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SAFETY ANALYSIS OF AUSTRALIAN CONCESSIONAL VEHICLE IMPORTS

by

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Abstract:

The Motor Vehicle Standards Act in Australia allows for limited volumes of vehicles to be imported that do not comply with the full requirements of the national standards. These vehicles are referred to as concessional vehicles. The objective of this study was to provide scientific assessment of the safety performance of vehicles imported to Australia under the concessional scheme. Two dimensions of safety performance were considered: Primary Safety (the risk of being involved in a crash) and Secondary Safety (the risk of sustaining an injury as an occupant of the concessional vehicle once the crash has occurred). The primary and secondary safety of concessional vehicles within the 4 main concessional schemes (Low Volume, Personal Imports, Pre 1989 and RAWS) was compared to non-concessional vehicles of similar years of manufacture. The analysis aimed to measure only the influence of vehicle related factors, including design and safety feature specification, on primary and secondary safety performance by controlling, as far as possible, for non-vehicle related factors such as driver characteristics and crash circumstances.

On average, concessional vehicles were found to have a higher crash risk relative to comparable non-concessional vehicles. Both Low Volume and RAWS vehicles were estimated to have statistically significantly higher crash risk than non-concessional vehicles of between 13.7% and 24.7%. The estimated crashworthiness of Personal Import, RAWS and Low Volume concessional vehicles was not statistically significantly different to non-concessional vehicles of similar years of manufacture. However, the crashworthiness of Pre 1989 vehicles was statistically significantly better than similar age non-concessional vehicles.

Key Words:
vehicle safety, crash risk, crashworthiness, injury outcome, used imported vehicle

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Preface

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Contributor Statement

Associate Professor Stuart Newstead	Study design, manuscript preparation and project management
Ms Linda Watson	Data preparation and analysis – secondary safety effects
Ms Laurie Budd	Data preparation and analysis – primary safety effects

Ethics Statement

Ethics approval was not required for this project.

Contents

EXECUTIVE SUMMARY

The Motor Vehicle Standards Act in Australia allows for limited volumes of vehicles to be imported that do not comply with the full requirements of the national standards. These vehicles are referred to as concessional vehicles. The objective of this study was to provide scientific assessment of the safety performance of vehicles imported to Australia under the concessional scheme.

Two dimensions of safety performance were considered: Primary Safety (the risk of being involved in a crash) and Secondary Safety (the risk of sustaining an injury as an occupant of the concessional vehicle once the crash has occurred). The primary and secondary safety of concessional vehicles within the 4 main concessional schemes (Low Volume, Personal Imports, Pre 1989 and RAWS) was compared to non-concessional vehicles from similar years of manufacture.

The analysis aimed to measure only the influence of vehicle related factors including design and safety feature specification, on primary and secondary safety performance by controlling as far as possible for non-vehicle related factors such as driver characteristics and crash circumstances. To achieve this, primary safety analysis was based on induced exposure techniques which use a crash type not influenced by vehicle primary safety to represent the influence of vehicle exposure and driver characteristics on crash type. Secondary safety was estimated using regression techniques modelling injury outcome as a function of concessional and non-concessional vehicle groups whilst controlling for a range of non-vehicle related factors available in the data. Analysis of both primary and secondary safety effect was based on crashes reported to police in Victoria, Western Australia, South Australia, Queensland and New South Wales over the years 2000 to 2012. Concessional vehicles were identified in the crash data through using Vehicle Identification Numbers to match records on concessional vehicle imports provided by the Commonwealth Government to vehicle details in the crash data.

On average, concessional vehicles were found to have a higher crash risk relative to comparable non-concessional vehicles. Across all concessional vehicle categories, a statistically significantly 13.6% increased crash risk was estimated. Analysis suggested different relative crash risk increases by concessional scheme type. Crash risk for Low Volume and RAWS vehicles were both statistically significantly higher than non-concessional vehicles by 13.7% and 24.7% respectively. In contrast the relative risk estimates for Personal Imports and Pre 1989 vehicles were not statistically significantly different from non-concessional vehicles, the former a reflection of the relatively small number of Personal Import vehicles.

The estimated crashworthiness of RAWS and Low Volume concessional vehicles was not statistically significantly different from non-concessional vehicles of similar years of manufacture. There was some indication the crashworthiness of Personal Imports was poorer than comparable non-concessional vehicles although this difference was not statistically significant. The crashworthiness of Pre 1989 vehicles was estimated to be around 25% better than similar age non-concessional vehicles with this difference being statistically significant at the 5% level.

1. BACKGROUND AND OBJECTIVES

After agreement from the minister in January 2014, the Department of Infrastructure and Regional Development commenced a legislative review of the *Motor Vehicle Standards Act 1989*. The Act delivers national vehicle standards for new motor vehicles and regulates the first supply of used imported vehicles to the Australian market. The review is looking to identify options to reduce the regulatory burden on business and improve the safety, environmental and anti-theft provisions of the legislation.

The Act allows for limited volumes of vehicles to be imported that do not comply with the full requirements of the national standards (referred to as concessional vehicles). For this reason, concessional vehicles are perceived as less safe by many stakeholders and are often criticised as undermining the safety objective of the Act. To date this perception has not been tested through the scientific analysis of real world data on the safety performance of concessional vehicles.

The objective of this study was to provide scientific assessment of the safety performance of vehicles imported to Australia under the concessional schemes. Two dimensions of safety performance were considered;

1. Primary Safety: the risk of being involved in a crash.
2. Secondary Safety: the risk of sustaining an injury as an occupant of the concessional vehicle once the crash has occurred.

Vehicles imported to Australia under the concessional scheme enter the fleet at a variety of ages. Due to progressive improvements in vehicle secondary safety over time demonstrated for the Australian vehicle fleet, allowing second hand vehicles to enter the Australian fleet in place of new vehicles is likely to have an impact on the overall safety of the fleet. Establishing whether and to what degree concessional vehicles impact the age profile and hence average safety of vehicles in the Australian fleet was not an aim of this study. Rather, the aim of this study was to examine the primary and secondary safety performance of concessional vehicles relative to vehicles of the same years of manufacture imported new to Australia and hence complying with all the required Australian Design Rules in force at the time of manufacture of the concessional vehicles.

Concessional vehicles in Australia have been allowed entry under 4 different schemes:

- **Pre 1989:** allows for the approval of applications to import road vehicles not fitted with identification plates that were manufactured before 1 January 1989. This option caters for the importation to Australia of older vehicles including enthusiast, classic or historic motor vehicles that are destined for restoration and hobby use. The option permits the importation of vehicles which do not comply with current Australian vehicle standards, and are therefore outside normal certification arrangements. However state and territory registration requirements generally require that the vehicles comply with the standards that applied at the date the vehicle was originally manufactured.

- **Personal imports:** allows migrants settling in Australia, and expatriate Australian citizens returning permanently to Australia after a long period overseas, to bring their personal road vehicle with them, where the vehicle has been owned and used for a period of 12 months or longer. The personal import option only covers individuals.

- **Registered Automotive Workshop Scheme (RAWS)**: allows for the importation and supply of used specialist or enthusiast vehicles to the market in Australia. Under this scheme only a Registered Automotive Workshop can import a used vehicle into Australia. A Registered Automotive Workshop is a business that has been approved to import and plate up to 100 used vehicles (per vehicle category), per year. The vehicles imported are to be on the Register of Specialist and Enthusiast Vehicles (with the exception of unrestricted used motorcycles). RAWS arrangements do not apply for vehicles manufactured before 1 January 1989.
- **Low Volume Scheme**: The Low Volume Scheme for new vehicles allows for the supply to the market of up to 25 or 100 vehicles per year per vehicle category. The Scheme provides a major concession in that it allows alternative forms of evidence to be submitted against some of the ADRs. In the main this applies to ADRs where destructive or expensive testing is required. The Low Volume Scheme for new vehicles is limited to vehicle make/models that are on the Register of Specialist and Enthusiast Vehicles. Until the RAWS scheme was introduced in 2002, the Low Volume Scheme also covered used vehicles.

This study aimed to measure the safety performance of concessional vehicles within each of the 4 importation schemes separately relative to non-concessional vehicles of similar age profile to those imported under each scheme.

Results of an analysis of the level of safety of concessional vehicles against the general vehicle population was anticipated to provide objective and scientifically rigorous evidence to inform the future policy direction on concessional vehicle rules. Ultimately it will inform the regulatory impact assessment process.

2. DATA AND METHODS

2.1 CRASH DATA

Data on crashes reported to police in the five largest states of Australia formed the basis for the analysis of concessional vehicle safety. Police reported crash data used in this project were originally provided for the Used Car Safety Ratings and included data from: New South Wales (NSW), Victoria (VIC), Queensland (QLD), Western Australia (WA) and South Australia (SA). The data for each state were supplied respectively by *Transprt for New South Wales* (TfNSW and the former RTA) in NSW, *VicRoads* in Victoria, *Queensland Transport*, Western Australian *Department of Main Roads* and the *Road Crash Information Unit of the Department of Transport, Energy and Infrastructure* in SA. This data covered the years, 2001-2012. Fields in the data cover crash circumstances, details of vehicles involved and peopled injured in the crash.

NSW, QLD, SA and WA crash data records were for crashes that resulted in death or injury or a vehicle being towed away. WA and SA data records also included crashes where property damage was greater than a defined sum (which was defined as $3000 after July 1 2003). Crashes are reported to the Police in Victoria if a person is killed or injured, if property is damaged but names and addresses are not exchanged, or if a possible breach of the Road Traffic Regulations has occurred. This means that uninjured records from the Victorian data are incomplete and only crashes involving injury are reliably reported in Victoria.

2.1.1 Vehicle Model Identification

Analysis was restricted to crash records for light passenger and light commercial vehicles. To identify the target vehicle population, a procedure initially developed by the NRMA based on decoding Vehicle Identification Numbers (VIN) or chassis numbers was extended and used as the primary means to determine the models of light vehicles manufactured from 1982. The decoding identified some light truck and unusual commercial models that were not considered further. Of the light passenger vehicles manufactured during 1982-2012 around 95% had their model identified by the VIN decoder.

RACV, Transport for NSW, NRMA, and VicRoads provided advice on the particular models that had experienced substantial changes in design and safety specification (and hence potential crashworthiness) and in which years the design and safety specification was relatively constant. This was validated and supplemented by information from Redbook on vehicle specification. This resulted in models being grouped into ranges of years of manufacture with homogeneous safety design and specification for analysis.

Vehicles were also classified into market groups to define those most directly comparable with the concessional vehicle fleet. The market groups defined are based heavily on those used by the Federal Chamber of Automotive Industries (FCAI) for reporting Australian vehicle sales as part of their VFACTS publication (see www.fcai.com.au for further details). The 10 market groups considered in the analysis are as follows with a broad description of the classification criteria used to define each (although the criteria are not strictly applied and some judgement on classification used according to where a vehicle is classified by VFACTS).

Passenger Cars

Light	Passenger car, hatch, sedan, coupe or convertible 3 or 4 cylinder engine, up to1, 500 cc, tare mass < 1150kg.
Small	Passenger car, hatch, sedan, wagon, coupe or convertible 4 cylinder engine, 1,501 cc - 2,000 cc, tare mass 1150-1350kg.
Medium	Passenger car, hatch, sedan, wagon, coupe or convertible 4 cylinder engine, 2,001 cc upward, tare mass 1350-1550kg.
Large	Passenger car, hatch, sedan, wagon, coupe or convertible 6 or 8 cylinder engine, tare mass > 1550kg.
People Movers	Passenger usage seating capacity > 5 people.

Sports Utility Vehicles (also called Four Wheel Drive Vehicles) (high ground clearance, wagon generally with off road potential)

SUV Small	Index rating < 550 (typically less than 1700kg tare mass)
SUV Medium	Index rating 550 - 700 (typically between 1700kg and 2000kg tare mass)
SUV Large	Index rating > 700 (typically greater than 2000kg tare mass)

Light Commercial Vehicles

Van	Blind & window vans.
Utility	Two and four wheel drive, normal control (bonnet), utility, cab chassis and crew-cabs.

The classification of SUV vehicles is based on an index developed by VFACTS that considers gross vehicle mass, maximum engine torque and the availability of a dual range transmission. The index typically classifies the vehicles roughly by tare mass as indicated on the classifications above.

2.1.2 Identification of Concessional Vehicles

The Commonwealth Government Department of Infrastructure and Regional Development provided a full list of all vehicles that have been approved for importation into Australia under the 4 concessional vehicle schemes over the years 2000 to 2013. The database included the following fields:

- Date of approval through the concessional scheme
- Concessional Scheme
- Year of manufacture
- Vehicle make
- Vehicle model
- Vehicle Identification Number (VIN)

Concessional vehicles were identified in the police reported crash data assembled for analysis through matching the concessional vehicle list to the crash data via the vehicle identification number. Where available in the crash data, vehicle make and model were used to verify the match.

Table 1 shows the number of concessional vehicles imported into Australia over the years 2000 to 2013 by concessional scheme. Over 236,000 vehicles have been approved under these schemes with historic vehicles being the most prevalent scheme followed by RAWS, and Low Volume with personal imports being the least prevalent scheme at only 9.3% of concessional imports.

Table 1: *Concessional vehicles approved, selected schemes and types, from 2000-01 to 2012-13*

Total		
Vehicles approved	236,188	100.0%
Historic vehicles		
Pre-1989 vehicles	97,089	41.1%
Mainstream concessional vehicles		
Personal import vehicles	21,969	9.3%
RAWS		
RAWS test vehicles	3,551	1.5%
RAWS cars	66,132	28.0%
Total	69,683	29.5%
Low volume		
Low volume	47,447	20.1%

Concessional vehicles appearing in the data were assigned one of the 5 following broad market groups, consistent with the market groups assigned to non-concessional vehicles:

1. Passenger cars (light, small, medium and large)
2. SUVs (small, medium and large) and people movers
3. Light commercial vehicles (van and utility body type, <3.5t tare mass)
4. Motorcycles
5. Racing Track vehicles
6. Heavy Vehicles

Since the available comparison data for non-concessional vehicles does not include groups 4, 5, and 6 above, concessional vehicles from these groups were excluded from the primary safety analysis as well as the secondary safety analysis. Table 2 shows the resulting number of concessional vehicles appearing in the crash data by scheme type and year of manufacture. A total of 7561 vehicles crashed over the years 2001 to 2012. For each scheme, the majority of vehicles were manufactured over the period 1990 to 2000 except for the Pre 1989 scheme. Some vehicles in the Pre 1989 scheme were identified with 1989 and 1990 years of manufacture which may be the result of known errors in recording year of vehicle manufacture of up to 2 years. This did not affect the validity of the analysis.

Table 2: *Concessional vehicles by scheme type and year of manufacture appearing in the police reported crash data*

Year of Manufacture		Concessional Group				Total
		Low Volume	Personal Import	Pre 1989	RAWS	
	1932	0	0	1	0	1
	1956	0	0	1	0	1
	1957	0	0	1	0	1
	1959	0	0	2	0	2
	1960	0	0	1	0	1
	1961	0	0	1	0	1
	1963	0	0	3	0	3
	1964	0	0	1	0	1
	1965	0	0	3	0	3
	1966	0	0	8	0	8
	1967	0	0	5	0	5
	1968	0	0	9	0	9
	1969	0	0	5	0	5
	1970	0	0	3	0	3
	1971	0	0	2	0	2
	1972	0	0	2	0	2
	1973	0	0	4	0	4
	1974	0	0	3	0	3
	1976	0	0	2	0	2
	1978	0	0	4	0	4
	1979	0	0	1	0	1
	1980	0	0	2	0	2
	1981	0	0	7	0	7
	1982	0	0	16	0	16
	1983	0	1	24	0	25
	1984	0	0	46	0	46
	1985	0	1	66	0	67
	1986	0	3	219	0	222
	1987	1	7	308	0	316
	1988	17	8	642	0	667
	1989	64	10	719	1	794
	1990	130	26	260	8	424
	1991	424	34	0	72	530
	1992	383	41	0	76	500
	1993	701	48	0	304	1053
	1994	337	55	0	278	670
	1995	329	38	0	301	668
	1996	125	28	0	302	455
	1997	47	38	0	170	255
	1998	31	21	0	170	222
	1999	21	26	0	112	159
	2000	17	23	0	66	106
	2001	15	12	0	54	81
	2002	14	8	0	36	58
	2003	6	6	0	63	75
	2004	10	9	0	32	51
	2005	3	5	0	3	11
	2006	3	2	0	4	9
	2007	1	3	0	1	5
	2008	0	1	0	2	3
	2009	0	0	0	1	1
	2010	0	0	0	1	1
Total		2679	454	2371	2057	7561

2.2 PRIMARY SAFETY ANALYSIS

Estimating crash risk associated with various vehicle types directly requires comprehensive information on the exposure of each vehicle to risk. Whilst information on the number of vehicles registered is generally available, this is considered inadequate on its own for measuring risk as it does not reflect the amount a vehicle actually travels or the environments in which it travels which can both influence measured crash risk. Detailed travel exposure data for various vehicle types, including concessional vehicles, is not available. Furthermore, since the focus of the analysis here is the contribution of the concessional vehicle itself to crash risk, other factors affecting crash risk such as driver and vehicle use characteristics that might vary between vehicle types need to be adequately controlled in the crash risk analysis. Like exposure data, driver and vehicle use characteristics are also not generally available for the estimation of crash risk.

Due to lack of suitable data to estimate crash risk directly, an alternative methodology was adopted in this study to measure relative crash risk of concessional vehicles compared to non-concessional vehicles. The methodology, known as induced exposure, uses involvement of vehicles in crash types likely to be unrelated to the primary safety performance of the vehicle. The rate of these crashes is then compared to the rate of crashes likely to be influenced by vehicle primary safety performance. The ratio between crashes influenced and not influenced by vehicle primary safety can then be compared across vehicle type with the difference in the ratio between vehicles representing a measure of relative crash risk between the vehicle types.

The advantage of using induced exposure techniques to measure relative crash risk is that they intrinsically control for many non-vehicle related factors affecting crash risk, such as driver characteristics, since these will generally be the same across the influenced and non-influenced crash types. Induced exposure techniques also overcome the key problem of not having travel exposure information. This methodology has been applied successfully in the past to estimate crash risk changes related to a number of vehicle related attributes such as the effectiveness of electronic stability control systems (Lie, Tingvall et al. 2006, Scully and Newstead 2008) and vehicle colour (Newstead and D'Elia 2010).

Application of induced exposure methods to estimate relative crash risk requires the identification of crash type unaffected by vehicle primary safety performance. Following the methods used to evaluate electronic stability control (Scully and Newstead 2008), side impact crashes involving another vehicle were used as the exposure inducing crash type. This crash type was used in the evaluation of ESC since it was deemed to be unrelated to vehicle handling characteristics, instead being a relatively random event with the frequency proportional to the vehicle's exposure to travel on the road network. All crash types other than multi vehicle side impacts were considered as potentially influenced by vehicle primary safety performance. Primary safety of concessional vehicles was estimated relative to non-concessional vehicles by comparing the ratio of non-side impact multi vehicle crashes to multi-vehicle side impact crashes involving concessional vehicles to the same ratio in crashes involving non-concessional vehicles. As noted, this provides an estimate of crash risk in the concessional vehicles relative to the non-concessional vehicles and not an estimate of absolute crash risk for either vehicle group. The mathematical formation of the analysis model is provided in the next sub-section of the report.

Confounding is possible in induced exposure analyses, in this instance when non-vehicle related factors linked to crash risk are not distributed between the primary safety sensitive (non-side impact) and induced exposure (multi-vehicle side impact) crash types in the same proportions for concessional and non-concessional vehicles. Where distributional differences are found for a factor, the analysis must be stratified by levels of this factor to control for confounding. Such an analysis was carried out in this study with the results described in the next section.

2.2.1 Primary Safety Data Preparation and Analysis

Crash data over the years 2001 to 2012 from the 5 available Australian states described in Section 2.1 with concessional vehicles identified were used for the primary safety analysis. Crashes for non-concessional passenger vehicles identified with a valid market group identified and manufactured between 1982 and 2000 (exclusive) were used as the comparison set of crashed vehicles. These vehicles were chosen because most of the concessional vehicles were manufactured between 1982 and 2000.

As described, side impact crashes in multi-vehicle crashes were identified as the induced exposure crash type for the statistical analysis. The method for identifying side impact crashes was different with each jurisdiction. For Queensland, Victoria and Western Australia, a variable indicating a side impact collision point for the vehicle was available. Side impact crash points for Queensland were: front right mudguard, front right door, rear right door, rear right mudguard, front left mudguard, front left door, rear left door and rear left mudguard. Side impact crash points for Victoria were: right side forward, right side rearward, left side forward and left side rearward. Side impacts for Western Australia were listed as ‘S’ in a two-vehicle crash. For WA, if the number of vehicles involved was missing, or greater than one, and the vehicle could be identified as stationary, and side impacted, then it was also selected.

If the impact point code was missing in Queensland, Victoria and Western Australia and the accident type (DCA – Definition for Classifying Crashes) variable was not missing, DCA was used to identify possible side impact crashes. These included: all vehicles from adjacent direction DCAs, vehicles from vehicle from the same direction (side swipe, lane change not overtaking, right turn side swipe and left turn side swipe only), manoeuvring (u-turn, leaving and entering parking, emerging from driveways and footpaths only), overtaking (pulling out and cutting in only). The side impacted vehicles could not be distinguished however none of these crash types were considered likely to be linked to vehicle secondary safety performance but rather were a consequence of driver error. Consequently all vehicles involved in these crashes where impact point was missing were included in the induced exposure crash set. If the side impact crash variable was missing and the DCA variable was missing in the Queensland data, ancillary crash type variables were used to identify possible side impact crashes including the incident nature variable.

For NSW and South Australia, vehicles identified as the non-key (second NSW involved unit) or not responsible unit (SA), in right-angle and other angle first impact (NSW), or sideswipes, turns right angles and hit parked vehicle (SA), multi-vehicle crash types were considered to have been impacted on the side by the key /responsible unit. These were allocated as the induced exposure crash type. Remaining crashes were allocated as sensitive to vehicle primary safety. All NSW vehicles other than the second unit in these crash types were considered not to be side impacted. For NSW a manoeuvring variable could indicate whether a vehicle was parked or stopped. Parked vehicles in multivehicle crashes, not of the rear-end type, were considered to have a side impact if they were listed third or higher in two-vehicle first impact crash types or second or higher in single vehicle first impact crash types.

Data from all jurisdictions were combined for analysis. The total crash counts for concessional vehicles by scheme and non-concessional vehicles for induced exposure and primary safety sensitive crash types is shown in Table 3.

Table 3: *Number of crashed vehicles by classification used in the induced exposure crash risk analysis.*

		Non-concessional Vehicles		Concessional Vehicles	
		Primary safety sensitive crashes	Induced exposure crashes	Primary safety sensitive crashes	Induced exposure crashes
		Count	Count	Count	Count
Import Scheme	Low Volume			2212	523
	Personal Import			382	86
	Pre-1989			2065	522
	RAWS			1745	377
	Control (non-concessional)	933378	258218		

The next step was to examine the distributional balance for concessional vehicles and non-concessional vehicles between induced exposure and primary safety sensitive crash types for potential analysis confounding factors. Potential confounding factors that could be reliably identified within each state data set included the state of crash, driver age and sex, broad vehicle market group and speed zone of crash. The right hand side of Table 4 shows the distribution of these factors across induced exposure and primary safety sensitive crash types within concessional and non-concessional vehicle groups. The left hand side of Table 4 shows the raw frequency data from which the proportions are calculated. Overall, the distribution of factors between crash categories is similar between concessional and non-concessional vehicles except for some notable exceptions. These are jurisdiction of crash and missing levels of driver age and sex. To avoid confounding effects on the analysis, data with missing driver age and sex was excluded from the analysis. The analysis was also stratified by state of crash to control for the effects of this factor.

Table 4: *Distribution of potential analysis confounding factor levels across induced exposure and primary safety sensitive crash types within concessional and non-concessional vehicle types.*

		Non-concessional Vehicles		Concessional Vehicles		Non-concessional Vehicles		Concessional Vehicles	
		Primary safety sensitive crashes	Induced exposure crashes	Primary safety sensitive crashes	Induced exposure crashes	Primary safety sensitive crashes	Induced exposure crashes	Primary safety sensitive crashes	Induced exposure crashes
		Count	Count	Count	Count	Row %	Row %	Row %	Row %
Jurisdiction	NSW	443717	146274	176	73	75%	25%	71%	29%
	VIC	123694	15118	638	59	89%	11%	92%	8%
	QLD	167325	62476	1628	465	73%	27%	78%	22%
	WA	467885	94053	2266	401	83%	17%	85%	15%
	SA	263507	84646	1696	510	76%	24%	77%	23%
Driver Sex	Unknown	39414	51801	203	140	43%	57%	59%	41%
	Female	601309	154562	1257	332	80%	20%	79%	21%
	Male	825405	196204	4944	1036	81%	19%	83%	17%
Driver Age Group	Unknown/missing	139626	66051	750	184	68%	32%	80%	20%
	25 to 59	781852	206474	2407	611	79%	21%	80%	20%
	Up to 25	390783	86725	2862	615	82%	18%	82%	18%
	60 and over	153867	43317	385	98	78%	22%	80%	20%
Speed Zone	missing/unknown	136360	26074	746	125	84%	16%	86%	14%
	Up to 75 kmh	1064447	343345	4501	1223	76%	24%	79%	21%
	80 and above kmh	265321	33148	1157	160	89%	11%	88%	12%
Condensed concessional vehicle market groups	L,M,S,Lght cars	1146775	323476	4836	1166	78%	22%	81%	19%
	S,M,L SUV and PM	162372	40140	954	224	80%	20%	81%	19%
	Light Commercial Vehicles	156981	38951	614	118	80%	20%	84%	16%

Following the methodology of previous induced exposure crash risk studies, a Poisson regression model was fitted to the data to estimate crash risks in each of the concessional vehicle classes relative to the control (non-concessional) vehicles. Having established the need to stratify the analysis by jurisdiction of crash, the form of the analysis model is given by Equation 1.

$$\ln(y_{cvs}) = \propto\ + \beta_{sv} +\ \gamma_{sc} +\ \delta_{svc})\ldots\text{Equation 1}$$

In Equation 1,

y is the crash count

c is the crash type index (induced exposure, primary safety sensitive)

v is the vehicle group (concessional vehicle by scheme, non-concessional vehicles)

s is the state indicator (NSW, Vic, WA, SA, QLD)

α,β,γ,δ are parameters of the model

The relative crash risks for each concessional vehicle type are estimated from the δ parameters of the model.

Zero inflation corrections were tested in fitting the model but not required and the additional estimate error confidence band produced by Pearson's scaling for over-dispersion was small and did not change the estimated significance.

2.3 SECONDARY SAFETY ANALYSIS

The measure of secondary safety performance adopted for the analysis was the crashworthiness metric defined in the Used Car Safety Ratings (Newstead, Watson et al. 2011). Crashworthiness ratings rate the relative safety of vehicles in protecting their own occupants in the event of a crash by examining injury outcomes to drivers in real world crashes reported to police. More specifically, the crashworthiness rating of a vehicle is a measure of the risk of death or serious injury to a driver of that vehicle when it is involved in a crash. This risk is estimated from analysis of all the records of injury to drivers of each vehicle type involved in real crashes on the road and recorded in the crash reports by police. It is measured in two components:

1. Rate of injury for drivers involved in crashes where a vehicle is towed away or someone is injured (injury risk – based on records of crashes from jurisdictions recording both injury and non-injury crashes: NSW, QLD, WA, SA)

2. Rate of serious injury (death or hospital admission) for injured drivers (injury severity – based on records of injured drivers where death or hospital admission is also recorded: VIC, QLD, WA, SA).

Multiplying these two rates together forms the crashworthiness rating. This is a measure of the risk of serious injury for drivers involved in crashes where a vehicle is towed away or someone is injured. Measuring crashworthiness as a product of two components, reflecting risk and severity of injury respectively, was first developed by Folksam Insurance, which publishes the well-known Swedish ratings (Gustafsson, Hagg et al. 1989) and were first published in Australia in 1994 (Cameron, Finch et al. 1994). These ratings are estimated using an analysis method that was developed to maximise the reliability and sensitivity of the results from the available data whilst adjusting for the effects on injury outcome of non-vehicle factors that differ between vehicles. In addition to the speed zone and driver sex, the method of analysis adjusts for the effects of driver age and the number of vehicles involved, producing results with all those factors and their interactions taken into account.

In this study, each of the two components of the crashworthiness rating was obtained by logistic regression modelling techniques (Hosmer and Lemeshow 1989). Such techniques are able to simultaneously adjust for the effect of a number of factors (such as driver age and sex, number of vehicles involved, etc.) on probabilities such as the injury risk and injury severity whilst estimating the role of vehicle model, market group or year of manufacture in the injury outcome. This method has previously been used to produce the Australian and New Zealand vehicle fleet crashworthiness ratings (Newstead, Watson et al. 2011). For estimation of the crashworthiness ratings, factors in the logistic model included the available non-vehicle factors influencing injury outcome as well as the variable indicating vehicle model, market group or year of manufacture. Details of how confidence limits on the regression estimates of injury risk and severity are calculated with these techniques also being used here.

A stepwise procedure was used to identify which non-vehicle factors and their interactions had an important influence on driver injury outcome. Logistic models were obtained separately for injury risk and injury severity because it was likely that the various factors would have different levels of influence on these two probabilities. The non-vehicle factors considered in the analysis for both injury risk and injury severity were

- **sex:** driver sex (male, female)
- **age:** driver age (≤25 years; 26-59 years; ≥60 years)
- **speedzone:** speed limit at the crash location (≤75 km/h; ≥80 km/h)
- **nveh:** the number of vehicles involved (one vehicle; >1 vehicle)
- **state:** jurisdiction of crash (Victoria, NSW, SA, QLD, WA, NZ)
- **year:** year of crash (1987, 1988, … , 2013)

These variables were chosen for consideration because they were part of the Victorian, Queensland, New South Wales, South Australia, Western Australia and New Zealand databases. Other variables were only available from one source and their inclusion would have drastically reduced the number of cases that could have been included in the analysis. All data were analysed using the Logistic Regression procedure of the SAS statistical package (SAS 1999).

As well as the covariates from the list above and their interactions that are significantly related to injury outcome in the risk and severity logistic models, the final models also include a factor indicating vehicle type. For the estimation of the Used Car Safety Ratings, the vehicle type variable indicated the make and model groupings of vehicles. The aim of the analysis in this study was not to estimate ratings for concessional vehicles by make and model of vehicle but to look at the average crashworthiness of concessional vehicles within each scheme. The aim was also to compare the average crashworthiness of the concessional vehicles against the average crashworthiness of similar non-concessional vehicles.

It was not possible to compare concessional and non-concessional vehicles by specific market groups and vehicle models within market groups. Instead, comparison was made through matching vehicles of similar year of manufacture so as to reflect the regulations and typical level of safety design available at the time the concessional vehicles were manufactured. Table 2 shows the majority of low-volume import, personal import and RAWS concessional vehicles available in the data were manufactured during the 1990s whilst the majority of pre 1989 concessional vehicles were manufactured in the 1980s. To enable similar comparison, the average crashworthiness of non-concessional vehicles manufactured from 1980-1990 and from 1991-2000 was estimated to compare to the pre 1989 and all other concessional vehicle groups respectively. For comparison, the average crashworthiness of non-concessional vehicles manufactured from 2001-2010 was also estimated.

Reflecting the vehicle groupings for which average crashworthiness was to be estimated, the vehicle type factor in the logistic models of injury risk and injury severity had 7 levels defined as following:

1. Non-Concessional 1982-1990
2. Non-Concessional 1991-2000
3. Non-Concessional 2001-2012
4. Low Volume
5. Personal Imports
6. Pre 1989
7. RAWS

Table 5 gives the number of involved and injured drivers in each of the 7 categories used for the injury risk analysis and the number of injured and seriously injured or killed drivers used for the injury severity analysis. Uninjured passengers in crashes are often not recorded by police and hence could not be considered in estimating crashworthiness. Furthermore, in over 95% of crashed vehicles, the driver is the occupant sustaining the most severe injury so driver protection is one of the most critical aspects of vehicle secondary safety.

Table 5: *Number of involved and injured drivers by vehicle group for estimation of vehicle crashworthiness ratings*

Crashworthiness Analysis Data	**Injury Severity Analysis Data (Vic, QLD,SA, WA)**		**Injury Risk Analysis Data (WA, SA, QLD, NSW)**	
Vehicle Group	**Severely Injured**	**Injured**	**Injured**	**Involved**
Non-Concessional 1982-1990	35767	161255	130574	765728
Non-Concessional 1991-2000	44838	208954	200658	1126534
Non-Concessional 2001-2012	21063	92775	95108	507018
Low Volume	132	486	378	1938
Personal Imports	34	103	90	312
Pre 1989	105	394	354	1737
RAWS	171	448	323	1491
Total	**102110**	**464415**	**427485**	**2404758**

3. ANALYSIS RESULTS

3.1 RELATIVE PRIMARY SAFETY OF CONCESSIONAL VEHICLES

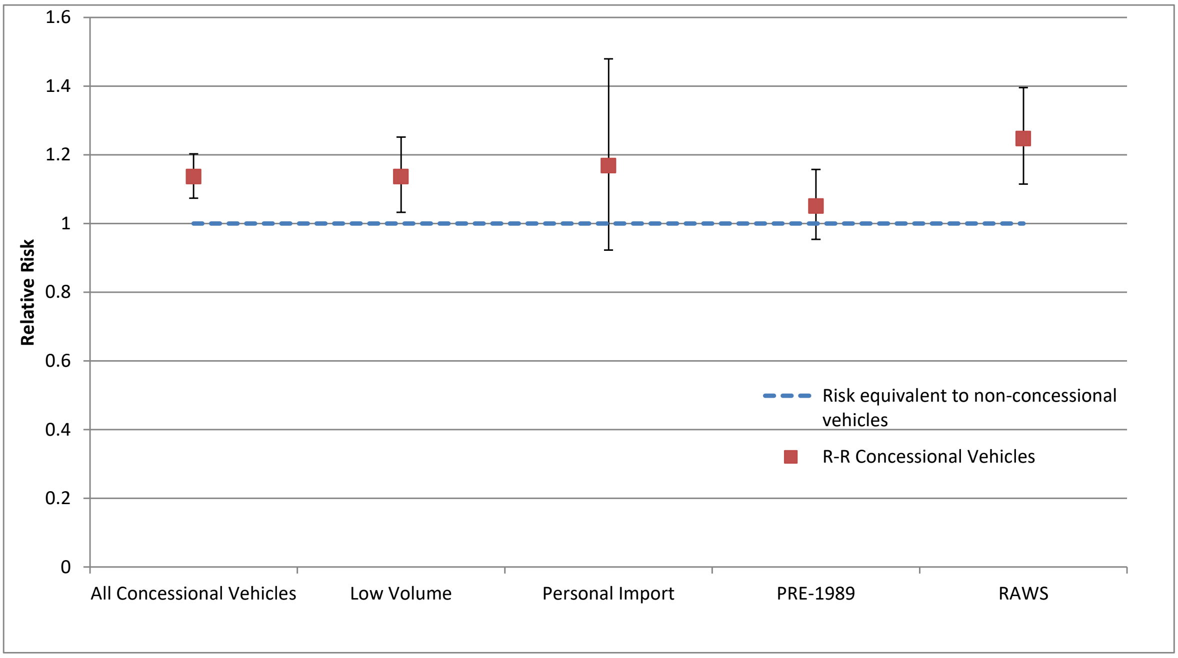
Using the data and methodology described in Section 2.2, estimates of concessional vehicle crash risk were estimated for each scheme type relative to comparable non-concessional vehicles. The resulting estimates are given in Table 6 along with statistical significance probabilities and 95% confidence limits. An average crash risk across all concessional vehicle types was also estimated. Relative risks higher than 1 indicate increased crash risk of the concessional vehicle type relative to the non-concessional vehicles. For example, RAWS vehicles were estimated to have a relative risk of 1.247, or a crash risk 24.7% higher than non-concessional vehicles. The statistical significance probability measures the probability of obtaining the relative risk estimate from the data through chance variation when the actual relative risk was 1 (i.e. there was no difference in relative risk between the concessional and non-concessional vehicles). Low statistical significance probabilities indicate that the concessional vehicle crash risk is likely different from the comparable non-concessional vehicles. The 95% confidence limits indicate the range in which the true (as opposed to the estimated) relative risk lies with 95% certainty.

Figure 1 plots the estimated relative risks and 95% confidence limits for each of the concessional vehicle types given in Table 6. The dashed line in Figure 1 is the line of equal crash risk for concessional and non-concessional vehicles. Confidence limits that do not overlap the dashed line in Figure 1 indicate a statistically significantly higher crash risk at the 5% level of significance.

Table 6: *Crash risk of concessional vehicles by scheme type relative to comparable non-concessional vehicles*

Scheme	Statistical Significance	Relative Risk (Concessional vehicles versus non-concessional vehicles)	95% Confidence Limits	
			Lower	Upper
All Concessional Vehicles	<.0001	1.136	1.073	1.203
Low Volume	0.009	1.137	1.032	1.251
Private Import	0.1961	1.168	0.923	1.480
PRE-1989	0.3156	1.051	0.954	1.158
RAWS	0.0001	1.247	1.115	1.396

Figure 1: *Crash risk of concessional vehicles by scheme type relative to comparable non-concessional vehicles*



Both Table 6 and Figure 1 show that the average crash risk across all concessional vehicles is statistically significantly higher than non-concessional vehicles by an estimated 13.6%. Different relative risks were observed by scheme type. Crash risk for Low Volume and RAWS vehicles were both statistically significantly higher than non-concessional vehicles by 13.7% and 24.7% respectively. In contrast the relative risk estimates for Personal Imports and Pre 1989 vehicles were not statistically significant. In the case of the Pre 1989 vehicles the relative risk estimate was very small at 1.05%. This suggests that if the risk of these vehicles is higher than non-concessional vehicles it is likely to only be higher by a small amount. In contrast, the estimated relative risk for the private imports was 1.168 (16.8% higher than non-concessional) with the lack of statistical significance reflecting the relatively small number of personal import vehicles compared to other concessional classes. This lack of data means the analysis could not conclusively identify whether personal import vehicles have a higher crash risk than non-concessional vehicles.

3.2 SECONDARY SAFETY OF CONCESSIONAL VEHICLES

3.2.1 Injury Risk

Injury risk was calculated by modelling the injury outcomes of the 2,404,758 drivers involved in police reported crashes in Western Australia, South Australia, Queensland and New South Wales using the logistic regression methods described in Section 2.3. The resulting estimates of relative injury risk for each of the vehicle groupings considered are shown in Table 7. Risk estimates provided in Table 7 represent the average proportion of crash involved drivers who are injured. Since the estimates are adjusted for non-vehicle related factors including driver characteristics and crash circumstances, the estimates reflect the contribution of only the vehicle group membership to the injury outcome.

Table 7 also provides statistical significance values for the estimated risks and 95% confidence limits on the risk estimates. In this instance, the statistical significance value is the probability of obtaining the risk value estimated when the real underlying risk for the vehicle group is not different to the average risk across all groups. The average risk across all vehicle groups is given in the first line of Table 7 (17.84%). The 95% confidence limit is the range in which the real underlying risk lies with 95% certainty. In the context of this analysis, the statistical significance probabilities are not particularly relevant since the comparison of interest is not of each concessional vehicle group with the average. A more relevant comparison is to compare the concessional vehicle risks and their confidence limits with the non-concessional age group averages. Figure 2 makes this comparison graphically.

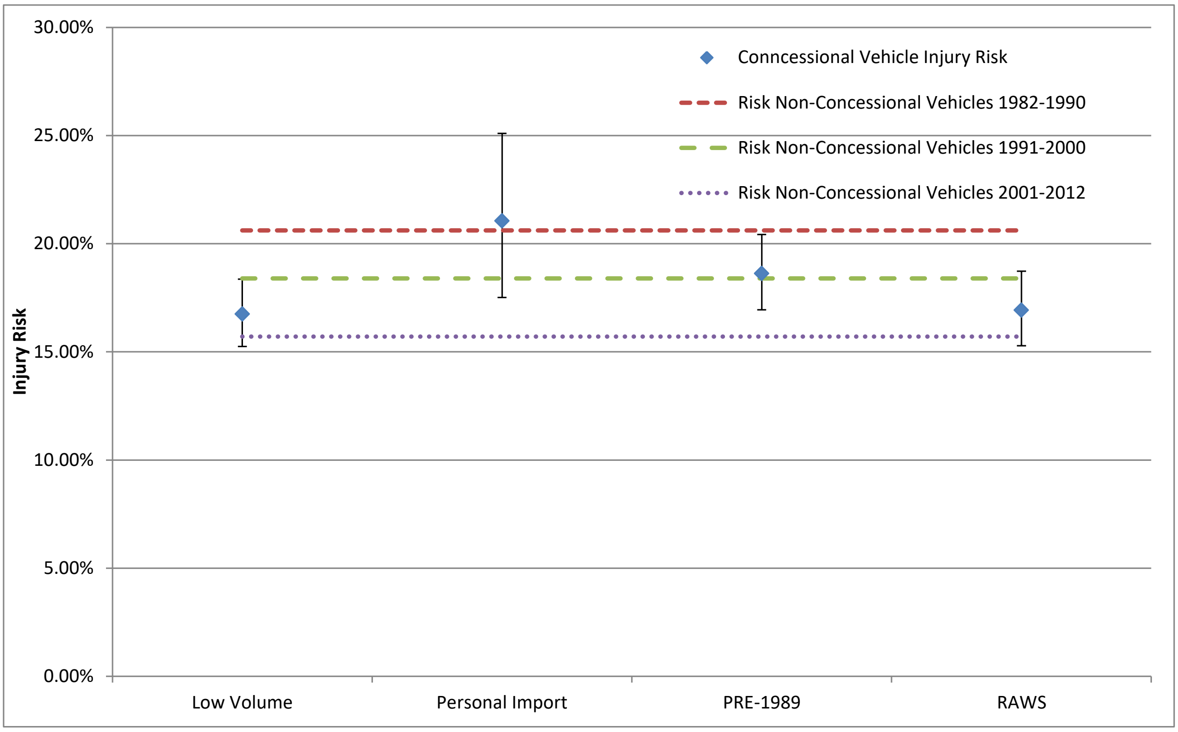
Table 7: *Adjusted average injury risk within concessional and non-concessional vehicle classes*

Vehicle Group	Statistical Significance	Risk	95% Lower CL	95% Upper CL
All Vehicle Average Injury Risk		17.84%		
Non-Concessional 1982-1990	<.0001	20.61%	19.91%	21.33%
Non-Concessional 1991-2000	0.0932	18.39%	17.75%	19.05%
Non-Concessional 2001-2012	<.0001	15.71%	15.14%	16.29%
Low Volume	0.1781	16.74%	15.24%	18.36%
Personal Imports	0.0779	21.05%	17.51%	25.10%
Pre 1989	0.3694	18.62%	16.95%	20.43%
RAWS	0.3108	16.93%	15.28%	18.72%

As noted previously, the majority of Low Volume, Personal Import and RAWS concessional vehicles were manufactured from 1991 to 2000 so the most relevant comparison of the injury risk of these concessional groups is with the injury risk of non-concessional vehicles of the same years of manufacture. The Pre 1989 concessional vehicle risk estimate should be compared with that for non-concessional vehicles manufactured from 1982-1990. The average injury risk for each of the three non-concessional groups is shown in Figure 2 along with the risk estimates and 95% confidence limits for the concessional vehicle groups.

Point estimates of injury risk for the Low Volume and RAWS vehicles suggest injury risk is actually lower than the average estimates for 1991-2000 non-concessional vehicles whilst the Personal Import vehicles have an estimated average injury risk higher than 1991-2000 non-concessional vehicles. None of these estimates are statistically significant at the 5% level as indicated by the overlap of the 95% confidence limits with the 95% confidence limits for the 1991-2000 non-concessional vehicles given in Table 7 (error bars for the non-concessional vehicles have been left off Figure 2 for clarity of presentation). The Pre 1989 vehicles also have an estimated injury risk less than the 1982-1990 non-concessional vehicles but again this is not statistically significant.

Figure 2: *Adjusted average injury risk within concessional and non-concessional vehicle classes*



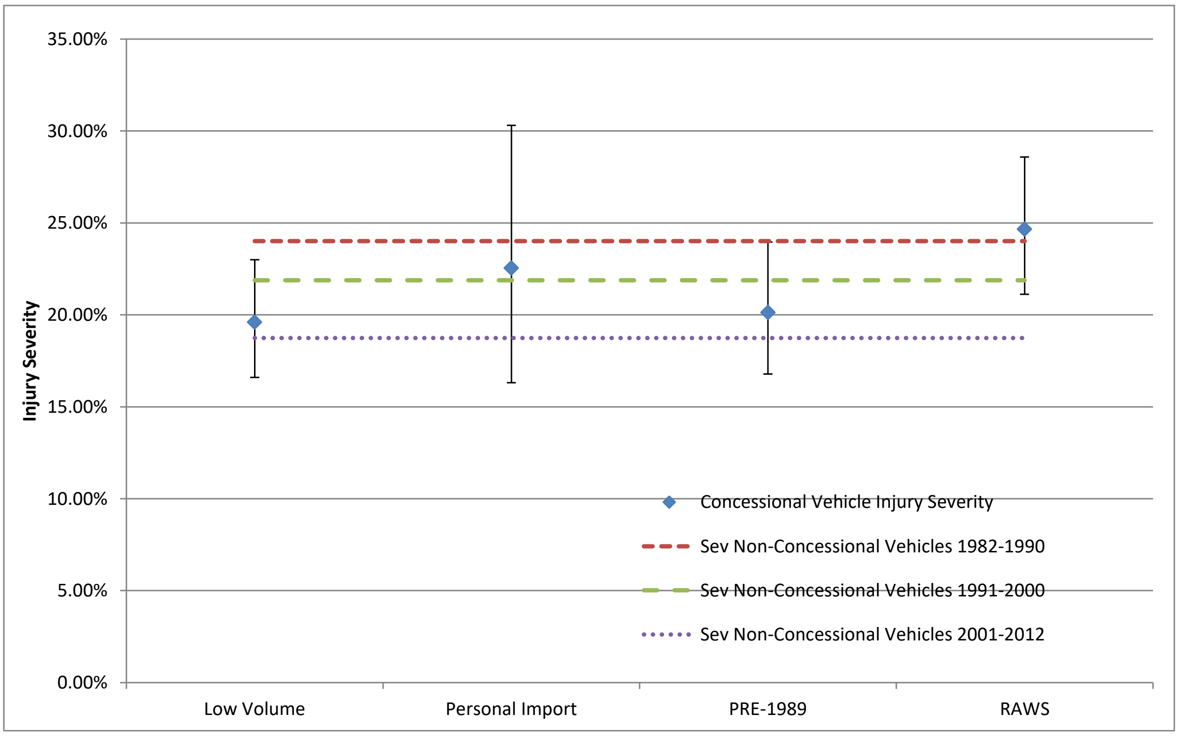
3.2.2 Injury Severity

Injury severity was calculated by modelling the level of injury sustained by the 464,415 drivers injured in police reported crashes in Western Australia, South Australia, Queensland and Victoria using the logistic regression methods described in Section 2.3. The resulting estimates of relative injury severity for each of the vehicle groupings considered are shown in Table 8. Interpretation of Table 8 is as per Table 7 again noting that the estimates are adjusted for the influence of non-vehicle related driver and crash factors. Figure 3 shows the graphical presentation of the injury severity and 95 % confidence limit by concessional vehicle group along with the average for each non-concessional comparison group. The relatively wide confidence limits on the injury severity estimates mean that none of the injury severity estimates for the concessional vehicle groups are statistically significantly different from their non-concessional comparison groups.

Table 8: *Adjusted average injury severity within concessional and non-concessional vehicle classes*

Vehicle Group	Statistical Significance	Severity	95% Lower CL	95% Upper CL
All Group Average Injury Severity		21.96%		
Non-Concessional 1982-1990	0.0033	24.01%	22.63%	25.45%
Non-Concessional 1991-2000	0.9035	21.88%	20.60%	23.21%
Non-Concessional 2001-2012	<.0001	18.74%	17.58%	19.95%
Low Volume	0.1659	19.60%	16.60%	22.99%
Personal Imports	0.869	22.55%	16.30%	30.31%
Pre 1989	0.3334	20.13%	16.78%	23.96%
RAWS	0.1396	24.66%	21.12%	28.58%

Figure 3: *Adjusted average injury severity within concessional and non-concessional vehicle classes*



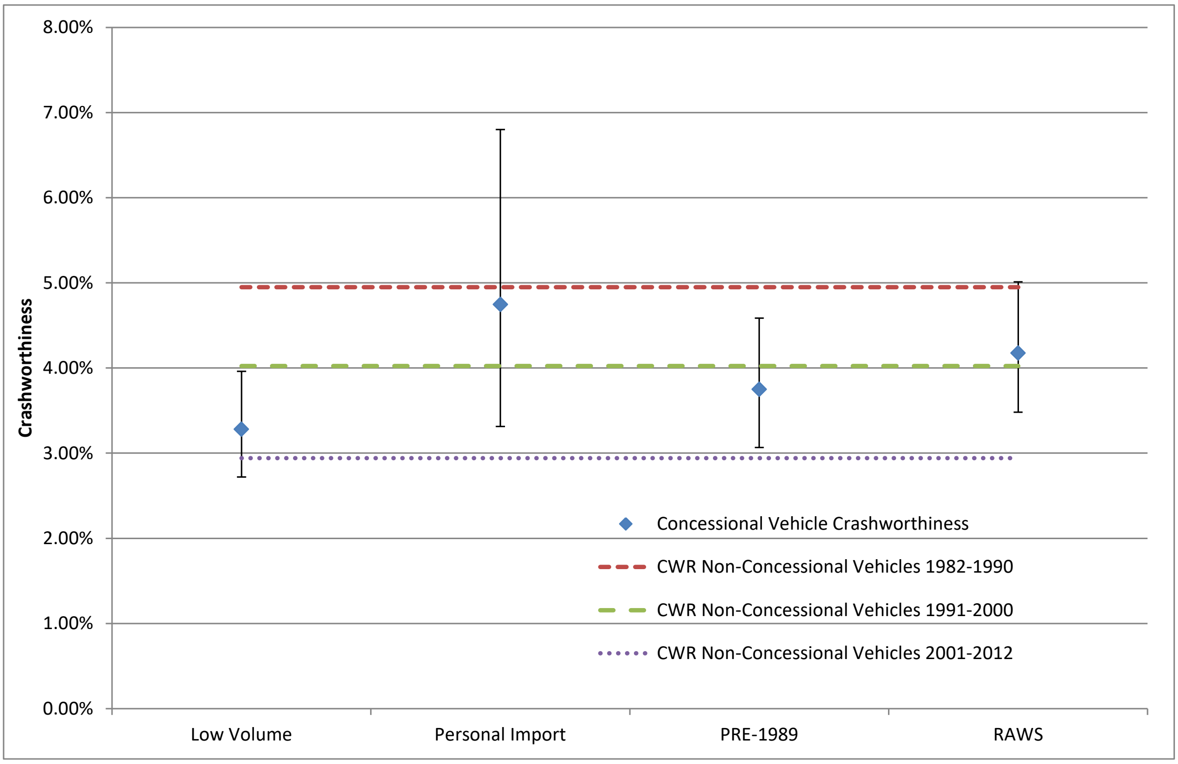
3.2.3 Crashworthiness

Estimates of crashworthiness, the proportion of drivers killed or seriously injured given involvement in a crash, were calculated by multiplying the corresponding injury risk and injury severity estimates for each vehicle group. Confidence limits for each crashworthiness estimate were calculated based on the asymptotic variance formula detailed in the Used Car Safety Ratings technical report (Newstead, Watson et al. 2011). The resulting crashworthiness estimates and 95% confidence limits are given in Table 9 and illustrated graphically in Figure 4.

Table 9: *Adjusted average crashworthiness within concessional and non-concessional vehicle classes*

Vehicle Group	Crashworthiness	95% Lower CL	95% Upper CL	95 CL Width
All Group Average Crashworthiness	3.92%			
Non-Concessional 1982-1990	4.95%	4.62%	5.30%	0.68%
Non-Concessional 1991-2000	4.02%	3.75%	4.31%	0.56%
Non-Concessional 2001-2012	2.94%	2.74%	3.17%	0.43%
Low Volume	3.28%	2.72%	3.96%	1.24%
Personal Imports	4.75%	3.31%	6.80%	3.49%
Pre 1989	3.75%	3.07%	4.58%	1.52%
RAWS	4.18%	3.48%	5.01%	1.53%

Figure 4: *Adjusted average crashworthiness within concessional and non-concessional vehicle classes*



The estimated crashworthiness of RAWS concessional vehicles is very similar to the average for non-concessional vehicles from the comparable years of manufacture 1991-2000 with the difference not being statistically significant. The point estimates of crashworthiness for Low Volume and Personal Import concessional vehicles suggests these are on average respectively safer and less safe than non-concessional vehicles manufactured from 1991-2000. However neither of these differences is statistically significant. The crashworthiness of Pre 1989 vehicles is around 25% better than similar age (1982-1990) non-concessional vehicles with this difference being statistically significant at the 5% level.

From a statistically perspective, the overlap in the 95% confidence limits for all concessional vehicle groups shows there is no statistical evidence that any one concessional group has better or worse crashworthiness than any other. This is partly a reflection of the limited crash involvement of concessional vehicles represented in the available data. Accumulation of additional crash data in the future might ultimately lead to estimates of crashworthiness that do differ between concessional schemes although it is unlikely based on current estimates that concessional vehicles would prove to be less crashworthy than non-concessional vehicles of a similar age. The only exception to this might be Personal Imports although Table 1 shows these represent less than 10% of total concessional imports.

4. DISCUSSION

This study has used real world crash data to estimate the primary and secondary safety of vehicles imported under Australian concessional vehicle import schemes relative to non-concessional vehicles in the existing Australian fleet with similar years of manufacture to the concessional vehicles. The aim of the study was to estimate, as far as possible, the influence of the vehicle attributes alone on primary and secondary safety performance through using analysis techniques that controlled for the influence of non-vehicle related factors such as travel exposure, driver characteristics and crash circumstances. Employment of high level study designs and analytical techniques allowed the research to effectively estimate the vehicle related effects on safety whilst controlling the non-vehicle related factors.

An important limitation of the analysis to acknowledge in the first instance relates to the coverage of vehicle types. The concessional vehicle import scheme in Australia includes some motorcycles and commercial vehicles. The scope of the police reported crash data available for analysis and the protocols developed for vehicle model identification only allows analysis to focus on light passenger vehicles (sedans, station wagons, hatchbacks, SUVs etc.) and light commercial vehicles (vans and utilities). Analysis of concessional vehicles was also limited to the same vehicle types to ensure comparisons could be made between similar vehicle types.

A further limitation of the data was geographical coverage as well as reporting criteria for police crash records. Data only from Australia's 5 largest states was available meaning Tasmania, the ACT and Northern Territory was not represented in the analysis. The missing states represent less than 8% of national crash data in Australia. Presuming that concessional vehicle registration is proportional to crash representation, the lack of national coverage of the data is unlikely to bias the analysis. The secondary safety analysis was also affected by different police crash reporting criteria between states. Data from NSW on serious injuries could not be used in the severity analysis whilst Victorian data could not be used in the injury risk analysis. This was also anticipated to have little effect on how representative the analysis results are on the safety performance of concessional vehicles across Australia.

Examination of the raw data on concessional vehicles both registered and crashing provides some insight into the importance of the issue of concessional vehicle safety. Records on a total of around 230,000 concessional vehicles approved for import into Australia were provided by the Department of Infrastructure and Regional Development. Given the total number of vehicles registered in the Australian fleet at the end of 2013 was around 17 million (ABS 2014), concessional vehicles represent at most 1.4% of the registered vehicle fleet presuming the majority of concessional vehicles imported are still registered. In comparison, Table 5 shows that concessional vehicles represent less than 0.3% of the total crash data. Given the identified higher crash risk for concessional vehicles in Section 3.1, the lower than expected crash involvement compared to registrations suggests concessional vehicles may either be driven less or have low absolute crash risk due to driver behaviour or vehicle use. Further detailed study of concessional vehicle exposure relative to other vehicles would be needed to verify this. Overall, concessional vehicles represent a small proportion of the registered fleet and even smaller proportion of the crashed vehicle population. Consequently the, safety performance of concessional vehicles at their current rate of importation is unlikely to have a major impact on broader road safety performance. However, this could change if the concessional scheme was expanded to allow a far greater number of imports annually.

Analysis of the relative primary safety performance of concessional vehicles found that, on average, concessional vehicles have a higher crash risk related to vehicle attributes than non-concessional vehicles. Although crash risk differences between concessional schemes were not statistically significant, there was some suggestion that the elevated risk was driven by all but the Pre 1989 vehicles and particularly the RAWS vehicles. Relative Crash risk of the Low Volume and RAWS vehicles was estimated to be statistically significantly higher than comparable non-concessional vehicles by 14% and 25% respectively. It cannot be determined from the analysis what vehicle related attributes might be driving the estimated increased crash risk. Further detailed study of specific concessional vehicles in these categories would be needed to gain an understanding. Other limitations to interpreting the crash risk estimates are discussed further below.

Analysis of the secondary safety performance of concessional vehicles showed no evidence that concessional vehicles are less crashworthy than non-concessional vehicles of comparable years of manufacture. There was some suggestion that Low Volume concessional vehicles were slightly more crashworthy than comparable non concessional vehicles and Personal Imports were slightly less crashworthy than comparable non concessional vehicles however neither of these results was statistically significant. Accumulation of additional data in the future and re-analysis might provide statistically reliable conclusions. However, given the estimated confidence limits, only the Personal Import vehicles are likely to be found to be less crashworthy than their comparison vehicles. This vehicle category has the lowest impact on overall road trauma of all concessional vehicles representing less than 10% of total concessional imports.

Ability to interpret the results of the primary and secondary safety analysis of concessional vehicles is limited somewhat due to a lack of a clear profile of the specific vehicle types and models within each concessional scheme. It was beyond the scope of the project to classify vehicles by attribute such as specific make and model or even the broad market group. This might be ultimately possible with significant additional effort although information on the specification of some vehicles might be difficult to obtain given the diversity of vehicles and their different countries of origin. A scan of the range of vehicle models in each concessional scheme revealed a great diversity in vehicle types, varying from light cars through to 4WD vans and large utilities in each scheme.

It is likely that the profile of vehicle types and market groups in the concessional vehicle schemes is different to those found in the non-concessional fleet. To a certain degree, this might be driving the observed difference in particularly primary safety performance but also possibly secondary safety performance. This is because both crash risk and crashworthiness are known to be related to vehicle market group to some degree (Keall and Newstead 2010, Newstead, Watson et al. 2011). The degree to which these differences might have influenced the estimates obtained in this study is unclear. Further work would be required specifically classifying concessional vehicles by market group and then controlling for any differences in market group between concessional and comparison vehicles to understand the impact of these differences on the results obtained. To a large degree, however, this is ancillary to the objectives of this study which was to examine whether the safety of the concessional vehicle fleet as is currently exists is different to the current non-concessional fleet comparable on the basis of year of manufacture and hence required safety standards.

5. CONCLUSIONS

The objective of this study was to provide scientific assessment of the safety performance of vehicles imported into Australia under the concessional scheme. Two dimensions of safety performance were considered: Primary Safety (the risk of being involved in a crash) and Secondary Safety (the risk of sustaining an injury as an occupant of the concessional vehicle once the crash has occurred - crashworthiness). The analysis aimed to measure only the influence of vehicle related factors including design and safety feature specification, on primary and secondary safety performance by controlling, as far as possible, for non-vehicle related factors such as driver characteristics and crash circumstances.

On average, concessional vehicles were found to have a higher crash risk relative to comparable non-concessional vehicles. Across all concessional vehicle categories, a statistically significantly 13.6% increased crash risk was estimated. Analysis suggested different relative crash risk increases by concessional scheme type. Crash risk for Low Volume and RAWS vehicles were both statistically significantly higher than non-concessional vehicles by 13.7% and 24.7% respectively. In contrast the relative risk estimates for Personal Imports and Pre 1989 vehicles were not statistically significantly different from non-concessional vehicles, the former a reflection of the relatively small number of Personal Import vehicles.

The estimated crashworthiness of RAWS and Low Volume concessional vehicles was not statistically significantly different from non-concessional vehicles of similar years of manufacture. There was some indication the crashworthiness of Personal Imports was poorer than comparable non-concessional vehicles although this difference was not statistically significant. The crashworthiness of Pre 1989 vehicles was estimated to be around 25% better than similar age non-concessional vehicles with this difference being statistically significant at the 5% level.

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