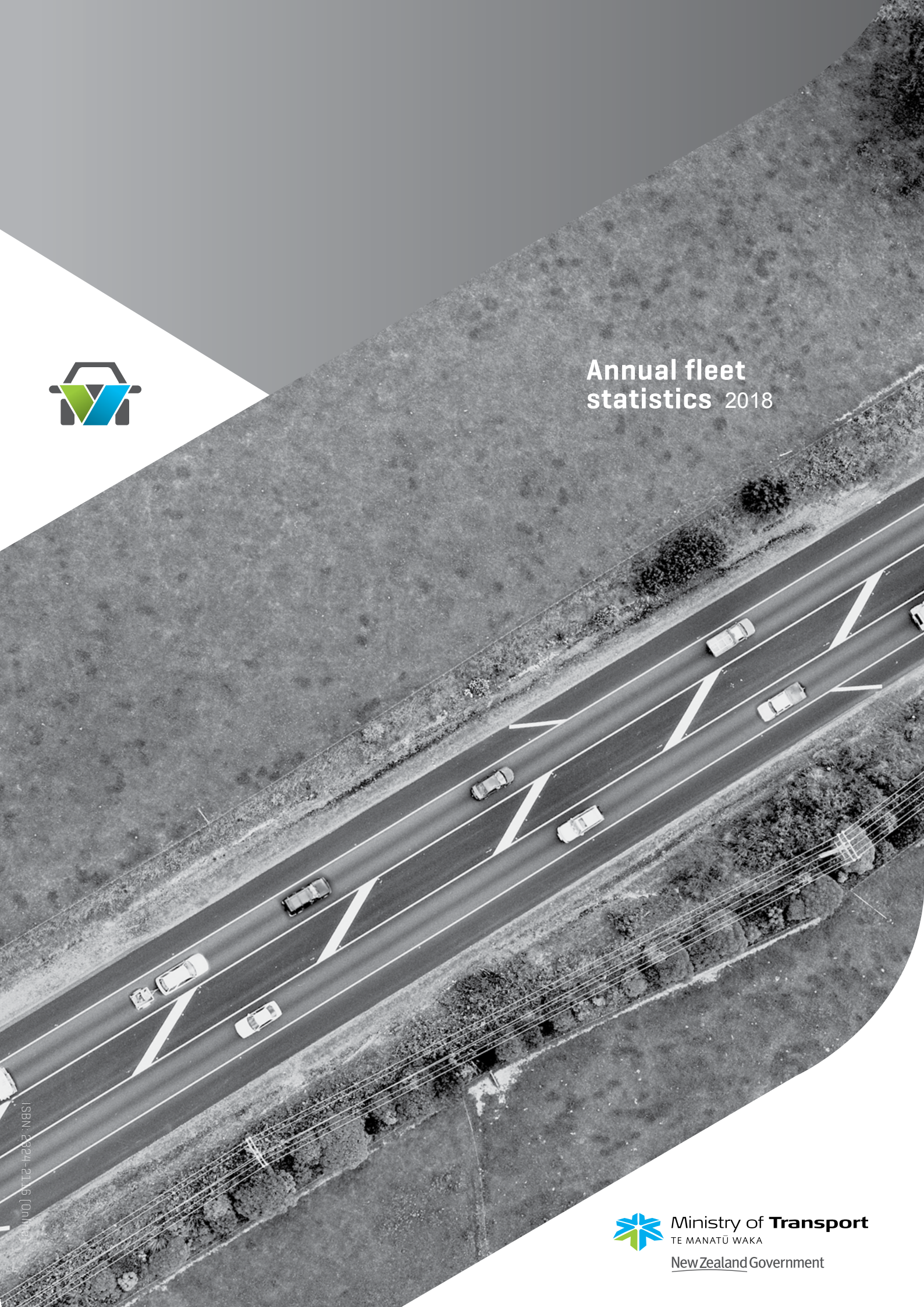
Annual fleet statistics 2018



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Ministry of Transport
TE MANATŪ WAKA
New Zealand Government

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Executive summary

In New Zealand, the light fleet (vehicles under 3.5 tonnes) alone constitutes over 90% of annual road vehicle travel. The heavy fleet, on the other hand, only constitutes 7% of annual travel but contributes to over a quarter of New Zealand's CO_2 emissions from transport. Hence, trends in both the composition and travel patterns of the light and heavy fleet are crucial to understanding their impact on transport outcomes.

This report presents a trend analysis – mostly macroscopic trends of *what and how New Zealanders are driving.* These broad trends of **what** and **how** can be used to understand underlying mechanisms (e.g. driving behaviours, mediating factors, externalities) and help discern the contribution of the road fleet to transport outcomes.

Trends

- 2018 had the largest fleet size to date. Vehicle numbers have increased since 2013; a trend that can be attributed to a stronger economy and the associated consequence of increased net migration.
- Annual light travel per capita has risen since 2013 - after a long period decline, between 2008 and 2012.
- Reported fuel efficiency of light vehicles has increased since the mid '00s. New vehicles entering the light fleet perform better in laboratory tests of fuel efficiency than the light fleet average.
- The light fleet continues to be dominated by petrol and diesel. Despite the increasing presence of light electric vehicles, market share is very low: 1 in 100 light vehicles are petrol/electric hybrids, and only 2 in 1000 light vehicles are fully electric. These minor contributions are completely eclipsed by diesel and petrol - which make up 98.8% of the light fleet engine types.
- New Zealand's light fleet is much older than similar countries (USA, Canada and Australia) due to the persistence of vehicles manufactured in the late '90s and mid '00s.
- The heavy fleet has continued to grow in annual travel. If the trend continues, the heavy fleet will likely exceed its current 27% contribution to CO_2 emissions from road transport.

Impact on transport outcomes

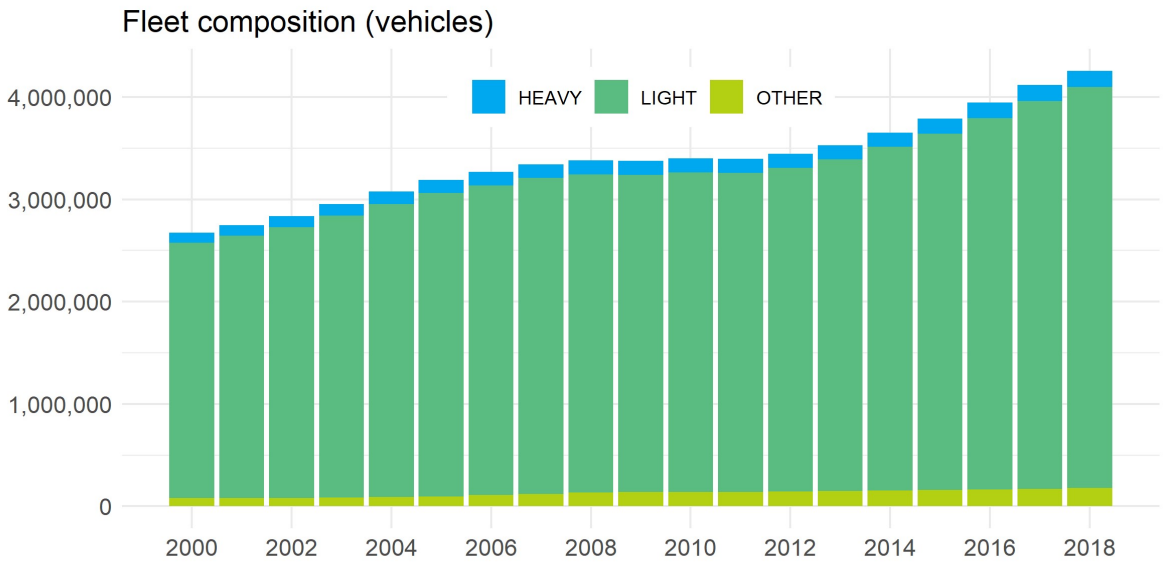
In the medium term, the future fleet will continue to be dominated by petrol and diesel engine vehicles. Combined with the increasing trends in both heavy and light vehicle travel, there will be significant demand on New Zealand roads. These trends ensure that emissions from the road fleet will remain a key focus in achieving national environmental and transport outcomes.

How to read this report

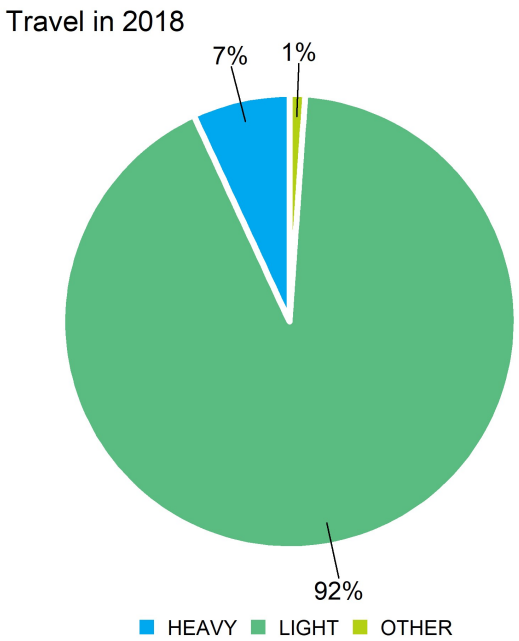
This report presents a high level trend analysis of the road vehicle fleet to inform the transport sector. Due to the prominence of light vehicles in the fleet, most of the report focuses on their particular characteristics and trends. The appendix drills into plausible explanations of certain trends in the light fleet. While attempts have been made to identify underlying mechanisms of the trends, the explanations do not carry a rigorous causal interpretation.

Introduction

New Zealand's vehicle fleet has been increasing since 2013. Of the 4.3 million vehicles in the 2018 vehicle fleet, just over 90% are light vehicles – cars, vans, utes, four-wheel-drives, sports utility vehicles (SUVs), buses and motor caravans (camper vans) with a gross vehicle mass up to 3.5 tonnes. The heavy fleet consists of trucks and buses. 'Other' includes motorcycles and unclassified vehicles such as agricultural equipment.



In addition to dominating the vehicle numbers, the light fleet constitutes more than 90% of the travel on New Zealand roads. Total travel in 2018 was around 49 billion km.

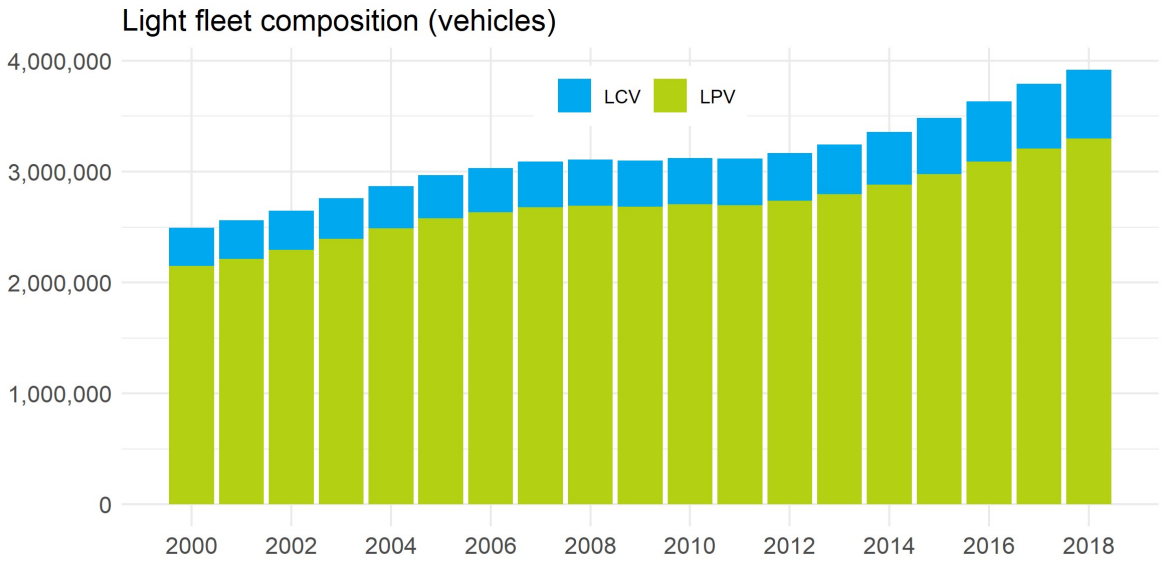


As the majority component of the New Zealand road fleet and travel, the trends and characteristics of the light fleet are crucial for understanding the impact on emissions and road network demand. The main section of the report presents trends and characteristics of light vehicles in New Zealand as they are the vehicle New Zealanders buy and drive.

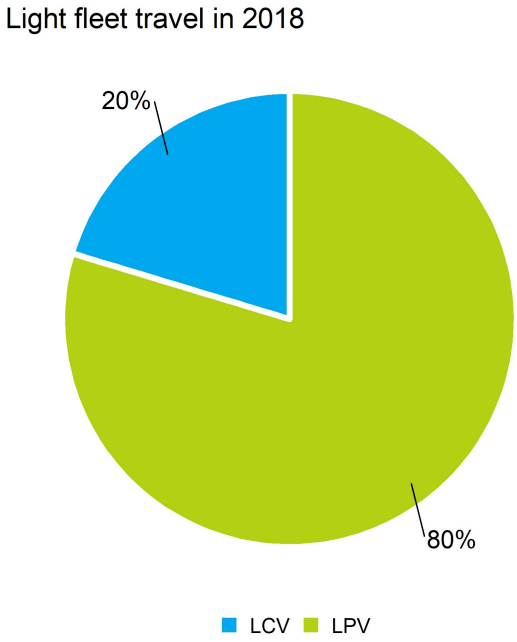
Light fleet trends

Record number of vehicles

Light vehicles can be split into two main types[1]: light passenger vehicles (LPV) and light commercial vehicles (LCV). Passenger vehicles, LPVs, comprise 85% of the 3.9 million strong light vehicle fleet. Since 2013, this subset has seen significant growth, increasing annually by 3.2% and culminating in the highest vehicle numbers yet in 2018.



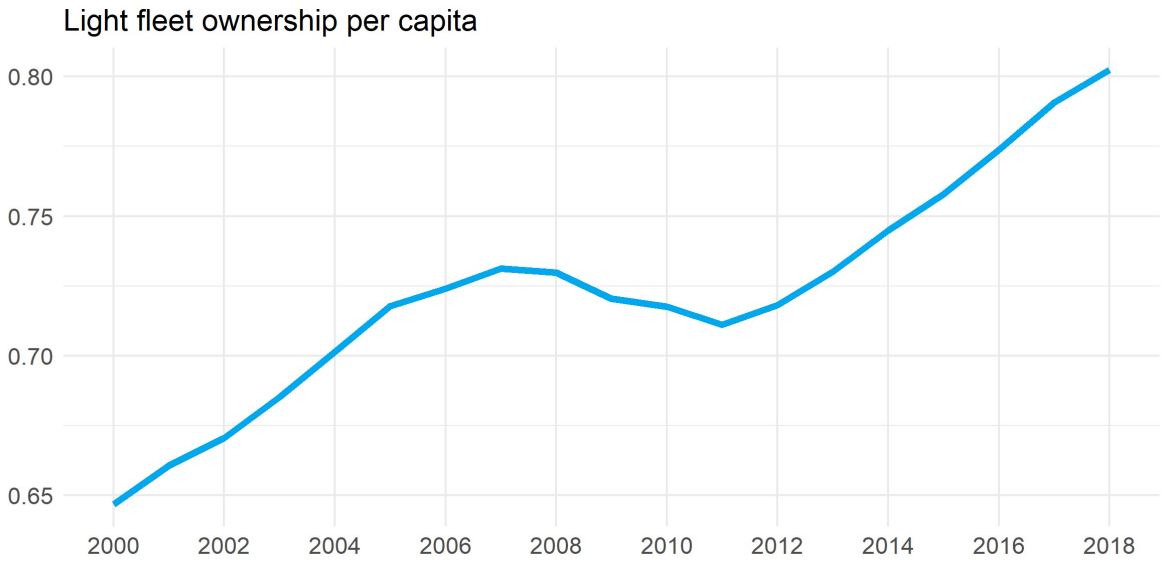
Although they only make up 15% of the light vehicle fleet, 20% of total light travel in 2018 was completed by LCVs. In 2018, LPVs and LCVs contributed to 73% and 19% of the total fleet VKT respectively, while heavy vehicles made up the remaining 8%.



[1] This classification is based on the *shape* of the vehicle using a set of criteria rather than the *purpose* the vehicle was purchased for.

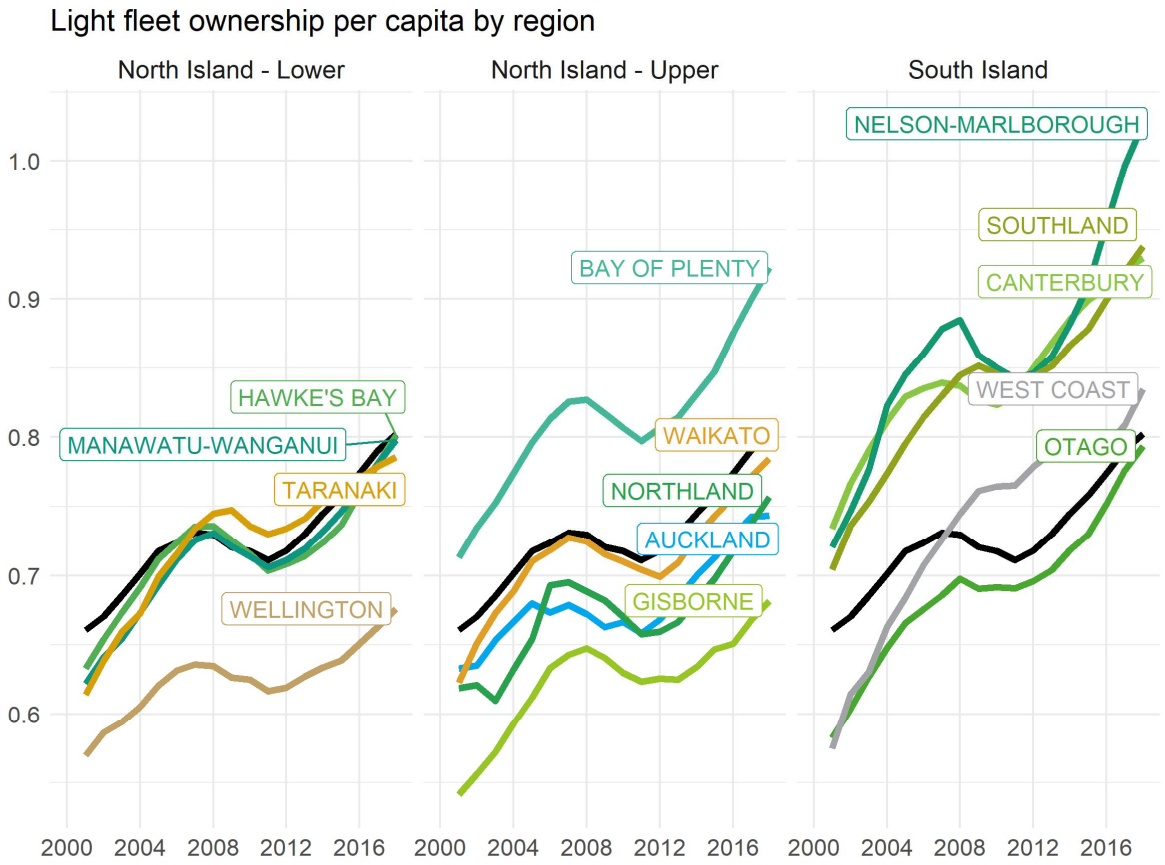
High levels of vehicle ownership

The light fleet has been growing steadily due to increasing vehicle ownership in the population. Following the slump between 2007 and 2011 due to the global recession, ownership recovered to annual growth rates seen before 2006. This steady growth rate is likely to push ownership to even higher levels.



As shown in the chart below, while the national average of light vehicle ownership is high (shown in black), there is significant regional variation. For the last decade, Wellington and Gisborne have had the lowest ownership rates while all the South Island regions, except Otago, are well above the national average. In the North Island, only the Bay of Plenty is consistently above the national average.

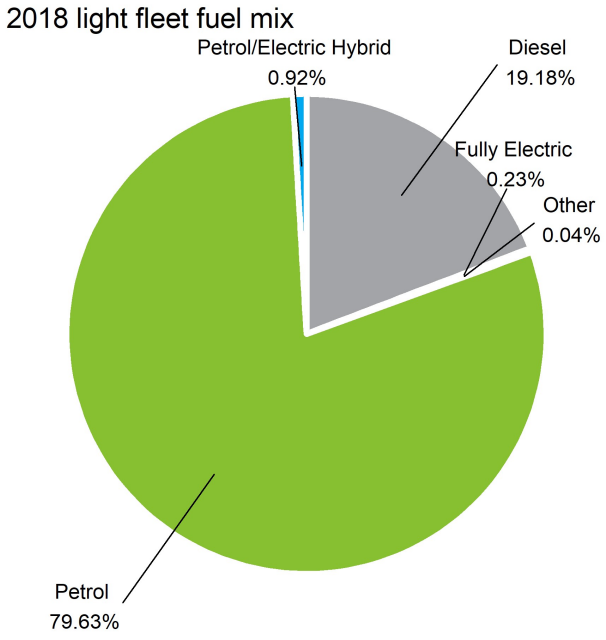
Only two regions have changed their position with respect to the national average: Taranaki and West Coast. Both regions exceeded the national average in 2007. While Taranaki has reverted to below the national average since 2016, the West Coast continues to be higher.



What is New Zealand driving?

Mostly petrol vehicles

Despite the gradual introduction of electric vehicles into the mainstream fleet, only 1 in 100 light vehicles are petrol/electric hybrids and fewer than 2 in 1000 light vehicles are fully electric. The light fleet continues to be dominated by petrol.

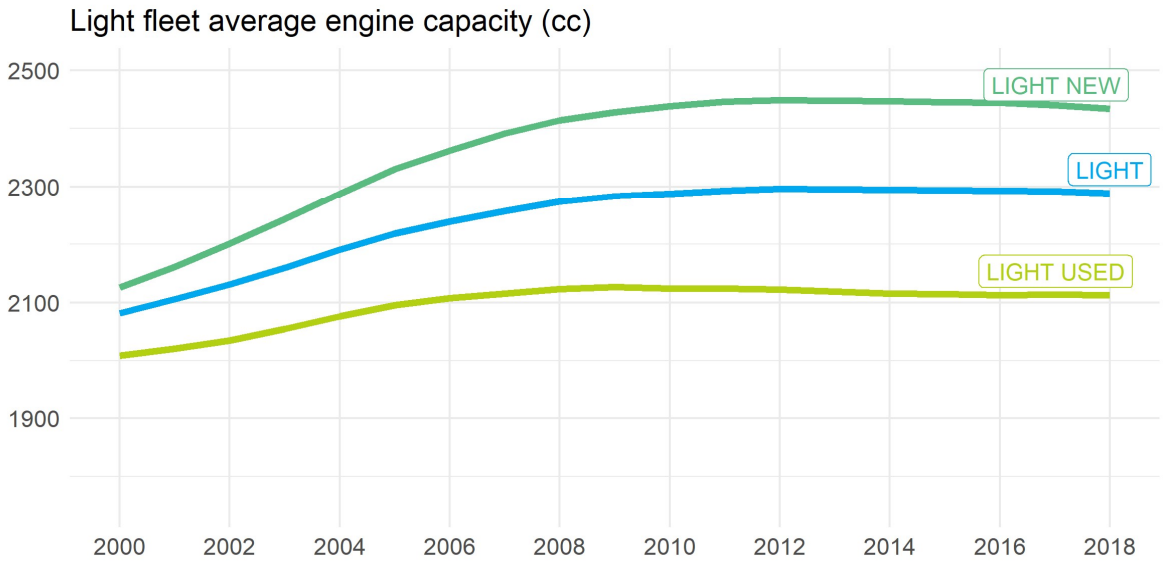


It is worth noting that LCVs and LPVs are not equally run by petrol and diesel. 91% of the 2018 LPV fleet is fuelled by petrol while 75% of the 2018 LCV fleet runs on diesel.

New vehicles with large engines

The average engine capacity of the light fleet increased by 10% within a decade – between 2000 and 2010. However, an average light vehicle engine size of 2300 cc has been consistent since 2011. For reference, 2300 cc is a 2.3L engine and is typically found in larger cars like station wagons.

New light vehicles have significantly larger average engine capacity than used imported vehicles. The gap between engine capacity of new and used vehicles also grew between 2000 and 2010 – from 100 cc to ~450 cc.

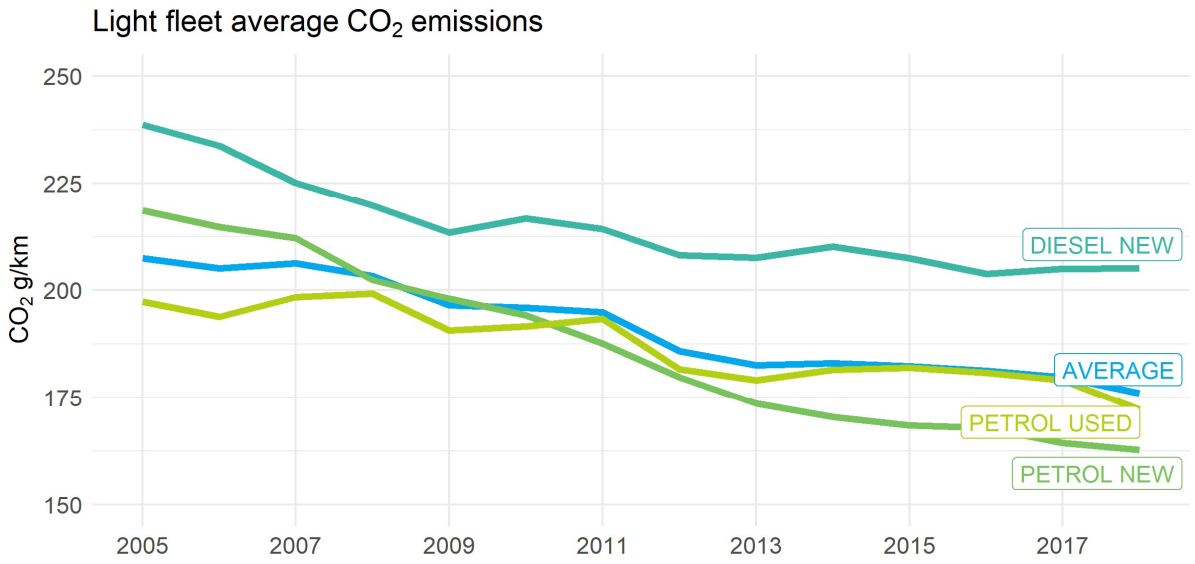


Vehicles entering light fleet with increasing reported fuel efficiency

The average 2018 light vehicle entering the fleet now has a lower reported CO_2 emission: 176 g/km compared to 207 g/km in 2005[2]. This is partly due to technological advances that have not only improved the fuel efficiency, but also improved vehicle performance to achieve better results in official test procedures. Reported CO_2 emissions have been decreasing particularly dramatically for new petrol vehicles, however average diesel emissions have remained relatively static since 2015. This suggests real-world emissions may actually be worsening[3].

[2] **Note on the calculation**: 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. Used diesel imports are not included in the analysis, as too few of them have known fuel consumption. Their absence doesn't impact the overall trends since they now comprise a very small fraction of used imports.

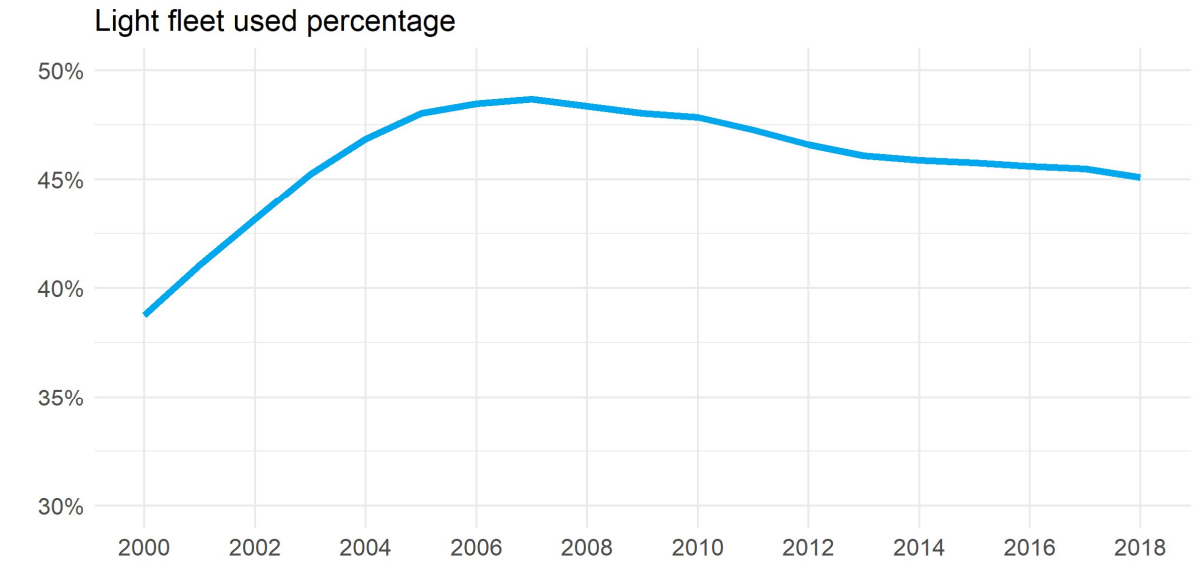
[3] Real-world fuel efficiency of light vehicles in New Zealand: https://www.atrf.info/papers/2015/files/ATRF2015_Resubmission_9.pdf



Fewer used imports but significant market share persists

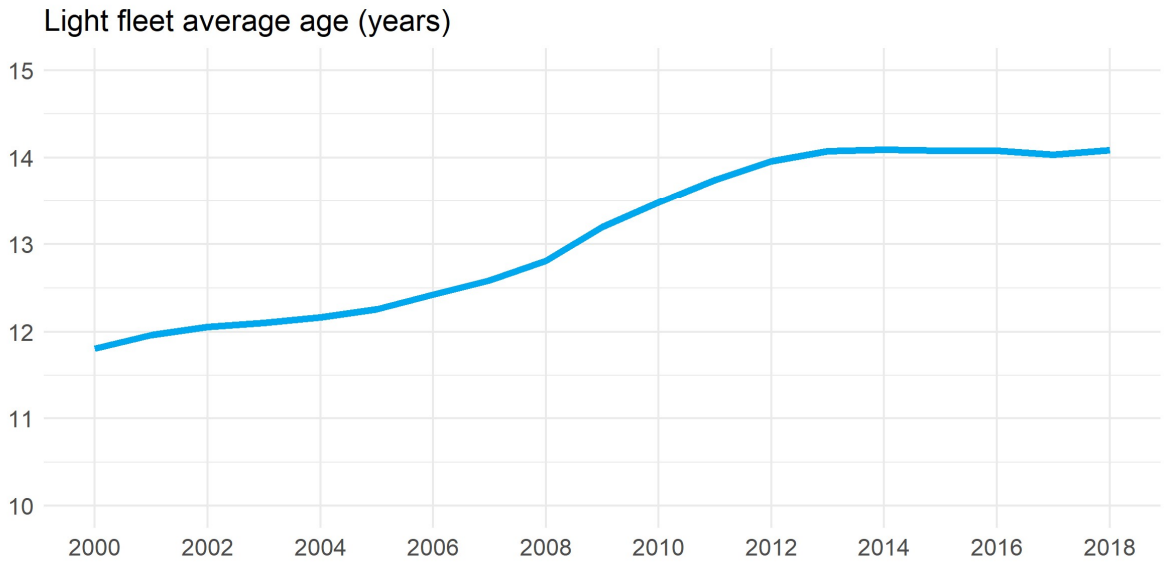
The used imports share of the light fleet has been decreasing steadily since 2008. However, the rate of decrease is nowhere close to the meteoric rise between 2000 and 2007 – when used import market share increased from 39% to 49%.

The used import market is very responsive to the state of the economy and the demands of the population. As discussed further in the report, the strength of the economy and an increase in net migration since 2013 could be a driver for a consistent demand for used vehicles - thus slowing down the decrease in used vehicle market share.



Older vehicles compared to international standards

While the average age of the light fleet hasn't changed much since 2012, there has been a significant change since 2000: the light vehicles in 2018 are almost 20% older than in 2000. The persistence of used imports made in the '90s is a key factor for the old light fleet.



New Zealand's light fleet is older compared to other developed countries – like Canada, USA and Australia who have high levels of motorisation, and similar patterns of development to New Zealand. The United Kingdom has not been included as its motorisation level is comparatively low.

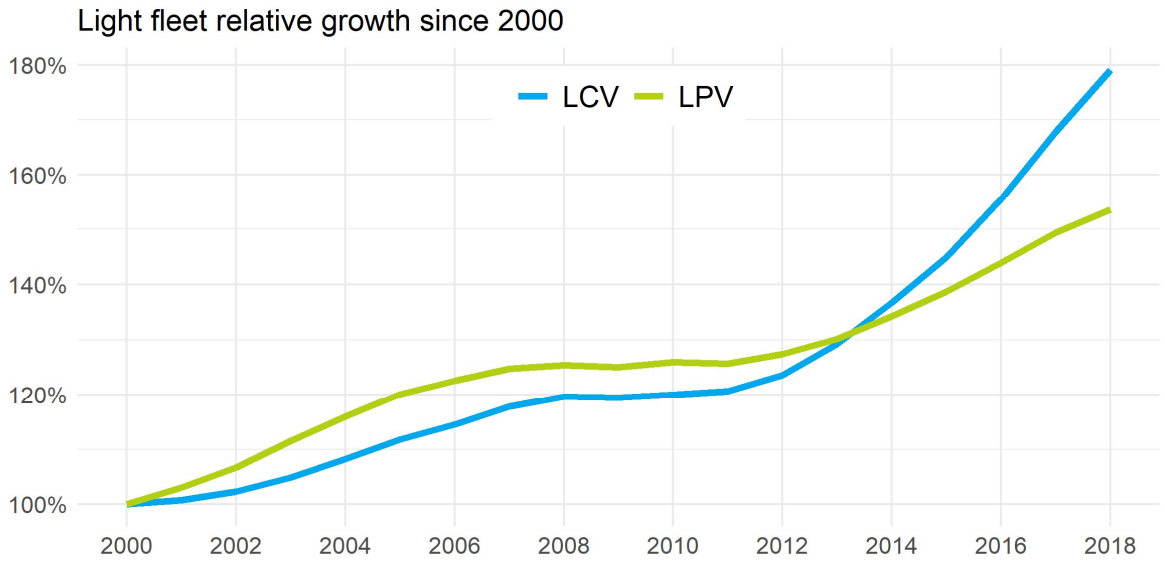
The average age of New Zealand's light vehicle fleet increased from 11.7 years in 2000 to 14.1 years in 2018, which is older than that in the USA (11.8 years for light vehicles in 2018)[4], Australia (10.2 years for all vehicles in 2018)[5] and Canada (9.7 years for light vehicles in 2018)[6].

In 2016, the greatest age difference was with Canada, 4.4 years, which comes to a 30% younger light vehicle in Canada.

Increasing popularity of light commercial vehicles

While the total number of LCVs in the fleet is smaller than LPVs, the growth rate for LCVs has increased since 2012 – when LCVs overtook LPVs in relative growth. This reflects a trend away from the purchase of petrol cars towards diesel powered utes and SUVs/4WDs.

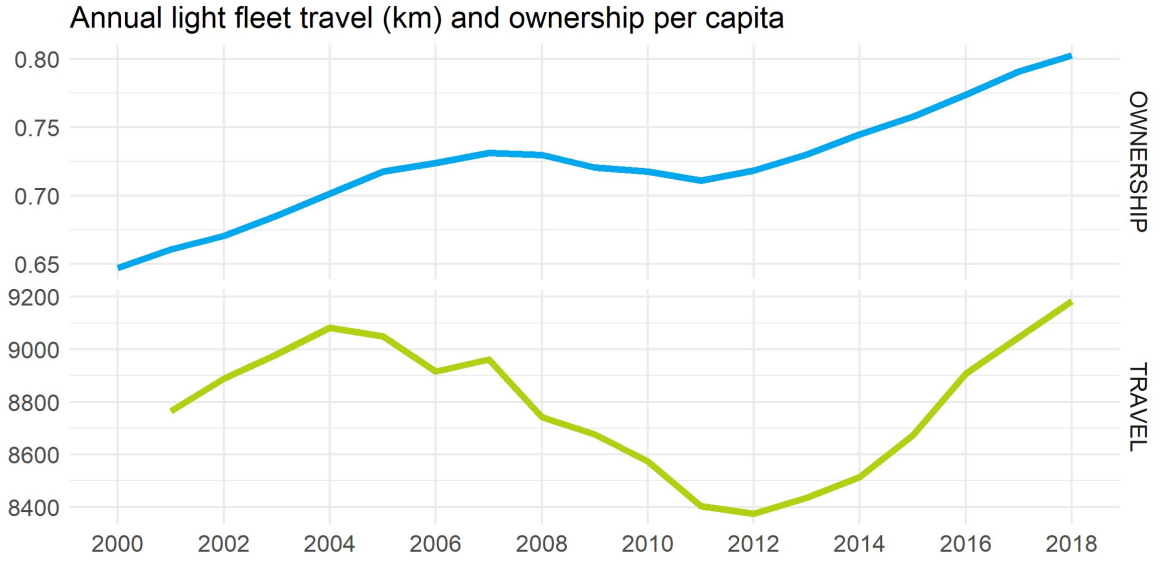
[4] https://news.ihsmarkit.com/press-release/automotive/average-age-cars-and-light-trucks-us-rises-again-2019-118-years-ihs-markit-
[5] www.abs.gov.au/AUSSTATS/abs@.nsf/mf/9309.0
[6] https://www.aiacanada.com/products.html/product/view/id/142



How is New Zealand driving?

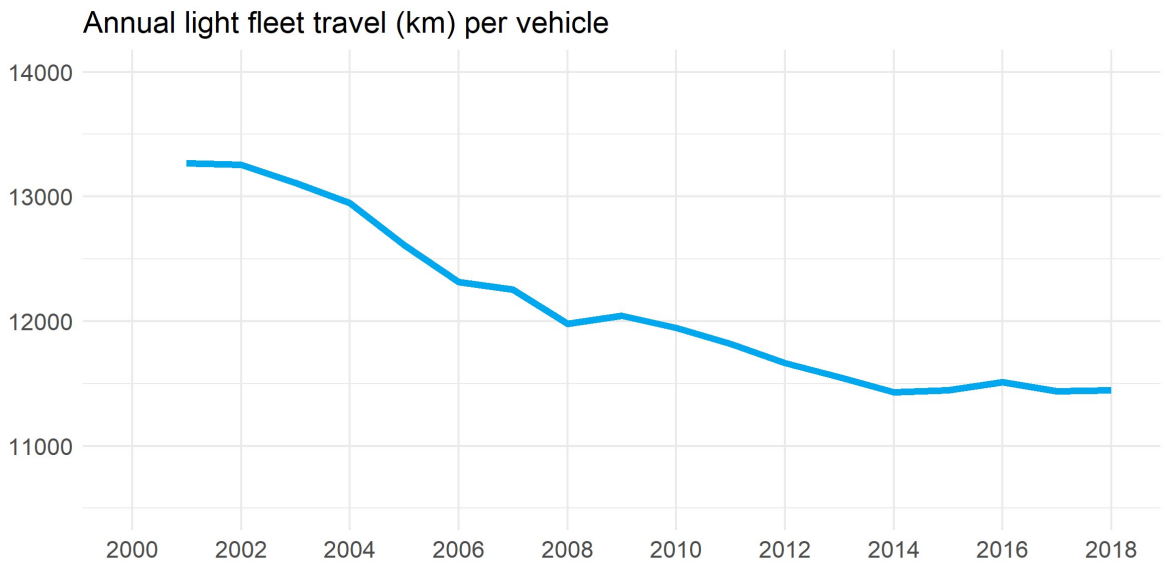
Increasing travel per capita

Per capita travel for light vehicles has mostly followed the trend of per capita light fleet ownership: an initial increase till the mid-2000s, dropping until 2012 and increasing every year since 2013. However, looking at the two series together, annual travel is seen to peak earlier – beginning a decreasing trend almost 3 years before a decrease in vehicle ownership. The reasons for this earlier decline are not fully understood at present, but are likely to be related to the economic situation.



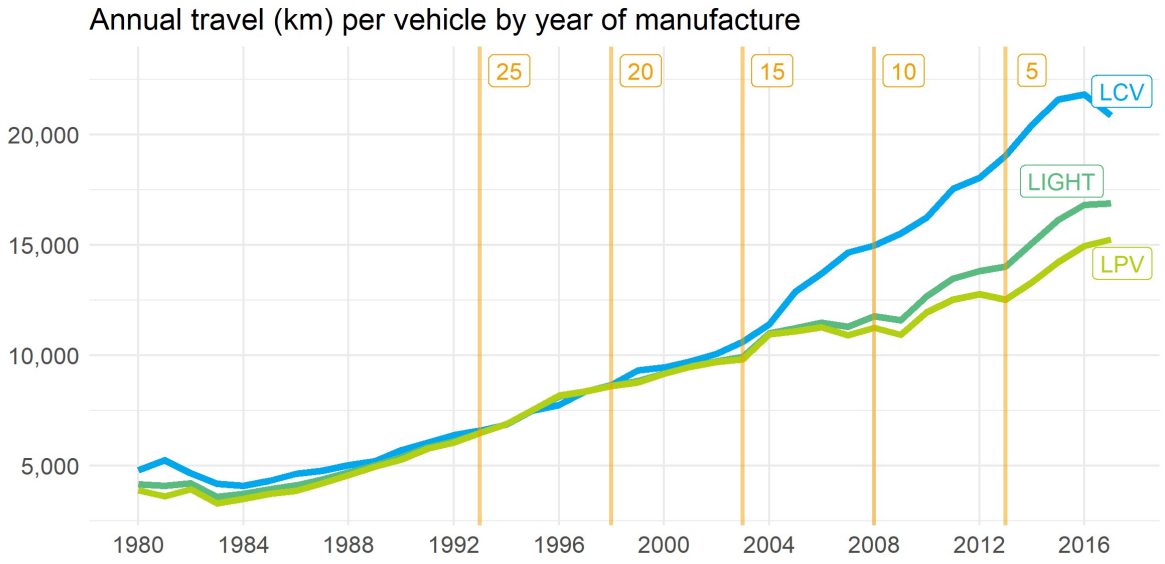
But decreasing travel per vehicle

Although New Zealand has high levels of vehicle ownership, this does not translate proportionately into more travel per vehicle. Since 2000, travel per light vehicle has declined every year until 2014 (with the exception of 2009 and 2007). This decreasing trend could be due to lingering old vehicles in the light fleet that are simply not driven around very far.



Driving further in young vehicles

Annual travel per light vehicle diminishes with vehicle age: older vehicles don't travel as far per year as newer vehicles. Furthermore, there are significant differences in travel patterns between LCVs and LPVs. In the first 10 years of a light vehicle's life, commercial vehicles are driven 30% further than passenger vehicles. This effect starts to diminish as the vehicles age, and has disappeared by the time they are 15 years old.

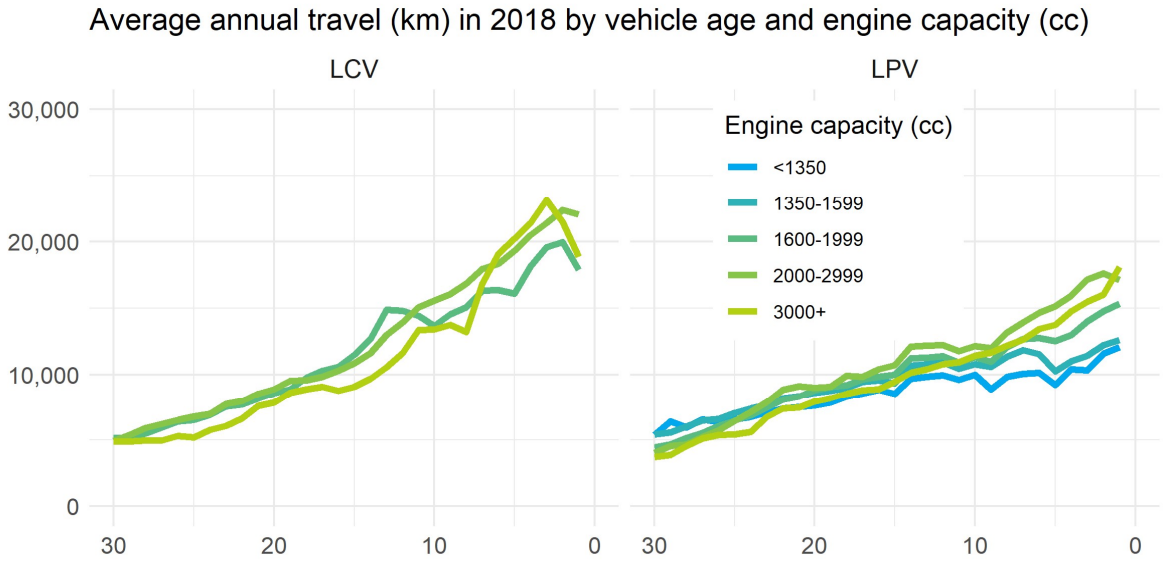


Driving further in vehicles with larger engines

Light passenger vehicles with smaller engines do less annual travel - especially early in their life. The exception to this trend is the most popular engine size band of 2000 - 2999 cc. These vehicles do more travel until they are 15 years old than the vehicles in other engine size bands – even those with engines greater than 3000 cc.

Early life and late life annual travel patterns of LPVs are inversely correlated with engine size. The drop off in annual travel by older vehicles is steeper for vehicles with larger engines. LCVs follow a

similar drop-off pattern but their average annual travel is higher. Like LPVs, LCVs with larger engines do the most travel early in their life[7].

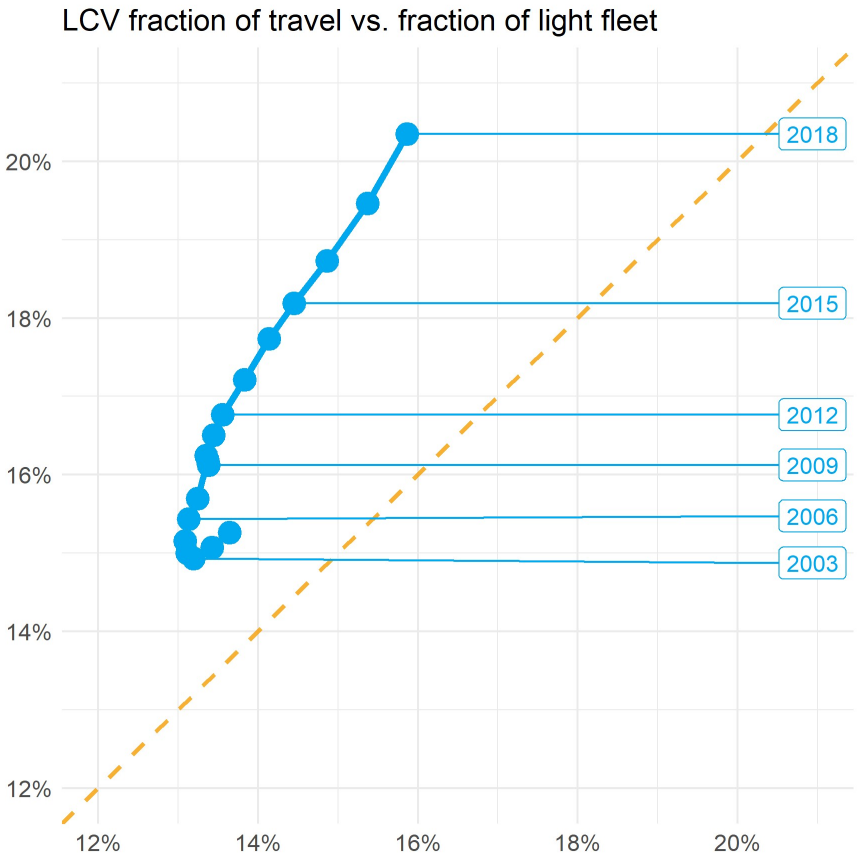


Driving further in light commercial vehicles

The contribution of LCVs to light travel is disproportionate to their numbers in the light fleet. This asymmetry in travel for a given fleet proportion can be seen in the difference to the orange diagonal line. If the contribution of LCVs to travel was equal to its proportion in the fleet, it would be a point on the orange diagonal line.

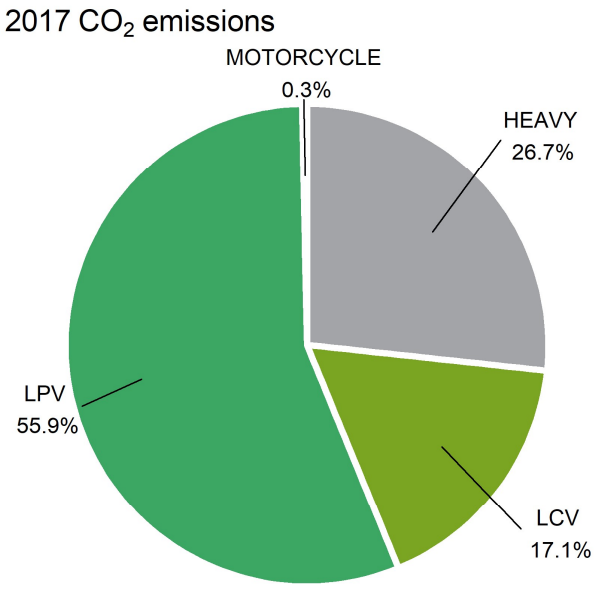
Between 2003 and 2012, the fraction of light fleet travel undertaken by LCVs grew from 15% to 17% while the vehicle fraction remained around 14% of the light fleet. Since 2012, the fraction of travel and light fleet composition of LCVs has been growing steadily – though travel continues to increase more than the proportion of LCVs. As at 2018, LCVs comprised around 16% of the light fleet but covered more than 20% of light fleet travel.

[7] Very small light commercials (engine capacity below 1600cc) are uncommon and have been suppressed from the plot due to the erratic nature of their trend.


LCV fraction of travel vs. fraction of light fleet
20%
18%
16%
14%
12%
12%
14%
16%
18%
20%
2018
2015
2012
2009
2006
2003

Heavy fleet trends

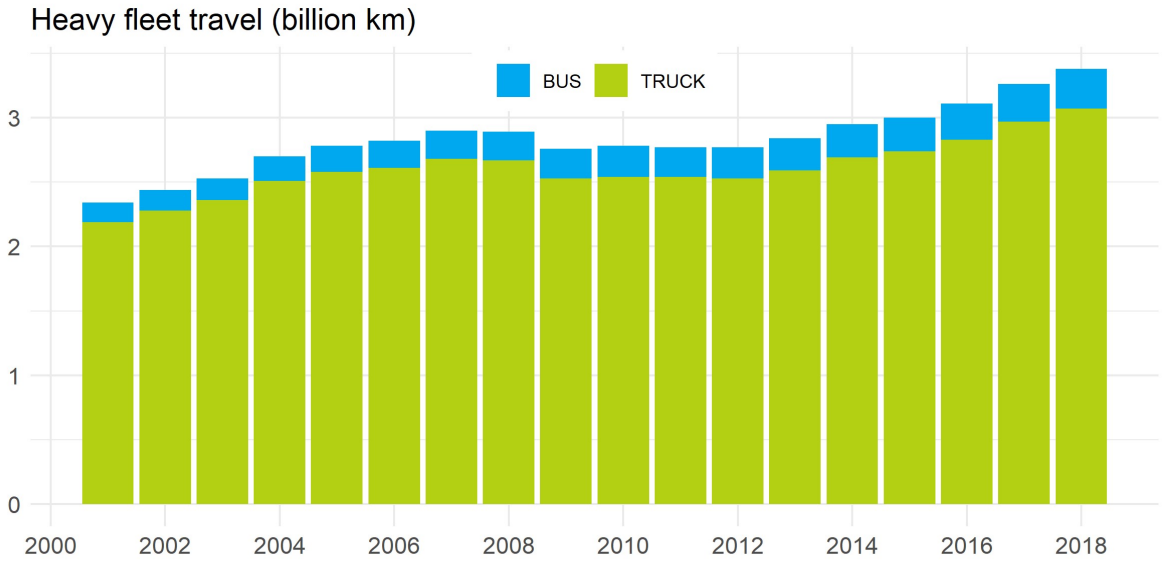
The light fleet constitutes 90% of annual travel on New Zealand roads but only contributes 73% of emissions from road transport. The heavy fleet only constitutes 7% of annual travel but contributes over 25% of road emissions. Hence, trends in the heavy fleet are crucial for understanding the nature of expected emissions.



Source: VFEM (Vehicle Fleet Emission Model)

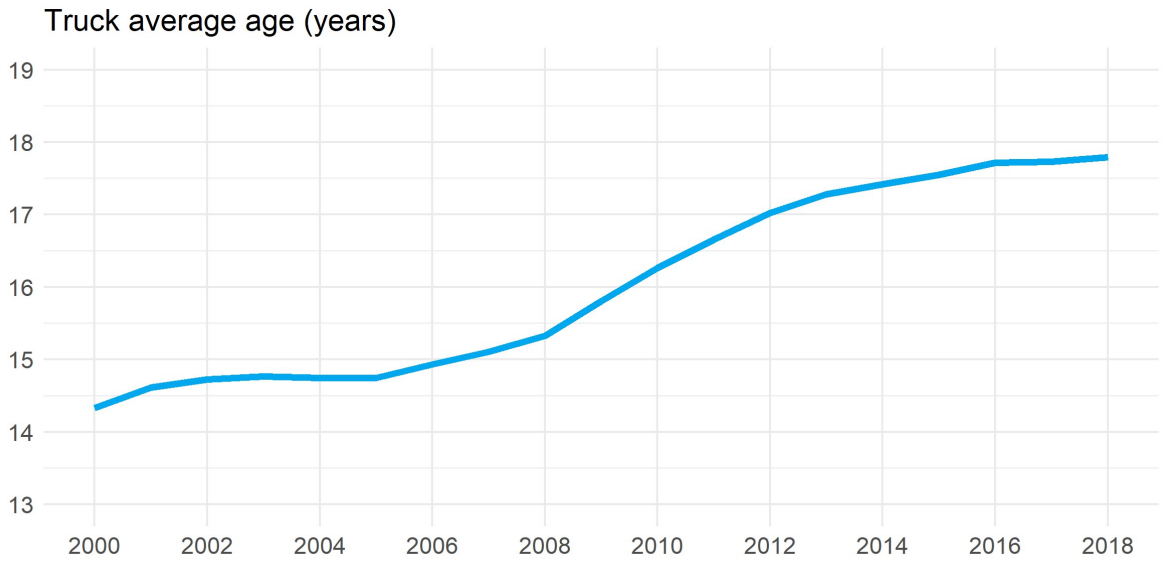
Increasing travel by road freight

Trucks, carrying freight, are the major contributor of heavy vehicle travel. Except for the period of 2008 - 2012 which were likely affected by economic conditions, annual distance covered by the heavy fleet has increased every year since 2000. Since 2013, the trend has been increasing with every year.



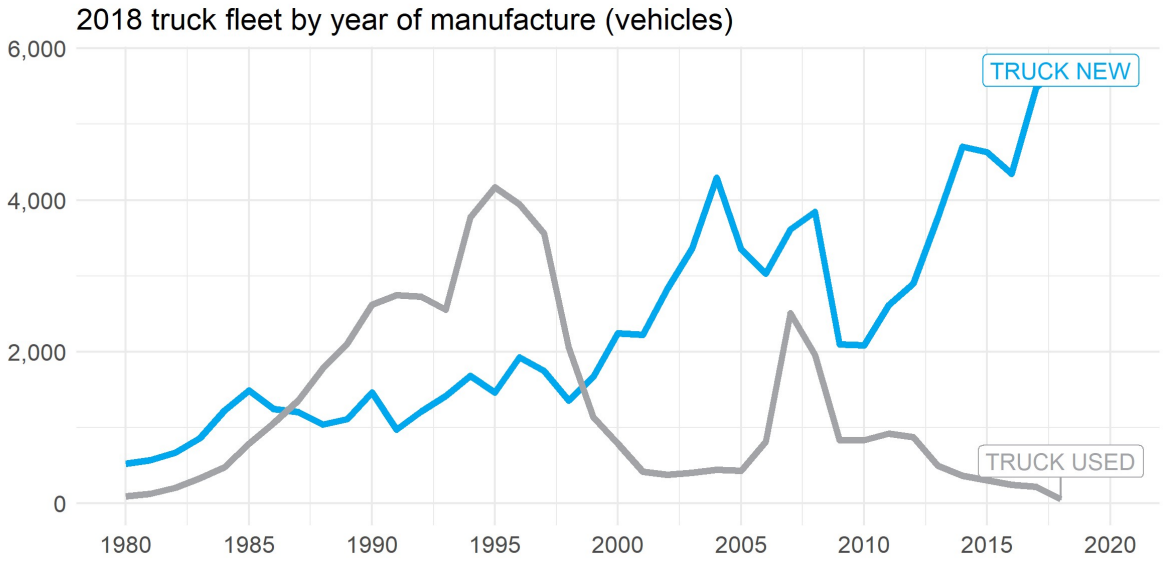
Aging vehicles affect average truck age

The average truck age increased significantly between 2005 and 2016 before plateauing for the last couple of years.



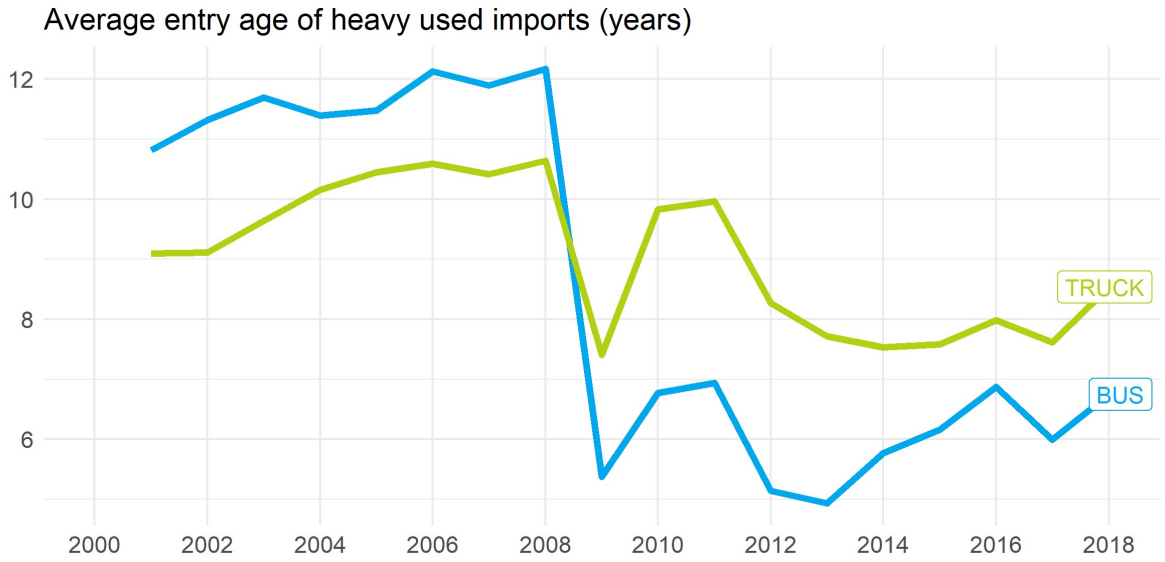
Like the light fleet, the truck age structure also shows large numbers of 1990s used imports. This peak reflects an externality – in this case, another country's regulations impacting New Zealand imports. Japan banned mid '90s vehicles in many cities for air quality reasons. Vehicles could be retrofitted to meet the new emissions requirements but many Japanese owners chose to export their vehicles. Some of these trucks ended up in New Zealand resulting in the largest used truck import spike in 30 years.

While 65% of trucks in the 2018 fleet are new, less than half of the new trucks were made in the last 10 years. The persistence of aging new trucks and used imports results in an older fleet.



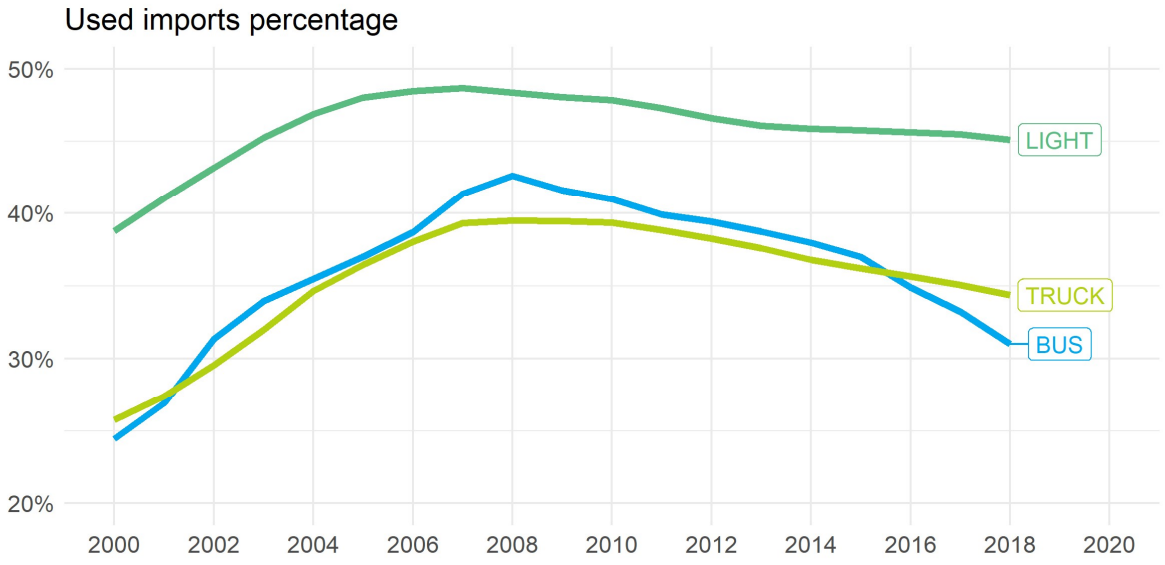
But younger used imports entering the fleet

Used trucks entering the fleet are now younger than they used to be. This is largely due to the **Vehicle Exhaust Emissions Rule**. Unlike the subtle impact on light vehicles, the rule caused the average age for heavy vehicles to drop sharply between 2008 and 2009.



Decreasing share of used imports

The dominance of new trucks has pushed down the share of used imports. The drop in the share of used trucks, and even buses, is more pronounced than for the light fleet. Between 2000 and 2007, the used import segment of the buses and trucks grew faster than the used light fleet - 15% absolute increase compared to 10% for the light fleet. However, this acceleration of used import market share has reversed into a deceleration since the 2007 **Vehicle Exhaust Emissions Rule** prevented the import of older used diesel vehicles.



Conclusion

Emissions

The millage covered by the light fleet is predominantly from larger, higher emission vehicles. The rate by which emissions are increasing is partially offset by fuel efficiency improvements – which continue to increase every year.

The light fleet is still dominated by fossil fuels. The electric subset of the vehicle fuel mix is at most 1% due mostly to the petrol/electric hybrids. Fully electric vehicles are a very small proportion (0.2%) of the light fleet. The mitigations offered by fuel efficient light vehicles are not sufficient to lower or reduce the current rate of CO_2 emissions.

Freight travel has been increasing since 2013 without any sign of decline. This suggests that the heavy fleet will continue to be the largest contributor of CO_2 emissions per vehicle. The heavy fleet has seen recent dramatic changes towards new and younger used vehicles. Like light vehicles, it is possible that recently-made heavy vehicles are able to mitigate some of the expected emissions through advances in engine efficiency. However, efficiency gains will have a lesser impact on the heavy fleet since their fuel use is directly proportional to the weight of the freight they carry.

Road network demand

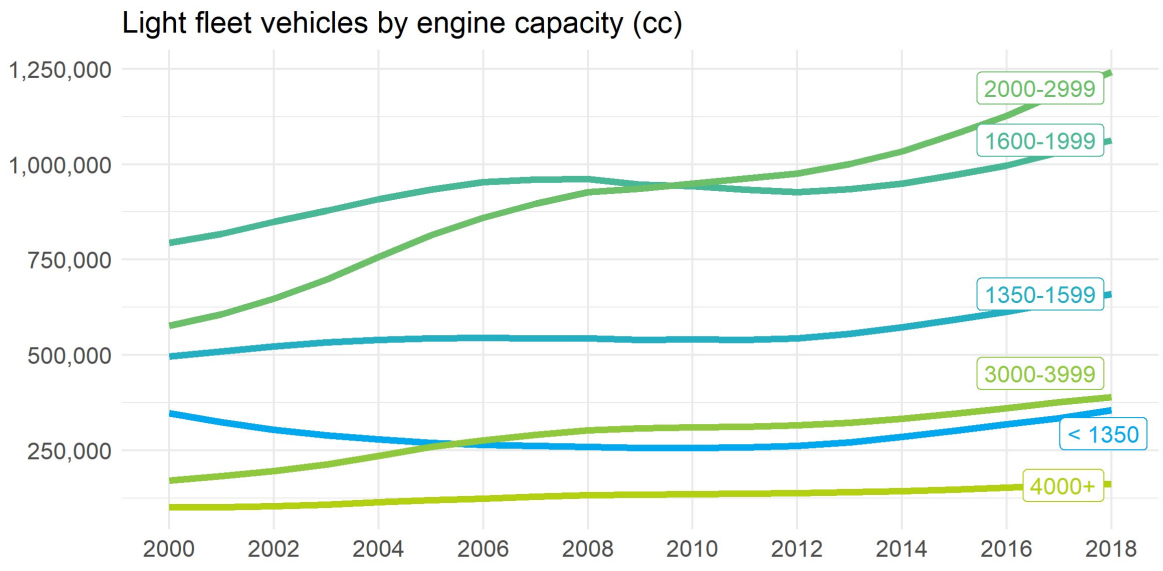
The increasing number and ownership of light vehicles hasn't entered a decline in the last 5 years. The trend looks to continue increasing which suggests more vehicles and further travel in 2019. The increasing trend in vehicle number and travel is also mirrored by the heavy fleet. Overall there continues to be an increase in the demand on New Zealand roads.

Appendix: Explanations

This section drills into a few interesting trends with some potential mechanisms that underlie them. Note, the explanations only offer *plausible causes* that cannot be interpreted as causation.

Why does the light fleet have large engines?

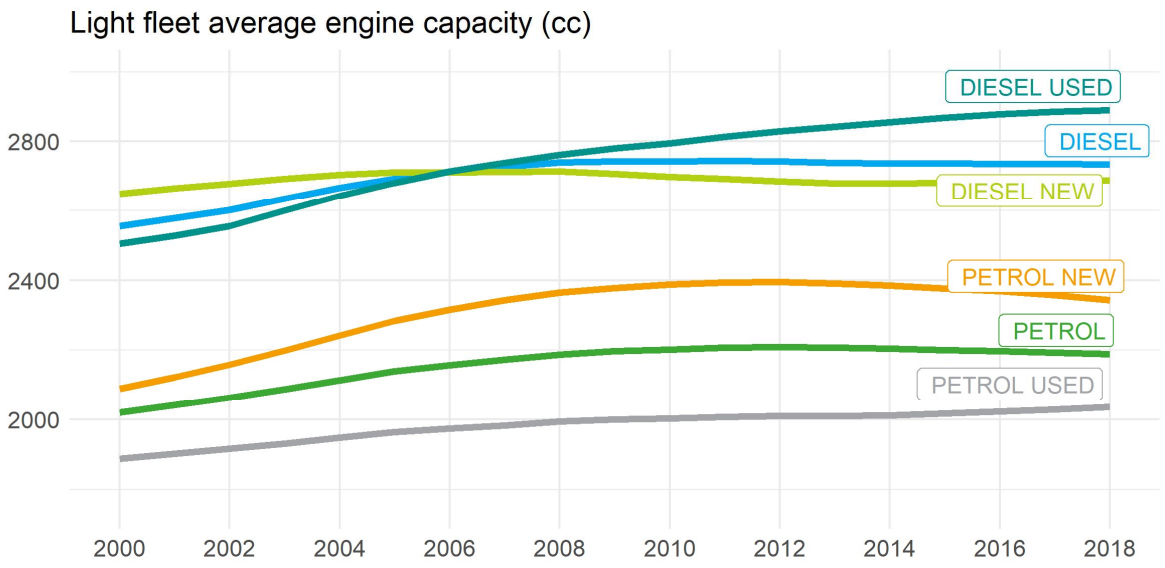
Since 2000, light vehicles with engines between 2000 - 2999 cc have been an increasing part of the light fleet. Light vehicles with small engines, less than 2000 cc, have languished with relatively flat or decreasing representation.



Diesel vehicles with larger engines

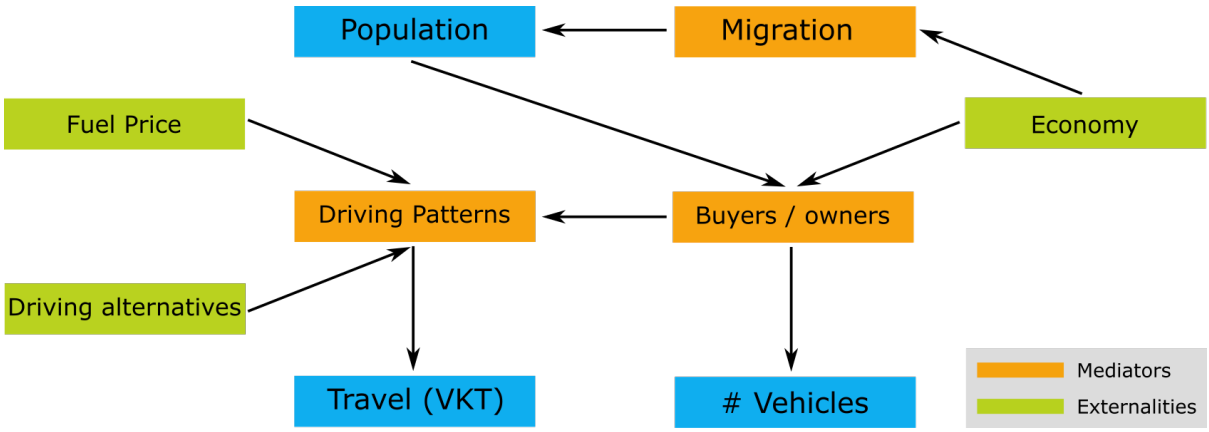
Though not shown in the previous figure, the highest growth rates since 2000 has been for the second largest engine size band: 3000 - 3999 cc. This is partly driven by the increasing popularity of LCVs – which are diesel vehicles with larger engines.

While the capacity of new petrol vehicles increased significantly between 2000 and 2010, the average diesel engine has always been larger than the average petrol engine. Unlike petrol vehicles, used diesel vehicles have increased engine capacity considerably – even overtaking new imports. The trend appears to be still increasing though at a lower rate than the high growth phase between 2002 and 2010.



Why is light vehicle ownership and travel growing?

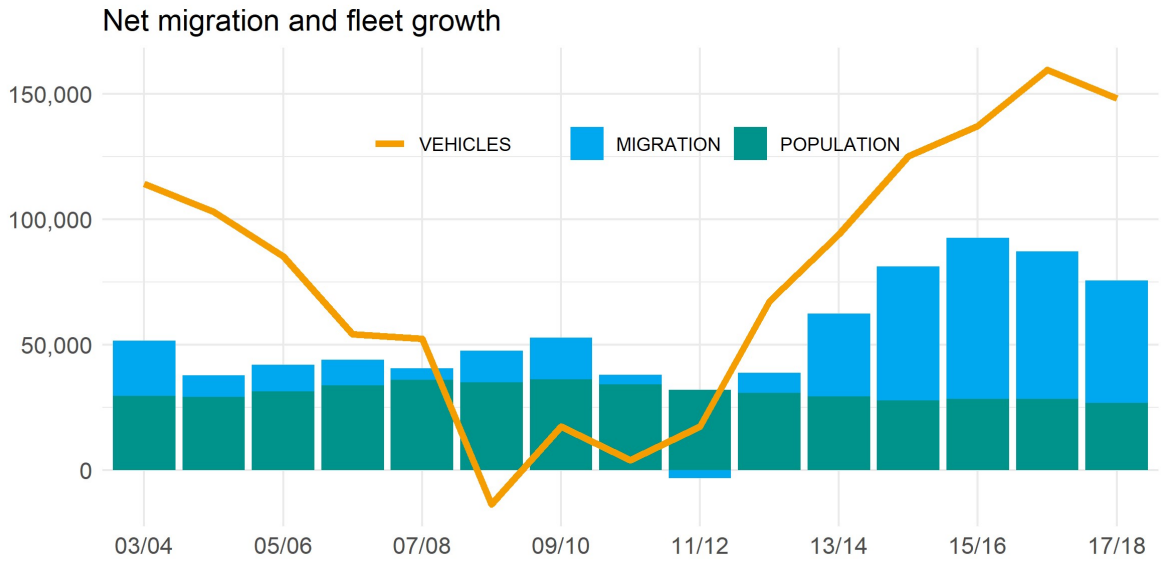
The relationships between fleet growth, ownership and travel is an intricate web which includes mediators and externalities. While a growing population is likely to result in in fleet growth, fleet numbers are directly due to the conversion of the population into vehicle owners. Similarly, while travel is affected by a growing population it is also mediated by the driving patterns of vehicle owners. Externalities like the economy, fuel prices and driving alternatives all influence individual decisions to drive and purchase vehicles.



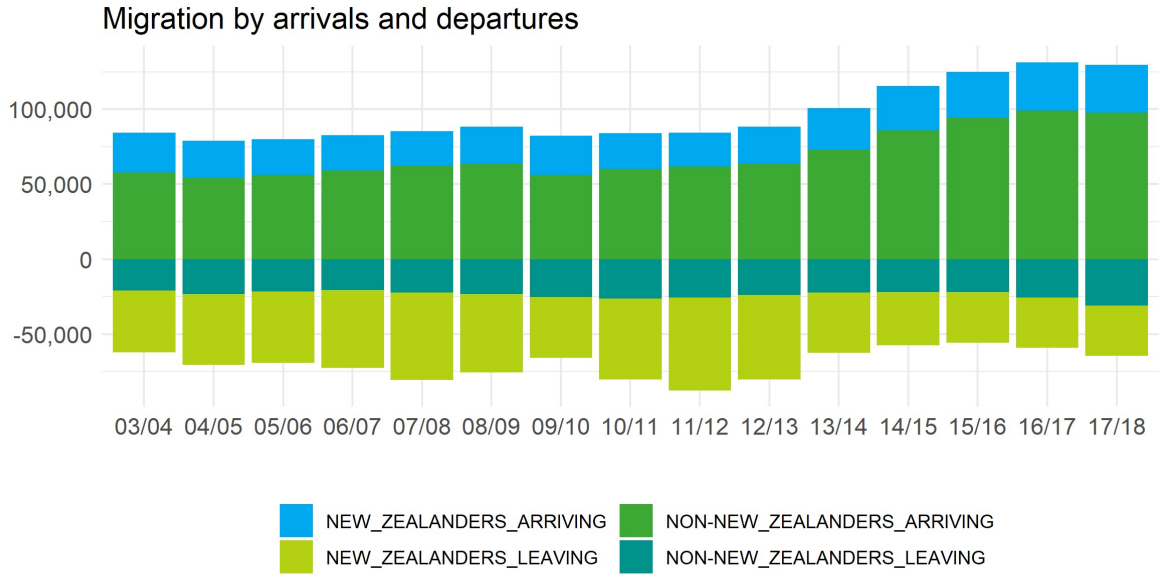
Net migration driving light fleet growth[8]

Light fleet growth since 2013 has mirrored population growth. In the figure below, both the population and light fleet numbers show growth - as a change from the previous year. Since 2011/12 New Zealand population has increased due to positive net migration: when arrivals started outnumbering departures.

[8] Migration data from Statistics New Zealand



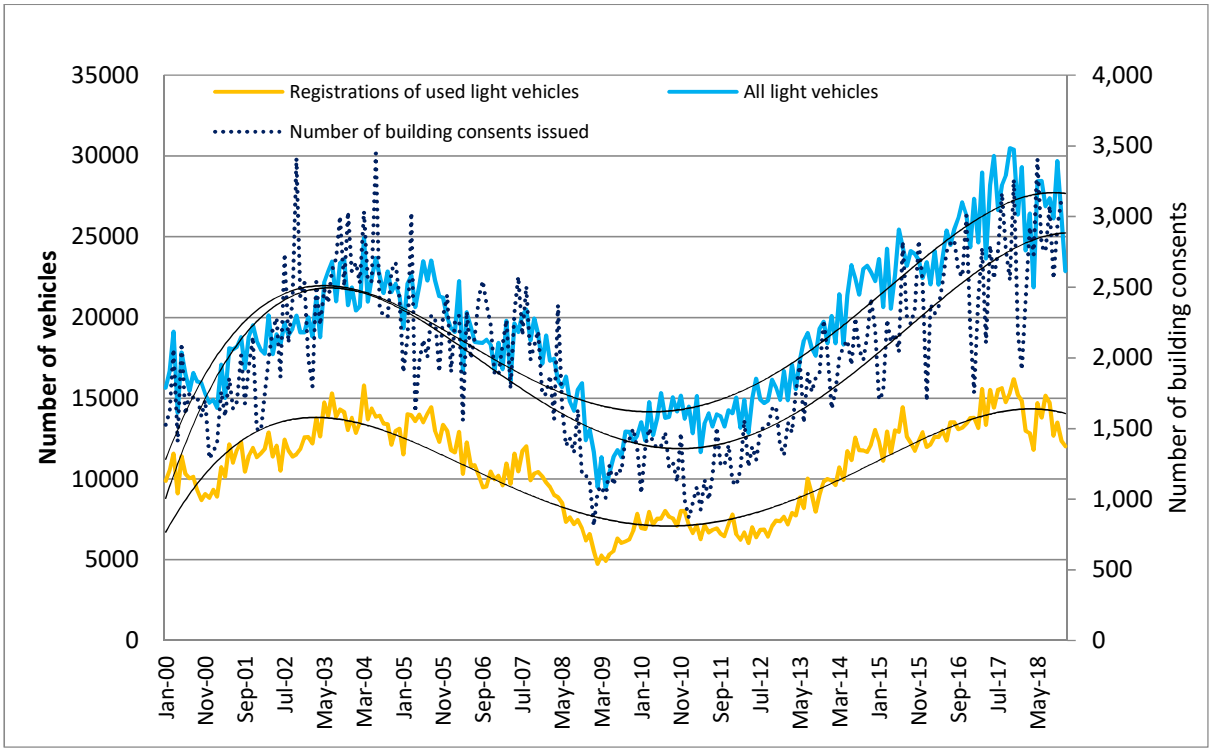
Migration can be broken down into **arrivals** (positive values) and **departures** (negative values). Increasing net migration since 2013 has been due to both (1) increasing arrivals and, (2) decreasing departures. The key drivers of these two trends have been the increasing arrivals of non-New Zealanders and decreasing departures of New Zealanders respectively.



Strong economy increases spending behaviour

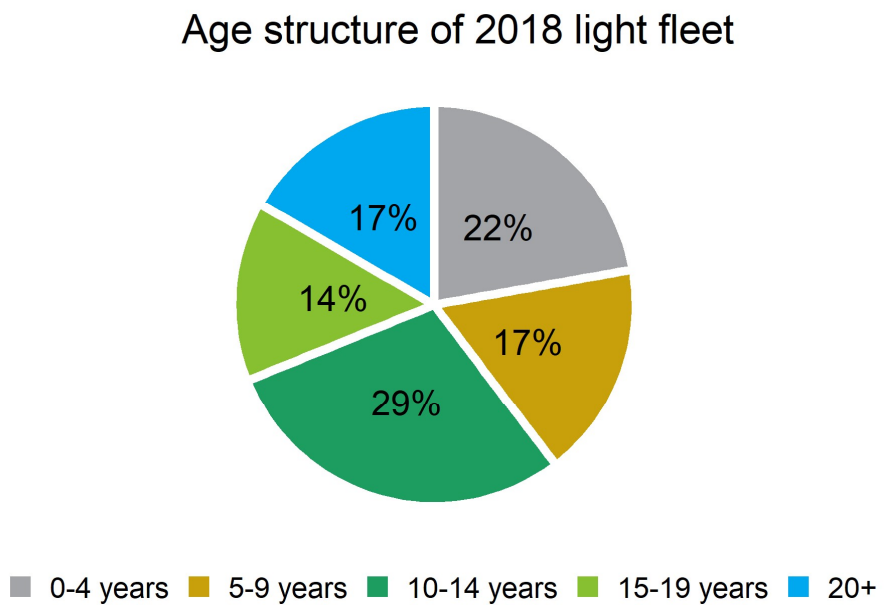
Net migration is a weak proxy of New Zealand's economic strength. The effect is weak since migration is also influenced by the global economy and economic strengths of countries that contribute to arrivals in New Zealand. The strength of the New Zealand economy can be better gleaned with building consents.

Building consents are a macroeconomic indicator of people's willingness to borrow which in turn reflects people's belief in the strength of the economy. Although there is no direct link between building consents and vehicle purchase, both track alongside each other since they are driven by a common externality: people's belief in the economy.



Why is the light fleet aging?

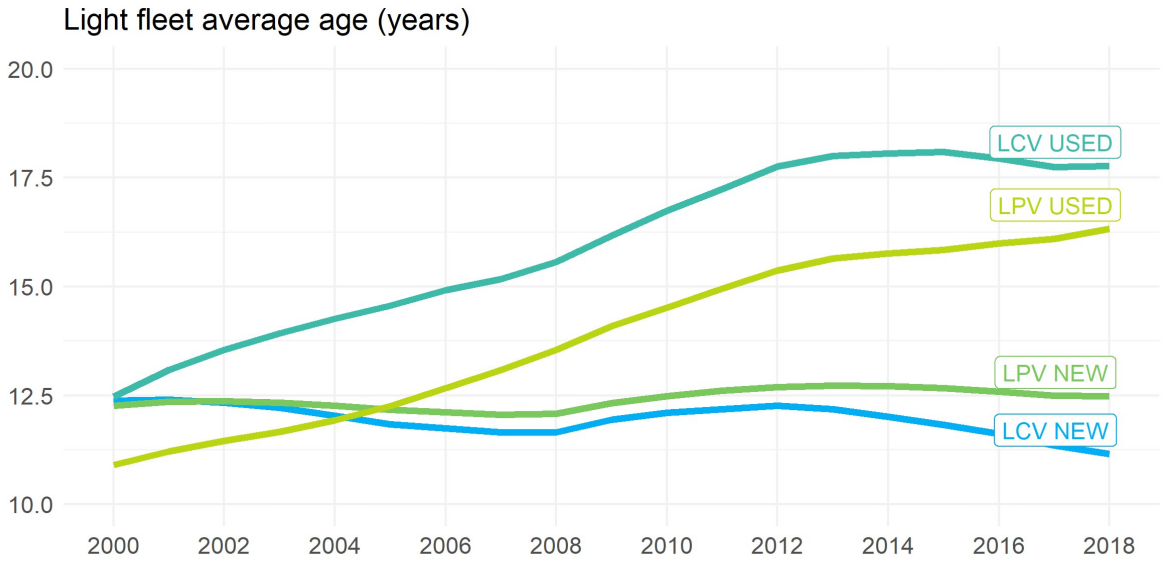
At the end of 2018, the proportion of very old vehicles was not too different from very young vehicles. Almost 1 in 5 vehicles in the 2018 light fleet are more than 20 years old – due to the persistence of vehicles manufactured in the mid to late 90s.



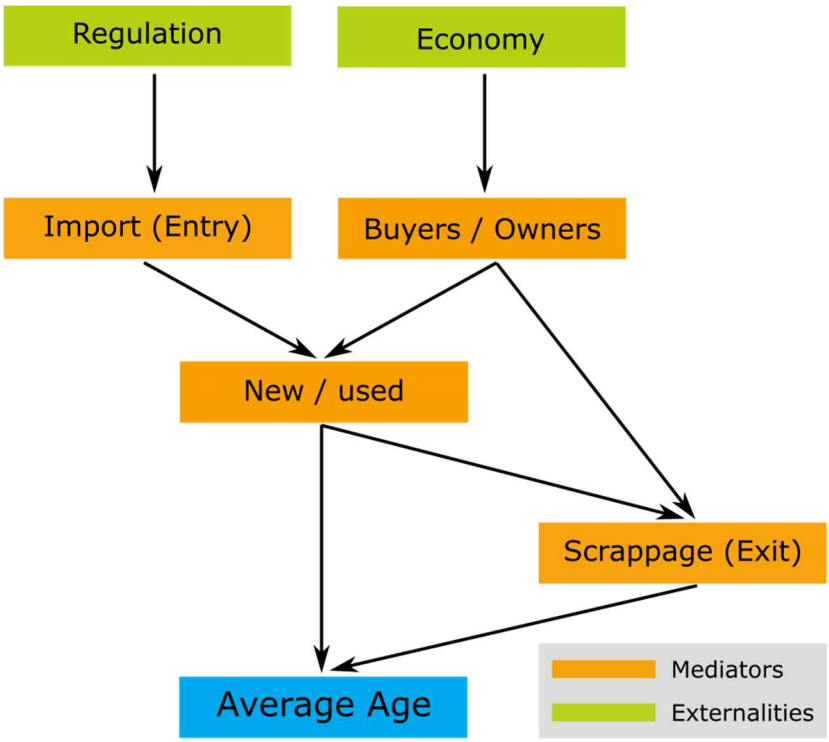
Aging used imports

The New Zealand light fleet is aging due to old used imports – both passenger and commercial vehicles. Only looking at the new imports, the average age is closer to those of USA and Australia: 10 - 12 years.

Used imports increased in average age till 2012/2013 and have since aged more slowly. The capping is likely due to (1) greater influx of new imports and, (2) end of life for some of the older vehicles imported in the 1990s and mid 2000s.



The aging of used imports is linked to several factors that drive two main mechanisms: (1) age at entry and, (2) age at exit. Both strongly affect the average fleet age. For example, a low exit age will result in a younger fleet.

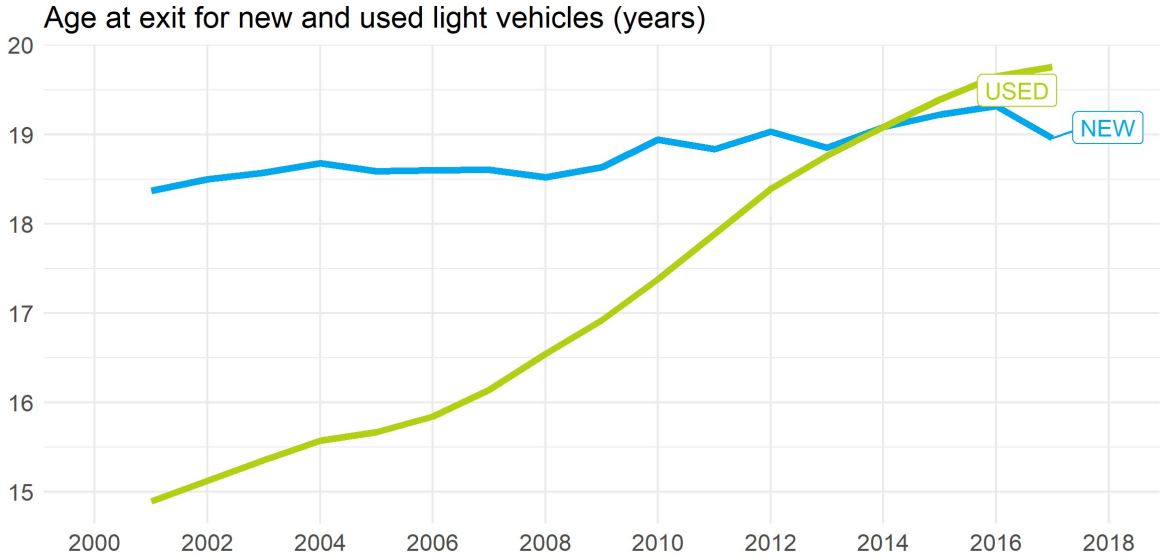


The phenomenon of aging used imports can be linked to both increasing age at exit and entry. Each of the mechanisms listed below are expanded in the following sections. Note, they are still not rigorous causal explanations.

- Increasing age at exit (scrappage)
    - Survivability of old vehicles (from the late '90s)
    - Due to externalities like a weaker economy
- Increasing age at entry
    - Due to externalities like Land Transport rules that affect age of vehicles at entry

Increasing scrappage age for used imports

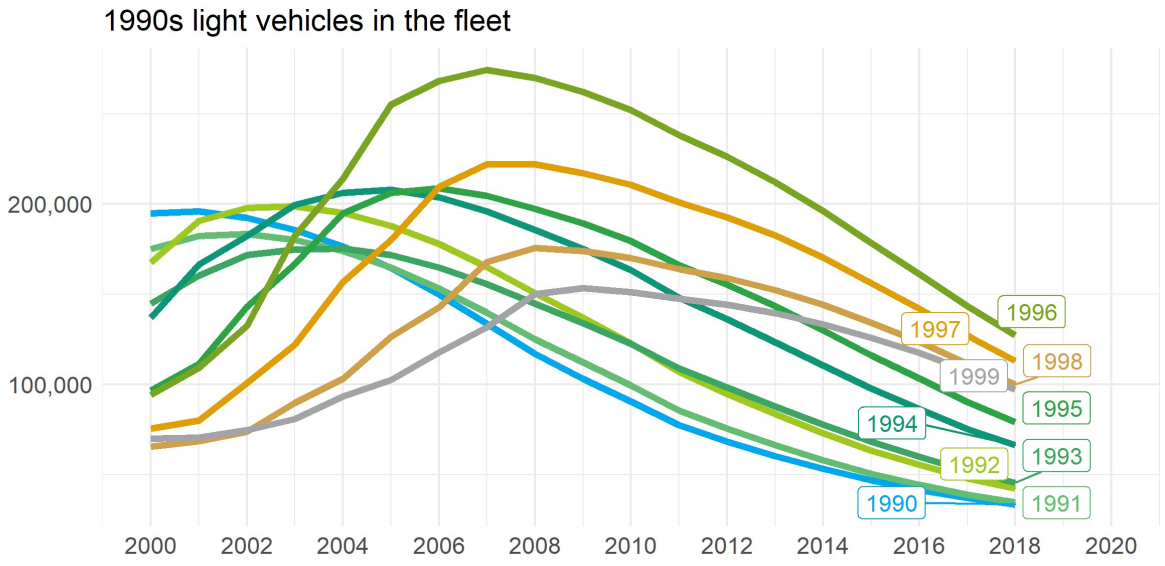
The used import segment of the light fleet is older due to an increasing lifespan. Used imports left the light fleet at an average age of 19.4 years in 2017 and new vehicles averaged 19 years[9]. New vehicles have been exiting the fleet at a similar age for that past 17 years with used imports catching up only in 2014. The reason for a consistent scrappage age for new vehicles is likely due to accumulated mileage but there might be additional underlying causes. Reasons for the increasing scrappage age of used imports will include the high survivability of used imports made in the 1990s and 2000s.



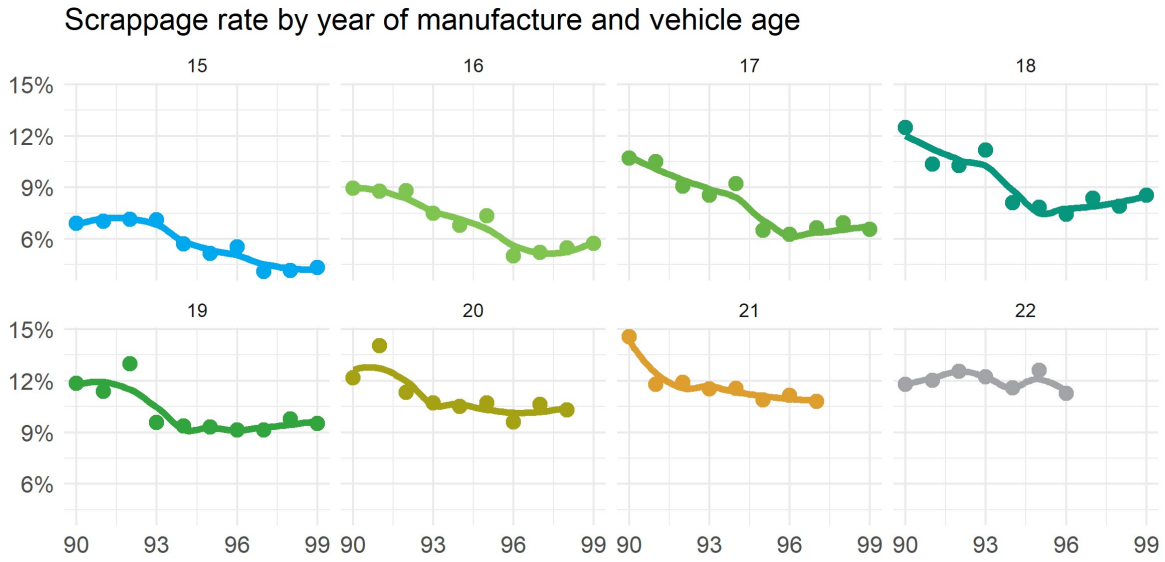
High survivability of late '90s vehicles

The **Frontal Impact Standard** introduced large numbers of vehicles made in the 1990s to the light fleet between 2000 and 2008. Of these, 1996 is over-represented with 50,000 more vehicles than any other year. Vehicles made in 1996 also have a remarkable survivability - with 127,000 vehicles still in the fleet in 2018.

[9] **Note:** Due to the new method of determining which vehicles have left the fleet, 2018 data has been suppressed in this year's publication. The 2018 result is likely to change because of ambiguity between scrappage and the timing of relicensing: vehicles that appear to have been scrapped in 2018 can be relicensed between 7 and 12 months after licence expiry. Thus, stable results for 2018 will only be available in 2020.



The higher survivability of vehicles manufactured in the late 1990s is due to lower scrappage rates. Within each plot, vehicles are scrapped at the same age and the scrappage rate is given by the manufacture year. These scrappage curves show that vehicles made in the mid to late 90s are always scrapped at a lower rate – regardless of the vehicle age at scrappage. The curves are most extreme for vehicles aged between 15 and 19 years at scrappage. Vehicles scrapped when they're over 20 years old don't have the same dependence on manufacture.



Externalities impact vehicle age

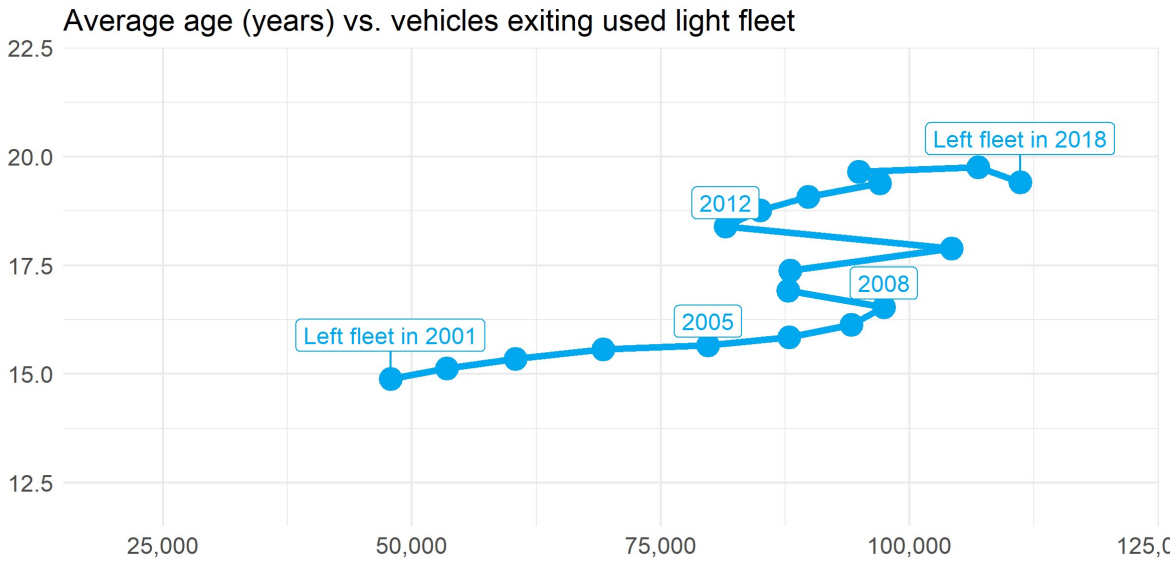
Like the ownership trends, the average age of the light fleet is dependent on several mediating factors and externalities. The types of vehicles that enter and exit the fleet are impacted by externalities like:

- **The strength of the economy:** which influences purchasing behaviour and thus, the number and type of vehicles both entering the fleet and exiting the fleet.
- **Vehicle rules:** which influence the type of vehicles entering the fleet.

Scrappage age affected by economy

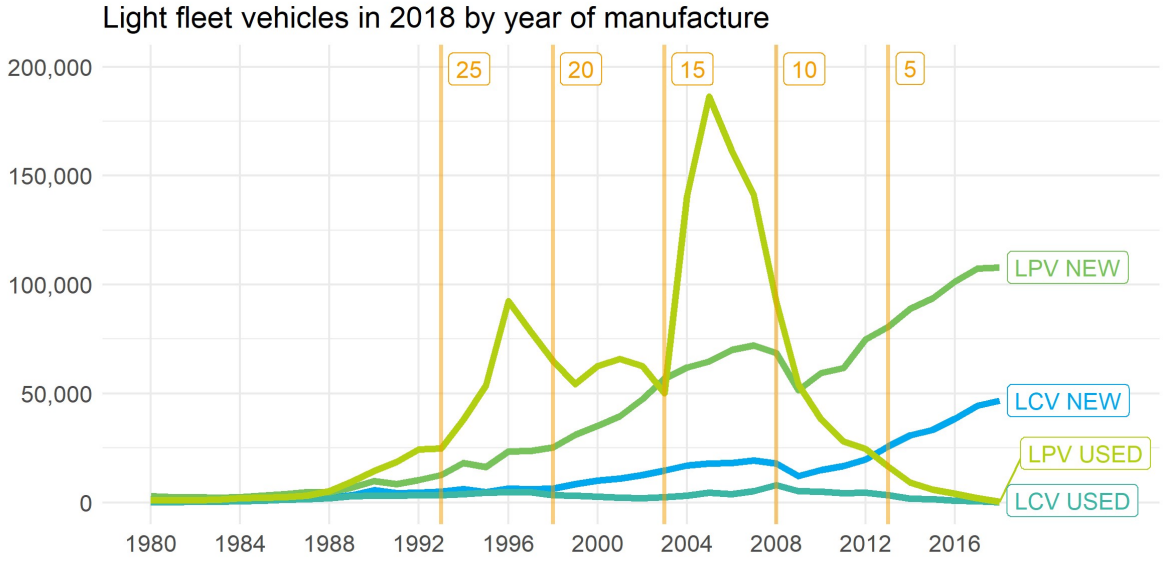
While the underlying mechanisms of scrappage are hard to pin down, there is an association between scrappage of used imports and economic strength. At a fleet level vehicle scrappage and purchase are intertwined. Just as vehicle purchase is responsive to people's belief in the economy, scrappage volumes and age are also affected, though the relationship is less clear.

The volume of used import scrappage increased annually until the economic downturn began in 2008/2009. During the downturn, the age at scrappage increased but volumes decreased. This reflects a decrease in consumer spend as New Zealanders became reluctant to trade in their older vehicles for a newer one. Following the recovery from the economic downturn, both average age and volume of the scrapped used imports have risen.



Vehicle age at entry impacted by vehicle rules

The light vehicle fleet age mix includes a significant number of used passenger vehicles manufactured in the mid 1990s (20 - 25 year old vehicles) and those made in the mid 2000s (10 – 15 year old vehicles).



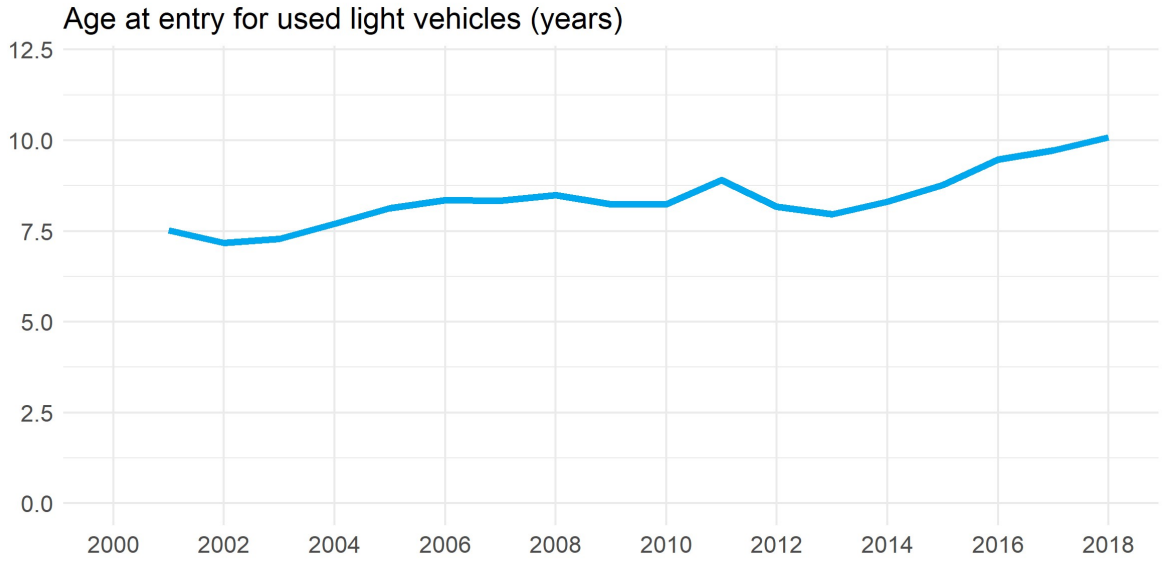
The 1996 year of manufacture peak in the New Zealand fleet is partly due to the **Frontal Impact Standard**[10] set in New Zealand. This rule had the effect of restricting used imports to vehicles manufactured during or after 1996 (and some older vehicles that met the standard).

The 2005 year of manufacture peak is likely due to the amendment of the **Vehicle Exhaust Emissions Rule**[11] that came into effect in 2012 to meet the **Japanese 05 Emission Standard**. From 2012, most vehicles built before 2005 could no longer be registered.

The amendments to the **Vehicle Exhaust Emissions Rule** have affected the average age of vehicles entering the fleet:

- After the introduction of the rule in 2008, the average age dropped in 2009 and 2010 – though the magnitude is very small.
- A broadening of compliant vehicles increased the average age in 2011.
- The **Japanese 05 Emission Standard** inclusion decreased the average age in 2012 and 2013.

From March 2020, the implementation of the last phase of a rule change[12], which was introduced from 2014, will require all light used vehicles entering the fleet to be fitted with the safety technology known as **Electronic Stability Control**. This rule will require used vehicles entering the fleet to be manufactured after 2012 in order to comply. This standard was required from 2012 in Japan. The change is expected to significantly reduce the age the used light vehicles entering the fleet, but will only be measurable from 2021 onwards.



[10] http://www.nzta.govt.nz/resources/rules/frontal-impact-2001-index.html
[11] https://www.nzta.govt.nz/resources/rules/vehicle-exhaust-emissions-amendment-2012-qa/
[12] https://www.transport.govt.nz/land/electronic-stability-control/