand new light vehicles has levelled off and that of used imports has dropped a little.

The New Zealand-new component of the fleet has a significantly larger average engine capacity than the used imported component.

The trends in diesel and petrol engine capacities are quite different, as shown in Figure 4.1b. The capacity of New Zealand-new petrol vehicles within the fleet showed the greatest increase. It also shows that the average diesel engine is significantly larger than the average petrol engine.

New Zealand did not record fuel consumption data on the vehicle register before 2005. Therefore, engine capacity was previously used as a proxy for fuel consumption, but it does not take improvements in engine efficiency into account, or other factors such as vehicle weight gain.

Figure 4.1a : Light fleet average engine capacity

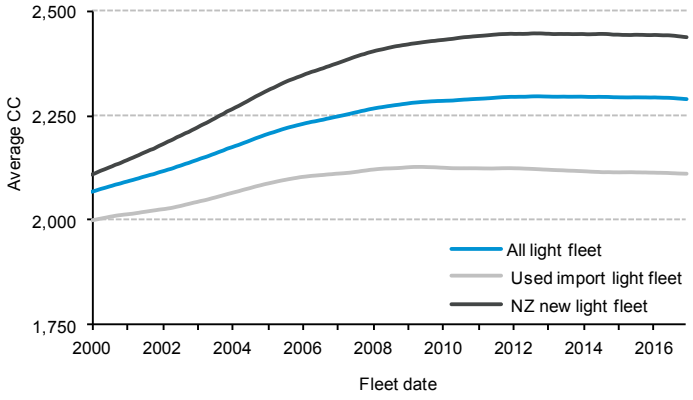
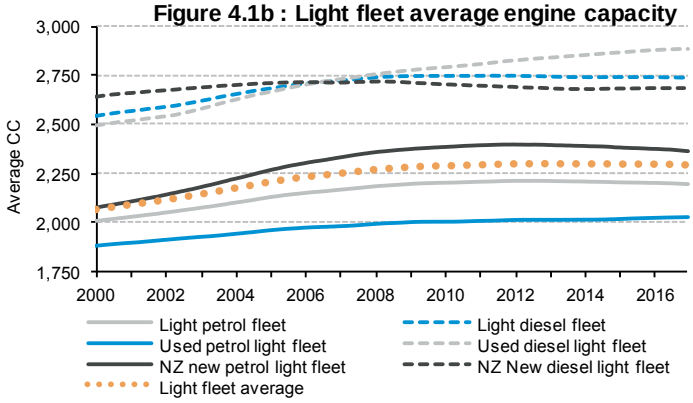
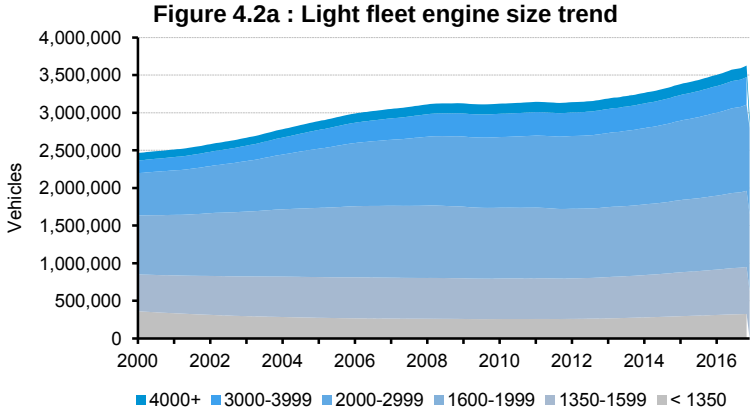


Figure 4.1b : Light fleet average engine capacity



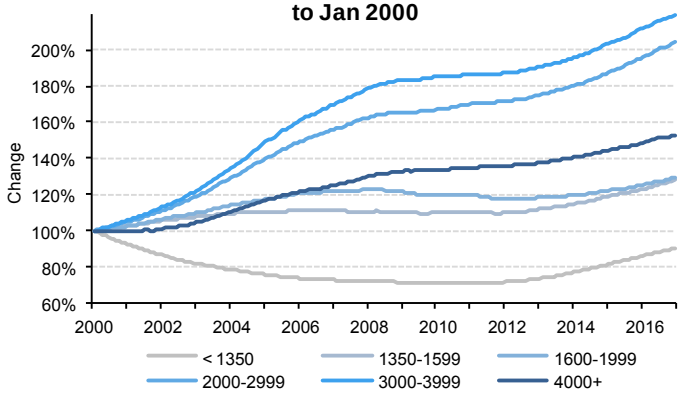
The mix of engine sizes in the light fleet has been changing. There has been significant growth in the 2000–2999cc class.

Figure 4.2a : Light fleet engine size trend



The engine-size class that showed the greatest rate of growth is 3000–3999cc, but the number of these vehicles is relatively low. The 2000-2999cc class has shown the most growth in terms of the numbers of vehicles.

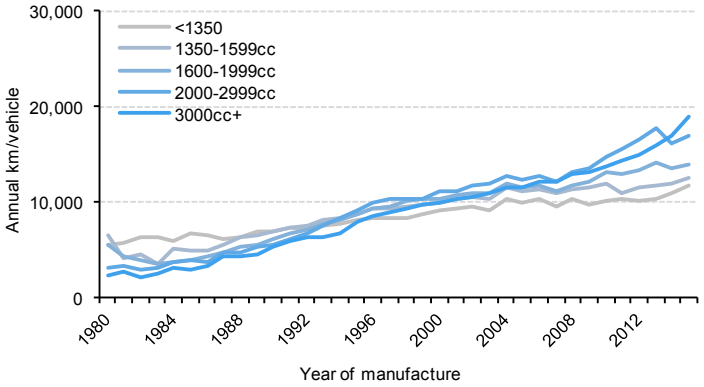
Figure 4.2b : Light fleet engine size trend, relative to Jan 2000



Light fleet travel by engine capacity and age

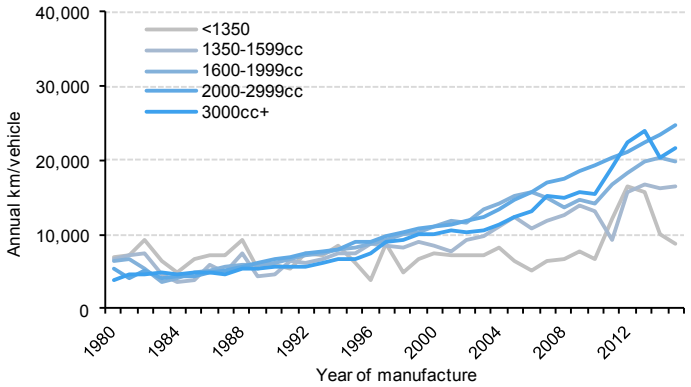
Smaller-engined light passenger vehicles do less annual travel than other vehicles, and vehicles with the largest engines travel more than other vehicles, especially early in their life.

Figure 4.3a : Light passenger average travel 2016



The pattern for light commercial vehicles is similar to that for light passenger vehicles, although the amount of travel is far higher. Again, the vehicles with larger engines do the most travel per vehicle early in their life. Very small light commercials are uncommon, which accounts for the erratic nature of their line in Figure 4.3b.

Figure 4.3b : Light commercial average travel 2016



Light fleet travel trend by engine capacity

Table 3 provides a different view of travel and engine capacity. The proportion of travel done by vehicles with engine sizes of 2000cc or more grew significantly between 2001 and 2008, but has only changed slightly since then.

Table 3 Light Fleet travel (millions VKT[7])

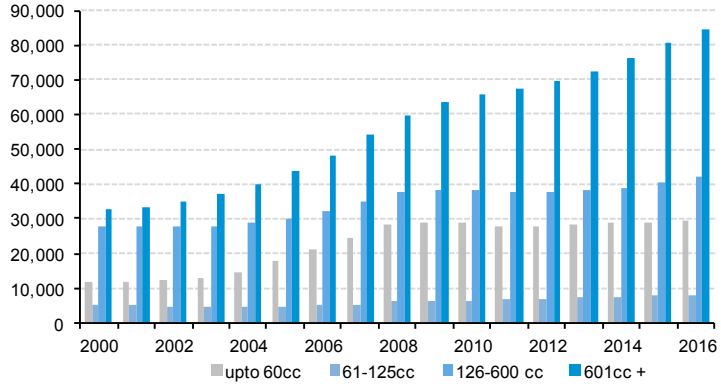
Period	Engines under 2000cc	Engines 2000+ cc	Travel by vehicles 2000+ cc	2000+ cc vehicles
2001	20,838	13,239	39%	35%
2002	21,077	14,125	40%	36%
2003	21,137	15,166	42%	38%
2004	20,936	16,336	44%	39%
2005	20,463	17,101	46%	41%
2006	19,913	17,512	47%	42%
2007	19,732	18,222	48%	43%
2008	19,125	18,209	49%	43%
2009	19,013	18,381	49%	44%
2010	18,982	18,390	49%	44%
2011	18,717	18,204	49%	45%
2012	18,693	18,308	49%	45%
2013	18,966	18,606	50%	45%
2014	19,443	19,137	50%	45%
2015	20,092	19,920	50%	45%
2016	20,955	20,945	50%	46%

[7] Vehicle Kilometres Travelled.

Motorcycle and moped fleet composition

Machines under 60 cc showed strong growth from 2005 to 2008, but have been static since then. Much of the growth is in machines over 600 cc, which have been increasing since the early 2000s.

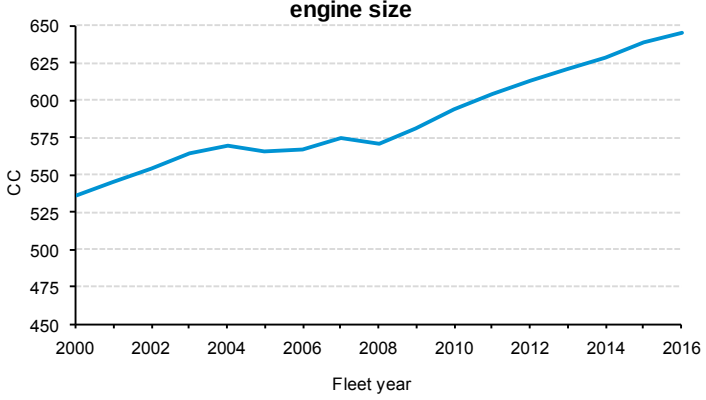
Figure 4.4 : Motorcycle fleet composition



Motorcycle and moped fleet average engine capacity

The growth in the under 60cc sector resulted in the average engine capacity staying much the same from 2004 and 2009. Subsequent sales of machines with large engines have increased the average engine capacity (see Figure 4.4 for a detailed breakdown of the fleet composition).

Figure 4.5 : Average motorcycle/moped fleet engine size



5. Vehicles entering and exiting the fleet

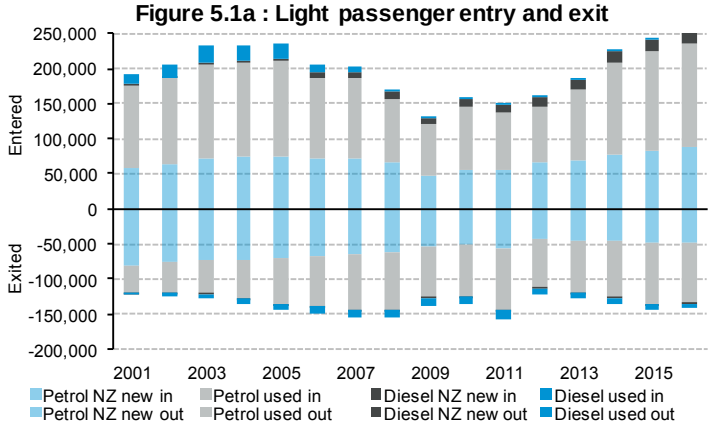
Figures 5.1a to 5.1e show the mix of vehicles that entered and exited the fleet between 2001 and 2016. The bars above zero on the vertical axis show vehicles entering the fleet and the bars below zero show vehicles that exited.

The recent light passenger fleet size changes are shown in Table 4a.

Table 4a : Light passenger fleet entries and exits			
Year	Registered	Scrapped	Net change
2011	150,230	157,817	-7,587
2012	161,206	123,396	37,810
2013	187,219	128,688	58,531
2014	225,723	135,629	90,094
2015	243,827	144,653	99,174
2016	257,244	142,511	114,733

More used imports are now leaving the light passenger fleet than New Zealand-new vehicles. This reflects the vehicle mix that entered the fleet during the 1990s. Light passenger vehicle registrations reflect economic cycles, though scrappage is less predictable.

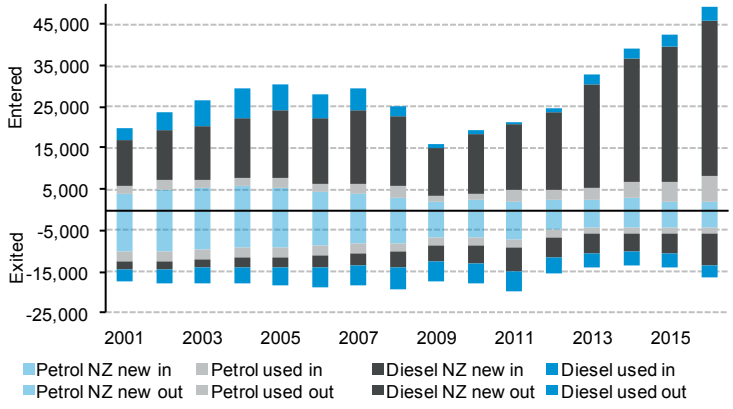
Figure 5.1a : Light passenger entry and exit



The light commercial fleet grew slightly in 2010 and 2011, then by increasing numbers each following year.The recent fleet size changes are shown in Table 4b below.

Table 4b : Light commercial fleet entry and exit			
Year	Registered	Scrapped	Net change
2011	21413	19963	1,450
2012	24603	15389	9,214
2013	32649	13958	18,691
2014	39210	13521	25,689
2015	42317	13866	28,451
2016	49449	16364	33,085

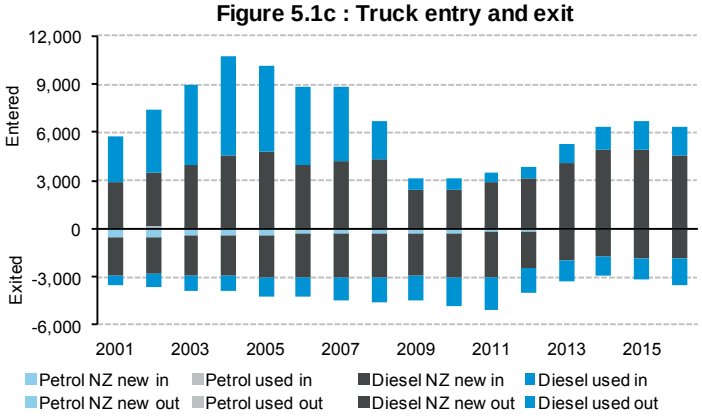
Figure 5.1b : Light commercial entry and exit



Comparing the light commercial fleet with the light passenger fleet shows that there are very few diesel-powered vehicles entering the passenger fleet. A high proportion of the new vehicles entering the light commercial fleet are diesel powered. Businesses are again buying significant numbers of vehicles, after the drop that started in 2009.

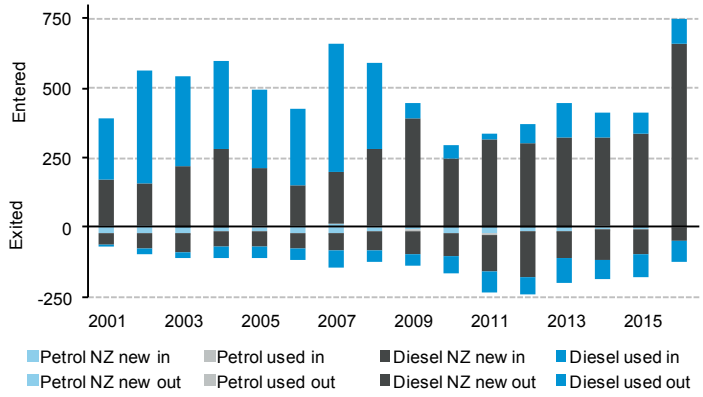
Figure 2.9 showed that used truck imports are typically lighter weight vehicles. Most of the used truck imports shown in Figure 5.1c have a gross vehicle mass under 10 tonnes (also see Figure 2.9). Used truck registrations remain at low levels but have picked up a little as vehicles become available that meet our emission requirements. While purchase patterns were influenced by the rule on used truck entry and the global financial crisis, there was not the same change in disposal patterns, which have remained relatively constant.

Figure 5.1c : Truck entry and exit



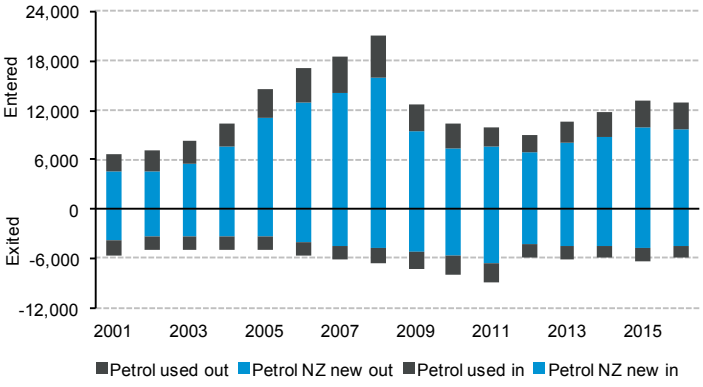
The majority of the buses entering the fleet until 2008 were relatively old used imports. The Vehicle Exhaust Emissions Rule effectively precluded these imports in January 2008. Bus purchase and scrapping patterns do not follow the same patterns as trucks. This may reflect the fact that purchases are linked to government and council funding, which tends to be constant.

Figure 5.1d : Bus entry and exit



The numbers of motorcycles and mopeds registered grew significantly between 2004 and 2008.

Figure 5.1e : Motorcycle entry and exit

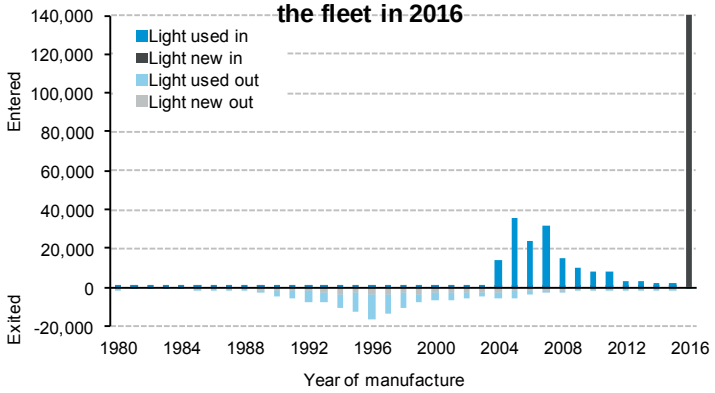


Year of manufacture of vehicles entering and leaving the fleet

Figures 5.2a to 5.2d show the year of manufacture of vehicles that entered (above the axis) and left the light fleet (below the axis) in 2016. Virtually all of the new vehicles were manufactured in 2016. Figure 5.2a shows that more used light vehicles manufactured in 2005 entered the light fleet than any other age. See also Figures 2.4, 2.5a and 6.2b.

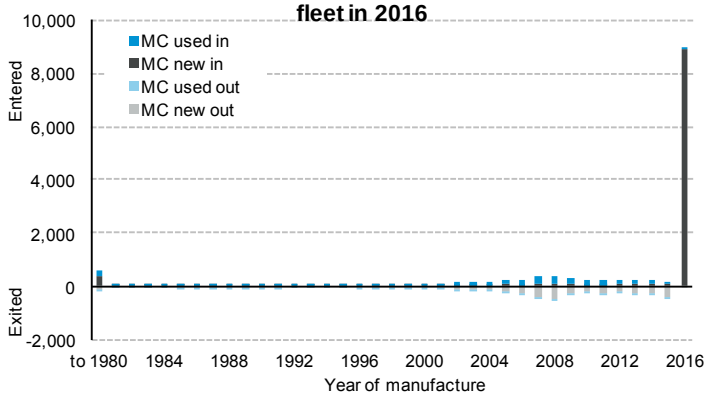
Used vehicles leave the fleet slightly earlier than New Zealand-new vehicles.

Figure 5.2a : Light vehicles entering or leaving the fleet in 2016



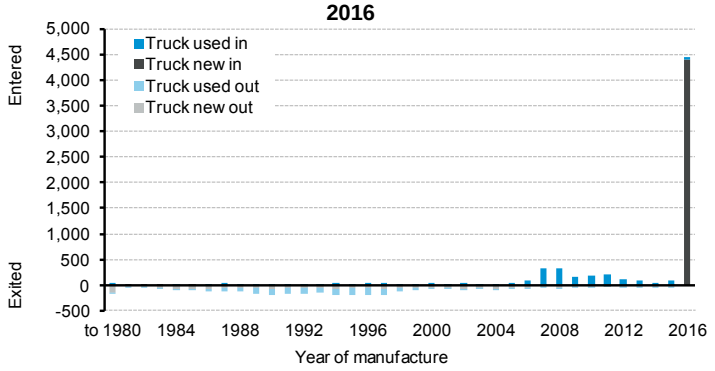
The numbers of near-new motorcycles leaving the fleet reflects the risk and severity of motorcycle crashes.

Figure 5.2b : Motorcycles entering or leaving the fleet in 2016



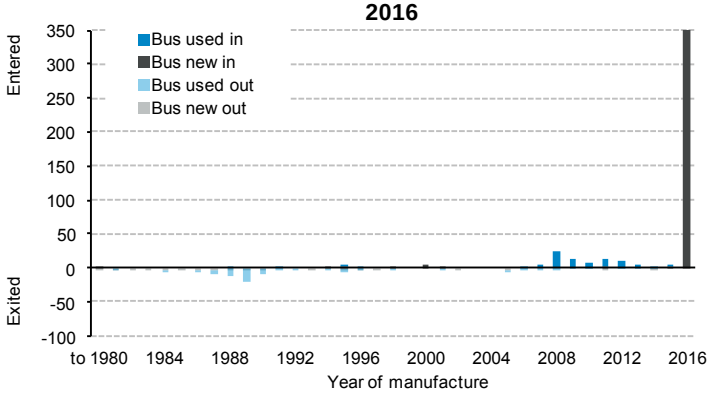
Few used imports entered the truck fleet in 2016. Trucks leave the fleet much later than light vehicles.

Figure 5.2c : Trucks entering or leaving the fleet in 2016



Extremely few used bus imports entered the fleet in 2016. Few buses leave the fleet, which may be influenced by vehicles eventually being converted into mobile homes.

Figure 5.2d : Buses entering or leaving the fleet in 2016



Engine size of vehicles entering and leaving the light fleet

The detailed breakdowns in Figure 5.3 show the engine sizes of light fleet entries and exits in 2016.

Figure 5.3a : Petrol vehicles entering/leaving the light 2016 fleet

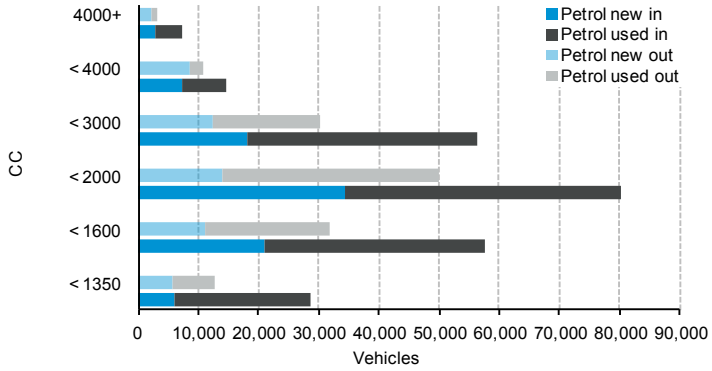
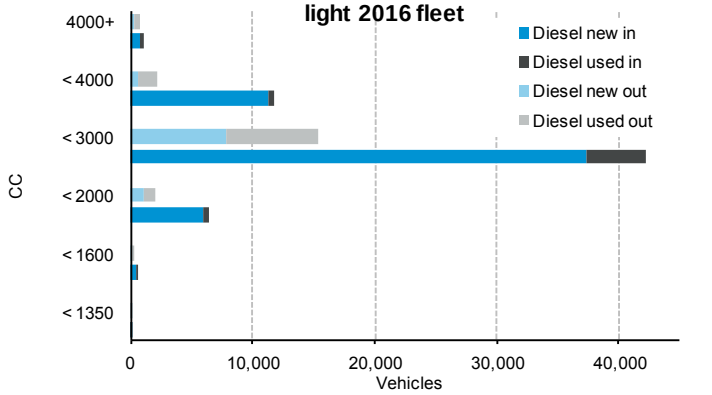


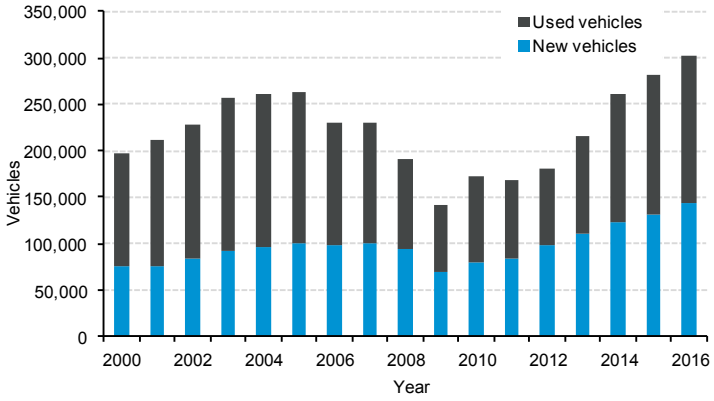
Figure 5.3b : Diesel vehicles entering/leaving the light 2016 fleet



6. Vehicles entering the fleet

Registrations of new light vehicles have continued to grow and were at their highest levels ever in 2016.

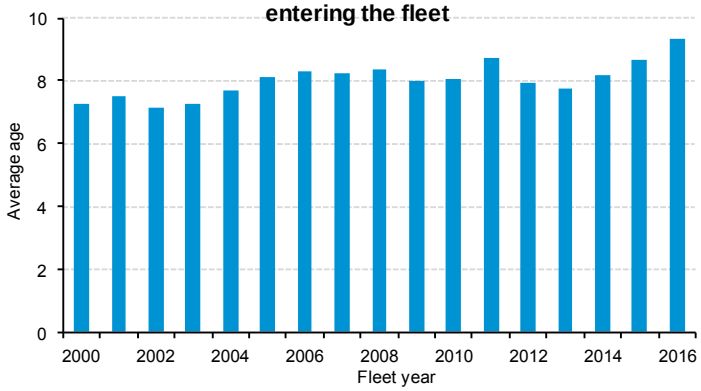
Figure 6.1 : Vehicles entering the light fleet



The average age of used imported vehicles entering the light fleet was increasing until 2008. The 2007 Vehicle Exhaust Emissions Rule took effect in January 2008, and required vehicles to be built to newer standards. That resulted in the average age dropping in 2009. By 2011 though, the average age of used imports entering the fleet was at an all time high. That was because older vehicles could be sourced for import, as the age range of the vehicles compliant with the rule broadened. The oldest used vehicles that could be imported in 2008 were typically manufactured in 2001, and it was still possible to import those vehicles until December 2011.

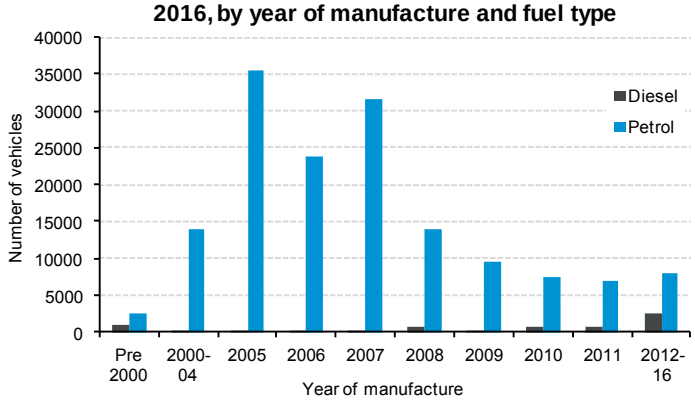
The next step of the Vehicle Exhaust Emissions Rule took effect in January 2012, requiring vehicles to be built to 2005 standards. The effect can be seen in the reduced average age on used import registrations in 2012, which continued in 2013. The average age on entry rose from 2014 reflecting the fact that older vehicles are compliant again.

Figure 6.2a : Average age of light used imports entering the fleet



A breakdown of used light vehicle imports in 2016 by age and fuel type shows they were overwhelmingly petrol powered.

Figure 6.2b : Used imports entering the light fleet in 2016, by year of manufacture and fuel type



The average age of used trucks and buses entering the fleet has dropped substantially following the introduction of the 2007 Vehicle Exhaust Emissions Rule in January 2008.

Figure 6.2c : Average age of heavy used imports entering the fleet

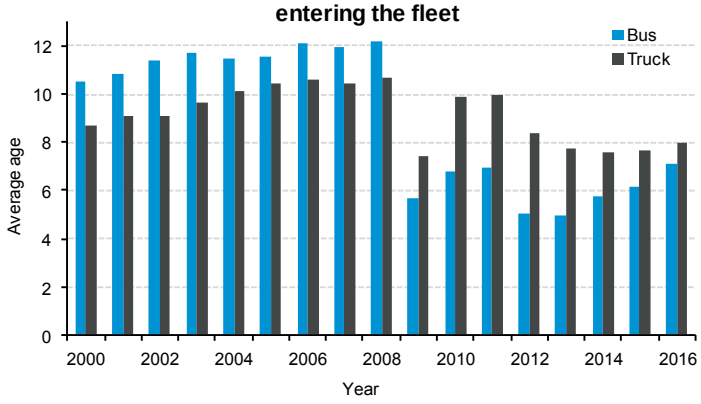
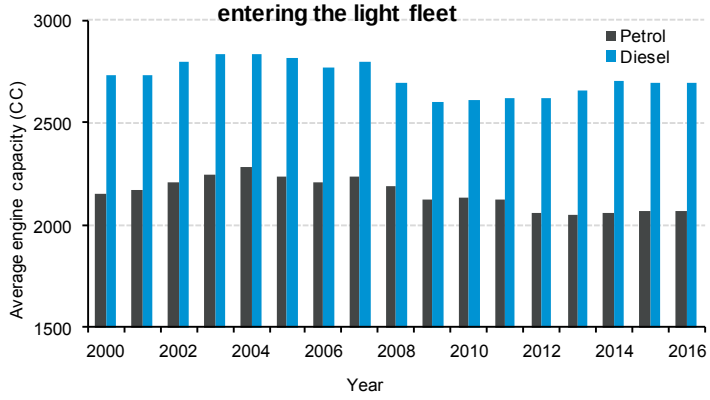


Figure 6.3 shows that the average engine capacity of petrol vehicles entering the light fleet was increasing until 2004. The average engine capacity of the light fleet continued to increase for some years after 2004 as the vehicles entering the fleet had larger engines than those exiting (see Figure 4.1a).

Diesel vehicles have been increasing in engine size form 2010 to 2014, and petrol vehicles have increased slightly in recent years.

Figure 6.3 : Average engine size of vehicles entering the light fleet



Used import versus New Zealand-new engine capacity mix

Figures 6.4a and 6.4b show that the engine size mix of the used imports entering the light fleet is different from that of New Zealand-new vehicles. There are relatively more smaller-engined used imported vehicles than New Zealand-new. Figure 5.3 provides a more detailed breakdown. It shows both entries and exits, and splits petrol and diesel.

Figure 6.4a : Engine size of NZ new vehicles entering the light fleet

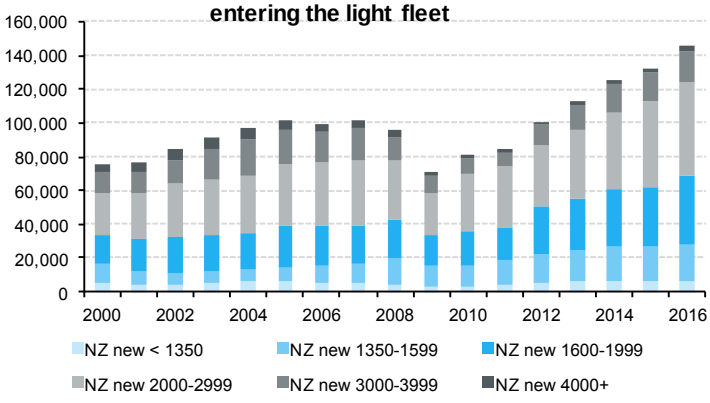
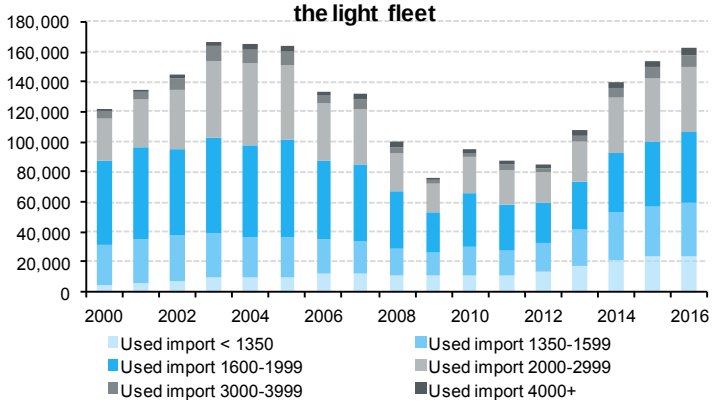
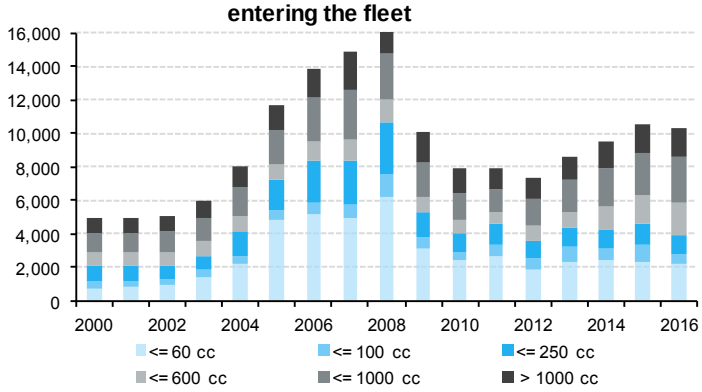


Figure 6.4b : Engine size of used imports entering the light fleet



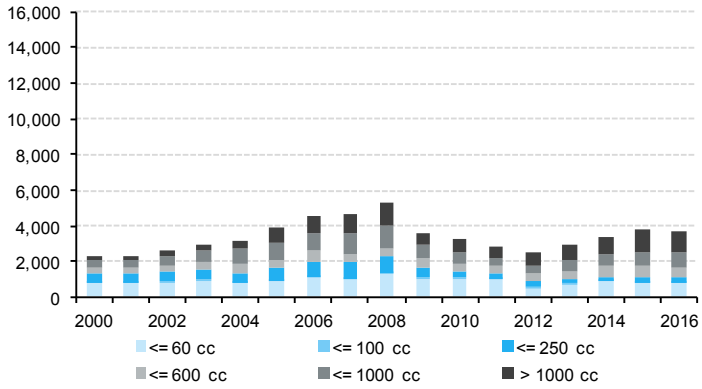
Much of the growth in new motorcycle registrations until 2008 was in machines under 60cc. Registrations have been increasing since 2012.

Figure 6.5a : New Zealand new motorcycles entering the fleet



Used motorcycle imports increased from 2005 to 2008, and again from 2012, but to a far lesser degree than new motorcycles (see above).

Figure 6.5b : Used motorcycles entering the fleet



7. Vehicles exiting the fleet

Until 2005 more New Zealand-new vehicles left the fleet than used imported vehicles, but Figure 7.1a shows that this has changed now that used imports make up about half the light fleet. The increase also reflects the fact that used imports tended to leave the fleet earlier than NZ-new vehicles, although this is changing (see Figure 7.2a).

Figure 7.1a : Vehicles leaving the light fleet

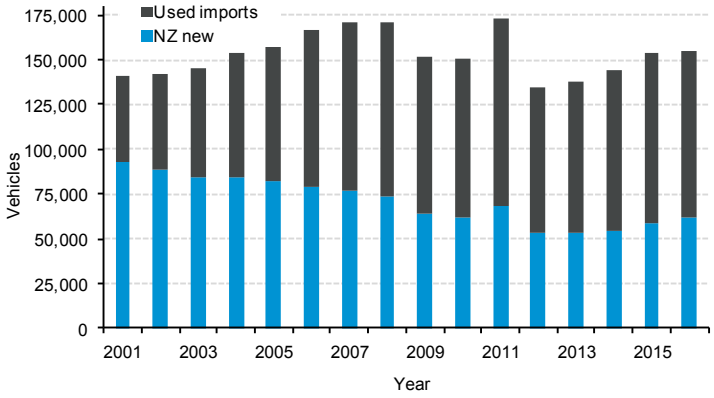
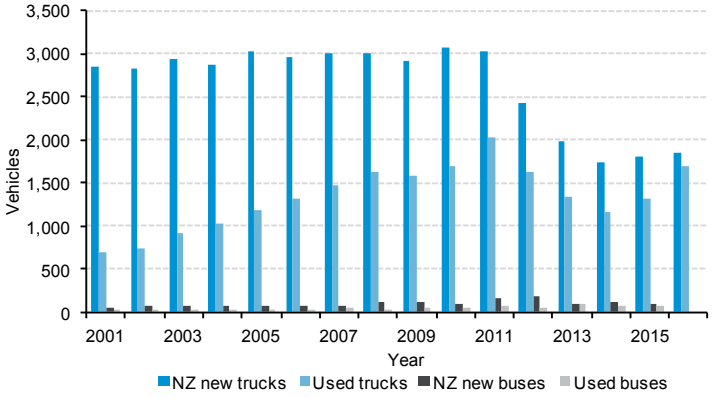


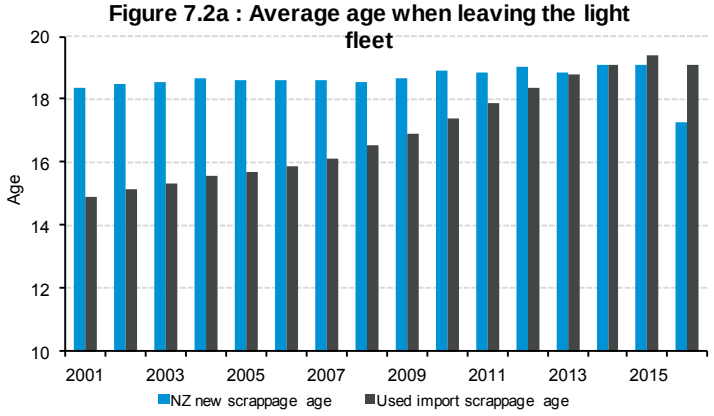
Figure 7.1b : Vehicles leaving the heavy fleet



Used imports left the light fleet at an average age of 19.2 years in 2015, and New Zealand-new vehicles averaged 18.5 years old (see Figure 7.2a). The age at scrappage of used imports is still increasing.

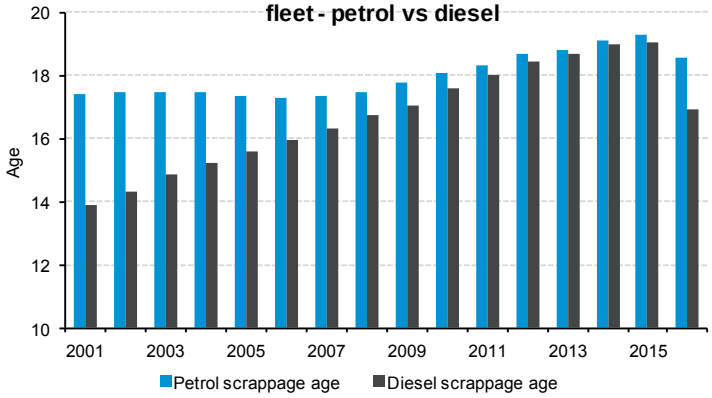
This apparent drop in scrappage age in 2016 may be due to the new method of determining which vehicles have left the fleet (see Appendix B). Possibly some of the vehicles that appear to have been scrapped in 2016 will be relicensed between 7 and 12 months after their licence expired and the 2016 result may change.

Figure 7.2a : Average age when leaving the light fleet



The average age of light diesel vehicles when scrapped has risen as the light diesel fleet has changed from being very commercially oriented (vans and utes) to including large numbers of SUVs and some diesel cars. The distance covered in the lifetime of light diesel vehicles exceeds that of petrol vehicles on average, even though they are scrapped earlier (see Figure 7.3a). Again the 2016 result may change.

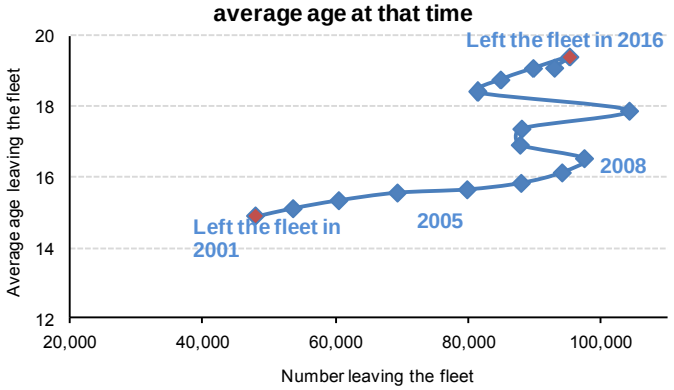
Figure 7.2b : Average age when leaving the light fleet - petrol vs diesel



There has been a change in the pattern of used imports leaving the fleet. Figure 7.2c shows how the volume of used imports increased until the economic downturn began in 2009. The average age of the used exports scrapped has risen every year.

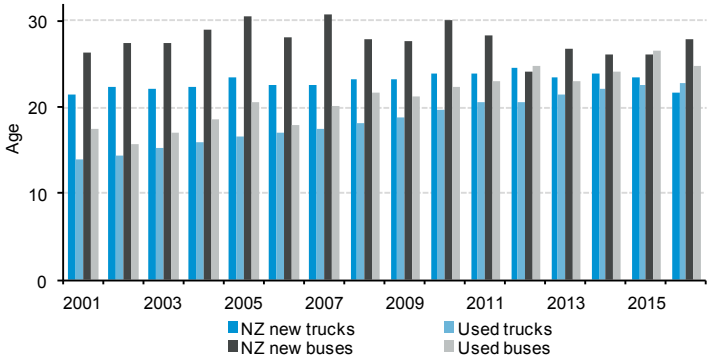
Many of the used imports manufactured in the mid 1990's will be reaching the end of their lives in the next 5 years, and the numbers leaving the fleet will increase. Figures 2.5a, 2.5b, 2.11 and 2.12 show the age structure of the light fleet.

Figure 7.2c : Used imports leaving the fleet vs average age at that time



While not many buses leave the fleet (see Figure 5.1d) the average age when they do is high (see Figure 5.2d). This has dropped in recent years to be similar to that of trucks.

Figure 7.2d : Average age when leaving the heavy fleet



How far have vehicles travelled before they leave the fleet?

The final warrant of fitness or certificate of fitness odometer reading provides a good estimate of lifetime travel. Figures 7.3a, 7.3b and 7.3c show that the average lifetime distance travelled has typically been increasing.

The lesser lifetime distance covered by used imports may reflect their smaller average engine size (see Figure 4.1a). Figure 7.3e shows that larger-engined vehicles typically cover a greater lifetime distance.

Figure 7.3a : Final odometer reading of vehicles leaving the light fleet

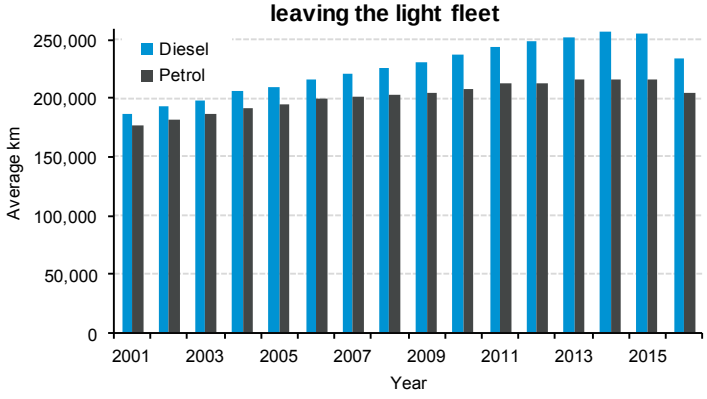


Figure 7.3b : Final odometer reading of vehicles leaving the light fleet

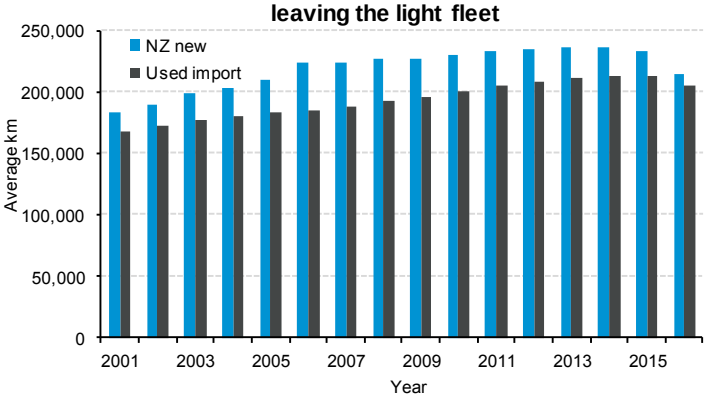
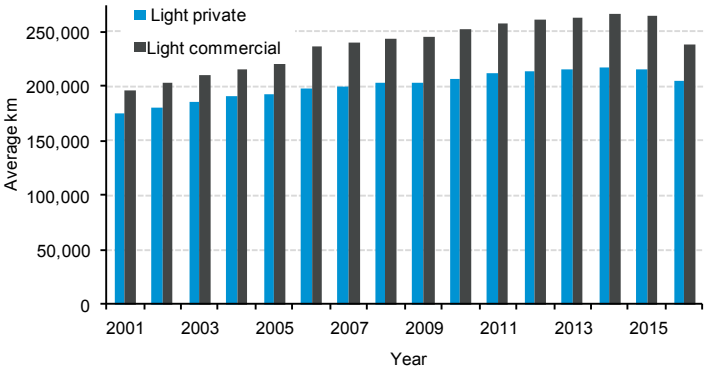
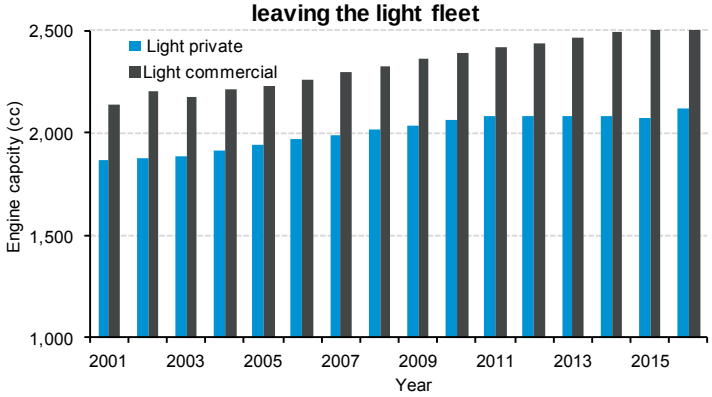


Figure 7.3c : Final odometer reading of vehicles leaving the light fleet



An examination of the engine sizes of vehicles leaving the fleet shows that the average size has been increasing. This may partly explain why the average lifetime distance has been increasing.

Figure 7.3d : Average engine size of vehicles leaving the light fleet



Figures 7.3e and 7.3f show that larger-engined vehicles travel further in their lifetime, which, combined with 7.3d, explains in part why the fleet average lifetime distance is increasing.

Figures 7.3e and 7.3f also show that lifetime distance has been increasing for vehicles of all engine sizes. When these two effects are combined, we get the lifetime distance increases seen in 7.3a, 7.3b and 7.3c.

Figure 7.3e : Final odometer reading of light passenger vehicles leaving the light fleet

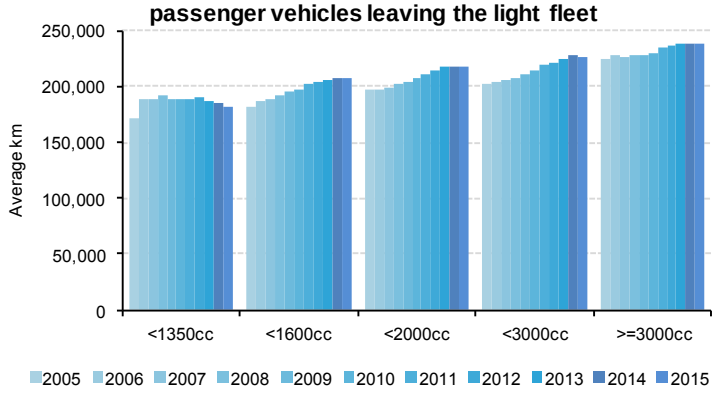
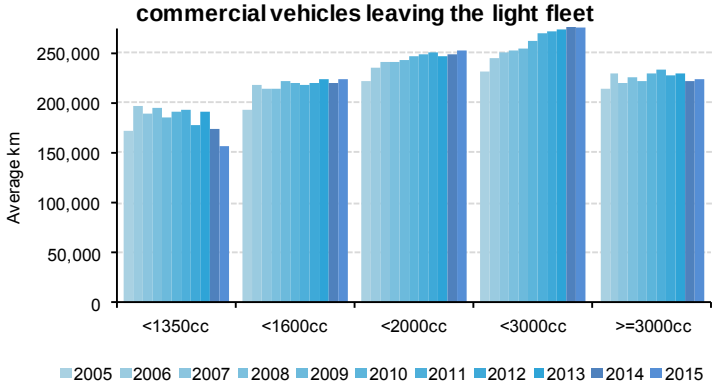


Figure 7.3f : Final odometer reading of light commercial vehicles leaving the light fleet



Although the average lifetime travel has been rising for most engine size bands, it has remained remarkably flat for engine sizes greater than 3,000cc. It is not known why travel has not grown in this class, but there are over 60,000 of these vehicles so low numbers are not the explanation.

SCRAPPAGE CURVES

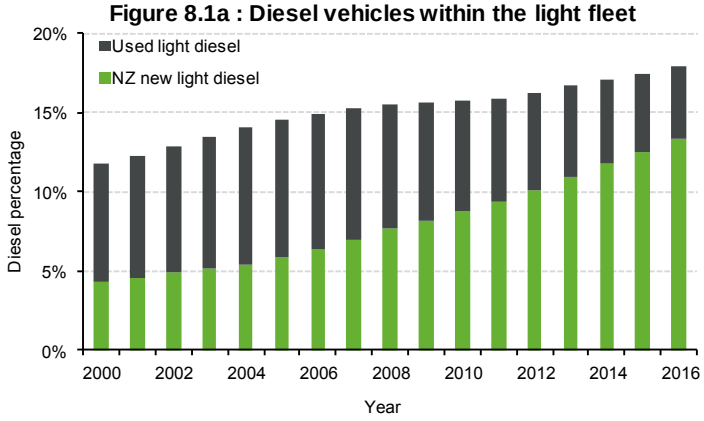
The accompanying spreadsheet (available from www.transport.govt.nz/research) includes scrappage curves for 2016. The curves show the percentage of vehicles of each age that were in the fleet at the start of January 2015, but gone from the fleet by the end of December 2016. They are shown in table 7.4 in the website spreadsheet.

8. The diesel fleet, diesel and petrol travel, CNG/LPG/electric vehicles

Proportion of diesel vehicles in the fleet

The proportion of the light fleet, which is diesel powered, grew from 11.7 percent in 2000 to 17.9 percent in 2016. The majority of light diesel vehicles are commercial vehicles (also see Table 4 and Figures 8.2a, 8.2b and 8.3.)

Figure 8.1a : Diesel vehicles within the light fleet



Most trucks are diesel powered. The petrol trucks in Figure 8.1b are either very old or large American SUVs that weigh more than 3500 kg.

Figure 8.1b : Diesel vehicles within the truck fleet

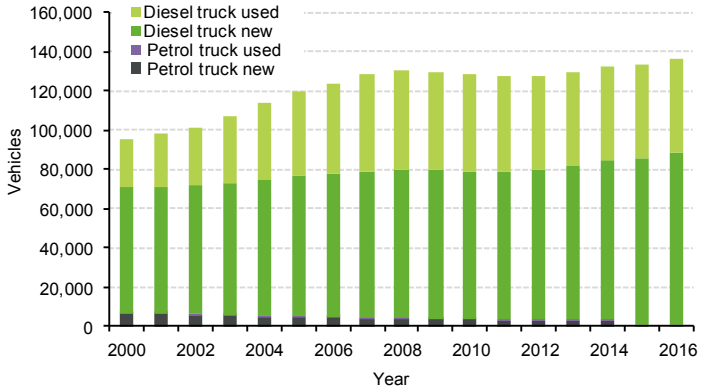
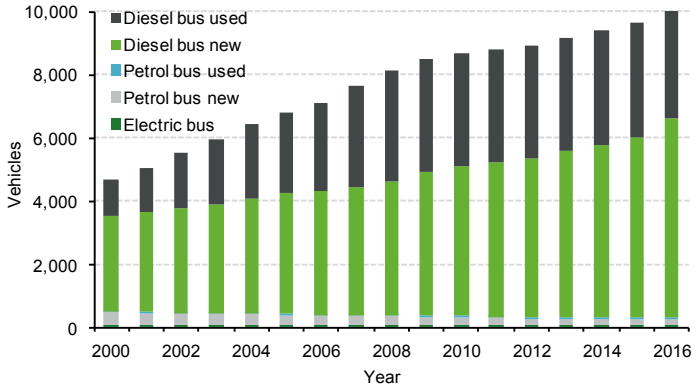


Figure 8.1c : Diesel vehicles within the bus fleet



Diesel vehicles in the light fleet and their travel

Table 4 shows the segment of the light fleet that is diesel powered and the percentage of light fleet travel by diesel vehicles. Figures 8.2a and 8.2b break down the light fleet and its travel. The vehicle percentages are based on the vehicles that recorded travel during 2016. **They were not necessarily still in the fleet at the end of the year.**

Table 5 Light diesel vehicles in 2016

	Diesel vehicles	Diesel travel
2016 light fleet overall	17.9%	23.2%
2016 light passenger fleet	8.5%	10.1%
2016 light commercial fleet	72.0%	79.9%

Figure 8.2a : Light fleet makeup by fuel type 2016

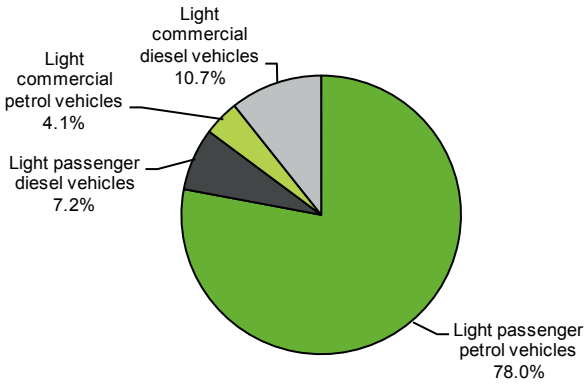


Figure 8.2b : Light fleet travel by fuel type 2016

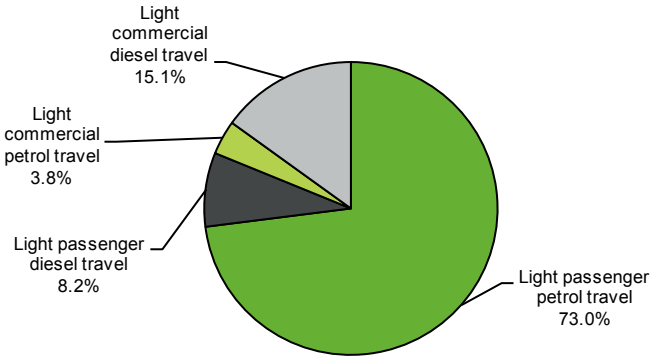


Figure 8.2c shows that light diesel vehicles continue to travel further on average each year than light petrol vehicles and that travel per vehicle is dropping.

Figure 8.2c Annual travel per light vehicle

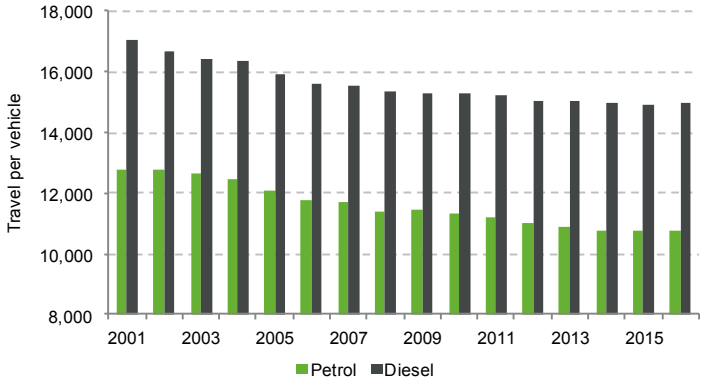
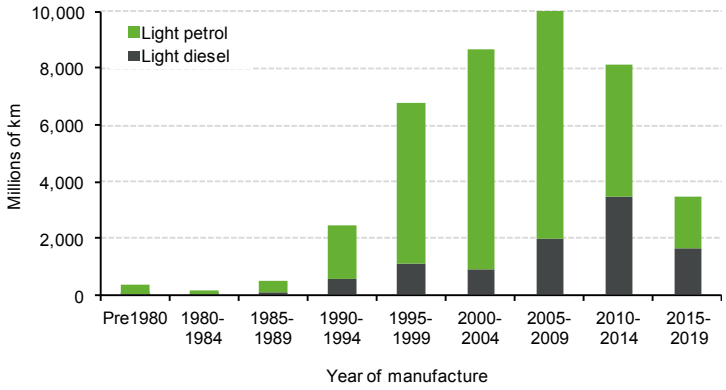


Figure 8.3 shows that the proportion of the light fleet travel by diesel vehicles built in the 1990's, when the harmful emissions standards were typically far inferior to recent standards, is now relatively low [8].

Figure 8.3 : Light petrol and diesel travel in 2016



[8] The PM (Particulate Matter) column in Table 1 in http://www.dieselnet.com/standards/eu/hd.php shows how successive standards have tightened emission requirements.

Vehicle fuel types

NZTA has just made a major revision to the fuel data held on the Motor Vehicle Register. They are now recording whether vehicles are conventional hybrids, electric or plug-in hybrids.

Table 6a Fuel types of vehicles in the fleet at Dec 2016

	Light vehicles	Motorcycles and mopeds	Trucks	Buses	Other/Unknown	Total
Petrol	2,959,623	163,829	2,947	169	1,435	3,128,003
Petrol hybrid	18,492	-	-	1	-	18,493
Diesel	649,121	6	135,837	9,979	26,617	821,560
Diesel hybrid	44	-	1	-	-	45
Electric	1,543	253	2	72	19	1,889
Electric (petrol extended)	122	-	-	-	-	122
Plugin petrol hybrid (PHEV)	773	-	-	-	-	773
LPG	1,309	2	146	24	70	1,551
CNG	26	1	45	23	7	102
Unknown	132	50	7	-	56	245
Total	3,631,185	164,141	138,985	10,268	28,204	3,972,783

This information has not been added to vehicles that have left the fleet, so we cannot track the growth of conventional hybrids.

Figure 8.4a shows that the number of light vehicles primarily fuelled by CNG, LPG or electricity is low. Figure 8.4b shows that the number of light vehicles with CNG or LPG as a dual fuel has dropped substantially over the last decade.

Figure 8.4a : Primary light vehicle fuel

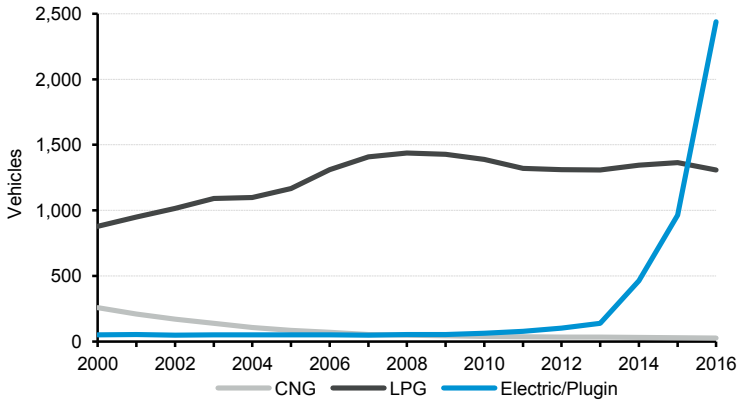
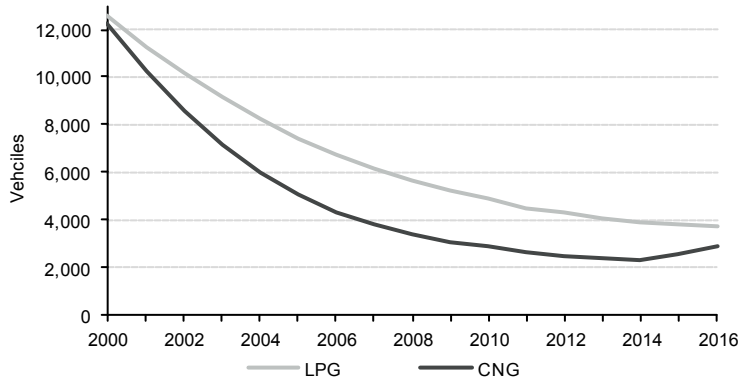


Figure 8.4b : Alternative light vehicle fuel



9. How fuel-efficient is the light fleet?

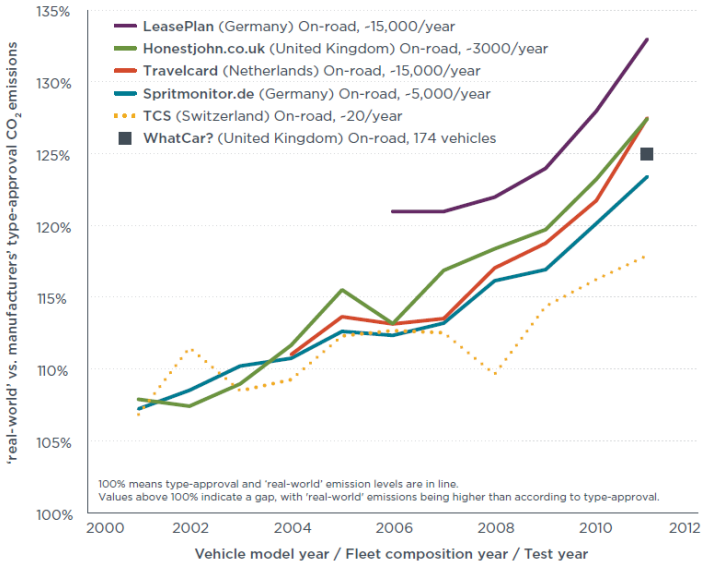
Issues in the test results

This section reports the fuel consumption figures that manufacturers get for their vehicles when they put them through standardised drive cycles in laboratory conditions.

While there will always be a difference between laboratory and real world results, they should be readily comparable over time. There is good evidence that the gap between laboratory results and real world fuel economy has been widening. A 2015 vehicle with a certain real world fuel economy is likely to have a lower laboratory result than a 2010 vehicle with the same real world economy.

Figure 9.0a from a recent European study shows the divergence between real world economy and laboratory test results. Real-world economy was 7% higher than test results in 2001 but the gap increased to around 25% by 2012.

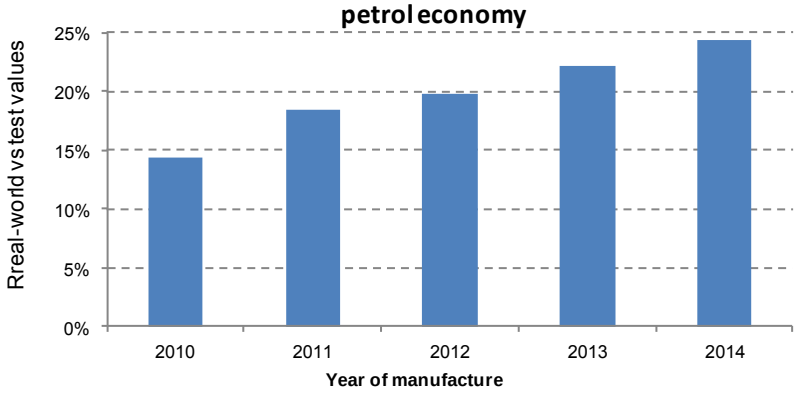
Figure 9.0a Real world emissions vs laboratory test results



Source : http://www.theicct.org/sites/default/files/publications/ICCT_LabToRoad_20130527.pdf

A similar comparison has been carried out in New Zealand[9] between the actual fuel consumption of light petrol corporate fleet vehicles and their laboratory test results. The result shown in Figure 9.0b is similar to the result shown above. Real world fuel economy is diverging from the test values for the same vehicle. It is possible that changes in congestion levels or driving behaviour may have also contributed to the divergence.

Figure 9.0b : Divergence between real world and test petrol economy



The implication is that the test value results for the newer vehicles shown in this section are becoming increasingly optimistic. Figure 9.4 shows that the average laboratory value for new light petrol vehicles was 192 g CO_2/km[10] for vehicles entering the fleet in the fourth quarter of 2010 and 167 g CO_2/km in the fourth quarter of 2014. That suggests an improvement of 13% in fuel economy.

[9] "Real-world fuel efficiency of light vehicles in New Zealand" Wang, McGlinchy, Badger, Wheaton, Ministry of Transport. This paper was presented at the Australasian Transport Research Forum (ATRF) in October 2015

[10] Vehicles using petrol or diesel produce CO_2 in direct proportion to the amount of fuel used.

However, based on the result above their real world economy may have been about 219 g CO_2/km in 2010 and 207 g CO_2/km in 2014, or an improvement of 5.5%.

The analysis does show that real world economy has been improving for vehicles with a given engine size and fuel type, but not as quickly as the laboratory results suggest.

The fuel economy of the light vehicles that have entered the fleet in the last two years has been static in terms of laboratory test results (see graph 9.4). The implication is that their average real world economy may have worsened.

CO_2 emissions of new light vehicles entering the fleet

Figure 9.1a shows the CO_2 emissions per kilometre of travel (g CO_2/km) of New Zealand-new light vehicles that entered the fleet from April 2005. The market share of the more fuel efficient petrol vehicles (up to 170g CO_2/km) has been growing. This may be partly due to a move to diesel SUVs instead of large-engine petrol vehicles.

Figure 9.1a : New light vehicle registrations
CO_2 emissions per km driven

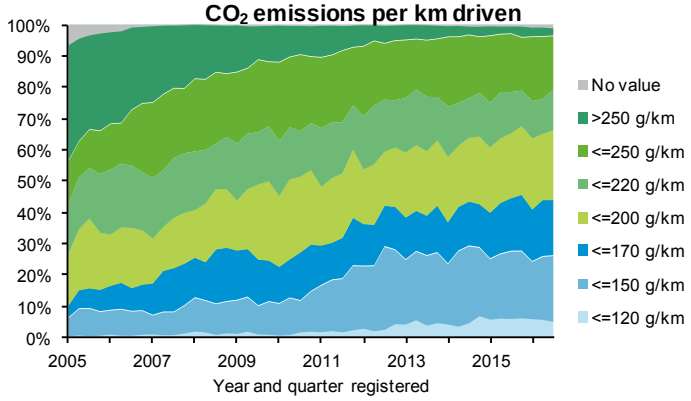
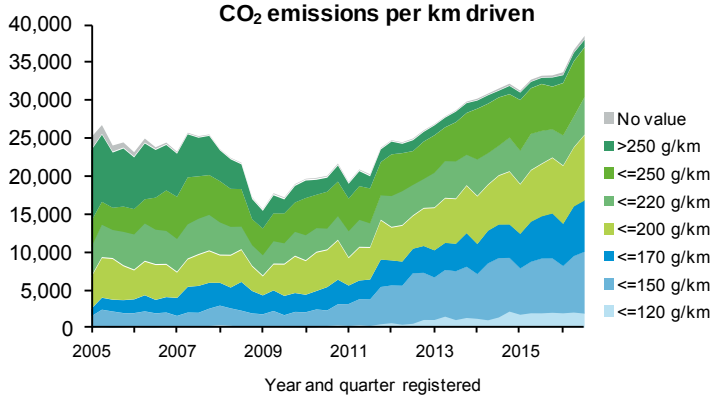


Figure 9.1b : New light vehicle registrations
CO_2 emissions per km driven



The values shown are for vehicles tested using the European test methodology (cold start). A small number of new vehicles are tested to the Japanese test standard (warm start) and their values have not been included as they are not directly comparable. A cold start test generally returns a higher consumption value than a warm start test for the same vehicle. The technical notes on page 52 detail how the g CO_2/km calculations are done.

The CO_2 emissions of used light petrol vehicles entering the fleet

Figure 9.2a is an estimation[11] of the carbon dioxide emissions of light used imported vehicles. The lower consumption segments (under 170 g/km) have lost market share since 2012.

Figure 9.2a : Used import light petrol registrations CO_2 emissions per km driven

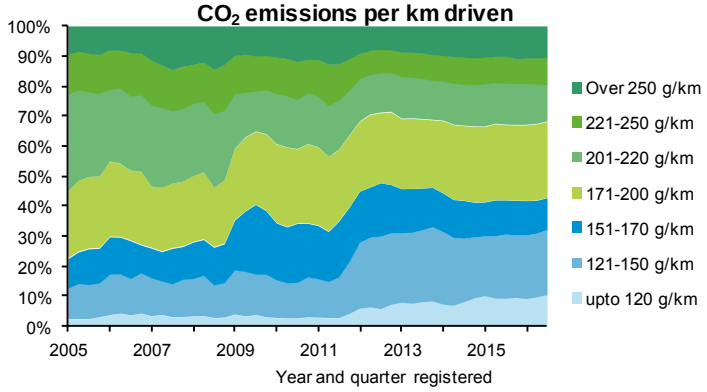
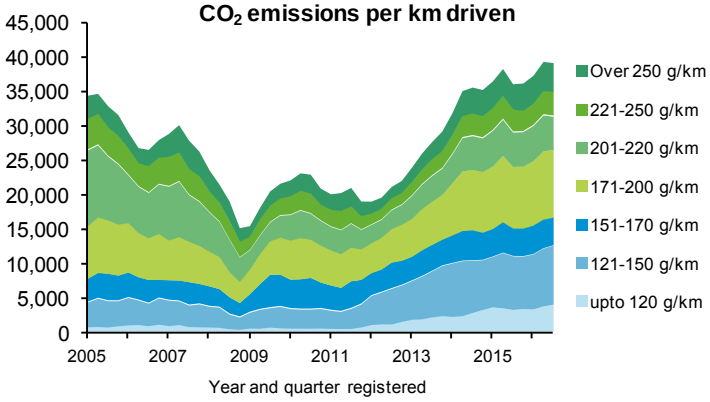


Figure 9.2b : Used import light petrol registrations CO_2 emissions per km driven



[11] The estimation process:

1. Convert the Japanese test values to European test values, using the Ministry's Japanese warm cycle to Euro cold cycle test converter (unpublished).
2. Split each quarter's new registrations into engine capacity bands.
3. Use the vehicles with known consumption values, in each engine capacity band, to establish a CO_2 mix for that engine capacity band and quarter.
4. Apply the CO_2 mix for each engine capacity band to the vehicles without a value for that quarter.

CO_2 emissions of used diesel vehicles entering the fleet

Only 5 percent of used import diesel vehicles had known fuel consumption test results. Therefore, it is not possible to analyse their fuel economy (see Table 6 in the Fleet Statistics spreadsheet).

Typically, used diesels will have higher fuel consumption than the used petrol vehicles, as the diesel engines are larger.

The number of used diesels imported is now very low (see Figure 5.3) and their omission from the figures below will not affect the result.

The quarterly fleet report provides more detailed analysis of trends in CO_2 emissions.

CO_2 emissions of petrol vehicles and new diesel vehicles entering the light fleet

Figure 9.3a shows the CO_2 emissions of the new and used petrol vehicles combined.

New Zealand-new vehicles with Japanese test cycle values have been included, after their values have been converted[12] to the equivalent European test value. The fuel economy of used imports without fuel economy values has been estimated using the methodology described on page 52.

Figure 9.3a : New and used light petrol CO_2 emissions per km driven

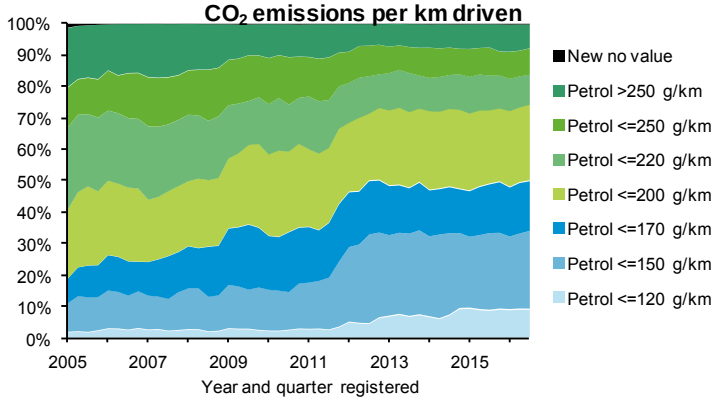
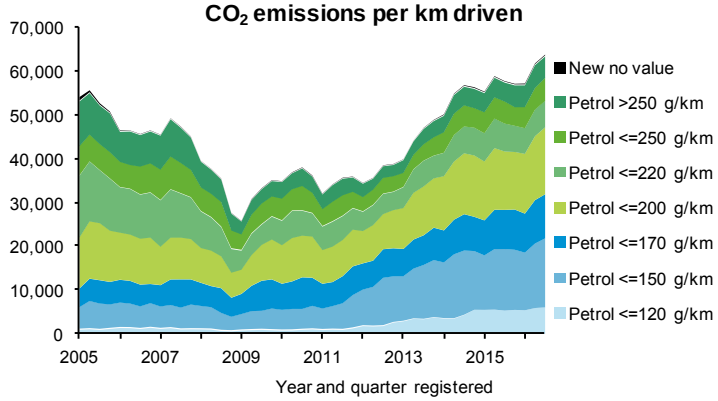


Figure 9.3b : New and used light petrol CO_2 emissions per km driven



[12] See page 52 for a description of the CO_2 emissions estimation process.

Figure 9.3c shows the CO_2 emissions of the new diesel vehicles. Used diesel vehicles could not be analysed as too few of them have known fuel consumption values.

Figure 9.3c : New light diesel registrations
CO_2 emissions per km driven

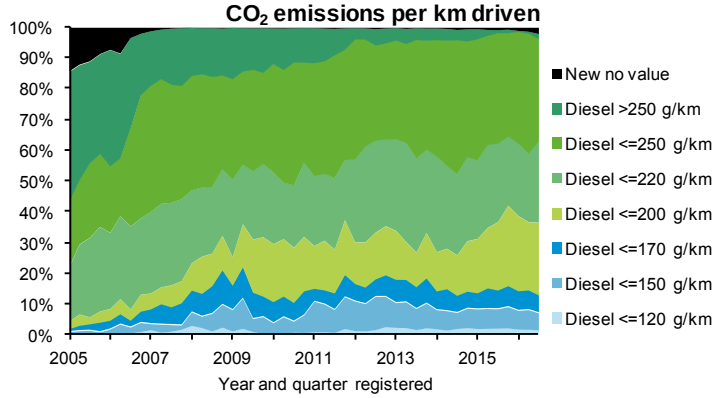
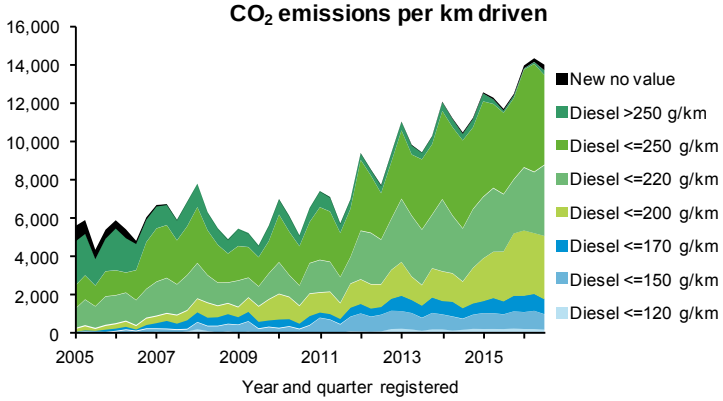


Figure 9.3d : New light diesel registrations
CO_2 emissions per km driven



Average CO_2 emissions of light vehicles entering the fleet

Figure 9.4 is a summary of the information that has been presented in Figures 9.1, 9.2 and 9.3. It shows some response to the increased fuel prices in 2006[13], 2008 and 2011-2014.

However, the used import fuel consumption data is not as reliable as the new vehicle data. The Ministry of Transport has estimated values from the used petrol imports that have a fuel consumption test value, and the Japanese test cycle values have also been converted to European test cycle values.

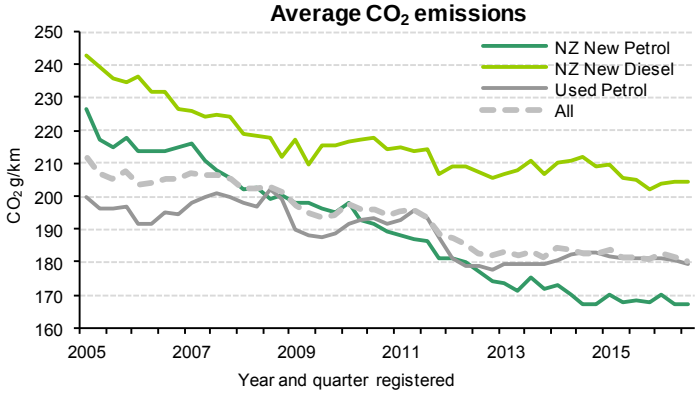
The used diesel imports are not included in the analysis, as too few of them have known fuel consumption. Used diesels make up a very low fraction of used imports now.

Figure 9.4 shows that there was:

- an improvement in fuel economy of light vehicles entering the fleet from 2005 to 2009
- little improvement in 2010 and 2011
- a marked drop from mid 2011 to the end of 2012 (also see Figure 9.6)
- little change since then

Figure 9.4 is updated each quarter in the Quarterly Fleet Statistics. Fuel economy and CO_2 g/km are in direct proportion, and CO_2 is used in Figure 9.4 so diesel and petrol vehicles can be combined neatly.

Figure 9.4 : Light vehicle registrations
Average CO_2 emissions



TECHNICAL NOTES

How CO_2 per km is calculated

The fuel consumption test results recorded on the vehicle register have been converted from litres per 100km (L/100km)to grams of CO_2 per kilometre driven. This allows direct comparison of petrol and diesel vehicles, which have different fuel consumption and CO_2 emissions (diesel vehicles typically have lower fuel consumption than their petrol equivalents, but there is more carbon in a litre of diesel compared with a litre of petrol). The conversions that have been used are:

- diesel g CO_2/km = 26.05 x diesel consumption (L/100km)[14]
- petrol g CO_2/per km = 22.961 x petrol consumption (L/100km)[15]

The petrol factor is based on the carbon content of the regular/premium mix sold in New Zealand in 2005 (premium petrol has a higher carbon content than regular petrol). It differs slightly from year to year due to changes in fuel properties.

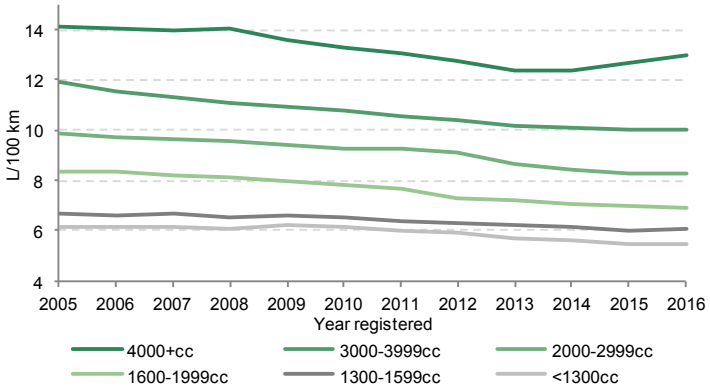
[13] See Section 12.
[14] Ministry of Economic Development, NZ Energy Greenhouse Gas Emissions 1990–2006.
[15] Ministry of Economic Development, NZ Energy Greenhouse Gas Emissions 1990–2006.

How have these economy gains come about?

Figure 9.4 shows the fuel economy of light vehicles entering the fleet has improved.

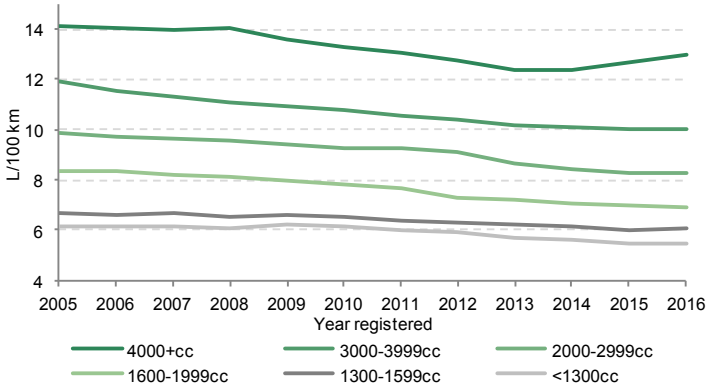
Figures 9.5a and 9.5b shows the economy trends within each engine cc band.

Figure 9.5a : Petrol economy trend by engine size



The economy trend for diesels with engine capacity under 1300cc varies as the sales of those vehicles are very limited.

Figure 9.5a : Petrol economy trend by engine size



There were no under 1300c diesels registered in 2011.

Emissions standards of vehicles in the light fleet

The numbers of New Zealand new and used imported light vehicles built to specific harmful exhaust emissions standards is shown in the Fleet Statistics spreadsheet tab 9.11. This information was first recorded on the vehicle register in early 2005, so it is not comprehensive. Since 2004 vehicles entering the fleet have been required to be built to recognised exhaust emissions standards. These relate to air quality and substances harmful to human health, and are not related to CO_2 emissions.

10. The engine size and age of the vehicles in use

The average vehicle age and engine capacity of the light fleet has already been detailed, but how do they compare with the average vehicle that is actually travelling on the road?

The technique to establish this is to weight engine size and age by travel.

If the fleet consisted of a 1000cc car that did 5,000 km/year and a 2000cc van that did 12,000 km/year:

- the average engine size of the fleet would be 1500cc = (1000+2000)/2.
- the travel-weighted engine size would be 1706cc=(1000x5000 + 2000x12000) / (5000+12000)

Similarly, if the fleet consisted of a 10-year-old vehicle doing 4,000km/year, and a 4-year-old vehicle doing 10,000km/year:

- the average fleet age would be 7 years = (4+10)/2.
- the average travel-weighted fleet age would be 5.7 years = (10 x 4000 + 4 x 10000) / (4000 + 10000)

Using this technique, Figures 10.1 and 10.2 show that the average vehicle actually travelling is younger than the average vehicle in the fleet and that it has a larger engine capacity than the average vehicle in the fleet.

Figure 10.1 : Light fleet travel-weighted average vehicle age

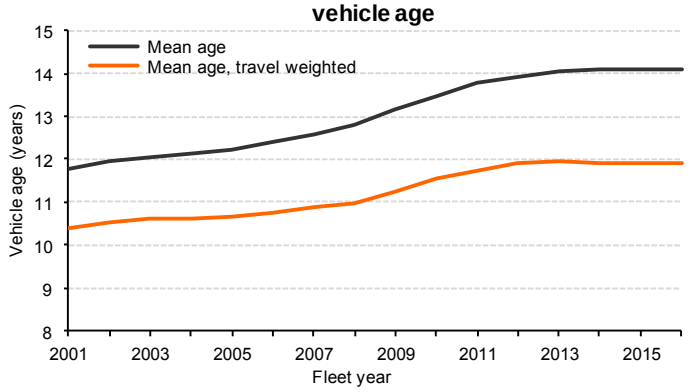
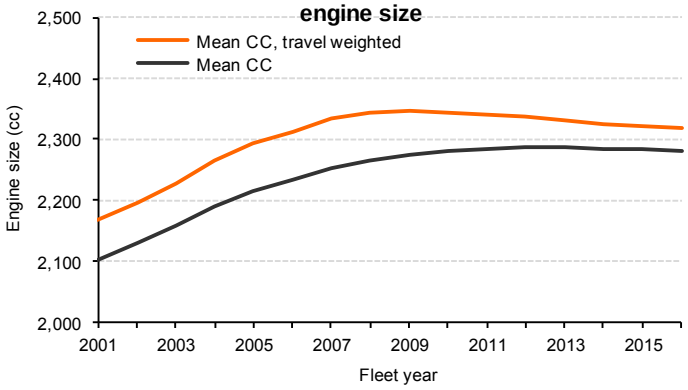


Figure 10.2 : Light fleet travel-weighted average engine size



11. Road freight

Originally our estimates of road tonne km were based on Road User Charges (RUC) sales. That approach was negated by the changes to RUC in 2012[16]. A new approach has been developed using weights from the NZTA WIMS (Weigh in Motion Sites) weighbridges combined with tare (unladen) weights from the vehicle register.

The increase in tonne-km from 2013 onwards (see Figure 11.2) relative to truck and trailer travel (see Figure 11.1), shows that the heavier high productivity motor vehicles (HPMV) are making an impact.

Figure 11.1 : Truck and trailer travel

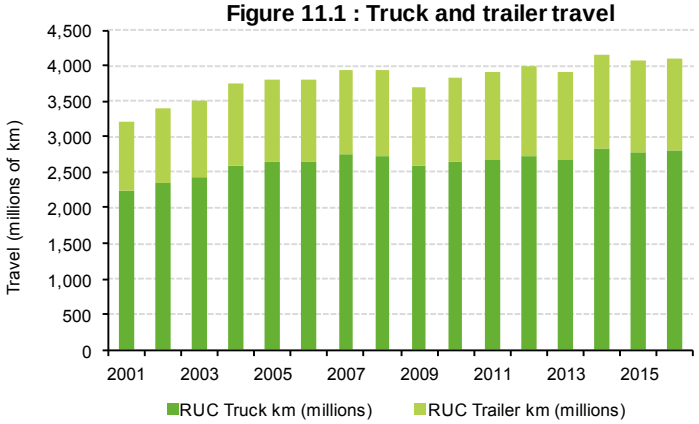
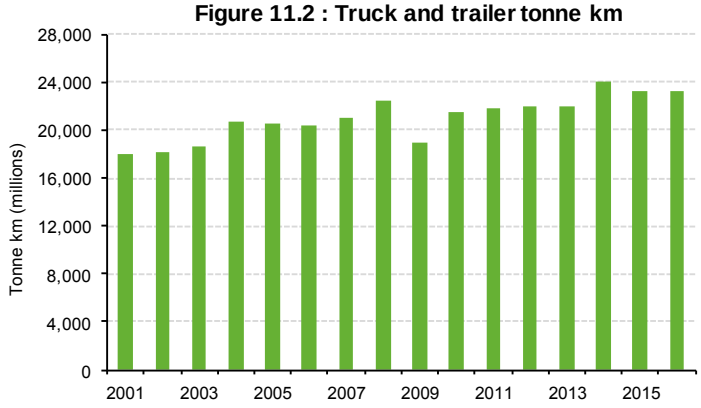


Figure 11.2 : Truck and trailer tonne km



[16] See http://www.transport.govt.nz/land/roadusercharges/roaduserchargeslegislationchanges/

Appendix A: Comparability with other published data

The fleet statistics in this analysis are not directly comparable with data published by the Transport Registry Centre of the NZTA. This analysis is based on a slightly different categorisation of the vehicle fleet and assessment of the number of active vehicles.

The information in this publication has been derived from a data extract from the New Zealand Motor Vehicle Register (MVR) which holds information on all active vehicles in New Zealand.

VEHICLE CATEGORISATION

The vehicle categorisation is the one used in the Vehicle Fleet Emissions Model (VFEM)[17], rather than the vehicle split traditionally found in statistics published annually by the New Zealand Transport Agency.

The major difference from the New Zealand Transport Agency statistics is that, in this analysis, light vehicles (under 3.5 tonnes) have been categorised into light passenger vehicles and light commercial vehicles. In the New Zealand Transport Agency data, light commercial vehicles are included with trucks, but they may actually be cars, vans, utes or SUVs. The New Zealand Transport Agency categorisation is not as useful when projecting the make-up of the fleet for the purposes of estimating fuel use or the level of emissions.

The objective of the Vehicle Fleet Emissions Model is to estimate the size and activity of the on-road fleet. For this reason, vehicles exempt from licensing (typically those used off road) and vehicles with restoration licences are excluded from the analysis.

Table 9 Vehicle types		
Fleet statistics types	**Motor Vehicle Register vehicle types**	**Mass**
Light Passenger Fleet	Passenger car/van	Up to 3500 kg
Light Commercial fleet	Goods van/truck/utility Motor caravan Bus (*)	Up to 3500 kg
Bus	Bus	Over 3500 kg
Truck	Passenger car/van Goods van/truck/utility Motor caravan	Over 3500 kg
Motorcycles	Motorcycle ATV Moped	
Miscellaneous (**)	Mobile machine Special purpose vehicle Tractor Agricultural machine	

(*) Light buses have been included in the light fleet as they have the same fuel use and emissions characteristics. Physically they are vans and SUVs.

(**) A small number of vehicles are classified as ‘miscellaneous'. Many of these vehicles are exempt from licensing and therefore not included in these analyses.

[17] The VFEM is a computer model of the New Zealand vehicle fleet that is used to predict CO_2 emissions and fuel use. Much of the analysis in this report was carried out as part of ongoing work by the Ministry of Transport to improve the accuracy of the VFEM.

VEHICLE CATEGORISATION VS MOTOR VEHICLE REGISTER VEHICLE BODY TYPE

The breakdown of vehicle categorisation by vehicle body type for the December 2014 fleet is shown in Table 10.

Table 10 Fleet statistics vehicle type derivation

	Fleet Statistics category						
Motor Vehicle Register Body Type	Light passenger vehicle	Light commercial vehicle	Heavy goods vehicle	Bus	Motor-cycle	Miscellaneous	Total
Articulated truck	0	70	8467	0	0	0	8537
Cab and chassis only	0	6379	1983	10	0	0	8372
Convertible	32260	0	1	0	0	0	32261
Flat-deck truck	0	15264	18180	0	0	0	33444
Hatchback	904184	0	0	0	0	0	904184
Heavy bus	0	14	300	0	0	0	314
Heavy van	170	9665	4727	0	0	0	14562
Light van	39265	124690	269	0	0	0	164224
Minibus	0	17002	0	125	0	0	17127
Mobile machine	0	0	0	0	0	7219	7219
Motorcycle	906	0	0	0	164141	0	165047
Other	0	0	0	0	0	904	904
Other truck	0	13455	79824	0	0	1627	94906
Saloon	915933	0	8	0	0	0	915941
Self propelled caravan	0	14767	24394	0	0	0	39161
Service coach	0	70	0	10133	0	0	10203
Sports car	58935	0	0	0	0	0	58935
Station wagon	1142692	4552	123	0	0	0	1147367
Tractor	0	0	0	0	0	18449	18449
Utility	0	330912	709	0	0	0	331621
	3094345	536840	138985	10268	164141	28199	3972778

VEHICLE TRAVEL ESTIMATES

Vehicle travel estimates have been calculated on the basis of the difference between successive warrant of fitness or certificate of fitness odometer readings. The resulting fleet travel estimate has been validated against three large-scale traffic counting exercises conducted by the former Land Transport Safety Authority (LTSA).

Appendix B: Vehicles in the fleet

Background

Each year the Ministry produces a comprehensive set of vehicle fleet statistics; the New Zealand Annual Vehicle Fleet Statistics. It is accompanied by less detailed Quarterly Fleet Reports[18].

Both publications report road travel, which is derived from the change of odometer readings between Warrant of Fitness (WOF) and Certificate of Fitness (CoF) inspections.

The vehicles reported on are those that are licensed to be used on the road, so vehicles exempt from licensing (not used on the roads) or not currently licensed are excluded.

The key trends are fleet size, travel, road travel per vehicle and road travel per person. These trends underlie understanding of transport and transport infrastructure demand.

It important to determine when vehicles leave the fleet

Central to the fleet statistics are accurate measures of the total fleet size, fleet age and total distance travelled. There is good information on vehicles entering the fleet, but it is less certain when vehicles leave the fleet.

Only around half the vehicles leaving the fleet are actively delicensed by their owners. Other vehicles which have not been relicensed remain active on the vehicle register for 12 months, for administrative reasons (henceforth the administrative approach). Most of those vehicles are not being used and if they are regarded as live we will overestimate the number of vehicles on the road.

More importantly we will also overestimate travel, as these vehicles will be assumed to travel the typical distances that vehicle of their type and age do. Unlicensed vehicles cannot undergo WoF/CoF so there will not be any odometer readings for them, hence the use of averages.

The Ministry's approach has been to take vehicles out of the fleet (and travel estimation) when their WoF/CoF was overdue by 6 months (the WoF-based approach). The WoF-based approach to removing vehicles was chosen because it gave a good match with the traffic counting survey estimates[19].

However, the WoF-based approach is no longer viable. Changes to the WoF that took effect in 2014[20] mean much of the fleet is now on 3 year (vehicles under 3 years old) and 1 year WoF cycle (vehicles manufactured from 2000 onwards) rather than a 6 monthly cycle.

Developing a new approach to determining when vehicles leave the fleet

Under the old WoF regime the vast majority of vehicles that were not actively deregistered would have left the fleet because they failed their 6 monthly WoF test and the owner elected to scrap rather than repair the vehicle. However, the growing number of vehicles on longer WoF cycles means using overdue WoF as a guide to scrappage will overestimate the size of the fleet and distort the statistics. This distortion will grow with time as more vehicles move to an annual WoF/CoF Cycle.

The Ministry has therefore needed to develop a new mechanism to provide estimates of the fleet size and travel. We have reviewed several options for determining when vehicles leave the fleet.

Adjust scrap dates to align vehicle removal more closely with the WoF approach

We know that there will be a relationship between when vehicles are removed using the administrative approach, and when the WoF-based approach would have taken the vehicle out of the fleet. We considered pushing the eventual administrative removal dates forward by a number of months to align them with the old approach, but we are not confident that relationship will endure as more vehicles move to one year WoF/CoF cycles.

This method would also involve waiting a year until lapsed status is definite, which would have delayed reporting unreasonably. It was not considered further.

[18] www.transport.govt.nz/research/newzealandvehiclefleetstatistics/
[19] The survey points in the road travel graph are from a series of large-scale traffic-counting exercises conducted by the LTSA then the Ministry of Transport. A sample frame was devised so that the counts done at those locations could provide a good national travel estimate and they are considered to be robust estimates.
[20] www.transport.govt.nz/land/vehiclelicensingreformconsultation/

a) Remove vehicles at end of licence, if not renewed within 90 days

If vehicles are not relicensed on time then two things can happen:

- either they are not relicensed within 12 months and are removed from the fleet (by the lapsing process)
- or they are relicensed late. About 98% of these vehicles are renewed within 90 days of licence expiry

One approach is to take vehicles out of the fleet on the day that its licence expires, if the licence is not renewed within 90 days. Using a 90 day period would allow fleet statistics to be calculated three months after the end of the period being reported.

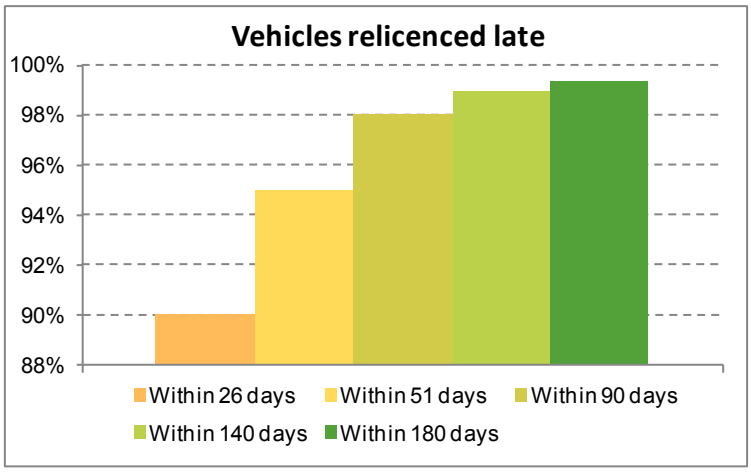
Unfortunately, the approach does not produce good results. Two percent of vehicles are renewed after 90 days. While that does not sound much, it significantly increases the number of vehicles that appear to have been scrapped and reduces the fleet size estimate.

b) Remove vehicles at end of licence, if not renewed within 180 days

The lapsing process takes a year before removing a vehicle. Waiting that long would give a definitive answer as to whether a vehicle was ever relicensed, but reporting would be delayed for a year.

Another approach is to consider a vehicle to have left the fleet on the date its licence expires, but to wait 180 days before removing the vehicle from the fleet. Waiting 180 days reduces the number of vehicles left out of the reported fleet which are eventually relicensed.

63% of vehicles are licensed on time. This graph shows the percentage of the remaining vehicles that are eventually relicensed within the periods shown. The change from 98% in 90 days to 99.34% in 180 days makes that approach perform far better than the 90 day option. Waiting longer before reporting would only improve reporting a little.



What is the effect of this approach on travel estimation?

If we use the 180 day removal process, a vehicle that should have been relicensed at the end of April 2014 would be regarded as having left the fleet in April, if it was not relicensed by October 2014. This would reduce the vehicle's contribution to 2014 travel from being in the fleet for the entire year (if removing the vehicle using the administrative method in 2015) to only being in the fleet from January-April 2014.

However this approach proved to produce numbers of scrapped vehicles that changed appreciably as the data firmed up over time.

c) Probability method

The reporting on the fleet composition and fleet travel is done after six months of data has become available after the analysis period. However that leaves vehicles that were not relicensed 6-12 months ago with uncertain status. Some will be relicensed before a year is up, and some will lapse out of the fleet after a year.

The most consistent estimates of the number of these vehicles that will drop out of the fleet has been found to be using a probability of scrappage .

- 23/48 of the vehicles not relicensed 10-12 months ago are scrapped
- 33/48 of the vehicles not relicensed 10-12 months ago are scrapped

There is a limited amount of change as the data firms up 9 and 12 months past the period being analysed – that is the price of reporting 6 months after the analysis period.