In 2016 4.7 million kiwis owned:

- ~4,000,000 vehicles of all kinds (not including trailers)
- ~3,000,000 light petrol vehicles
- ~650,000 diesel powered light vehicles
  - mostly vans, utes light trucks and 4WDs (very few cars)
- ~145,000 diesel heavy vehicles (trucks and buses)
- ~110,000 motor bikes
- ~30,000 mopeds
In 2016 4.7 million kiwis owned (cont):

Among these are:

- ~18,000 hybrid vehicles (~0.5% of the fleet) NB This is an underestimate
- ~2,900 CNG powered light vehicles
- ~5,000 LPG powered light vehicles
- ~2,800 electric light vehicles (ie cars) NB 5479 as at Nov 2017
- ~75 electric trolley buses
- ~1 electric truck (now might be 2 or even 3!)
- ~780,000 vehicles made in 1996 or older (ie 20% of the fleet is more than 20 years old)
- ~120,000 vehicles made in 1980 or older (ie 3% of the fleet is more than 35 years old)
The NZ vehicle fleet

- About 92% (3.7 million) of our vehicles on road are light vehicles (i.e., cars, 4WDs, vans, utes and light trucks)
- Just 4% are heavy

Make up of the fleet (2016)

- Light passenger: 78%
- Light commercial: 14%
- MCycle: 4%
- Trucks: 4%
- Bus: 0.3%
The NZ vehicle fleet: where is the fuel used?

- The 4% (~145,000) that are heavy vehicles responsible for ~ 21% of fuel used
- The 14% light commercials use around 15% of the fuel

**Percentage fuel used (2016)**

- Light passenger fleet: 64.8%
- Light commercial: 15.1%
- Motorcycle: 0.4%
- Heavy fleet: 21.5%

Source: VFEM (Vehicle Fleet Emissions Model)
The size of the New Zealand vehicle fleet has been increasing pretty much since records began. In 2007, growth tapered off and remained almost flat for 6 years. But fleet size has been growing again since 2012. NZ’s population has grown since 2000s, so per capita values for ownership (and travel) fell until 2013 but have grown again since then.
Why does the fleet grow?

There is a strong relationship between vehicle imports and building consents, which are an indicator of people’s willingness to borrow.
• Travel has remained remarkably constant since 2003, despite economic changes
• Growth in travel since 2013 is probably in response to increase in vehicle fleet size
• Per vehicle travel has fallen pretty consistently for light vehicles over last decade
Vehicle ownership is not uniform throughout New Zealand
Significant regional variation in ownership levels

Least vehicles per capita are in Gisborne and Wellington
Most vehicles per capita are in Canterbury and Nelson/Marlborough and Southland
Average age varies widely throughout country

Mean fleet age of all light vehicles in local government regions
(Dec 2014)

Data provided by NZ Transport Agency. It is not consistent with other age data presented here.
Average age varies widely throughout country

Mean fleet age of all light vehicles in local government regions
(Dec 2014)

Vehicles get older as you go south!

Data provided by NZ Transport Agency. It is not consistent with other age data presented here.
Average age of light vehicles

• The trend for increasing age as you go south is not as clear if we map it
• Clearly see the younger fleets in the cities
• Oldest fleets are in middle of the South Island
• Queenstown stands out as an anomaly
• We do not know why the age increases!

Map of average age of light vehicles (Dec 2014)
- Blue is younger than average,
- Red is older than average
The New Zealand vehicle fleet is aging!

We have an old fleet by OECD standards:

- Average age of light vehicles: 14.12 years old
- Average age of heavy vehicles: 17.74 years old

Lots of stories in newspaper and online.
It is true that the average age of vehicles in our fleet has been steadily rising since around 2000. The fleet got younger (by 0.1 years) in 2014 for first time since 2000. Trend is aging, but perhaps not as dramatic as it looks.
What will happen to fleet age in coming years?

► The Ministry has spent a lot of time trying to model the aging of the vehicle fleet
► We found that the rates of scrappage are more important than imports, but are virtually impossible to predict accurately
► Although imports were up in 2013 over previous years, 2013 had the lowest level of vehicle scrappage since 2002!
► Scrapping has increased since 2014, but less than imports

► Short answer is we don’t know what will happen to average age!
THE REAL QUESTION IS WHY IS THE NZ FLEET SO MUCH OLDER THAN OTHERS?
100% of vehicles enter new, then slowly leave due to accidents and mechanical reasons.
We have a completely disproportionate number of vehicles built 1995 – 1997
Age distribution of NZ light vehicle fleet (Dec 2016)

- 1996 peak is still visible but second peak forming with surge in imports since 2013
Fleets are aging in many countries

Average age of light passenger vehicles fleets

Most fleets got older, except Australia
Mainly a result of improved rust prevention
It is the bulge of Japanese used vehicles that is getting older

- Average age of NZ New vehicles is staying pretty constant (~12.8yrs) while Japanese-used rising steadily
- The effect of restricting import of used diesels in 2007 has had clear effects on average age
  - reducing imports does not increase scrappage
BUT, DOES VEHICLE AGE MATTER
Newer vehicles tend to have better occupant protection

Injury risk by year of manufacture (with 95% confidence limits)

Source: Vehicle safety ratings estimated from Police reported crash data: 2012 update Monash 2012

On average, variables for road safety do improve with younger vehicles
But crashes are not related to average vehicle age.

Crashes and casualties by age of vehicles in different Council areas

- Crashes per 10,000 population
- Casualties per 10,000 population
- Total fatalities

Average vehicle age in council area

<table>
<thead>
<tr>
<th>Average vehicle age in council area</th>
<th>Crashes per 10,000 population</th>
<th>Casualties per 10,000 population</th>
<th>Total fatalities</th>
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R² = 0.0005
R² = 0.1209
R² = 0.1793
R² = 0.0005

Crashes and casualties by age of vehicles in different Council areas.
BUT WHAT ABOUT HARMFUL EMISSIONS?
Do newer vehicles produce less harmful emissions?

Percentage reductions in Japanese diesel emissions with changing standards

Year of Standard

- 1974
- 1977
- 1979
- 1983
- 1988/90
- 1994
- 1997/99
- 2002/04
- 2005
- 2009

NOx
PM10

Volkswagen scandal has shown us that this may not be true either
What is happening with emissions at a vehicle level?

- To find out what is happening at an individual vehicle level we use remote sensing which measures pollutants in exhausts of vehicles as they drive past measuring device.
- Many tens of thousands of vehicles have been measured in series of research trials since 2003.
- Heavy vehicles are hard to measure due to vertical exhausts!
- The good news is that per-vehicle levels of harmful emissions from light petrol vehicles are declining steadily, primarily as a result of introduction of standards.

![Graph showing CO and NO emissions over years from 2003 to 2015.](image-url)
• Of concern, is that for light diesel vehicles emissions are not falling
• But, survey in 2015, Euro 6 is working!

Emissions, by standard for 2015 research

In this data
Japan 05 emissions are roughly the same as Euro 5
BUT WHAT ABOUT FUEL USE?
Fuel use vs fleet size

- There is very little evidence that age and fuel economy are linked
  - If efficiency was improving, fuel use (PJ) would decline relative to fleet size
- Since 1974 (when fuel data starts) there has been a very close relationship between fuel use and size of fleet ($R^2 = 0.94$)
- Appears other variables, like state of economy, (or changes to fleet age) are not strongly affecting fuel use

Fuel data from “All Domestic Transport”
Engine sizes of older vehicles are usually smaller

Average engine size of petrol vehicles in the fleet of a given age (2001-2016)

- Until fairly recently if you replace a vehicle with a newer model, the replacement will have a larger engine.
- But trend has shifted in recent years with move away from big petrol to 4WD diesel effect may be less important
Engine sizes of older vehicles are usually smaller.

Average engine size of petrol vehicles in the fleet of a given age (2016)

- In 2016, it may no longer be true that vehicle entering will have smaller engine than one leaving,
  - if it is petrol
On average, older vehicles travel less

- If you replace an older vehicle with a younger vehicle, on average it will travel further
- This relationship has not changed noticeably since 2000
Quick conclusions

• This means, that on average, if we had a younger fleet (as a result of actively getting rid of our existing older vehicles) the resulting fleet would probably have a larger engine size and travel further than our current fleet!

• Actively intervening to create a younger fleet to reduce CO₂ emissions, would probably not work

• However, if the size of the fleet shrinks as older used vehicles are scrapped (and if they are not replaced) then fuel use may also fall
Quick conclusions (cont)

• MOT analysis also shows that the increased risk (exposure) from increased travel means safety disbenefit from adding newer vehicles - unless they have a very high standard of safety.

• If newer vehicles travel further this also means that policies that are related to how far vehicles travel (eg total fuel consumption and exposure risk) will get greater benefit from focussing on new vehicles.
While the average age of the fleet has risen in past 10 years, the age of scrapping has not changed markedly.

This means that we turn over vehicles about the same age as Australia or US.
Average travel is a more useful variable

- Distance is a better predictor of scrappage than age, as people dispose of vehicles due to mechanical failure, not age.
- Distance travelled over vehicle lifetime has steadily increased since 2000.
- We don’t know why Japanese used vehicle total travel is lower.
“WHY DON’T WE RUN A SCRAPPAGE SCHEME?”
Costs and benefits of scrappage scheme

- In 2007 and 2009 the Ministry of Transport ran scrappage schemes in which we offered small incentives to encourage people to scrap their vehicles.
- Trials were run in Auckland, Wellington and Christchurch
- Analysis showed that the monetised benefit of removing a vehicle 12 months earlier than it would otherwise have been scrapped were in the order of $20 to $120.
- Greatest safety gains were in using PT, which is much safer to use than private motor car
- Trade Me data from 2014 (most recent available) said average sale price of car more than 15 years old is ~$2,000

BUT HAVEN’T VEHICLES GOT MORE EFFICIENT OVER TIME?
Efficiency vs weight

Much of the benefit of increasing technical efficiency has been traded off against weight and increased power

Fuel economy and weight of selected Holden Commodore models 1980 - 2002

Data provided by Australian govt official (pers com). Checked against published figures where possible.
US data suggests fuel economy (MPG) actually got worse between 1980s and mid-2000s.

Source: http://www.epa.gov/otaq/fetrends.htm
Divergence between rated fuel consumption and real world in independent European testing

- European research also shows that steady divergence between fuel economy measured by manufacturers compared with results from real world driving.
- Strong suggestion from this and Japanese data that manufacturers build cars to pass the test, not for real world.
- This may partly explain why we are not seeing expected changes in the fuel economy in the real world.
- Also, other variables, like congestion may also have gotten worse over this time.

Source: http://www.theicct.org/sites/default/files/publications/ICCT_LabToRoad_20130527.pdf
All light petrol vehicles – divergence in FE (%)

- This is data from MOT research comparing real world fuel use vs manufacturers published figure
- A small number of petrol vehicles are more fuel efficient than would be expected from the type approval numbers
- There is some correlation between real-world and type approval FE values

\[ Y = 0.81X + 2.78; \ R^2 = 0.55 \]
Light petrol vehicles: Divergence in fuel economy

The trend for vehicles to use more fuel than test values state is clear for NZ light petrol - divergence is increasing.

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