THE ROLE OF VEHICLE AGE IN ROAD FATALITIES AND THE COMMUNITY AWARENESS ACTIVITIES EMPLOYED TO ENCOURAGE FLEET RENEWAL AND REDUCE ROAD TRAUMA

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ABSTRACT

Following a period of steady decline in national road tolls in Australia and New Zealand, recent consecutive increases in annual road fatalities have caused community concern, with policy makers and road safety organisations working to ascertain reasons for this trend reversal.

It is well established that newer vehicles generally offer higher levels of safety when compared to older vehicles, due to technology developments and the inclusion of specific safety features, with studies based on real-world data supporting this [1,2]. Statistical studies of real world crashes often report on factors such as driver age, crash type and posted speed limit, however the involvement of vehicle age in fatal crashes is less understood.

To build a greater understanding of the age of vehicles involved in crashes occurring in Australia and New Zealand, ANCAP began monitoring the age of light passenger and sports utility vehicles involved in fatal crashes, with the findings used to inform road safety policies and community education and awareness activities.

In 2018, ANCAP developed a national community awareness campaign targeting community consideration of vehicle age with the objective of encouraging fleet renewal.

This paper sets out the research findings over the analysed five-year period from 2012-2016 and the effectiveness of the subsequent national community awareness campaign.

BACKGROUND

The Australasian New Car Assessment Program (ANCAP Safety) provides consumers with transparent advice and information on the level of occupant and pedestrian protection provided by different vehicle models in the most common types of crashes, as well as their ability - through technology - to avoid a crash. The program influences the design of new vehicles, encouraging vehicle manufacturers to offer a level of safety above that required by regulation and to continue to increase safety performance as technology develops.

CRASH DATA ANALYSIS

Method

Vehicle occupants represent the largest road user group in road fatalities each year, accounting for 66% of Australian road fatalities over the period 2012-2016 and 71% in New Zealand [3,4]. Specifically, occupants of light passenger vehicles and sports utility vehicles (SUVs) represent approximately 49% and 56% of road fatalities in Australia and New Zealand respectively over the period, while these vehicle types represent 75% and 78% of the respective vehicle fleets [5,6].

The analysis focusses on road fatalities where an occupant of a passenger car or SUV was fatally injured and compares the age distribution of those vehicles involved against the age distribution of the passenger car and SUV fleet. Other road user groups and vehicle types have not been included. Australia and New Zealand have been analysed separately due to fleet profile differences and to provide information specific to each country.

To perform the analyses, two key datasets were required:

1. Road fatality data identifying the fatality type, vehicle type and year of manufacture; and
2. Fleet data identifying the type and age of vehicles within the registered (AUS) / licensed (NZ) fleet.

Datasets for occupant fatalities occurring in light passenger vehicles and SUVs range from 500 to 700 fatalities each year in Australia and 120 to180 fatalities in New Zealand. Organising this data into groups by vehicle year of manufacture matching the information reported by the fleet statistical data allowed age comparisons to be made between vehicles involved in occupant fatalities and vehicles within the respective fleets.

Data sources

Australian fleet information was sourced from the *Motor Vehicle Census, Australia* reports published by the Australian Bureau of Statistics (ABS) [5,7-10], while New Zealand fleet information was sourced from the *New Zealand Vehicle Fleet Status* reports published by the New Zealand Ministry of Transport [11-14].

For Australia, Motor Vehicle Census reports are based on the fleet at 31 January of the report year. For the purpose of this analysis, fleet information at 31 January is considered a good representation of the fleet at the end of the previous year.

Vehicle age amongst the Australian passenger car and SUV fleet is reported in four groups based on year of manufacture. Three of these groups span five years each while the remaining group includes vehicles that are fifteen years or older. These groups roll over based on the year in which the motor vehicle census is conducted.

For New Zealand, the fleet status data is reported at 31 December. Vehicle year of manufacture is generally reported in six groups, each spanning 10 years, however these groups do not rollover and remain consistent each year. As a result, the newest group identifying vehicles built between '2010-current' continues to grow with each status report as more new vehicles are added to the fleet.

Australian road fatality data identifying the fatality type, vehicle type and year of manufacture was sourced from the Bureau of Infrastructure, Transport and Regional Economics (BITRE) National Crash Database [16]. Corresponding New Zealand data has been provided by the New Zealand Ministry of Transport and the New Zealand Transport Agency [17].

Results

Tables 1 and 2 show the age distribution amongst passenger vehicles and SUVs involved in occupant fatalities over the period 2012 to 2016. Vehicle age shown is based on the age in the year in which the crash occurred. Occupant fatalities where the vehicle year of manufacture is unknown represent 11% of the Australian dataset and less than 1% of the New Zealand dataset.

Vehicles aged 24 years or less were involved in the majority of occupant fatalities, with older vehicles, particularly those aged 30 years or more, involved in relatively few occupant fatalities. The average age of light passenger vehicles involved in occupant fatalities during the five-year period was found to 12.7 years in Australia and 16.1 years in New Zealand.

Table 1.
Occupant fatalities by vehicle age at the time of crash (2012 to 2016)

Vehicle age (years)	Occupant fatalities in Australia	Percentage	Occupant fatalities in New Zealand	Percentage
0-4	361	12%	42	6%
5-9	554	18%	79	10%
10-14	745	25%	162	22%
15-19	638	21%	259	34%
20-24	297	10%	155	21%
25-29	62	2%	44	6%
30-34	25	1%	3	0%
35-39	4	0%	3	0%
40-44	3	0%	0	0%
45-49	5	0%	2	0%
50-54	1	0%	0	0%
55-59	1	0%	0	0%
60-64	2	0%	0	0%
65-69	0	0%	0	0%
70-74	0	0%	0	0%
75-79	0	0%	2	0%
80-84	1	0%	1	0%
Unknown	334	11%	1	0%
Total	3033	100%	753	100%

Table 2.
Occupant fatality data key statistics (2012 to 2016)

	Average age (years)	Mode	Minimum age (years)	Maximum age (years)
Australia	12.7	14	0	83
New Zealand	16.1	18	0	83

The results comparing the age of vehicles involved in occupant fatalities and the age of vehicles within the fleet are shown separately for each year in Australia and New Zealand in Figures 1 and 2 below.

Australia

The results found that in Australia during 2016, vehicles built in 2012 or later represented the largest portion of registered vehicles at 31%, and were involved in the fewest occupant fatalities at 12%. Vehicles built between 2007 and 2011 represented 27% of registered vehicles and were involved in 13% of occupant fatalities. Vehicles built between 2002 and 2006 represented 22% of registered vehicles and were involved in 21% of occupant fatalities. The oldest group, those built in 2001 or earlier, represented the smallest portion of registered vehicles at 20% and held the largest share of occupant fatalities at 36%.

On average over the five-year period analysed, the newest vehicles aged up to four years (at the time of crash) represented 31% of registered vehicles in Australia and were involved in 12% of occupant fatalities. The oldest age

group, those vehicles aged 15 years or older, represented 20% of registered vehicles on average and were involved in 34% of occupant fatalities.

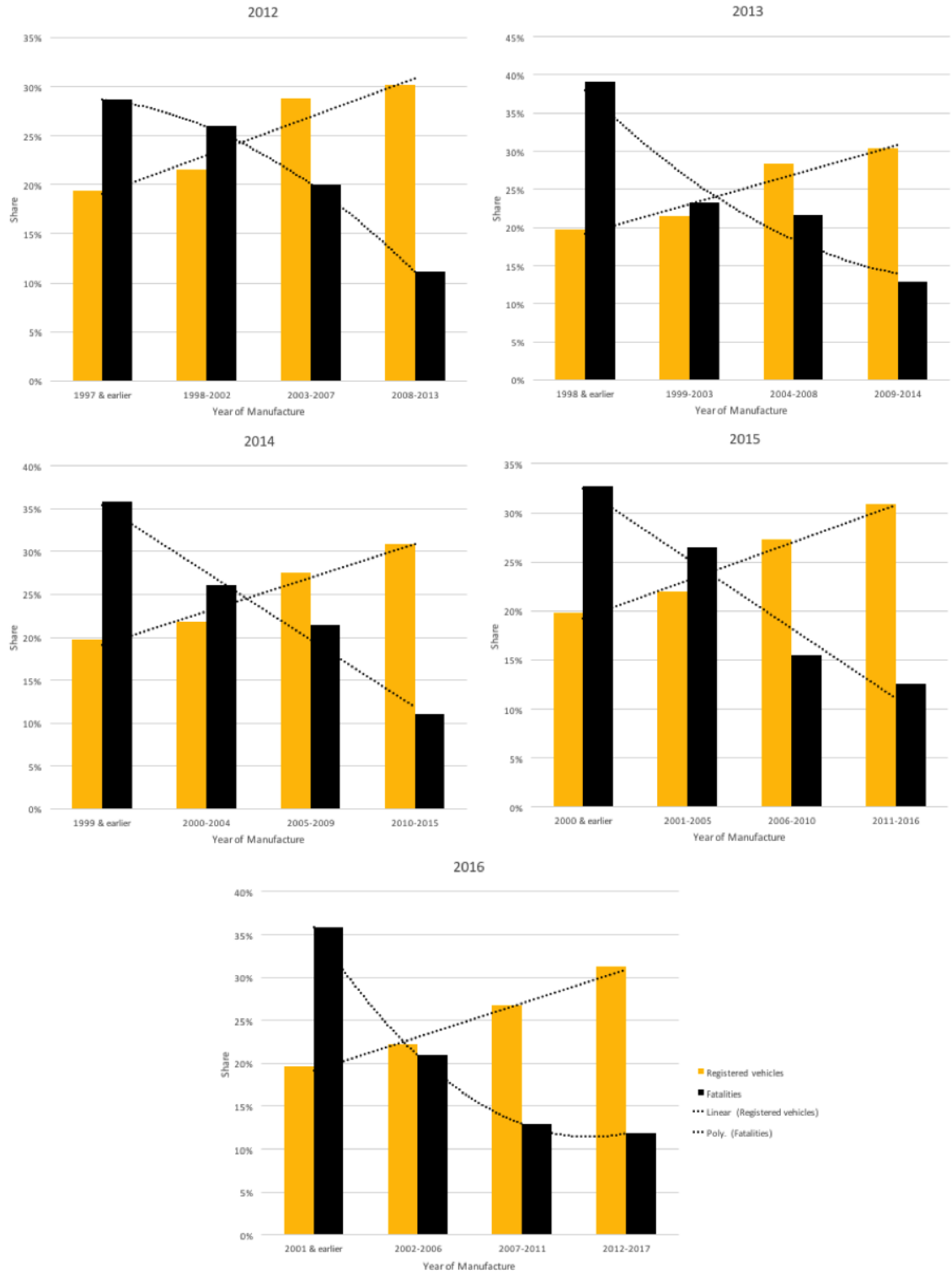
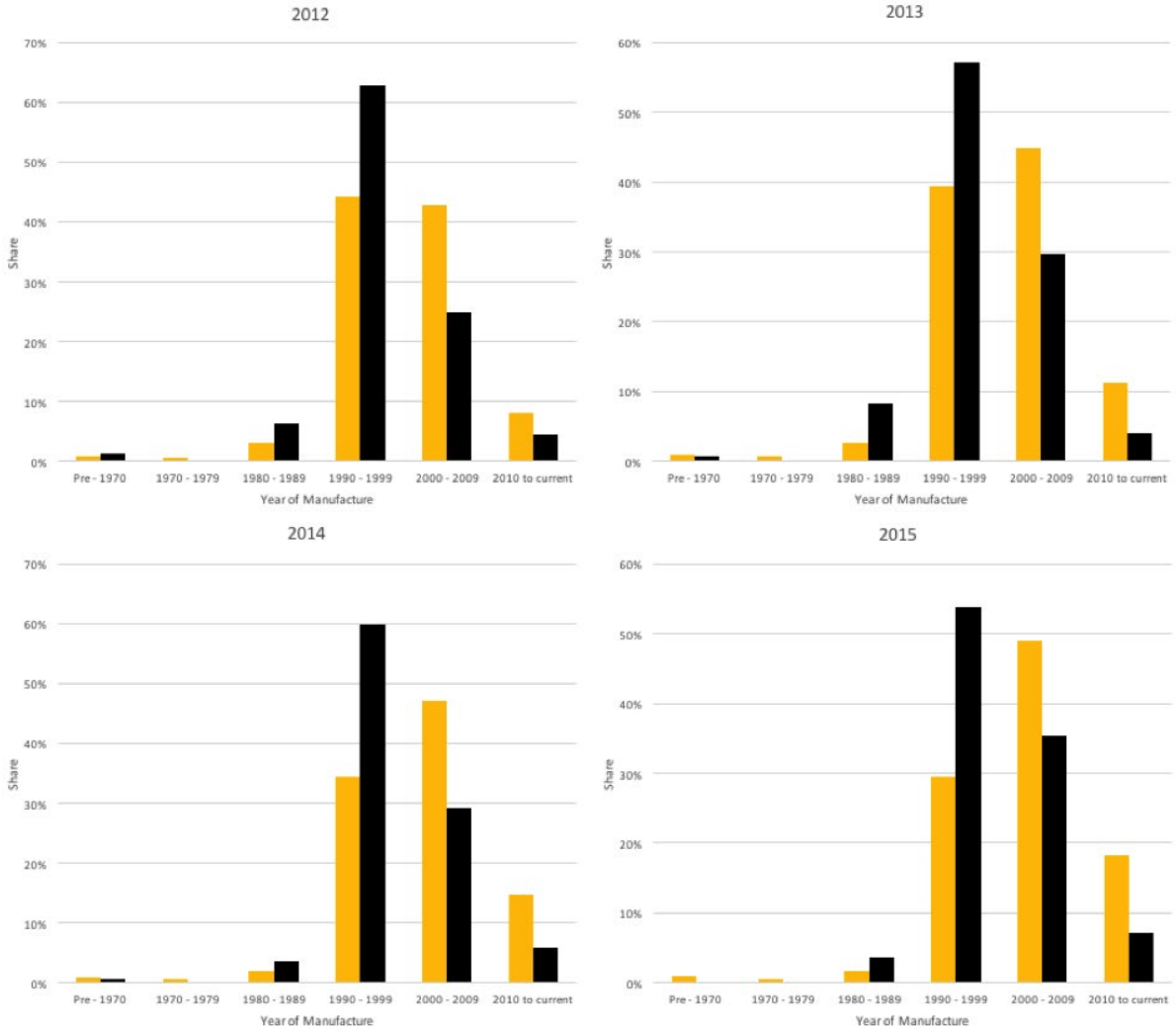


Figure 1 Age of vehicles involved in occupant fatalities vs age of registered vehicles (light passenger vehicles and SUVs) in Australia

New Zealand

The results found that in New Zealand for 2016, the newest vehicles built in 2010 or later represented 22% of licensed vehicles and were involved in 6% of occupant fatalities. Vehicles built between 2000 and 2009 represented 50% of licensed vehicles and were involved in 44% of occupant fatalities. Vehicles built from 1990 to 1999 represented 25% of licensed vehicles and were involved 45% of fatalities. Vehicles built prior to 1990 collectively represented 3% of licensed vehicles and were involved in 5% of occupant fatalities.

The New Zealand analysis shows relative consistency over the five-year period for vehicles built between 1990 and 2009. On average over the period, vehicles built between 1990 and 1999 represented 35% of licensed vehicles and were involved in 56% of occupant fatalities, while vehicles built between 2000 and 2009 represented 47% of licensed vehicles and were involved in 33% of occupant fatalities.



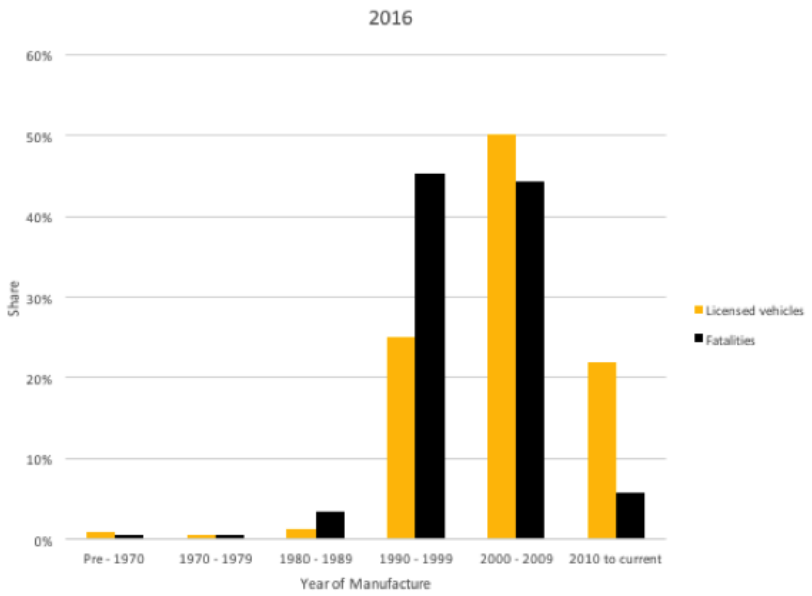


Figure 2. Age of vehicles involved in occupant fatalities vs age of licensed vehicles (light passenger vehicles and SUVs) in New Zealand.

The differing age groupings reported by Australia and New Zealand, due to the differing reporting methods of the respective fleet statistics, make comparisons between the two datasets difficult. However, limited statistical datasets of the New Zealand fleet were available [6] allowing for some comparison to be made between the results. Figure 3 shows the age of vehicles involved in occupant fatalities in New Zealand during 2016 grouped into age groups common with the corresponding Australian results.

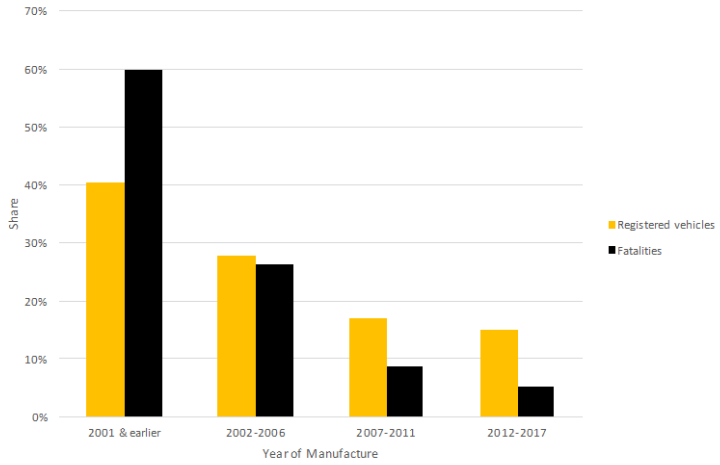


Figure 3. Age of vehicles involved in occupant fatalities vs age of licensed vehicles (passenger vehicles and SUVs) in New Zealand (2016).

Figure 3 shows that in New Zealand during 2016, the oldest vehicles, built in 2001 or earlier, represented 40% of licensed vehicles and were involved in 60% of occupant fatalities. In contrast, the newest vehicles built in 2012 or later represented 15% of licensed vehicles and were involved in 5% of occupant fatalities.

Table 3
Average age of vehicles involved in occupant fatalities

	2012	2013	2014	2015	2016	2012-2016
Australia						
Fatalities	12.2 years	12.8 years	12.5 years	12.9 years	13.1 years	12.7 years
Registered vehicles	9.8 years	9.8 years	9.8 years	9.8 years	9.8 years	9.8 years
New Zealand						
Fatalities	15.7 years	16.4 years	15.6 years	15.9 years	16.8 years	16.1 years
Licensed vehicles	14.0 years	14.2 years	14.2 years	14.3 years	14.4 years	14.2 years

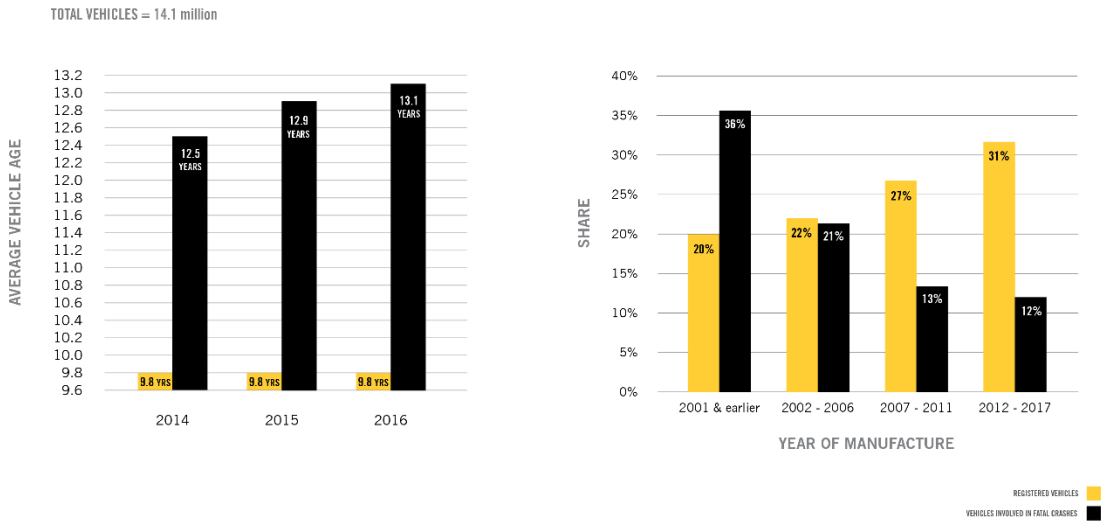


Figure 4. Fatalities vs. Registered Vehicles, Australian Light Vehicle Fleet (passenger cars & SUVs)

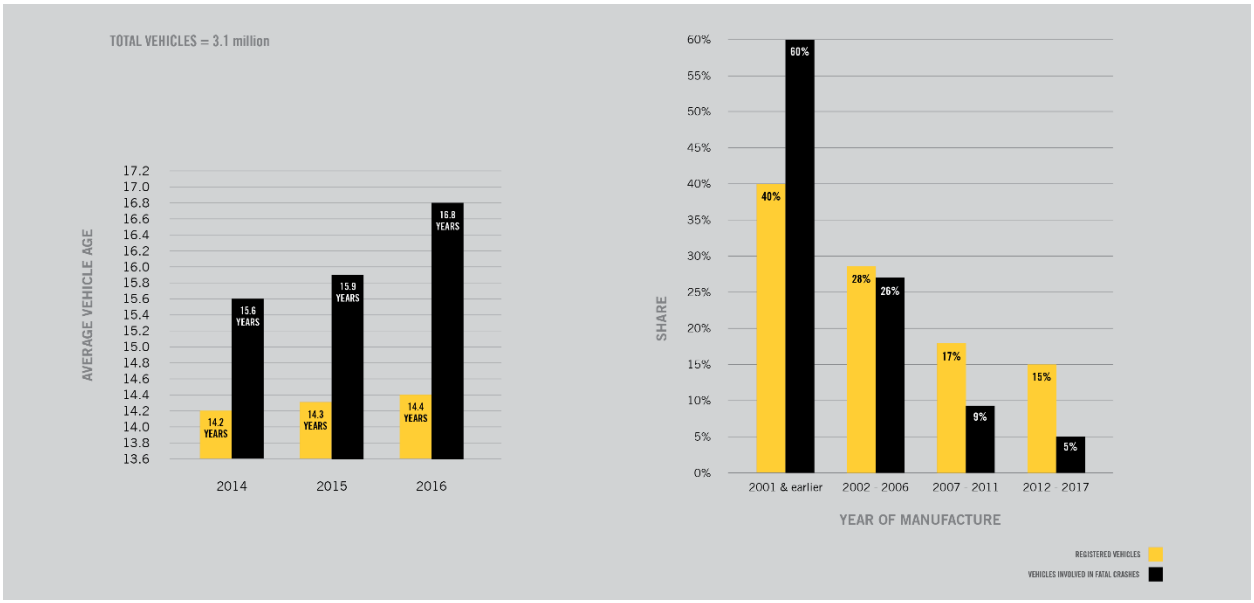


Figure 5. Fatalities vs. Registered Vehicles, Australian Light Vehicle Fleet (passenger cars & SUVs)

Analysis Discussion

The results of the analysis show that older vehicles were consistently over-represented in occupant fatalities in both Australia and New Zealand over the period 2012 to 2016. Australian Motor Vehicle Census data consistently shows a relatively linear relationship between vehicle age and the share of the registered vehicle fleet over the five-year period, with fleet share decreasing with vehicle age. In contrast, the results suggest the relationship between vehicle age and involvement in occupant fatalities is the reverse, with crash involvement increasing with vehicle age. This relationship however is limited, as shown in Table 1, where vehicles aged 25 years and older were involved in much fewer occupant fatality crashes.

Over the five-year period, the Australian results consistently show that the oldest group of vehicles reported in the Motor Vehicle Census data represented the smallest portion of registered vehicles, yet were involved in the most occupant fatalities. Contrast to this, the newest vehicles represented the largest portion of registered vehicles and were involved in the smallest portion of occupant fatalities.

The New Zealand results comparing the age distribution of vehicles involved in occupant fatalities and licensed vehicles in the fleet presents differently due to the vehicle age groups provided in the source fleet statistics datasets. Vehicles built between 1990 and 1999 were consistently over-represented in occupant fatalities while vehicles built between 2000 and 2009 were consistently shown to be involved in less fatalities yet represented more of the licensed fleet. The portion of registered vehicles built in 2010 or later increased over time as expected, however the involvement of those vehicles in occupant fatalities remained relatively constant.

In comparing the results between Australia and New Zealand, Figure 3 suggests a differing relationship between vehicle age and share of the licensed vehicle fleet in New Zealand, with newer vehicles representing less of the fleet than older vehicles. However, the relationship between vehicle age and involvement in occupant fatalities does appear similar, increasing with age.

This observed difference between the Australian and New Zealand distribution of vehicle age amongst the fleet reflects significantly differences in fleet profiles. Notably in New Zealand, used imports represent roughly 50% of the passenger vehicle and SUV fleet [15].

Over the five-year period, the average age of vehicles involved in occupant fatalities was found to be consistently older than the average age of vehicles in the respective fleet for both Australia and New Zealand, supporting the notion that older vehicles are over-represented in occupant fatality crashes.

The average age results shown in Table 3 also suggest a potential trend where the average age of vehicles involved in occupant fatalities is increasing. It is plausible that as newer vehicles become safer, and therefore are involved in fewer serious crashes, the share of serious crashes which older vehicles are involved in may increase. This does, however, imply that overall road fatality numbers will reduce. Further work is needed to establish whether a trend indeed exists or is emerging.

COMMUNITY AWARENESS ACTIVITIES

The findings of the analysis of the Australian and New Zealand registered light vehicle fleet highlighted the need for a redoubling of efforts across all *Safe Systems* pillars, and provided added impetus for ANCAP to enhance community awareness of the importance of newer, safer vehicles beyond the routine publication of ANCAP safety ratings for new market entrants.

New Car Assessment Programs such as ANCAP have the ability to drive improvements in vehicle safety through non-regulatory, consumer information and advocacy activities and this was leveraged through a series of interlinked community awareness activities.

Car-to-Car Advocacy Test

The first of these activities was the conduct of a car-to-car crash test - undertaken to visually communicate the research findings to the general community. The advocacy test was conducted between a 1998 Toyota Corolla hatch

and a 2015 Toyota Corolla hatch using similar test parameters as ANCAP's offset deformable barrier (frontal offset) crash test at 64 kilometres per hour with a 40 per cent offset on the driver's side.

The older vehicle sustained catastrophic structural failure with dummy readings showing a high risk of serious head, chest and leg injury to the driver. The 1998 model achieved a score of 0.40 out of 16.00 points which would fall within the parameters for a zero star ANCAP safety rating. In contrast, the 2015 model performed well, scoring 12.93 out of 16.00 points – within five star parameters. Test results and imagery were distributed widely with unprecedented global public interest.

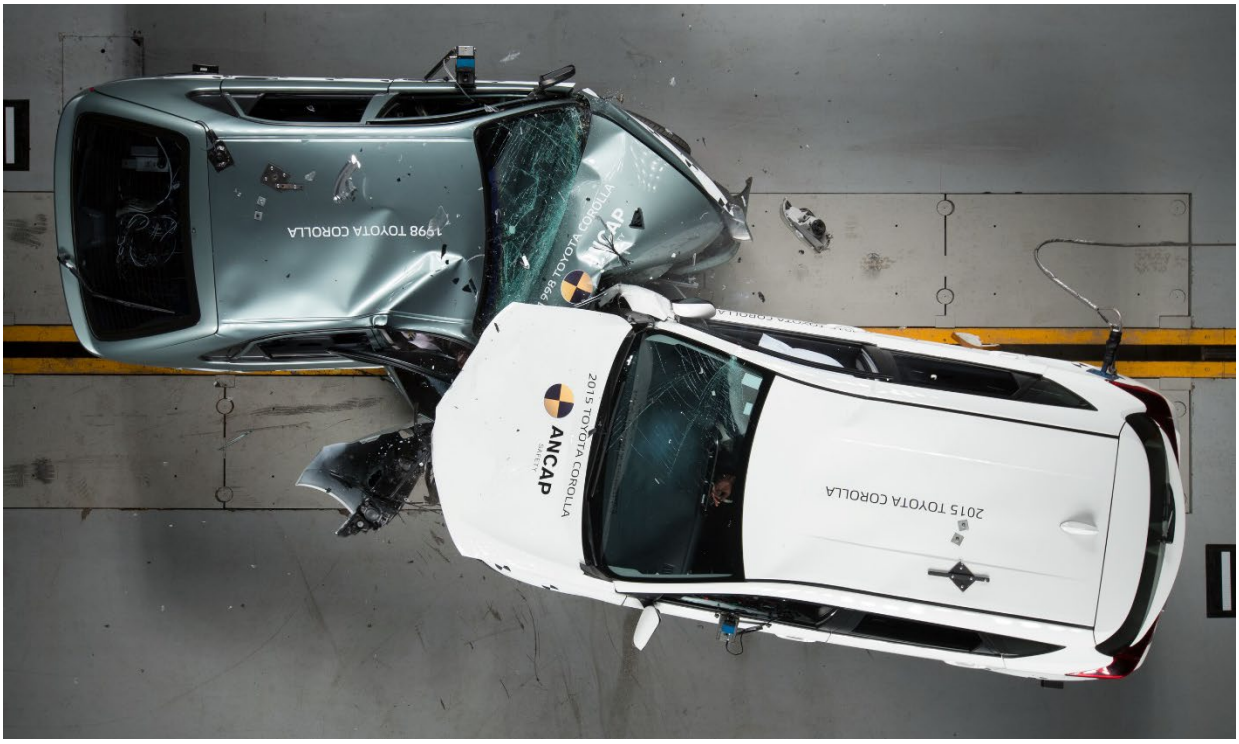


Figure 6. ANCAP car-to-car advocacy test between 1998 Toyota Corolla and 2015 Toyota Corolla (2017).

National Community Awareness Campaign

Drawing upon the public success of the car-to-car test, a national community awareness campaign was derived, titled '*Safer Vehicle Choices Save Lives*'[18]. The primary element of the campaign was the production and national screening of two parallel television commercials (TVC) with the premise to highlight the different crash outcomes between occupants of older vehicles and occupants of more contemporary vehicles. The commercials were produced to evoke consumer awareness and active consideration of vehicle age as a key contributing factor in road fatalities, and the effect safer vehicle choices can have on reducing road trauma.

Vision of the car-to-car advocacy test was incorporated into the commercials with the viewer left to consider the fate, or survivability, of each driver based on the safety performance of the two vehicle models. The call-to-action used in the commercials was, "*Find out who survives*".

This was the first national road safety campaign released in Australia which highlighted the *vehicle* as the determining factor in crash survivability.

Campaign execution

The campaign commenced national rollout from July 2018 in collaboration with all 23 ANCAP member organisations. While nationally-executed, campaign materials were produced for carriage across all Australian states and territories through the use of tailored branding and inclusion of local vehicle registration plates to reinforce jurisdictional relevance to the viewer.

By August 2018, over two thirds of Australia's total population, or 78 per cent of its car driving population, had been exposed to the campaign achieving an audience reach figure of 15.26 million [19] through a moderate investment of AUD$225,000.

Campaign effectiveness

Formal evaluation of the effectiveness of the campaign - including recall, messaging and behavioural impacts - was undertaken half way through the execution of the campaign. 1,041 respondents across all Australian state and territories – regional and metropolitan – were surveyed to explore unprompted and prompted recall and cut-through. In order to provide a nationally representative sample the survey targeted respondents from a mix of genders, age ranges (18-65 years), and driving status (drivers and non-drivers) [20].

The survey revealed a very high level of consumer impact, and attitudinal and behaviour change. As a result of seeing the campaign, respondents were compelled to think, discuss and act. It prompted 29 per cent of respondents to *consider* and 27 per cent to *check* the safety of their current vehicle(s). For one in five (21 per cent), this meant visiting the ANCAP website. This correlated to a 15.2 per cent increase in visitors to the ANCAP website when compared against the same period the year prior. Seventy (70) per cent of respondents stated they would check the ANCAP safety rating before buying their next car.

More serious reflections such as considering purchasing a new car (13 per cent) or actually committing to purchase a safer car (12 per cent) were also reported. One in three (34 per cent) reported feeling compelled to discuss car safety with others. Eighty (80) per cent of respondents stated the campaign message was '*Very / Quite Good*'.

Message recall was also strong with 72 per cent of respondents stating the campaign related to the importance of newer, safer vehicles.

LIMITATIONS

A key limitation to the research findings is that the study does not investigate crash causation and factors contributing to the involvement of vehicles of various ages in fatal crashes. Driver demographics are considered a significant factor contributing to older vehicle involvement in serious crashes with many older vehicles being driven by more at-risk drivers, such as the young and inexperienced, and the elderly and frail [21].

The size of the dataset and statistical significance of the results, particularly New Zealand, also presents a limitation in the reliability of the analysis findings.

CONCLUSIONS

Investigating the involvement of vehicle age in fatal crashes and comparing the age distribution to that of the registered / licensed fleet over the period 2012 to 2016, found that older vehicles aged between 15 and 25 years old were consistently over-represented in road fatalities where the occupant of a passenger vehicle or SUV was fatally injured. Significantly older vehicles aged 30 years or more were not found to be significantly involved in occupant fatality crashes.

The average age of vehicles involved in occupant fatality crashes each year over the analysed period suggests a potential trend towards an increasing over-representation of older vehicles involved in occupant fatalities, which may be influenced by a reduced involvement of newer vehicles in occupant fatalities.

Equal in importance to understanding road safety challenges is to undertake independent testing to prove it, and then activate change through public communication and advocacy. Non-regulatory, consumer-focused communications activities can have a positive impact on consumer behaviour and vehicle choice. The '*Safer Vehicle Choices Save Lives*' campaign, while activated through a modest investment, has achieved strong consumer cut-through and resultant behavioural change.

Active consideration of vehicle safety among the general community can be bolstered through the conversion of scientific testing into compelling and effective consumer-facing materials screened through mainstream and social

media. This can be leveraged further by partnering with credible organisations which are relevant and resonate with the viewer. Public advocacy activities such as this can and should be applied globally to assist in reducing the age of registered vehicles and subsequently drive down road trauma.

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