MONASH University
Accident Research Centre

VEHICLE CRASHWORTHINESS RATINGS: VICTORIA AND NSW CRASHES DURING 1987-92

SUMMARY REPORT

by

Max Cameron
Caroline Finch
Tri Le

Monash University
Accident Research Centre

February 1994

Report No. 55

Printed by the Australian Road Research Board as part of an agreement with
Monash University Accident Research Centre.

MONASH UNIVERSITY ACCIDENT RESEARCH CENTRE
REPORT DOCUMENTATION PAGE

Report No.	Report Date	ISBN	Pages
55	February 1994	0 7326 0054 5	24

Title and sub-title:

Vehicle Crashworthiness Ratings: Victoria and NSW Crashes During 1987-92

Author(s)

Cameron, M.H.
Finch, C.F.
Le, T.

Type of Report & Period Covered

Summary Report, 1992-94

Sponsoring Organisations - This project was funded through the Centre's baseline research program, for which grants have been received from Australian Road Research Board, Department of Justice, Royal Automobile Club of Victoria Ltd., Transport Accident Commission, and VIC ROADS, and by a grant from the New South Wales Roads and Traffic Authority and the NRMA.

Abstract:
Crashworthiness is the relative safety of vehicles in preventing severe injury in crashes. Crashworthiness ratings for 1982-92 model vehicles were developed based on data on crashes in Victoria and New South Wales during 1987-92. Crashworthiness was measured by a combination of injury severity (of injured drivers) and injury risk (of drivers involved in crashes). Injury severity was based on 45,000 drivers injured in crashes in the two States. Injury risk was based on 220,000 drivers involved in crashes in New South Wales where a vehicle was towed away. The ratings were adjusted for the driver sex and age, the speed limit at the crash location, and the number of vehicles involved, factors which were found to be strongly related to injury risk and/or severity. They estimate the risk of a driver being killed or admitted to hospital when involved in a tow-away crash, to a degree of accuracy represented by the confidence limits of the rating in each case. The estimates and their associated confidence limits were sufficiently sensitive that they were able to identify 26 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles which have superior or inferior crashworthiness characteristics compared with the average vehicle. However the results are based on a number of assumptions and warrant a number of qualifications which should be noted.

Key Words: (IRRD except when marked*)
Injury, Vehicle Occupant, Collision, Passenger Car Unit, Passive Safety System, Statistics

EXECUTIVE SUMMARY

During 1990, the New South Wales Road Safety Prize was awarded to the idea that a system of "Car Safety Rating" should be initiated. During the same year, the Victorian Parliamentary Social Development Committee recommended that ways should be investigated for Victorian consumers to give high priority to motor vehicle occupant protection in the vehicles they purchase. Monash University Accident Research Centre (MUARC) commenced a project to develop crashworthiness ratings (the relative safety of vehicles in preventing severe injury in crashes) and produced rating scores for 1982-90 model vehicles which were published and widely distributed during 1992.

This report describes the development of updated crashworthiness ratings for 1982-92 model vehicles based on crash data from Victoria and New South Wales. Crashworthiness was measured by a combination of injury severity (of injured drivers) and injury risk (of drivers involved in crashes). Injury severity was based on 45,000 drivers injured in crashes in the two States during 1987-92. Injury risk was based on 220,000 drivers involved in crashes in New South Wales where a vehicle was towed away.

The crashworthiness ratings were adjusted for the driver sex and age, the speed limit at the crash location, and the number of vehicles involved, factors which were found to be strongly related to injury risk and/or severity. These adjustments were made with the aim of measuring the effects of vehicle factors alone, uncontaminated by other factors available in the data which affected crash severity and injury susceptibility. A new method of analysis was employed to produce crashworthiness ratings with proportionately smaller variability than obtained by the method used previously.

The rating scores estimate the risk of a driver being killed or admitted to hospital when involved in a tow-away crash, to a degree of accuracy represented by the confidence limits of the rating in each case. The estimates and their associated confidence limits were sufficiently sensitive that they were able to identify 26 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles which have superior or inferior crashworthiness characteristics compared with the average vehicle.

It is concluded that the additional crash data has enabled the crashworthiness ratings to be obtained for a larger range of car models than previously. Together with an improved method of analysis, the new data set has been able to produce more up-to-date and reliable estimates of the crashworthiness of individual car models than those published previously. However the results and conclusions are based on a number of assumptions and warrant a number of qualifications which should be noted.

ACKNOWLEDGMENTS

A project as large and complex as this could not have been carried out without the help and support of a number of people. The authors particularly wish to acknowledge:

- Professor Peter Vulcan and Dr Brian Fildes of the Monash University Accident Research Centre (MUARC) for their constructive advice throughout the project
- Mr John Stanway, Mr Doug Kearsley and Mr David Attwood of the Transport Accident Commission (TAC) for the provision of TAC claims data
- Mr David Ryan, Mr Phil Symons and Mr Peter Green of VIC ROADS Business Services Division for the provision of data from Victorian Police crash reports
- Mr David Anderson, Mr Bob Gardner and Dr Gray Scott of VIC ROADS Road Safety Division for their continuing support for the project
- Mr Michael Griffiths and Mr Robert Ramsay of the New South Wales Roads and Traffic Authority (RTA) for their support for the project and the release of data from NSW Police crash reports
- Mr Peter Caldwell and Mr Jack Haley of the National Roads and Motorists Association (NRMA) for their support for the project and for providing procedures to determine the models of vehicles crashing in NSW
- Ms Maria Pappas of the NRMA who developed and applied the procedures to determine the models of vehicle recorded on NSW Police crash reports
- Mr Murray Cameron of CSIRO Division of Mathematics and Statistics who coordinated and facilitated the transfer of the crashed vehicle files from NRMA to MUARC
- Mr Andrew Graham and Mr Michael Adams of the NSW RTA who prepared and provided data files from NSW Police crash reports
- Mr John McKenzie, Mr John Sanderson and Mr Ron de Forest of the Royal Automobile Club of Victoria (RACV) for their support for the project
- Mr Michael Case and Mr Richard Stolinski, also of the RACV, for the provision of logic to determine the models of vehicles from information obtained from the Victorian vehicle register by the TAC, and for advice on substantive changes in designs of specific models over the years
- Mr David Kenny of MUARC for updating and refining the RACV logic to determine the models of vehicles recorded in TAC claims records
- Mr Stuart Newstead of MUARC for supplementary advice on design changes of specific models, and for reviewing and updating the classification of models into market groups
- Ms Cheryl Hamill, formerly of VIC ROADS, and Mr Foong Chee Wai and Mr Terry Mach, formerly of MUARC, for developing and implementing the procedures for merging TAC claims records and Victorian Police crash report data
- Dr Alan Miller of the CSIRO Division of Mathematics and Statistics for suggesting the analysis method used in this report to improve the sensitivity of the results
- Officers of the Victorian and NSW Police Forces and of the Transport Accident Commission who diligently recorded the information on crashes and injuries which formed the basis of this report.

VEHICLE CRASHWORTHINESS RATINGS: VICTORIA AND NSW CRASHES DURING 1987-92

SUMMARY REPORT

Table of Contents

VEHICLE CRASHWORTHINESS RATINGS: VICTORIA AND NSW CRASHES DURING 1987-92

SUMMARY REPORT

1. BACKGROUND

During 1990, the New South Wales Road Safety Prize was awarded to the idea that a system of "Car Safety Rating" should be initiated. This proposal led to a joint project between the NSW Roads and Traffic Authority (RTA) and the NRMA with the objective of using vehicle crash records and injury data to develop comparison tables of the relative safety of vehicles.

During the same year, the Victorian Parliamentary Social Development Committee (SDC) in its report on its Inquiry Into Vehicle Occupant Protection recommended that ways should be investigated for Victorian consumers to give high priority to motor vehicle occupant protection in the vehicles they purchase (SDC 1990).

In the second half of 1990, the Monash University Accident Research Centre (MUARC) commenced a project to develop consumer advice on vehicle safety performance from mass accident data. The development of crashworthiness ratings (the relative safety of vehicles in preventing severe injury in crashes) was given priority in the project because of their potential to find significant differences between makes and models.

Early in 1992, MUARC produced vehicle crashworthiness ratings based on crash data from Victoria during 1983-90 and New South Wales during 1989-90 (Cameron, Mach and Neiger 1992). These rating figures were widely distributed in the form of a "Driver Protection Ratings" brochure. The ratings were based on data for 22964 drivers injured in crashes in the two States, plus data for 73399 drivers involved in tow-away crashes in NSW. Crashworthiness was measured in two components:

1. Rate of injury for drivers involved in tow-away crashes (injury risk)
2. Rate of serious injury (death or hospital admission) for injured drivers (injury severity).

The crashworthiness rating was formed by multiplying these two rates together; it then measured the risk of serious injury for drivers involved in crashes. Measuring crashworthiness in this way was first developed by Folksam Insurance who publish the well-known Swedish ratings (Gustafsson et al 1989).

These ratings took into account the speed zone of the crash and the driver sex. Since these ratings were published an alternative analysis method has been developed to improve the reliability and sensitivity of the results. In addition to the speed zone and driver sex, the new method potentially adjusts for the effects of driver age, number of vehicles involved, and whether the crash involved a fixed object collision or not, to produce new results with all those factors taken into account. Based on a comparison of methods applied to the previous data, the new method produces crashworthiness ratings with proportionately smaller variability.

This report summarises the data and analysis methods used to update the previously published crashworthiness ratings. The new ratings cover the drivers of cars, station

wagons, four-wheel drive vehicles, passenger vans, and light commercial vehicles manufactured during 1982-92 and crashing in Victoria or NSW during 1987-92. Further details are given in the technical report on this stage of the project (Cameron, Finch and Le 1994).

2. CRASH DATA

The data from crashes in the two States was updated to the end of 1992, additional data on crashes in NSW during 1987-88 was obtained, and pre-1987 crashes in Victoria were excluded, so that the crash data from the two States covered the common period 1987-92.

2.1 Victorian Crashes

Detailed injury data have been collected by the Transport Accident Commission (TAC) and its predecessor, the Motor Accidents Board, as part of their responsibilities to provide road transport injury compensation. For each claimant, a description of the injuries was recorded, as well as whether the person was admitted to hospital. Some details of the vehicle occupied (but not its model) were obtained by TAC from the VIC ROADS registration system.

TAC injury claims from drivers of cars and station wagons manufactured since 1982, who were involved in crashes in the period 1983 to 1990, had been merged with Police crash reports for the previous crashworthiness ratings (Cameron et al 1992). The Police reports were on all drivers involved in crashes, no matter whether the Police officer recorded the person as injured or uninjured (this procedure was followed because it was possible for an injury claim to be made in circumstances where injury was not apparent at the time of the crash). 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 (Green 1990).

To update the ratings, data on TAC claims by drivers and Police reports on crashes in Victoria during 1991-92 were merged and added to data on crashes during 1987-90. The resulting merged file covered 13,943 injured drivers of 1982-92 model cars crashing during 1987-92.

2.2 New South Wales Crashes

The NRMA supplied files covering 221,971 light passenger vehicles involved in Police reported crashes during 1987-92 which resulted in death or injury or a vehicle being towed away. The NRMA had added the model and year of manufacture to these vehicles after matching with the NSW vehicle register via registration number and vehicle make. The files supplied covered only vehicles manufactured during 1982-92, but covere four-wheel drive vehicles, passenger vans, and light commercial vehicles as well as cars and station wagons.

The vehicle files (which also contained driver age and sex) were merged with files supplied by NSW RTA covering details of the person casualties (killed and injured persons) and the reported crashes for the same years. Each vehicle/driver matched uniquely with the corresponding crash information, but only injured drivers could match with persons in the casualty files. A driver who did not match was considered to be uninjured. Out of the 221,971 drivers involved in tow-away crashes, 31,127 were injured.

The presence of uninjured drivers in the merged data file meant that it was suitable for measuring the risk of driver injury (in cars sufficiently damaged to require towing). This contrasted with the Victorian data file, which could not be used to measure injury risk directly because not all uninjured drivers were included.

2.3 Combined Data from the Two States

When the data on the injured drivers was combined for analysis, it covered 45,070 drivers of 1982-92 model vehicles who were injured in crashes in Victoria or NSW during 1987-92. This information was used to assess the injury severity of the injured drivers of the different makes and models.

The information on the 221,971 drivers involved in tow-away crashes in NSW was used to assess the injury rate of drivers of the different makes and models.

3. MODELS OF VEHICLES

The Victorian vehicle register provided the make and year of manufacture of the crashed vehicle but not the model. Models were initially derived for cars manufactured during 1982-88 using logic developed and supplied by the Royal Automobile Club of Victoria (RACV) based on the make, year and power-mass units. Power-mass units (PMU) are the sum of RAC horsepower units (PU) and the vehicle mass in units of 50 Kg (MU). Refined logic was developed by MUARC based on make, year, PMU, PU, MU and body type, and extended to cover 1989-92 models. The MUARC logic was applied to the combined Victorian data in conjunction with the RACV logic to derive passenger car models for the model years 1982-92.

The NRMA located the crashed vehicles in NSW vehicle registration records after matching by registration number and vehicle make. The NRMA decoded the Vehicle Identification Number (VIN) or chassis number obtained from the register to determine the models of light passenger vehicles. The decoding identified some light truck and unusual commercial models which were not considered further. Of the vehicles manufactured during 1982-92, all but 4.1% had their model identified. Further details are given by Pappas (1993).

RACV provided advice on the particular models which had experienced substantial changes in design (and hence potential crashworthiness) during model years 1982-92 and in which years the design was relatively constant. This resulted in certain models being split into ranges of years of manufacture. Where the new model was introduced near the beginning or end of a year (up to two months either way), this process was relatively straightforward (accepting a small mis-classification in some circumstances); however when the model changed near the middle of the year, the model for that year was kept separate and potentially treated as a "mixed" model (eg. the Daihatsu Charade 1987 models).

Advice had previously been provided by VIC ROADS regarding models (sometimes only for specific years) which were essentially the same design or construction, though registered as having different manufacturers, which could be combined with each other. This information was used in the analysis to combine some models, otherwise one or both members of each such pair of models would have been excluded and a crashworthiness rating figure would not have been produced (Section 4.2).

The previously published crashworthiness ratings (Section 1) had not included results for those models with relatively high standard deviations for the estimate. The standard deviation is an indication of how well the estimated rating measures the true risk of serious injury. A review of the excluded models revealed that those ratings based on fewer than 20 injured drivers and/or fewer than 100 involved drivers had tended to have unacceptably high standard deviations. For the updated ratings given in this report, models with fewer injured and involved drivers than the above numbers were not considered further (or were combined with similar models). The final set of updated ratings were based on at least these numbers of drivers, and in most cases much larger numbers.

For the purpose of publication, the models were also categorised in market groups as follows:

- Passenger cars and station wagons: Large
  Medium
  Small
  Sports
  Luxury
- Four-wheel drive vehicles
- Passenger vans
- Commercial vehicles (less than 3000 Kg GVM)

4. ANALYSIS

As described in Section 1, the crashworthiness rating is a measure of the risk of serious injury to the driver of each specific model car when it is involved in a crash. It is defined to be the product of two estimated probabilities: 1) the probability that a driver involved in a crash is injured (injury risk) and 2) the probability that an injured driver is hospitalised or killed (injury severity).

Previous crashworthiness ratings were based on a normalisation technique which adjusted for driver sex and speed zone, the two factors which are found to vary the most between makes and models of cars. The updated crashworthiness ratings are based on an alternative method of analysis which improves the precision of the resultant ratings. This method of analysis is based on logistic modelling techniques which are able to adjust for the effect of various factors (such as driver age and sex, number of vehicles involved etc.) on both injury risk and injury severity (Hosmer and Lemeshow 1989).

4.1 Logistic Models for Each Component

The first stage in the analysis of the data was identification of suitable logistic models of each of the crashworthiness components (ie. injury risk and injury severity) separately to identify possible factors, other than vehicle design, that might have influenced the crash outcome. This was done without considering the type of car in the logistic model as the aim was to determine the effects of other factors most likely to be involved across a broad spectrum of crashes. Such factors are often referred to as potential confounders of the relationship between vehicle safety and injury risk (or injury severity), and need to be taken into account so that the crashworthiness of individual models can be clearly seen without contamination from such factors.

The factors considered in this stage of the analysis 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; ≥2 vehicles)

These variables were chosen for consideration because they were available from both the Victorian and New South Wales 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.

The type of collision (with fixed object versus not with fixed object) was also considered as a possible important variable. However, it was found to be highly correlated with the number of vehicles involved (nveh) and was not, therefore, included in the final regression models.

4.2 Individual Car Models

Injury risk and injury severity for individual cars was estimated after adding the car model to the logistic model described in Section 4.1.

In order to ensure that the logistic model adequately described the data and did not yield crashworthiness estimates which were imprecise, individual car models with small frequencies were pooled with similar models (Table 1) or excluded from the analysis. Car models were excluded if, after pooling of models, either:

i) there were less than 100 involved drivers; or
ii) there were less than 30 injured drivers.

The car models which were pooled or excluded from the analyses are indicated in Appendix 1. The final crashworthiness ratings were obtained for 87 individual car models (or pooled similar models).

Table 1: Pooled Models of Cars

Laser 82-89	with	Mazda 323 82-88
Telstar 83-87	with	Mazda 626 83-86
Telstar 88-91	with	Mazda 626 88-91
Falcon EA Wagon	with	Falcon EB Wagon
Corsair 89-92	with	Pintara 89-92
Commodore VN-VP	with	Lexcen 89-92
Nova 89-92	with	Corolla 89-92
Astra 84-86	with	Pulsar/Vector 82-86
Astra 87	with	Pulsar/Vector 87
Astra 88-89	with	Pulsar/Vector 88-90
Barina 85-88	with	Suzuki Swift 85-88
Barina 89-92	with	Suzuki Swift 89-92
Apollo 89-92	with	Camry 88-92
Ford Maverick 88-92	with	Nissan Patrol 82-92
Suzuki Scurry 85-87	with	Holden Carry 85-90
Nissan XFN Utility	with	Ford Falcon Utility
Mercedes Benz 200 86-92	with	Mercedes Benz 300 83-92

4.3 Market Group Analyses

In addition to the individual car model analyses, logistic regression analyses were performed based on broad market groups as defined in Section 3. The market group analyses provided reference ratings for models in each group.

5. RESULTS

5.1 Injury Risk

A logistic regression model incorporating all of the factors given on Section 4.1 was considered. Both driver sex and speedzone were significantly associated with injury risk and were included in the logistic regression as both main effects and an interaction term. No other factor significantly improved the fit of the logistic model.

5.2 Injury Severity

The analysis identified a number of important factors - sex, age, speedzone and nveh. In addition, significant interactions were found between sex and age, sex and nveh and age and nveh. Further details are given in the technical report (Cameron et al 1994).

5.3 Crashworthiness Ratings

The crashworthiness ratings for each car model and market group, were obtained by multiplying the individual injury risk and injury severity estimates. Because each of the two components have been adjusted for the confounding factors, the resultant crashworthiness rating is also adjusted for the influence of them.

Crashworthiness ratings were able to be obtained for the "average" car as well as for each individual model and market group after adjusting for these factors.

Appendix 2 gives the crashworthiness ratings and the associated 95% confidence intervals for each of the 87 car models included in the analyses. Each rating is expressed as a percentage, representing the number of drivers killed or admitted to hospital per 100 drivers involved in a tow-away crash. Overall ratings for the market groups are also given. The table indicates the overall ranking of the crashworthiness ratings from 1 (lowest or best crashworthiness rating) to 87 (highest or worst crashworthiness rating).

Each crashworthiness rating is an *estimate* of the true risk of a driver being killed or admitted to hospital in a tow-away crash, and as such each estimate has a level of uncertainty about it. This uncertainty is indicated by the confidence limits in Appendix 2. There is 95% probability that the confidence interval will cover the true risk of serious injury (death or hospital admission) to the driver of the particular model of vehicle.

The ratings in Appendix 2 exclude those models where:

- the width of the confidence interval exceeded 7, or
- the ratio of the confidence interval width to the rating score exceeded 2.1 (this criterion was also necessary because smaller confidence intervals tended to occur for the lower rating scores, but the confidence intervals were relatively wide in proportionate terms).

5.4 Comparisons with the All Model Average Rating

The confidence limits can be used to judge whether the true risk of death or hospitalisation for a driver of a specific model car involved in a tow-away crash is really different from the overall average for all models, ie. 2.66 per 100 involved drivers. An upper limit below the average is indicative of superior crashworthiness, whereas a lower limit above the average suggests inferior crashworthiness. Other models also have crashworthiness ratings at the low or high end of the scale, but their confidence limits overlap the all model average. Although such models may also have superior or inferior crashworthiness characteristics, the data base did not contain sufficient numbers of these models for the data to represent scientific evidence that this is the case.

Fifteen models had ratings representing evidence of superior crashworthiness because their upper confidence limits were less than the average rating. Five of these were large cars and a further six were luxury models. Two were classified as medium cars and one was a relatively old small car. The remaining model was a commercial panel van based on one of the large passenger car models displaying superior crashworthiness. The specific models were (in order of lowest estimated risk of serious driver injury in a crash):

- BMW 5 Series (1983-92 years of manufacture)
- Saab 900 Series (1983-92)
- Peugeot 505 (1983-92)
- Honda Accord (1986-89)
- Volvo 200 Series (1982-92)
- Toyota Crown/Cressida (1982-85)
- Honda Prelude (1983-92)
- Ford Falcon Panel Van (1982-92)
- Ford Telstar / Mazda 626 (1988-91)
- Ford Falcon EA Sedan (1988-91)
- Holden Commodore VN/VP (1988-92) / Toyota Lexcen (1989-92)
- Ford Falcon X-series Wagon (1982-88)
- Mitsubishi Magna (1985-90)
- Ford Falcon X-series Sedan (1982-88)
- Toyota Corolla (1982-84).

Eleven models had ratings representing evidence of inferior crashworthiness because their lower confidence limits were greater than the average rating. Seven of these were small cars, three were light commercial vehicles, and the remaining model was a pooled family of passenger vans. The specific models were (in order of highest estimated risk of serious driver injury in a crash):

- Subaru Sherpa/Fiori (1989-92)
- Suzuki Mighty Boy (1985-88)
- Holden Carry (1985-90) / Suzuki Scurry (1985-87)
- Subaru Brumby (1982-92)
- Daihatsu Handivan (1982-90)
- Suzuki Hatch (1982-89)
- Daihatsu Charade (1982-86)
- Holden Barina (1985-88) / Suzuki Swift (1985-88)
- Honda Civic (1984-87)
- Nissan Pulsar/Vector (1982-86) / Holden Astra (1982-86)
- Mitsubishi passenger vans (1982-92).

6. CONCLUSIONS

Additional crash data has enabled the crashworthiness ratings to be obtained for a larger range of car models than previously. Together with an improved method of analysis, the new data set has been able to produce more up-to-date and reliable estimates of the crashworthiness of individual car models than those published previously.

The rating scores estimate the risk of a driver being killed or admitted to hospital when involved in a tow-away crash, to a degree of accuracy represented by the confidence limits of the rating in each case. The estimates and their associated confidence limits are sufficiently sensitive that they are able to identify 26 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles which have superior or inferior crashworthiness characteristics compared with the average vehicle.

7. ASSUMPTIONS AND QUALIFICATIONS

The results and conclusions presented in this report are based on a number of assumptions and warrant a number of qualifications which the reader should note. These are listed in the following sections.

7.1 Assumptions

It has been assumed that:

- TAC claims records and NSW Police crash reports accurately recorded driver injury, hospitalisation and death.
- There was no bias in the merging of TAC claims and Victorian Police crash reports related to the model of car and factors affecting the severity of the crash.
- Crashed vehicle registration numbers were recorded accurately on Police crash reports and that they correctly identified the crashed vehicles in the Victorian and NSW vehicle registers.
- The adjustments for driver sex, age, speed zone and the number of vehicles involved removed the influences of the main factors available in the data which affected crash severity and injury susceptibility.
- The form of the logistic models used to relate injury risk and injury severity with the available factors influencing these outcomes (including the car models) was correct.

7.2 Qualifications

The results and conclusions warrant at least the following qualifications:

- Only driver crash involvements and injuries have been considered. Passengers occupying the same model cars may have had different injury outcomes.
- Some models with the same name through the 1982-92 years of manufacture may have varied substantially in their construction and mass. Although there should be few

such models in these updated results, the rating score calculated for these models may give a misleading impression and should be interpreted with caution.

- Other factors not collected in the data (eg. crash speed) may differ between the models and may affect the results. However, earlier analysis has suggested that the different rating scores are predominantly due to vehicle factors alone (Cameron et al 1992).

REFERENCES

CAMERON, M.H., FINCH, C.F., and LE, T. (1994), "Vehicle Crashworthiness Ratings: Victoria and NSW Crashes During 1987-92 - Technical Report". Monash University Accident Research Centre.

CAMERON, M.H., MACH, T., and NEIGER, D. (1992), "Vehicle Crashworthiness Ratings: Victoria 1983-90 and NSW 1989-90 Crashes - Summary Report". Report No. 28, Monash University Accident Research Centre.

GREEN, P. (1990), "Victorian Road Accident Database: Frequency Tables for Accident Data Fields: 1988". Accident Studies Section, VIC ROADS.

GUSTAFSSON, H., HAGG, A., KRAFFT, M., KULLGREN, A., MALMSTEDT, B., NYGREN, A., and TINGVALL, C. (1989), "Folksam Car Model Safety Rating 1989-90". Folksam, Stockholm.

HOSMER, D.W., and LEMESHOW, S. (1989), "Applied Logistic Regression". Wiley, New York.

PAPPAS, M. (1993), "NSW Vehicle Occupant Protection Ratings Documentation". Report to NRMA Ltd. and Road Safety Bureau, Roads and Traffic Authority, NSW.

SOCIAL DEVELOPMENT COMMITTEE (1990), "Inquiry into Vehicle Occupant Protection". Parliament of Victoria.

APPENDIX 1

MAKES AND MODELS OF CARS INVOLVED IN VICTORIAN AND NSW CRASHES DURING 1987-92

APPENDIX 1

Makes and models of cars involved in Victorian and NSW crashes during 1987-92

MAKE/MODEL OF CAR	EQUIVALENT MODELS	MARKET GROUP	NUMBER OF CARS WITH INVOLVED DRIVERS	NUMBER OF INVOLVED CARS WITH INJURED DRIVERS
4RUNNER/HILUX		4WD	4671	680
ACCORD (82-85)		Luxury	810	138
ACCORD (86-89)	ROVER QUINTET (86-89)	Luxury	363	49
ACCORD (90-92)		Luxury	82	8
ALFA ROMEO 33		Sport	261	33
APOLLO	CAMRY (87-92)	Medium	253	47
APPLAUSE		Small	129	16
ASTRA (84-86)	PULSAR (82-86)	Small	729	212
ASTRA (87)	PULSAR (87)	Small	298	78
ASTRA (88-89)	PULSAR (88-90)	Small	458	90
AUDI		Luxury	151	24
BARINA (85-88)	SWIFT (85-88)	Small	1000	329
BARINA (89-92)	SWIFT (89-92)	Small	427	91
BLUEBIRD		Medium	5573	999
BMW 3 SERIES		Luxury	927	101
BMW 5 SERIES		Luxury	397	30
BMW 6 SERIES		Luxury	2	
BMW 7 SERIES		Luxury	96	7
BRUMBY		Commercial	422	107
BUNDERA	LANDCRUISER	4WD	6	
CALIBRA		Sport	7	1
CAMIRA		Medium	7086	1818
CAMRY (83-86)		Medium	530	76
CAMRY (87-92)	APOLLO	Medium	4102	541
CAPRI		Sport	161	23
CARRY	SCURRY	Commercial	228	61
CELICA (82-85)		Sport	878	130
CELICA (86-89)		Sport	205	29
CELICA (90-92)		Sport	137	15
CHARADE (82-86)		Small	846	242
CHARADE (87)		Small	101	25
CHARADE (88-92)		Small	729	145
CHARGER/VALIANT		Large	10	
CITROEN AX		Small	1	
CITROEN BX19/BX16		Medium	16	1
CIVIC (82-83)		Small	349	66
CIVIC (84-87)		Small	952	181
CIVIC (88-92)		Small	513	81
COLT		Small	4068	950
COMMODORE VB		Large	8	1
COMMODORE VC		Large	13	
COMMODORE VG UTE		Commercial	83	9
COMMODORE VH-VL		Large	18353	3177
COMMODORE VN/VP	LEXCEN	Large	5194	639
COMMODORE VP UTE		Commercial	9	1
CONCERTO	ROVER 416i	Luxury	49	6
CORDIA		Small	726	125
COROLLA (82-84)		Small	3383	788
COROLLA (85-88)		Small	5715	1242
COROLLA (89-92)	NOVA (90-92)	Small	1818	257
CORONA		Medium	6336	1036
CORSAIR	PINTARA (89-92)	Medium	193	25
CORTINA		Medium	14	23
CROWN/CRESSIDA (82-85)		Luxury	798	134
CROWN/CRESSIDA (86-88)		Luxury	327	29
CROWN/CRESSIDA (89-92)		Luxury	246	29
DAIHATSU F20/25/50/55		Commercial	46	11
DROVER	SIERRA	4WD	112	36
ESCORT		Small	12	

Shaded models are those that were excluded from the logistic regression analyses or final results on the basis that:

1) There were < 100 involved drivers

2) There were < 30 injured drivers

3) They could not be pooled with other variables

4) The confidence interval of the crashworthiness rating was too wide

APPENDIX 1

Makes and models of cars involved in Victorian and NSW crashes during 1987-92

MAKE/MODEL OF CAR	EQUIVALENT MODELS	MARKET GROUP	NUMBER OF CARS WITH INVOLVED DRIVERS	NUMBER OF INVOLVED CARS WITH INJURED DRIVERS
EXA (83-86)		Sport	209	40
EXA (87-92)		Sport	42	5
EXCEL		Small	836	265
FAIRLANE N & LTD D		Luxury	484	48
FAIRLANE Z & LTD F		Luxury	2016	309
FALCON EA SEDAN		Large	2629	321
FALCON EA WAGON	FALCON EB WAGON	Large	612	66
FALCON EB SEDAN		Large	470	60
FALCON EB WAGON	FALCON EA WAGON	Large	191	38
FALCON PANEL VAN		Commercial	1257	131
FALCON UTE	NISSAN XFN UTE	Commercial	2495	266
FALCON X SEDAN		Large	21296	2946
FALCON X WAGON		Large	4973	649
FEROZA		4WD	60	7
FESTIVA	MAZDA 121 (87-90)	Small	17	4
FIAT		Medium	152	32
FORD BRONCO		4WD	75	9
FORD F100		Commercial	63	6
FORD F150		Commercial	161	17
FORD MAVERICK	PATROL	4WD	168	17
FORD SIERRA		Medium	3	
GALANT		Medium	94	12
GAZELLE		Medium	169	210
GEMINI (82-84)		Small	2706	745
GEMINI (85-87)		Small	900	266
HANDIVAN		Small	314	80
HATCH		Small	542	158
HI-JET		Commercial	107	43
HIACE/LITEACE		Commercial	3370	484
HOLDEN PIAZZA		Sport	9	2
HONDA ACTY		Small	14	2
HONDA CITY		Commercial	173	35
HONDA CRX		Sport	79	11
INTEGRA (86-88)		Luxury	188	26
INTEGRA (89)		Luxury	72	11
INTEGRA (90-92)		Luxury	36	5
JACKAROO		4WD	207	39
JAGUAR		Luxury	279	36
JEEP		4WD	51	5
KINGSWOOD		Large	14	4
LANCER		Small	427	65
LANCIA		Medium	12	2
LANDCRUISER		4WD	2116	299
LAND ROVER		4WD	47	8
LANTRA		Medium	20	3
LASER/METEOR (82-89)	MAZDA 323 (82-88)	Small	12524	3075
LASER/METEOR (90)		Small	717	130
LASER/METEOR (91-92)		Small	324	50
LEGEND	ROVER 825/827	Luxury	106	6
LEXCEN	COMMODORE VN-VP	Large	288	32
LEXUS		Luxury	8	
LIBERTY		Medium	219	25
MAGNA (85-90)		Large	7831	1044
MAGNA (91-92)		Large	249	23
MAXIMA		Luxury	41	1
MAZDA 121 (87-90)	FESTIVA	Small	159	28
MAZDA 121 (91-92)		Small	77	18
MAZDA 323 (82-88)	LASER (82-89)	Small	1800	508
MAZDA 323 (89)		Small	68	12

Shaded models are those that were excluded from the logistic regression analyses or final results on the basis that:

1) There were < 100 involved drivers

2) There were < 30 injured drivers

3) They could not be pooled with other variables

4) The confidence interval of the crashworthiness rating was too wide

APPENDIX 1

Makes and models of cars involved in Victorian and NSW crashes during 1987-92

MAKE/MODEL OF CAR	EQUIVALENT MODELS	MARKET GROUP	NUMBER OF CARS WITH INVOLVED DRIVERS	NUMBER OF INVOLVED CARS WITH INJURED DRIVERS
MAZDA 323 (90-92)		Small	201	33
MAZDA 626 (82)	TELSTAR (82)	Medium	359	106
MAZDA 626 (83-86)	TELSTAR (83-87)	Medium	1809	422
MAZDA 626 (87)		Medium	80	4
MAZDA 626 (88-91)	TELSTAR (88-91)	Medium	426	50
MAZDA 626 (92)	TELSTAR (92)	Medium	25	1
MAZDA 929 (82-90)		Luxury	1134	168
MAZDA 929 (91)		Luxury	8	
MAZDA 929 (92)		Luxury	1	
MAZDA MX5		Sport	47	6
MERCEDES BENZ 100 SERIES		Luxury	171	17
MERCEDES BENZ 200 SERIES (82-85)		Luxury	250	23
MERCEDES BENZ 200 SERIES (86-92)	MERCEDES BENZ 300 SERIES	Luxury	93	10
MERCEDES BENZ 300 SERIES	MERCEDES BENZ 200 SERIES (86-92)	Luxury	412	35
MERCEDES BENZ 400 SERIES		Luxury	63	10
MERCEDES BENZ 500 SERIES		Luxury	35	3
MIGHTY BOY		Commercial	289	84
MIRA		Small	28	5
MITSUBISHI PASSENGER VANS		Van	2714	444
MR2 (87-90)		Sport	46	10
MR2 (91-92)		Sport	4	
NAVARA		Commercial	937	123
NIMBUS (82-91)		Medium	304	45
NIMBUS (92)		Medium	2	1
NISSAN 180B/200B		Medium	6	
NISSAN 280C		Large	30	3
NISSAN 280ZX		Sport	34	10
NISSAN 300C/BROUGHAM		Large	47	6
NISSAN 300ZX		Sport	149	21
NISSAN 720 UTE		Commercial	831	118
NISSAN B120		Commercial	56	15
NISSAN NX/NX-R		Small	9	
NISSAN SUNNY/120Y		Small	11	2
NISSAN XFN UTE	FALCON UTE	Commercial	24	3
NOVA	COROLLA (90-92)	Small	185	30
PAJERO		4WD	749	110
PASEO		Small	26	3
PATHFINDER		4WD	101	10
PATROL	FORD MAVERICK	4WD	948	96
PEUGEOT 205/205GTI		Small	34	5
PEUGEOT 405		Medium	29	5
PEUGEOT 505		Medium	275	32
PINTARA (86-88)		Medium	1174	196
PINTARA (89-92)	CORSAIR	Medium	849	89
PORSCHE 911		Sport		1
PORSCHE 928		Sport		1
PORSCHE 944		Sport	40	6
PRAIRIE		Medium	181	37
PRELUDE (82)		Luxury	100	14
PRELUDE (83-92)		Luxury	826	107
PULSAR/VECTOR (82-86)	ASTRA (84-86)	Small	2878	856
PULSAR/VECTOR (87)	ASTRA (87)	Small	422	82
PULSAR/VECTOR (88-90)	ASTRA (88-89)	Small	1726	263
PULSAR/VECTOR (91)		Small	174	21
PULSAR/VECTOR (92)		Small	26	7
RANGE ROVER		Luxury	310	42
RENAULT 19TXE		Medium	3	
RENAULT 20TS		Medium	10	3
RENAULT 21TXE		Medium	5	

Shaded models are those that were excluded from the logistic regression analyses or final results on the basis that:

1) There were < 100 involved drivers

2) There were < 30 injured drivers

3) They could not be pooled with other variables

4) The confidence interval of the crashworthiness rating was too wide

APPENDIX 1
Makes and models of cars involved in Victorian and NSW crashes during 1987-92

MAKE/MODEL OF CAR	EQUIVALENT MODELS	MARKET GROUP	NUMBER OF CARS WITH INVOLVED DRIVERS	NUMBER OF INVOLVED CARS WITH INJURED DRIVERS
RENAULT 25/25GTX		Medium	23	2
RENAULT FUEGO		Medium	187	25
ROCKY F70/75		4WD	207	54
RODEO		Commercial	956	128
ROLLS ROYCE		Luxury	7	1
ROVER 3500		Luxury	79	9
ROVER 416i	CONCERTO	Luxury	87	7
ROVER 825/827	LEGEND	Luxury	9	2
ROVER QUINTET	ACCORD (86-89)	Luxury	95	27
RX7 (82-85)		Sport	257	59
RX7 (86-91)		Sport	71	9
RX7 (92)		Sport	1	
S-COUPE		Sport	42	3
SAAB 900		Luxury	243	35
SAAB 9000		Luxury	55	4
SCURRY	CARRY	Commercial	23	11
SHERPA/FIORI		Small	272	78
SHUTTLE		Commercial	259	47
SIERRA	DROVER	4WD	918	196
SIGMA/SCORPION		Medium	6819	1248
SKYLINE		Large	1546	276
SONATA		Medium	95	10
STANZA		Medium	301	52
STARION		Sport	91	16
STATESMAN/CAPRICE (82-89)		Luxury		12
STATESMAN/CAPRICE (90-93)		Luxury	79	3
SUBARU 1800/LEONE		Medium	2165	395
SUBARU SVX		Sport	1	
SUPRA		Sport	154	29
SUZUKI ALTO		Commercial	33	13
SWIFT (84)		Small	103	29
SWIFT (85-88)	BARINA (85-88)	Small	356	86
SWIFT (89-92)	BARINA (89-92)	Small	192	25
TARAGO		Van	1707	277
TELSTAR (83-87)	MAZDA 626 (83-86)	Medium	4388	926
TELSTAR (88-91)	MAZDA 626 (88-91)	Medium	757	99
TELSTAR (92)	MAZDA 626 (92)	Medium	2	
TERCEL		Medium	176	25
TORANA/SUNBIRD		Medium	3	
VERADA		Large	35	2
VITARA		4WD	232	44
VOLVO 200 SERIES		Luxury	1139	111
VOLVO 300 SERIES		Medium	97	11
VOLVO 700 SERIES		Luxury	421	52
VOLVO 900 SERIES		Luxury	13	3
VORTEX		Sport	27	4
VOLKSWAGON			153	19
			202557	35989

Shaded models are those that were excluded from the logistic regression analyses or final results on the basis that:

1) There were < 100 involved drivers
2) There were < 30 injured drivers
3) They could not be pooled with other variables
4) The confidence interval of the crashworthiness rating was too wide

APPENDIX 2

CRASHWORTHINESS RATINGS OF 1982-92 MODELS OF CARS INVOLVED IN CRASHES DURING 1987-92

APPENDIX 2

Crashworthiness Ratings of 1982-92 Models of Cars Involved in Crashes During 1987-92

Make	Model of car	Year of manufacture	CRASHWORTHINESS RATINGS: Serious injury rate per 100 drivers involved	Overall rank order	Lower 95% confidence limit	Upper 95% confidence limit	Width of confidence interval	Ratio of confidence interval width to rating
ALL MODEL AVERAGE			**2.66**		**2.60**	**2.73**	**0.13**	**0.05**
Large cars			**2.33**		**2.22**	**2.44**	**0.22**	**0.09**
Ford	FALCON EA/EB WAGON	88-92	**1.79**	12	0.88	2.70	1.82	1.02
Ford	FALCON EA SEDAN	88-91	**1.94**	15	1.43	2.44	1.02	0.53
Ford	FALCON EB SEDAN	91-92	**1.99**	17	0.72	3.26	2.54	1.28
Holden	COMMODORE VN/VP	88-92						
Toyota	LEXCEN	89-92	**2.11**	18	1.74	2.49	0.75	0.36
Ford	FALCON X SERIES WAGON	82-88	**2.15**	20	1.76	2.53	0.77	0.36
Mitsubishi	MAGNA	85-90	**2.15**	21	1.85	2.46	0.60	0.28
Ford	FALCON X SERIES SEDAN	82-88	**2.16**	22	1.98	2.35	0.37	0.17
Nissan	SKYLINE	82-90	**2.37**	35	1.71	3.03	1.32	0.56
Holden	COMMODORE VH-VL	82-88	**2.50**	39	2.30	2.70	0.40	0.16
Medium cars			**2.71**		**2.58**	**2.85**	**0.27**	**0.10**
Peugeot	505	83-92	**1.23**	3	0.15	2.30	2.14	1.75
Ford	TELSTAR	88-91						
Mazda	626	88-91	**1.85**	14	1.13	2.57	1.44	0.78
Nissan	PINTARA	89-92						
Ford	CORSAIR	89-92	**2.12**	19	1.24	3.00	1.76	0.83
Toyota	CAMRY	87-92						
Holden	APOLLO	89-92	**2.30**	31	1.88	2.73	0.85	0.37
Mitsubishi	NIMBUS	82-91	**2.32**	32	0.67	3.97	3.30	1.42
Nissan	STANZA	82-83	**2.34**	33	0.72	3.96	3.24	1.39
Toyota	CORONA	83-87	**2.35**	34	2.01	2.69	0.68	0.29
Subaru	1800/LEONE	82-90	**2.49**	38	1.90	3.08	1.18	0.47
Mitsubishi	SIGMA/SCORPION	82-87	**2.60**	42	2.27	2.94	0.67	0.26
Nissan	PINTARA	86-88	**2.69**	44	1.87	3.50	1.63	0.61
Ford	TELSTAR	83-87						
Mazda	626	83-86	**2.72**	46	2.37	3.07	0.70	0.26
Nissan	BLUEBIRD	82-86	**2.78**	48	2.38	3.17	0.79	0.28
Holden	CAMIRA	83-89	**2.94**	57	2.61	3.27	0.66	0.22
Mazda	626	82	**3.17**	64	1.69	4.65	2.96	0.93
Nissan	PRAIRIE	83-86	**3.32**	67	0.85	5.78	4.92	1.48
Toyota	CAMRY	83-86	**4.11**	78	2.43	5.79	3.35	0.82
Nissan	GAZELLE	84-88	**4.16**	79	2.38	5.94	3.56	0.86

APPENDIX 2

Crashworthiness Ratings of 1982-92 Models of Cars Involved in Crashes During 1987-92

Make	Model of car	Year of manufacture	CRASHWORTHINESS RATINGS					
			Serious injury rate per 100 drivers involved	Overall rank order	Lower 95% confidence limit	Upper 95% confidence limit	Width of confidence interval	Ratio of confidence interval width to rating
ALL MODEL AVERAGE			**2.66**		**2.60**	**2.73**	**0.13**	**0.05**
Small cars			**3.13**		**3.00**	**3.27**	**0.27**	**0.09**
Toyota	COROLLA	89-92						
Holden	NOVA	89-92	**2.17**	23	1.40	2.94	1.53	0.71
Toyota	COROLLA	82-84	**2.19**	25	1.78	2.59	0.81	0.37
Mazda	323	90-92	**2.19**	26	0.25	4.13	3.88	1.77
Mitsubishi	LANCER	88-92	**2.26**	28	0.91	3.61	2.71	1.20
Mitsubishi	CORDIA	83-89	**2.72**	45	1.60	3.84	2.23	0.82
Toyota	COROLLA	85-88	**2.77**	47	2.34	3.20	0.86	0.31
Nissan	PULSAR/VECTOR	88-90						
Holden	ASTRA	88-90	**2.79**	49	2.15	3.43	1.29	0.46
Ford	LASER/METEOR	90	**2.80**	50	1.64	3.97	2.33	0.83
Ford	LASER/METEOR	82-89						
Mazda	323	82-88	**2.86**	51	2.64	3.09	0.45	0.16
Holden	BARINA	89-92						
Suzuki	SWIFT	89-92	**2.90**	53	1.67	4.13	2.47	0.85
Mitsubishi	COLT	82-90	**2.96**	58	2.51	3.41	0.90	0.30
Nissan	PULSAR/VECTOR	87						
Holden	ASTRA	87	**2.99**	60	1.97	4.01	2.04	0.68
Holden	GEMINI	82-84	**3.02**	61	2.49	3.54	1.05	0.35
Honda	CIVIC	88-92	**3.07**	62	1.66	4.48	2.82	0.92
Holden	GEMINI	85-87	**3.28**	65	2.33	4.23	1.90	0.58
Hyundai	EXCEL	86-92	**3.29**	66	2.34	4.24	1.90	0.58
Honda	CIVIC	82-83	**3.33**	68	1.58	5.08	3.49	1.05
Nissan	PULSAR/VECTOR	82-86						
Holden	ASTRA	84-86	**3.61**	73	3.12	4.10	0.98	0.27
Honda	CIVIC	84-87	**3.80**	74	2.72	4.88	2.15	0.57
Daihatsu	CHARADE	88-92	**3.87**	75	2.51	5.22	2.71	0.70
Ford	LASER/METEOR	91-92	**4.03**	77	1.94	6.13	4.19	1.04
Holden	BARINA	85-88						
Suzuki	SWIFT	85-88	**4.17**	80	3.27	5.07	1.80	0.43
Daihatsu	CHARADE	82-86	**4.80**	81	3.54	6.05	2.51	0.52
Suzuki	HATCH	82-89	**5.16**	82	3.35	6.97	3.62	0.70
Daihatsu	HANDIVAN	82-90	**5.75**	83	3.14	8.35	5.21	0.91
Subaru	SHERPA/FIORI	89-92	**6.62**	87	3.73	9.51	5.78	0.87

APPENDIX 2

Crashworthiness Ratings of 1982-92 Models of Cars Involved in Crashes During 1987-92

Make	Model of car	Year of manufacture	CRASHWORTHINESS RATINGS: Serious injury rate per 100 drivers involved	Overall rank order	Lower 95% confidence limit	Upper 95% confidence limit	Width of confidence interval	Ratio of confidence interval width to rating
ALL MODEL AVERAGE			**2.66**		**2.60**	**2.73**	**0.13**	**0.05**
Luxury cars			**2.09**		**1.83**	**2.34**	**0.51**	**0.25**
BMW	5 SERIES	83-92	**1.12**	1	0.08	2.16	2.08	1.86
Saab	900	83-92	**1.21**	2	0.00	2.44	2.44	2.01
Honda	ACCORD	86-89	**1.48**	4	0.34	2.62	2.28	1.54
Range Rover		82-92	**1.59**	5	0.40	2.78	2.38	1.50
Volvo	700 SERIES	83-91	**1.61**	6	0.46	2.75	2.29	1.43
Volvo	200 SERIES	82-92	**1.61**	7	0.92	2.30	1.38	0.86
Mercedes Benz	200 SERIES 300 SERIES	86-92 83-92	**1.65**	8	0.60	2.69	2.09	1.27
Ford	FAIRLANE N & LTD D	88-92	**1.70**	9	0.59	2.82	2.23	1.31
Toyota	CROWN/CRESSIDA	82-85	**1.76**	10	0.94	2.57	1.63	0.93
Honda	PRELUDE	83-92	**1.76**	11	0.89	2.63	1.74	0.99
Ford	FAIRLANE Z & LTD F	82-88	**2.28**	30	1.69	2.87	1.18	0.52
Honda	ACCORD	82-85	**2.46**	36	1.47	3.45	1.98	0.80
BMW	3 SERIES	82-92	**2.63**	43	1.59	3.67	2.08	0.79
Mazda	929	82-90	**2.92**	56	1.99	3.84	1.85	0.64
Sports cars			**3.07**		**2.26**	**3.88**	**1.62**	**0.53**
Toyota	CELICA	82-85	**2.90**	54	1.83	3.97	2.13	0.74
Mazda	RX7	82-85	**3.34**	69	1.41	5.26	3.85	1.15
Alfa Romeo	33	82-92	**3.58**	71	1.24	5.92	4.68	1.31
4-Wheel drive vehicles			**2.65**		**2.34**	**2.96**	**0.62**	**0.23**
Nissan	PATROL	82-92						
Ford	MAVERICK	88-92	**1.94**	16	1.15	2.73	1.58	0.82
Mitsubishi	PAJERO	83-92	**2.24**	27	1.22	3.27	2.05	0.91
Toyota	LANDCRUISER	82-92	**2.47**	37	1.84	3.10	1.27	0.51
Toyota	4RUNNER/HILUX	82-92	**2.59**	40	2.13	3.04	0.91	0.35
Daihatsu	ROCKY F70/75	87-92	**3.53**	70	1.08	5.99	4.91	1.39
Suzuki	SIERRA	82-92	**3.87**	76	2.62	5.12	2.50	0.65
Passenger vans			**3.41**		**2.87**	**3.94**	**1.08**	**0.32**
Toyota	TARAGO	83-90	**2.89**	52	2.12	3.67	1.55	0.53
Mitsubishi	PASSENGER VANS	82-92	**3.59**	72	2.86	4.31	1.45	0.40

APPENDIX 2

Crashworthiness Ratings of 1982-92 Models of Cars Involved in Crashes During 1987-92

Make	Model of car	Year of manufacture	CRASHWORTHINESS RATINGS: Serious injury rate per 100 drivers involved	Overall rank order	Lower 95% confidence limit	Upper 95% confidence limit	Width of confidence interval	Ratio of confidence interval width to rating
ALL MODEL AVERAGE			**2.66**		**2.60**	**2.73**	**0.13**	**0.05**
Commercial vehicles (GVM <= 3000kg)			**3.02**		**2.69**	**3.34**	**0.65**	**0.22**
Ford	FALCON PANEL VAN	82-92	**1.83**	13	1.04	2.62	1.58	0.86
Nissan	NAVARA	86-92	**2.18**	24	1.24	3.11	1.87	0.86
Ford	FALCON UTE	82-92						
Nissan	XFN UTE	88-92	**2.27**	29	1.68	2.87	1.20	0.53
Holden	RODEO	82-92	**2.59**	41	1.55	3.63	2.08	0.80
Nissan	720 UTE	82-85	**2.90**	55	1.76	4.04	2.28	0.79
Toyota	HIACE/LITEACE	82-92	**2.97**	59	2.37	3.58	1.21	0.41
Holden	SHUTTLE	82-91	**3.07**	63	0.85	5.29	4.44	1.45
Subaru	BRUMBY	82-92	**5.79**	84	3.77	7.81	4.04	0.70
Holden	CARRY	85-90						
Suzuki	SCURRY	85-87	**5.90**	85	2.86	8.95	6.09	1.03
Suzuki	MIGHTY BOY	85-88	**6.57**	86	3.77	9.37	5.60	0.85