Peer Reviewed Papers

A Comparison of the Pedestrian Passive Safety Performance of the New Vehicle Fleet in Australia, France and the United Kingdom

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This paper was originally presented at the 2007Road Safety Research, Policing and Education Conference held in Melbourne.

Abstract

Improvements to frontal vehicle design can improve a pedestrian's chance of survival in a collision but there are no design rules pertaining to pedestrian protection in Australia. Some overseas regulators are mandating a minimum level of pedestrian protection, and one consequence of this is likely to be a flow of safer designs into the Australian vehicle fleet. To assess this size of this effect, the distribution of pedestrian safety performance in the new car fleet of Australia was compared to those of France and the United Kingdom. A greater proportion of new passenger vehicles rated less than 2-stars for pedestrian safety by the European New Car Assessment Program (Euro NCAP) and the Australasian New Car Assessment Program (ANCAP) are sold in Australia than in France and the United Kingdom. Furthermore, the portion of the new car fleet in France and the United Kingdom assessed by the Euro NCAP/ANCAP since the beginning of 2006 has shown significant improvement and has a larger proportion of better performing vehicles than the equivalent segment of the Australian new car fleet. This period corresponds with the introduction of new vehicle pedestrian safety regulations in Europe.

Introduction

In the 10 years up to July 2007, 2595 pedestrians were killed on Australian roads [1]. A significant proportion of serious and fatal injuries are caused by the initial pedestrian interaction with the front of the vehicle [2] Therefore, it follows that considerate design of the front of a vehicle should improve a pedestrian's chance of survival and reduce the incidence and severity of injury in a collision.

Currently there are no Vehicle Design Standards/Australian Design Rules (ADRs) that consider the safety of pedestrians or other vulnerable road users in the event of a collision. Europe and Japan now mandate a minimum level of pedestrian protection in new models of passenger vehicles sold in those jurisdictions, and one consequence of this is that vehicles designed to comply with pedestrian protection regulation are flowing into the Australian vehicle fleet.

The Australian Government is committed to harmonizing Australian vehicle standards with global regulations [3] An ad hoc group under Working Party 29 of the United Nations Economic Commission for Europe (UNECE) on passive safety is developing a draft global technical regulation on pedestrian protection [4] and so it might be expected that Australia will examine any final proposal issued by the UNECE with a view to adopting such a regulation for passenger vehicles sold in Australia.

However, it remains a fact that there is no current legal requirement for minimum levels of pedestrian protection in new passenger cars sold in Australia. Therefore, improvements in new vehicles sold in Australia are only accruing through the importation of vehicles that are required to comply with regulations overseas, the global nature of vehicle research and development, and/or impetus from new car assessment programs.

New car assessment programs in Europe, Australia and Japan are promoting pedestrian-safe passenger vehicles. While there is no compulsion on manufacturers to design vehicles to do well in these programs, vehicles have performed well, demonstrating that improvements in vehicle design for pedestrian protection are possible. Perceptions of safety, including that of pedestrian safety, are reported to affect consumers' choices [5], but it is likely that perceptions about pedestrian protection on consumers' choices are somewhat less influential than perceptions about occupant protection. The occupant safety ratings (which are separate from the pedestrian safety ratings) of new cars usually far exceed the minimum required by the relevant ADRs. At this time, the same cannot be said for levels of pedestrian protection, with very poor assessments still prevalent. As such, vehicle regulation may have a more important role in improving levels of pedestrian protection than regulation for occupant protection.

Table 1: Relationship between points scored and pedestrian star rating in Euro NCAP/ANCAP tests

Points scored	0 - 0.99	1 - 9.49	9.5 - 18.49	18.5 - 27.49	27.5 - 36
Star rating	0	1	2	3	4

From a road-safety perspective, the importance of a particular model's level of pedestrian protection should be in proportion with that model's representation in the vehicle fleet – high-selling models of vehicle are more likely to be involved in pedestrian crashes simply due to the effect of exposure.

It is therefore pertinent to ask: how is Australia currently benefiting from overseas developments in design in the area of pedestrian protection? And how does any such benefit compare with countries now subject to regulation in the area? Furthermore, what change in the safety of the fleet might be expected from the introduction of relevant regulation in Australia?

Aim

The aim of this study was to examine recent trends in the pedestrian safety of new passenger vehicles, to assess the impact of these trends on the performance of the new car fleet in Australia, and to compare this performance with that of the new car fleets of two highly populated European countries: France and the United Kingdom. We wish to see whether the impact of new regulation in Europe is detectible in the European new car fleet and to what extent any such impact is flowing through to the Australian new car fleet

Background

Recent International developments in pedestrian safety

Since 1 October 2005, new types of passenger vehicles given type-approval in Europe must comply with Phase I (of II) of a European Council Directive that requires a certain performance level in child headform and full legform impact tests [6]. New vehicles that are not of a 'new type' are not required to comply. Phase II requirements will be more stringent than Phase I, in the number of tests, and the performance requirements of the tests. The European Council intends to introduce Phase II in 2010 [7] .

Japan has regulated to ensure that new types of passenger car and their derivatives introduced after 1 September 2005, and all types after 1 September 2010, comply with pedestrian head impact performance requirements. Currently there are no requirements for a legform impact test [7]).

New Car Assessment Programs (ANCAP and Euro NCAP)

The European New Car Assessment Programme (Euro NCAP) and the Australasian New Car Assessment Program (ANCAP) test selected new passenger vehicles to assess their pedestrian protection performance, and publish the results as information for consumers. The vehicle is awarded up to 36 points, based on the results of a series of subsystem tests, in which dummy components are fired at the front of the vehicle. The vehicle is then given a star rating of between 0 and 4 stars based on the amount of points it has scored (Table 1). In 2002, ANCAP and Euro NCAP adopted revised pedestrian testing protocols (currently version 4.1), which are largely based on the work of Working Group 17 of the European Enhanced Vehicle Safety Committee (EEVC). ANCAP pedestrian assessments are conducted under the same protocol as those for Euro NCAP and so Euro NCAP results can be republished by ANCAP as well. A summary of the assessment methods and full results from previous ANCAP tests have been previously documented by [8]. All current and historical assessments are available on the ANCAP (http://www.ancap.com.au) and Euro NCAP (http://www.euroncap.com) websites.

Methods

To assess the performance in pedestrian protection of the current Australian, French and British new-car fleet, we required two pieces of information: the composition of individual models in the new car fleets of each country and a measure of those models' performances in pedestrian impact tests. The fleet composition we wish to consider is the one that is representative of vehicles being sold currently, rather than an historical one, and so we sought the most recent sales data that was available. To take account of seasonal fluctuations, we used 12 months of sales data from each country. The Australian new car fleet was based on the 12 months of sales to June 30, 2007 [9]. For French [10] and British [11] sales, we used sales data to 31 December, 2006.

For each model in the sales data, we assumed that its representation in the new car fleet was current. Where the model had been superseded during the 12 month period, we assigned its sales figures to the replacement model of vehicle (where possible). To these data we applied current Euro NCAP/ANCAP assessment results.

Table 2 Number of vehicles tested since 2002 in Euro NCAP and ANCAP by the rating awarded

Program	0 Star	1 Star	2 Star	3 Star	4 Star	Total
Euro NCAP	7	55	56	20	1	139
ANCAP	1	29	13	1	0	44
Total	8	8	69	21	1	183

Note: The Euro NCAP numbers are those published to June 2007 and the ANCAP numbers are vehicles tested to June 2007.

While we do not have evidence regarding the compliance of individual models of vehicle with either European or Japanese regulation, the results of Euro NCAP and ANCAP assessments can serve as a guide. Furthermore, Euro NCAP/ANCAP assessments provide greater differentiation between the performance of different models than the pass/fail assignments of the regulation. Our assessment is that vehicles that just pass Phase I of the European Council Directive would receive around 10 points in a Euro NCAP/ANCAP assessment, (i.e. in the upper-one to lower-two-star range.)

After assigning the relevant Euro NCAP/ANCAP assessment to each model, we ranked the sales volumes of the models of vehicle in each country's new car fleet by their Euro NCAP/ANCAP assessment, and assembled cumulative distributions of Euro NCAP/ANCAP performance for each country's fleet. In doing so, we are able to compare the proportion of fleets performing at any specified level.

Finally, we disaggregated each distribution by the assessment period (2002-2003, 2004-2005, 2006-2007) to assess trends in the performance of the new car fleet in each country.

Results

The performance of vehicles in Euro NCAP/ANCAP pedestrian tests

A summary of the ratings for all vehicles tested by ANCAP or Euro NCAP to the current testing protocol is given in Table 2. Note that these numbers include assessments of vehicles that are now obsolete. It is noteworthy that 68% of ANCAP's vehicle assessments achieved a score of 1 star or less, compared to 45% of vehicle assessments by Euro NCAP.

Trends in the performance of vehicles in Euro NCAP/ANCAP pedestrian tests

Figure 1 shows the distribution of current results (only those models that are still part of the current new car fleet), split into the years in which the assessment was performed. As assessments are usually made at the time or soon after a model release, the test period indicates the age-rank of the vehicle model (i.e. models tested in 2002-2003 are older models than those tested in 2004-2005 etc). Figure 1 shows that that vehicle models assessed more recently have performed better than vehicles released in earlier periods. The median assessment of current new cars, assessed in 2002-2003, is around 7 points, while the median assessment of current cars assessed in 2006–2007 is around 14 points.

The composition of new vehicle fleets in Australia, France and the United Kingdom

While individual vehicle models may perform well or poorly, and Figure 1 indicates that newer vehicle models perform better than models released four years ago, a vehicle model's performance is relevant to road safety to the extent to which the model is registered and driven on the road. While there have been assessments made of 183 models of vehicle, relatively few dominate the overall fleet performance – 50% of all new vehicle sales in Australia are accounted for by 17 models. A similar number account for 50% of new vehicle registrations in France (18 models) but a greater number do in the United Kingdom (22 models) (Figure 2).

Most of the vehicles assessed by Euro NCAP are also available in Australia, but for many of these models, their contribution to the new-car fleet varies significantly between Europe and Australia (and also between countries in Europe). Figure 5 shows the differences between the new vehicle fleet compositions in each country; models comprising the top 50% of sales in France and the UK account for around 3% and 14% of the new car fleet in Australia. This lack of correspondence between the new car fleets of Australia and the new car fleets of France and United Kingdom show that great differences in the performance of the respective fleets are possible.

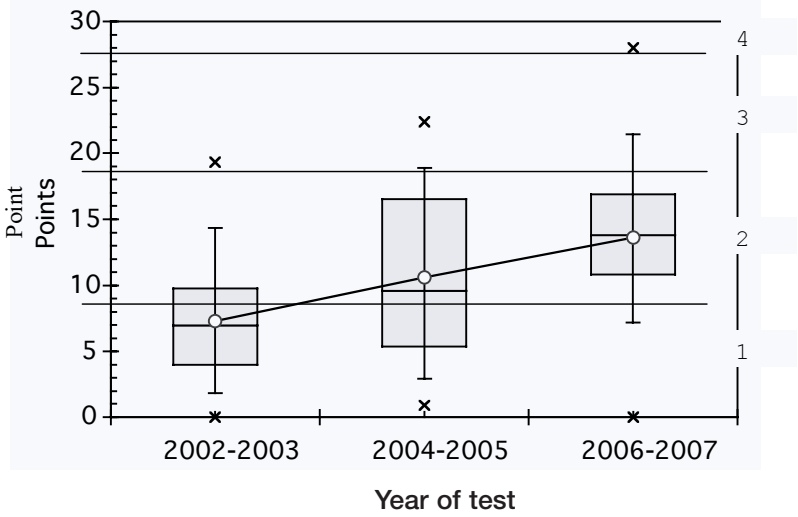

Figure 1 - Box and whisker plot of current Euro NCAP/ANCAP pedestrian test results by test year. ("o" indicates the mean, the box covers the interquartile range, the error bars show 10th and 90th percentile values and "x" shows the highest and lowest values.)

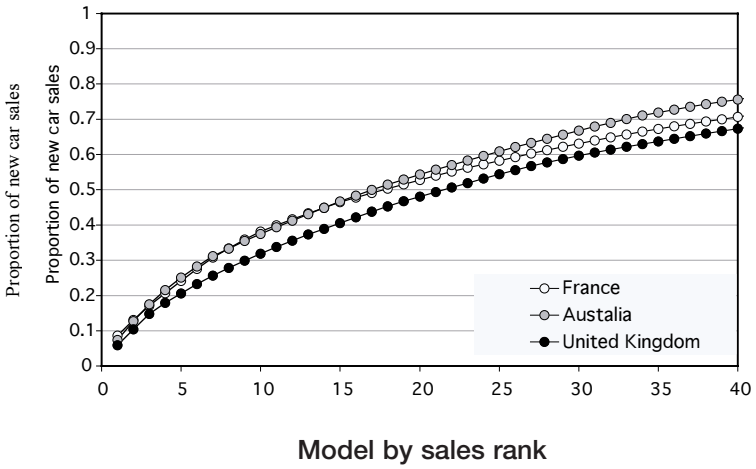

Figure 2 Cumulative proportion of new passenger vehicle sales by sales rank (e.g. the top selling vehicle has sales rank = 1, second top selling vehicle = 2, etc)

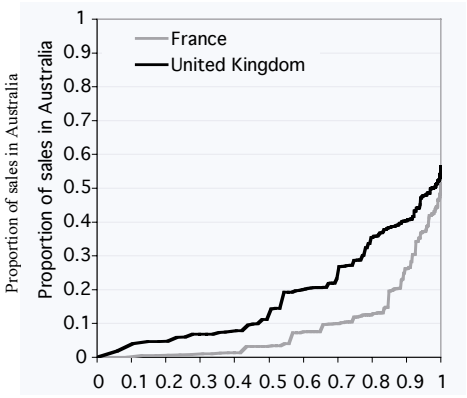

Figure 3 The proportion of the new car fleet in Australia represented by top selling vehicles in France and the United Kingdom.

The pedestrian assessment of the new-car fleets in Australia, France and the United Kingdom

Not every passenger vehicle sold in Australia, France and the United Kingdom had been assessed by Euro NCAP/ANCAP. However, as the programs target higher selling models of vehicle, 82%, 80% and 73% of the new car fleets in Australia, the United Kingdom and France (respectively) can be assigned assessment scores. Vehicles are assigned points to a maximum of 36, based on the results of the tests used in the assessment and these are grouped into star-ratings.

Figure 4 shows the cumulative distribution of performance in Euro NCAP/ANCAP tests of the new-car fleet in each country. Fifty six per cent of new passenger vehicles sold in Australia have a pedestrian safety star rating of less than 2, compared to 34% in France, and 42% in the United Kingdom; this implies that pedestrians struck by new vehicles in Australia are 65 percent more likely to be struck by a 0 or 1 star car than pedestrians in France and 33 per cent more likely than pedestrians in the UK. Note though that most of the differences in the fleet performance occur below 2.5 stars, and so the prevalence of better performing vehicles (pedestrian rating of 3 stars) is similar in each country and relatively small – under 20 per cent of the new car fleet.

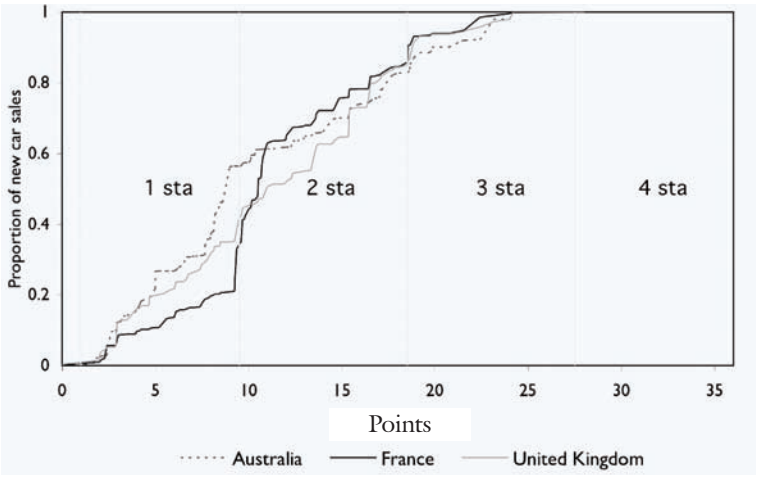

Figure 4 Cumulative performance of the new car fleet in Euro NCAP/ANCAP pedestrian tests for Australia, France and the United Kingdom, for models assessed by Euro NCAP/ANCAP.

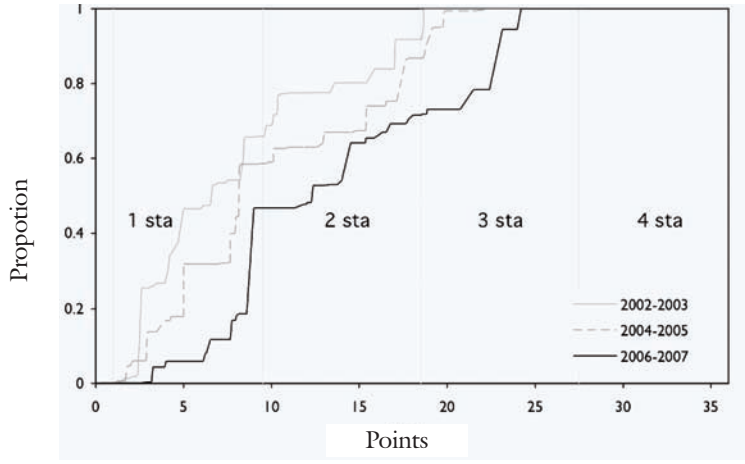

Figure 5 Cumulative Australian new car fleet performance by assessment period. Sales volumes from July 2006 to June 2007 are used to define the new car fleet.

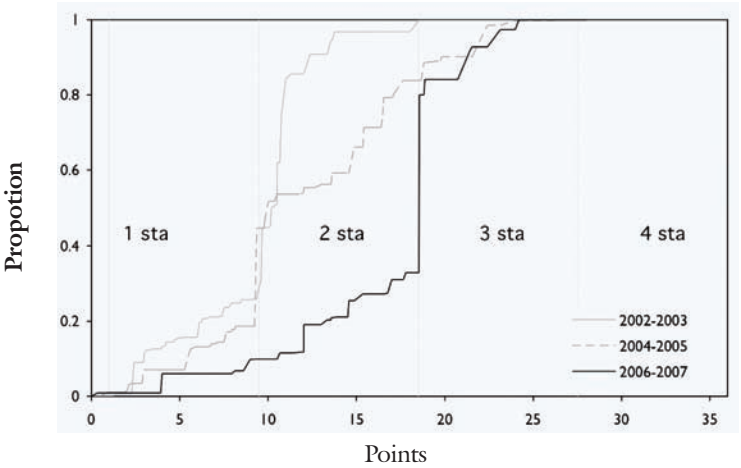

Figure 6 Cumulative French new car fleet performance by assessment period. Sales volumes from calendar year 2006.

The performance of the new car fleet by model-age

As the previous analysis showed, the prevalence of better performing vehicles is similar in each country. But we should also consider that, as many current models were released in Europe prior to September/October 2005, much of the new car fleet is still not required to comply with the European Directive nor the Japanese Regulation. (Such a requirement will only come into force in 2011.) Therefore we disaggregated the distributions shown in Figure 4 by the period of the Euro NCAP/ANCAP assessment on the basis that assessments are made within a relatively short period after the release of the model, and that, according to Figure 1, assessments have generally improved since 2002. We disaggregated the fleet according to three assessment periods: 2002-2003, 2004-2005 and 2006-2007. This grouping should provide an ordering of models by their release date.

Note that the relative contributions of these groups to each new car fleet are not even: a greater proportion of the new vehicle fleet are of models assessed in 2002-2003 than of models assessed in the other periods. Relatively few new vehicles sold were been assessed in 2006-2007. Nevertheless, we expect the latest group to represent post-regulation design in Europe and Japan, and as such, some indication of the present state of performance amongst this segment in the new car fleet.

Figure 5, Figure 6 and Figure 7 show the distribution of performance of the new car fleet for each country, split into the period of assessment. Several things are notable: in every country the performance has improved in each successive period, as the distribution of each subsequent period lies to the right of the previous period. However, the new-car fleet performance of models assessed in 2006-2007 in France and the United Kingdom shows much greater improvements over previous periods than the improvement of the equivalent segment of the Australian fleet.

Figure 8 highlights the difference between the performance of the Australian recent-model new car fleet and those of France and the United Kingdom. Figure 8 shows that around 50% of cars sold in Australia that were assessed in 2006-2007 are rated at 2 stars or greater, whereas the equivalent segment of sales in France and the UK are rated at 3 stars or greater.

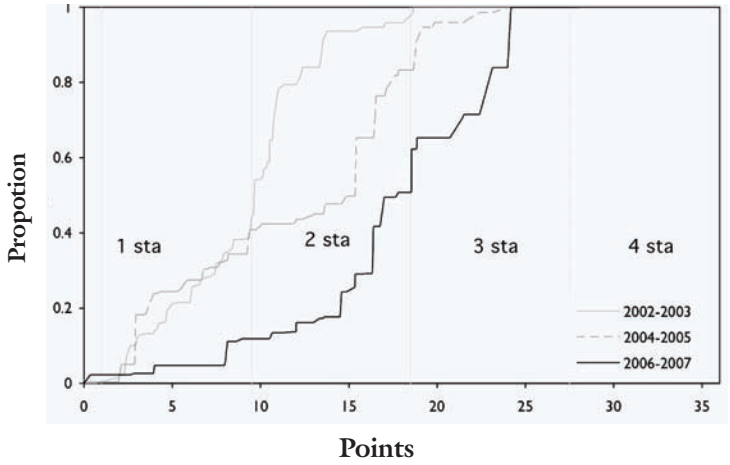

Figure 7 Cumulative UK new car fleet performance by assessment period. Sales volumes from calendar year 2006.

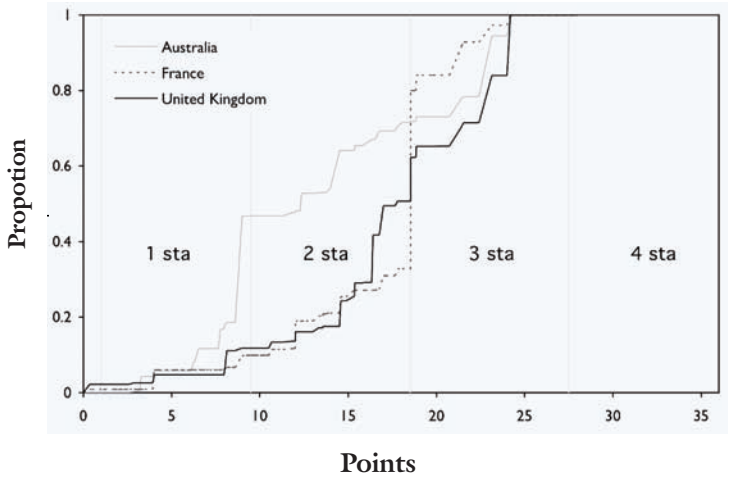

Figure 8 New car fleet performance of vehicles in Australia, France and the United Kingdom assessed in 2006-07.

Discussion and conclusions

This analysis has shown a gap in pedestrian safety performance between the new car fleets of Australia and the new car fleets of France and the United Kingdom. One implication of these differences is that pedestrians who are struck in Australia by a new vehicle are around 65% more likely to be struck by a one-star vehicle than pedestrians in France and around 33% more likely than a pedestrian in the United Kingdom. The prevalence of 3-star cars in the new car fleet is similar in each country and relatively low: under 20%.

Delaney et al. [12] could not detect a difference in real-world pedestrian injury outcomes between one-star and two-star cars in Europe, and so the real-world safety implication of the difference between Australia and the two European countries examined here is not clear – our assumption has been that Euro NCAP/ANCAP-style pedestrian testing is related to pedestrian safety. A positive relationship between the head impact component of the test and real-world outcomes has been demonstrated before [13]. Additionally, our comparison of the fleet rating of recently released models shows a much wider gap between the Australian and European passenger cars, with a greater proportion of newer model, new vehicles rated at three-star being sold in France and the UK. These newer models are all required to meet Phase I of the European Directive on pedestrian safety.

The analysis here suggests that the introduction of regulation in Europe is associated with changes in the Euro NCAP performance of the French and British fleets that is discernibly greater than changes in the equivalent segment of the Australian new car fleet. This might suggest that regulation has sped the introduction of vehicle countermeasures related to pedestrian protection into the European fleet. Similar regulations in Australia might have a similar effect.

Acknowledgements

The authors thank Michael Paine for providing detailed Euro NCAP data.

The authors also wish to declare that the Centre for Automotive Safety Research is contracted to ANCAP to provide testing services for the pedestrian assessment of new vehicles sold in Australia.

The Centre for Automotive Safety Research receives core funding from the Motor Accident Commission (South Australia) and DTEI. The views expressed in this report are those of the authors and do not necessarily represent those of the University of Adelaide, ANCAP or CASR's sponsors.

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Moped Crashes in Queensland

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This paper was originally presented at the 2007Road Safety Research, Policing and Education Conference held in Melbourne.

Abstract

Motor scooter and moped sales are booming, but little is known about their crash involvement. In Queensland, most scooters are mopeds which can be ridden with a car licence only. This paper begins by defining scooters and mopeds and discussing the difficulties in identifying them in crash and other data bases. It then presents the results of analyses of moped crashes identified from crash and registration data supplied by Queensland Transport.

The registration data classed 227 vehicles in crashes as mopeds but further examination of make and model information identified an additional 79 mopeds. The number of moped crashes increased from 25 in 2001 to 97 in 2005, with larger percentage growth in crashes of riders licensed in Queensland than elsewhere. The most common crash types were “angle” (37%) and “fall from vehicle” (23%).

Moped crashes were more likely to occur in tourist areas, on weekdays and in low speed zones than motorcycle crashes. The distributions of crash type and crash severity were similar. Moped riders in crashes were much more likely than motorcycle riders to be female (37.9% versus 7.2%), younger and hold an interstate (10.8% versus 1.3%) or overseas licence (7.8% versus 0.7%).

The challenges in interpreting the results of the analyses of the crash data are discussed.