M O N A S H U N I V E R S I T Y

VEHICLE CRASHWORTHINESS AND AGGRESSIVITY RATINGS AND CRASHWORTHINESS BY YEAR OF VEHICLE MANUFACTURE:

VICTORIA AND NSW CRASHES DURING 1987-98
QUEENSLAND CRASHES DURING 1991-98

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VICTORIA AND NSW CRASHES DURING 1987-98 QUEENSLAND CRASHES DURING 1991-98

by

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Vehicle Crashworthiness and Aggressivity Ratings and Crashworthiness by Year of Vehicle Manufacture: Victoria and NSW Crashes During 1987-98, Queensland Crashes During 1991-98

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Abstract:
Crashworthiness ratings measure the relative safety of vehicles in preventing severe injury to their own drivers in crashes whilst aggressivity ratings measure the serious injury risk vehicles pose to drivers of other vehicles with which they collide. Crashworthiness and aggressivity ratings for 1982-98 model vehicles were developed based on data on crashes in Victoria and New South Wales during 1987-98 and in Queensland during 1991-98. Crashworthiness and aggressivity were measured by a combination of injury severity (of injured drivers) and injury risk (of drivers involved in crashes). The ratings were adjusted for the driver sex and age, the speed limit at the crash location, the number of vehicles involved, the state in which the crash occurred and the year in which the crash occurred. These factors were strongly related to injury risk and/or severity for both aggressivity and crashworthiness. Both ratings estimate, with the appropriate focus, 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 crashworthiness estimates and their associated confidence limits were sufficiently sensitive that they were able to identify 58 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles that have superior or inferior crashworthiness characteristics compared with the average vehicle. Aggressivity rating estimates and their associated confidence limits were sufficiently sensitive that they were able to identify 23 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles that have superior or inferior aggressivity characteristics compared with the average vehicle. Also investigated was the relationship between vehicle crashworthiness and the year of manufacture of Australian vehicles manufactured from 1964 to 1998. Cars, station wagons and taxis manufactured during the years 1964 to 1998 were considered.

The results of this report are based on a number of assumptions and warrant a number of qualifications that should be noted.

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

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EXECUTIVE SUMMARY

This report describes the development of further updated crashworthiness ratings and aggressivity ratings for 1982-98 model vehicles. Crashworthiness ratings measure the relative safety of vehicles in preventing severe injury to their own drivers in crashes whilst aggressivity ratings measure the serious injury risk vehicles pose to drivers of other vehicles with which they collide. Both measures are estimated from data on real crashes. The update is based on crash data from Victoria and New South Wales during 1987-98 and from Queensland during 1991-98. The rating of vehicle crashworthiness through analysis of real crash data, as carried out here, and through crash tests carried out by consumer groups such as the Australian New Car Assessment Program has encouraged manufacturers to improve vehicle safety.

Both crashworthiness and aggressivity were measured by a combination of injury severity (of injured drivers) and injury risk (of drivers involved in crashes). Crashworthiness injury severity was based on 151,354 drivers injured in crashes in the three States during 1987-98. Crashworthiness injury risk was based on 648,829 drivers involved in crashes in New South Wales and Queensland where a vehicle was towed away. Aggressivity injury risk was based on 418,212 drivers involved in crashes between two vehicles in New South Wales and Queensland where a vehicle was towed away. Aggressivity injury severity was based on 106,057 drivers injured in two-car crashes in the three States during 1987-98.

The crashworthiness and aggressivity ratings were adjusted for the driver sex and age, the speed limit at the crash location, the year in which the crash occurred and the state in which the crash occurred. Crashworthiness ratings were also adjusted for the number of vehicles involved in the crash. These factors were found to be strongly associated with injury risk and injury severity. Adjustments were made with the aim of measuring the effects of vehicle factors alone, uncontaminated by other factors available in the data that affected crash severity and injury susceptibility.

The crashworthiness rating scores estimate the risk of a driver of the focus vehicle 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. Statistically reliable crashworthiness ratings were calculated for 167 individual vehicle models. The estimates and their associated confidence limits were sufficiently sensitive that they were able to identify 58 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles that have superior or inferior crashworthiness characteristics compared with the average vehicle.

Aggressivity ratings were calculated for 96 models of Australian passenger vehicles (passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles) manufactured between the years 1982-98. Aggressivity rating scores estimate the risk of a driver of a vehicle impacting with the focus vehicle being killed or admitted to hospital when involved in a tow-away crash. The degree of accuracy of the aggressivity ratings is 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 23 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles that have superior or inferior aggressivity characteristics compared with the average vehicle. Estimated vehicle aggressivity towards drivers of other vehicles was found to have a proportional relationship with vehicle mass. It was also found to have little or no relationship

with ratings of vehicle crashworthiness, demonstrating the independence of the two complementary measures.

It is concluded that the additional crash data has enabled the crashworthiness and aggressivity ratings to be obtained for a larger range of car models than was previously possible. The expanded 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 that should be noted.

A final stage of the project investigated the relationship between vehicle crashworthiness and the year of manufacture of vehicles for the years of manufacture 1964 to 1998. This study updated an earlier one that studied vehicles manufactured in the years 1964 to 1997.

The crashworthiness of passenger vehicles (cars, station wagons and taxis), measured by the risk of the driver being killed or admitted to hospital as the result of involvement in a tow-away crash, has been estimated for the years of manufacture 1964 to 1998. Similar to the original study, this study showed improvements in crashworthiness over the period of study, with the greatest gains over the years 1970 to 1979 during which a number of new Australian Design Rules aimed at occupant protection took effect. Gains in crashworthiness have also been observed over the years 1989 to 1998.

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1. INTRODUCTION

1.1 Crashworthiness Ratings

In 1990, the NSW Roads and Traffic Authority (RTA) and the NRMA set out on a joint project to develop a 'car safety rating' system based on Police records of crash and injury involvement. The objective was to use vehicle crash records and injury data to develop ratings for the relative safety of vehicles. The NRMA and RTA entered into discussions with the CSIRO to conduct the necessary analysis, and by early 1991 had produced some relative ranking of vehicles.

Also during 1990, the Victorian Parliamentary Social Development Committee (SDC), in its report on its inquiry into vehicle occupant protection, recommended ways should be investigated for Victorian consumers give to 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 injuries in crashes) was given priority in the project because of their potential to find significant differences between makes and models.

In mid 1991, the NSW and Victorian groups became aware of each others activities and, following discussions, agreed to proceed jointly rather than have two competing vehicle safety rating systems; one based on Victorian data and the other on NSW data. Later, the NSW RTA and NRMA agreed that MUARC should undertake the analysis of the joint NSW/Victorian data sets. The NSW RTA and NRMA performed preliminary work on the NSW data base to, as far as possible, provide a clean set of data with accurately inscribed models for each vehicle. The data were then handed over to MUARC for analysis.

Crashworthiness ratings rate the relative safety of vehicles by examining injury outcomes to drivers in real crashes. The crashworthiness rating of a vehicle is a measure of the risk of serious injury to a driver of that vehicle when it is involved in a crash. This risk is estimated from large numbers of records of injury to drivers of that vehicle type involved in real crashes on the road.

In 1994, MUARC produced vehicle crashworthiness ratings based on crash data from Victoria and New South Wales during 1987-92 (Cameron et al, 1994a,b). These ratings updated an earlier MUARC set produced by Cameron et al (1992b). 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 two components reflecting risk and severity of injury was first developed by Folksam Insurance who publishes the well-known Swedish ratings (Gustafsson et al 1989).

The results of these ratings are summarised in Cameron et al (1994a) with a full technical description of the analysis methods appearing in Cameron et al (1994b). These ratings use an analysis method that was developed to maximise the reliability and sensitivity of the results from the available data. 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 taken into account.

Subsequent to the ratings of Cameron et al (1994a,b), four further updated sets of ratings were produced during 1996, 1997, 1998 and 1999 (Newstead et al 1996, Newstead et al 1997, Newstead et al 1998, Newstead et al 1999). These covered vehicles manufactured over the period 1982-94, 1982-95, 1982-96 and 1982-97 respectively, and crashing during 1987-94, 1987-95, 1987-96 and 1987-97 respectively, incorporating some enhancements to the methods of statistical analysis. For the first time, the 1999 ratings incorporated police reported crash data from Queensland whereas previously only crash data from New South Wales and Victoria had been used. The 1999 crashworthiness ratings covered 145 individual models of sedans, station wagons, four wheel drives, passenger vans and light commercial vehicles and were given as estimates of risk of severe injury for each model along with 90% and 95% confidence limits on each estimate. These rating figures were widely distributed in the form of a "Used Car Safety Ratings" brochure, based on similar brochures produced from the earlier ratings.

Another focus of the vehicle crashworthiness ratings study has been to track historical improvements in the average crashworthiness of the vehicle fleet since 1964. In 1994, the Royal Automobile Club of Victoria (RACV) commissioned a study to investigate the effects of the year of manufacture of vehicles (vehicle year) on their road safety (Cameron et al 1994c). This project focused on investigating the relationship between crashworthiness and vehicle year of manufacture for the years 1964 to 1992. The aim of the original study of Cameron et al (1994c) was, to the extent possible, to measure the crashworthiness of vehicles of different years of manufacture, after eliminating the influence of other key factors affecting the risk of injury which might also be associated with vehicle year (eg. driver age and sex, use on high speed roads, etc.).

The original study of Cameron et al (1994c) showed that the crashworthiness of passenger vehicles in Australia has improved over the years of manufacture 1964 to 1992 with rapid improvement over the years from about 1970 to 1979. Drivers of vehicles manufactured during 1970 to 1979 could be expected to have benefited from the implementation of a number of Australian Design Rules (ADRs) for motor vehicle safety which previous research has shown to be effective in providing occupant protection. The study has been updated with each vehicle crashworthiness ratings update. The most recent analysis included vehicles with years of manufacture from 1964 to 1997 (Newstead et al 1999).

1.2 Aggressivity Ratings

When crashworthiness ratings were first presented internationally, at the 1992 IRCOBI Conference in Italy (Cameron et al 1992a), the authors were encouraged to expand the analysis to measure the risk of injury that each individual model represents to other road users, in

addition to the occupants of the subject model. It was suggested that MUARC were in a unique position to consider this issue since its ratings were based on tow-away crashes.

A reviewer's comments on the paper presenting the first update of the ratings, to the 1995 IRCOBI Conference in Switzerland, emphasised the same issue. The reviewer wrote "partner protection and collision compatibility are very important for overall road safety and they can no longer be omitted in the discussion about 'car safety'". He recommended that this "shortcoming" should be addressed in the introduction and conclusion of the paper, and this was done in the published version (Cameron et al 1995).

Together, these international reactions to MUARC's work in this area indicated that the crashworthiness ratings should be extended to add a measure of the "aggressivity" of individual car models when they crash. Aggressivity ratings measure the risk of injury that a vehicle poses to occupants of other vehicles it impacts, and to other unprotected road users such as pedestrians, bicyclists and motorcyclists. The addition of aggressivity ratings represents further consumer advice which purchasers of cars could take into account when choosing a specific model.

Cameron, Newstead and Le (1998) have already completed an initial study that reviewed methods of rating vehicle aggressivity that have been developed internationally, such as those by Broughton (1994, 1996) and Hollowell and Gabler (1996). Concepts from this review were then taken to develop a methodology for rating the aggressivity of Australian passenger vehicles making appropriate uses of the rich source of real crash data available from the state of New South Wales in Australia, collected for crashes occurring in the years 1987 to 1995. The methods developed were then successfully applied to estimate aggressivity ratings for a selection of Australian passenger vehicles that had accumulated sufficient real crash history.

1.2.1 Aggressivity Ratings For Australian Passenger Vehicles

The original study of Cameron et al (1998) investigated the feasibility and methods of providing aggressivity ratings for Australian passenger vehicles in terms of the threat that each subject model represented to:

1. Occupants of other cars colliding with the subject model cars, and
2. Pedestrians, bicyclists and motorcyclists (if possible, separately) impacted by the subject model cars.

In general, crashes involving pedestrians, bicyclists and motorcyclists are seldom reported to the Police unless someone is killed or injured (usually the unprotected road user). This means that an estimate of the risk of injury cannot be calculated for the unprotected road users for inclusion in the second type of aggressivity rating. Consequently, the measure of aggressivity towards unprotected road users, described by Cameron et al (1998), is a measure of injury severity only (ie the risk of serious injury given some injury was sustained). As such, this aggressivity measure is less able to discriminate between the performance of individual vehicle models as it is based on relatively small quantities of data. Examining the estimates of the injury severity index in crashworthiness ratings demonstrates the lack of discriminatory power of this component alone in assessing relative vehicle safety performance.

The lack of discrimination between the aggressivity of different vehicle models afforded by the index described makes the measure of aggressivity towards unprotected road users of limited practical value. In addition to this, there seems to be generally less interest in aggressivity of vehicles towards unprotected road users than there is in vehicle to vehicle compatibility, as

measured by the rating of aggressivity toward other car drivers, in the vehicle safety community at present. Consequently, the measure of aggressivity towards unprotected road users has not been further pursued in this report.

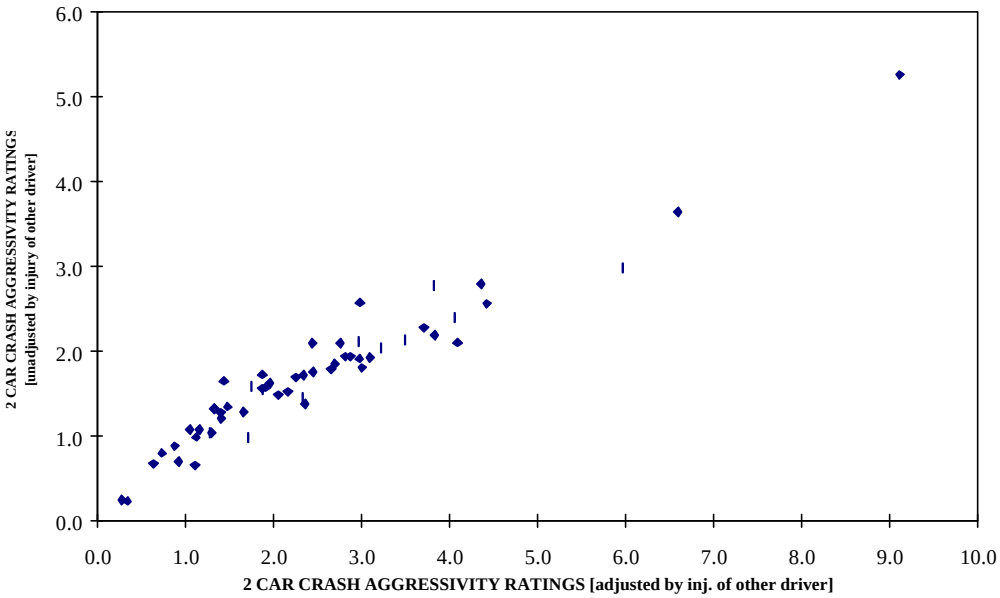
This problem described in estimating aggressivity for unprotected road users did not occur for measuring aggressivity towards drivers of other cars, for whom the available data allowed estimates of both the risk of injury and of their injury severity.

1.2.2 Injury risk of drivers to other cars

As in Europe and the United States, the aggressivity rating considered in this study has been based on two-car crashes between light vehicles (ie. heavy vehicle collisions have been excluded). The NSW and Queensland data on two-car crashes used in this study covers all Police reported crashes where at least one vehicle was towed or a pre-defined minimum damage level was attained. Consequently, the number of crashes in which neither driver was injured was available, at least so far as tow-away crashes are concerned. A measure of the risk of injury of the other drivers colliding with the subject model, unadjusted for any other factors, can be defined as:

Injury risk of other drivers = RO = proportion of drivers involved in crashes of tow away or greater severity who were injured

Figure 1 : Aggressivity ratings towards drivers of other vehicles vs Aggressivity ratings towards drivers of other vehicles adjusted for crash severity (by using the injury level of the driver of the subject vehicle)



Another more complex measure, considered by Cameron et al (1998), takes into account the injury outcome of the drivers of the focus model vehicles, hence providing an indication of the crash severity. Cameron et al (1998) indicated, however, that inclusion of the injury outcome of the driver of the subject vehicle made little difference to the estimated aggressivity ratings of the subject vehicles, as shown in Figure 1. Consequently, this more complex measure was not further considered here.

1.2.3 Injury severity of drivers of other cars

The injury severity of other drivers could be measured in a number of ways from the information on injury recorded on NSW and Queensland Police reports and TAC claims (viz. killed; admitted to hospital; or injury requiring medical treatment). One measure of injury severity, analogous to that used in the crashworthiness ratings estimates, is:

Injury severity of other drivers = SO = proportion of injured drivers who were killed or admitted to hospital.

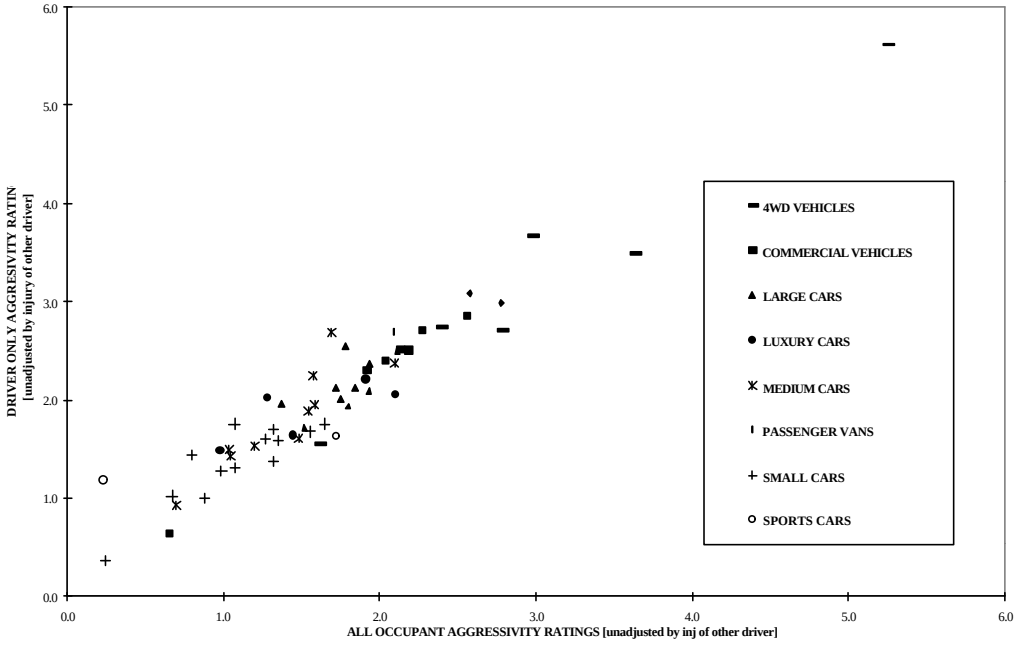
In estimating aggressivity ratings, the injury severity of drivers of other vehicles colliding with the subject model cars, SO, has been calculated in the same way.

1.2.4 Consideration of all occupants of other vehicles

The most severely injured occupant in each other car has also been considered by Cameron et al (1998) as the basis for calculating RO and SO instead of just the injured drivers. Little difference was found in the estimated aggressivity ratings when considering all vehicle occupants than when considering drivers only, as shown in Figure 2.

Given the demonstrated closeness between the aggressivity ratings considering all vehicle occupants and those considering drivers only in Figure 2, aggressivity ratings based on all vehicle occupants have not been considered in this report. This decision is also supported by the extra complexity of data preparation for calculation of aggressivity ratings towards all vehicle occupants and noting that analysis of the most severely injured occupant of each vehicle in the database showed that 98.5% of these were the driver of the vehicle.

Figure 2: Estimated vehicle aggressivity towards other drivers vs. Estimated vehicle aggressivity towards all other vehicle occupants



1.2.5 Overall measure of aggressivity towards drivers of other cars

Based on the definition of RO and SO above, an aggressivity measure for each subject car model was then calculated as:

Aggressivity to other car occupants = AO = RO x SO.

This measures the risk of the driver of other cars being killed or admitted to hospital when involved in collisions with the subject model cars.

Before this aggressivity measure was calculated, consideration was given to taking into account likely differences between the crash circumstances of the subject car models which may result in a distorted view of its aggressivity only partly related to the characteristics of the subject cars. Factors available in the data to consider such differences include:

- speed limit at the crash location
- subject vehicle driver age (younger drivers may be driving at relatively fast speeds not fully represented by the speed limit)
- subject vehicle driver sex (male drivers may be driving at relatively fast speeds or more aggressively)
- other car occupant age (older occupants are more susceptible to injury)
- other car occupant sex (female occupants are more susceptible to injury, but males appear to be associated with relatively high injury severities)

Logistic regression techniques have been used to adjust RO and SO, separately, for any major differences that emerge between models of the subject cars regarding these factors. The adjusted RO and SO have been multiplied together for each subject car model to provide the final measure of aggressivity, AO.

1.3 Project Aims

The aim of this project was to update the previously published crashworthiness ratings of Newstead et al (1999) and aggressivity ratings towards drivers of other vehicles of Cameron et al (1998). The update included additional crash data from the year 1998 from Victoria and NSW and from the years 1997 and 1998 from Queensland. The updated ratings cover the drivers of cars, station wagons, four-wheel drive vehicles, passenger vans, and light commercial vehicles manufactured during 1982-97 and crashing in Victoria or NSW during 1987-98 or Queensland during 1991-98.

This project also aimed to update the results of the study of crashworthiness by vehicle year of manufacture to include vehicles manufactured over the years 1964 to 1998. This component of this project also used the same methods and data sources as the crashworthiness ratings project, the exception being that pre-1982 vehicles were also included.

2. CRASH DATA

Data from Victoria, NSW and Queensland used to produce the crashworthiness ratings of Newstead et al (1999) covering vehicles manufactured over the period 1982-97 and crashing during the years 1987-97 was again used here. In addition, data for 1998 for both NSW and Victoria and data for 1997 and 1998 from Queensland were obtained and integrated bringing the total period of crash data covered to 1987-98. Subsets of these data were taken in order to estimate the aggressivity measures. The methods of selecting appropriate cases from each data source will be detailed here.

2.1 Victorian Crashes

The Transport Accident Commission (TAC) and its predecessor, the Motor Accidents Board, as part of their responsibilities to provide road transport injury compensation, have collected detailed injury data. For each claimant, a description of the injuries was recorded, as well as whether the person was admitted to hospital. TAC obtained some details of the occupied vehicle (but not its model) from the VicRoads registration system. When the TAC was established in 1987, it introduced a requirement that the crashes resulting in an injury claim should be reported to the Police, and started adding Police accident numbers (if and when available) to the claims records.

TAC injury claims from all types of road users who were involved in crashes in the period 1987 to 1997 had been merged with Police crash reports for the previous crashworthiness ratings (see Cameron et al (1994a,b) for a description of the method of matching). The Police reports were for all persons involved in crashes, regardless of 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).

The levels of matching of TAC claims with persons recorded on Police reports for each year during 1987-97, achieved by Newstead et al (1999) for the last crashworthiness ratings, are shown in Table 1. To update the ratings, files on TAC claims during 1998 were obtained. These were merged with the Police reports on crashes in Victoria during 1998, achieving the match rates also shown in Table 1. The methods of matching for the 1998 data were the same as used previously and detailed in Cameron et al (1994b).

The merged files of TAC claims with Police reports for 1998 were added to the earlier data on crashes during 1987-97, which then represented 167,915 TAC claims for injury during 1987-98. The resulting file covered 37,554 injured drivers of 1982-98 model cars who had accepted TAC claims. The information on these drivers was combined with data on drivers injured in NSW and Queensland (see Section 2.4) to produce the updated crashworthiness ratings.

For the study of crashworthiness by year of vehicle manufacture, of the 167,915 merged TAC claims for injury during 1987-98, 74,367 were injured drivers of cars, station wagons or taxis manufactured over the years 1964-98. Again, the information on these drivers was combined with data on drivers injured in NSW and Queensland (see Section 2.4).

Table 1: TAC claims for injury compensation from crashes during 1987-98

Year	TAC claims (all types of injured road users)	TAC claims matched with Police reports	Match rate (%)
1987	30,892	17,509	56.7
1988	28,427	16,672	58.6
1989	25,399	17,494	66.3
1990	19,633	13,886	70.7
1991	19,538	12,774	65.4
1992	19,251	13,118	68.1
1993	18,590	12,618	67.8
1994	19,341	11,927	61.6
1995	20,189	12,452	61.7
1996	19,954	14,034	70.3
1997	18,754	13,036	69.5
1998	18,561	12,395	66.8

In the study of vehicle aggressivity by Cameron et al (1998), a decision was made not to use the Victorian crash data for calculation of aggressivity ratings based on a number of practical considerations. Calculation of aggressivity ratings towards drivers of other vehicles requires selecting vehicles involved in two car crashes followed by matching of the vehicle and occupant injury details for the two cars involved in the crash. The crash data for Victoria used in calculating crashworthiness ratings covered vehicle models from 1982 to 1998. For the Victorian data, however, a vehicle is only included in the data for estimation of crashworthiness ratings if the driver is injured. This is because the vehicle details for the driver are obtained from the TAC insurance claim information with the driver only appearing in the TAC claims data if they were injured.

When attempting to match pairs of vehicles involved in a crash, the two vehicles in the crash only matched using the crashworthiness data if both drivers were injured and driving vehicles manufactured over the years 1982 to 1998. For those vehicles manufactured over the period 1982 to 1998 not matching with the other vehicle in the crash using the crashworthiness data, it was necessary to return to the full Victorian Police reported crash data files for 1987-98. Using the full Victorian Police reported crash data files for 1987-98 it was possible to retrieve crash records for vehicles manufactured before 1982 to determine driver injury status and for vehicles of all years of manufacture with uninjured drivers that crashed with a 1982-98 vehicle with injured drivers. This enabled the Victorian data to be used for calculating aggressivity ratings. It did, however, rely on the Police classification of driver injury for drivers of vehicles manufactured prior to 1982 rather than using the TAC injury classification. It is assumed this did not affect the analysis greatly.

The data matching process for Victorian data described above identified 22,521 vehicles manufactured between 1982 and 1998 that had been involved in a crash with one other vehicle where the other vehicle had no restriction on its year of manufacture. Of the drivers of these other vehicles, 8,169 were injured and 14,352 were uninjured. It was not possible to use the uninjured records from the Victorian data as they are incomplete due to the fact that only crashes involving injury are reliably reported in Victoria. Hence only the 8,169 records of other driver

injury were used for calculation of the injury severity component of the vehicle aggressivity ratings toward drivers of other vehicles.

2.2 New South Wales Crashes

NRMA supplied files covering 517,824 light passenger vehicles involved in Police reported crashes during 1987-98 that resulted in death or injury or a vehicle being towed away. 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 1982-98, but covered four-wheel drive vehicles, passenger vans, and light commercial vehicles as well as cars and station wagons. The method of assembly of this data is given in Cameron et al (1994b).

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. Of the 517,824 drivers involved in tow-away crashes, 82,694 were injured.

Of the 517,824 1982-98 model year vehicles involved in crashes in NSW, 369,966 were coded as being involved in crashes with one other traffic unit (ie. the crash involved a total of two traffic units). In order to compare occupant injury levels in crashes involving two vehicles, it was necessary to match the crash and occupant injury information for each of the two vehicles involved in the crash.

The data used for calculation of the crashworthiness ratings covered only vehicles manufactured from 1982 to 1998. Consequently, initial matching of only the crashworthiness data to determine pairs of vehicles involved in a crash identified both the vehicles in the crash when both vehicles were manufactured from 1982 to 1998. A second matching stage was then required to identify the details of drivers of vehicles manufactured before 1982 that had collided with the unmatched 1982-98 model year vehicles in the crashworthiness file. This required retrieval of the remaining crash records in the 1987-98 NSW crash files not used for crashworthiness ratings in order to match vehicles manufactured prior to 1982. The two stage data matching process identified 330,936 matched records of vehicles manufactured between 1982 and 1998 that had been involved in a crash with one other vehicle where the other vehicle had no restriction on its year of manufacture. Of the drivers of these other vehicles, 55,570 were injured. These records were used for calculation of vehicle aggressivity ratings toward drivers of other vehicles.

For the study of crashworthiness by vehicle year of manufacture, the NSW data represented 1,273,403 drivers of cars, station wagons or taxis manufactured from 1964 to 1998 who were involved in tow-away crashes. Of these drivers, 210,779 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 Queensland Crashes

Queensland Transport supplied files covering 131,005 light passenger vehicles involved in Police reported crashes during 1991-98 that resulted in death or injury or a vehicle being towed away. The files supplied covered all years of vehicle manufacture up to 1998 including models of four-wheel drive vehicles, passenger vans, and light commercial vehicles as well as cars and station wagons.

The vehicle files (which also contained links to separate files with driver age and sex) were merged with files supplied by Queensland Transport 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. As for NSW, a driver who did not match was considered to be uninjured. Out of the 131,005 drivers involved in tow-away crashes, 31,106 were injured.

Of the 131,005 vehicles reported as crashed in Queensland and used in estimation of crashworthiness ratings, 95,369 were coded as being involved in crashes with one other traffic unit (ie. the crash involved a total of two traffic units). In order to compare occupant injury levels between two vehicles involved in a crash, it was necessary to match the crash and occupant injury information for each of the two vehicles involved in the crash in the same manner as for NSW. Using the same two stage data matching process as used for NSW and described above, the process identified 87,276 vehicles manufactured between 1982 and 1998 that had been involved in a crash with one other vehicle where the other vehicle had no restriction on its year of manufacture. Of the drivers of these other vehicles, 42,318 were injured. These records were used for calculation of vehicle aggressivity ratings toward drivers of other vehicles.

For the study of crashworthiness by vehicle year of manufacture, the Queensland data represented 163,114 drivers of cars, station wagons or taxis manufactured from 1964 to 1998 who were involved in tow-away crashes. Of these drivers, 33,054 were injured.

As with the data from NSW, the presence of uninjured drivers in the data file meant that it was also 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.

2.4 Combined Data from the Three States

When the data on the injured drivers was combined for analysis, it covered 151,354 drivers of 1982-98 model vehicles who were injured in crashes in Victoria or NSW during 1987-98 or in Queensland during 1991-98. This information was used to assess the injury severity of the injured drivers of the different makes and models when computing crashworthiness ratings. The information on the 648,829 drivers involved in tow-away crashes in NSW during 1987-98 or Queensland during 1991-98 was used to assess the injury rate of drivers of the different makes and models for computing crashworthiness ratings.

The combined data for estimation of vehicle aggressivity ratings covered 106,057 drivers of vehicles colliding with 1982-98 model vehicles who were injured in two car crashes in Victoria or NSW during 1987-98 or in Queensland during 1991-98. This information was used to assess the injury severity of the injured drivers colliding with the different makes and models when computing aggressivity ratings. The aggressivity injury risk component was estimated from

information on the 418,212 drivers involved in two-car tow-away crashes in NSW during 1987-98 or Queensland during 1991-98.

For the study of crashworthiness by year of vehicle manufacture, the combined data covered 318,209 drivers of vehicles manufactured between 1964 and 1998 who were injured in crashes in Victoria or NSW during 1987-98 or Queensland during 1991-98. For the assessment of injury risk by year of vehicle manufacture, the combined data covered 1,436,517 drivers involved in tow-away crashes in NSW during 1987-98 or Queensland during 1991-98.

3. MODELS OF VEHICLES

A procedure developed by the NRMA located the crashed vehicles in NSW vehicle registration records after matching by registration number and vehicle make. The Vehicle Identification Number (VIN) or chassis number obtained from the register was decoded to determine the models of light passenger vehicles. The decoding identified some light truck and unusual commercial models that were not considered further. Of the vehicles manufactured during 1982-98, all but around 4% had their model identified. Further details are given by Pappas (1993). The same VIN decoding procedure was used to identify vehicle models in the Queensland data, achieving a similar level of decoding accuracy to NSW.

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 50kg (MU). Refined logic was developed by MUARC based on make, year, PMU, PU, MU and body type, and extended to cover 1989-93 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 1982-93.

For vehicles crashing in the years 1994 to 1998, where available, the Victorian vehicle register provided the VIN of each crashed vehicle along with the information described above. VINs are recorded on the Victorian vehicle register for most vehicles from 1989 year of manufacture onwards. Where a VIN was available for a vehicle appearing in the 1994 to 1998 crash data, the model information was decoded from the VIN using the methods of Pappas (1993). Where the VIN was not available, the RACV and MUARC logic, described above, was used to obtain model details.

RACV, NRMA and the Australian Transport Safety Bureau (ATSB, formerly FORS) provided advice on the particular models which had experienced substantial changes in design (and hence potential crashworthiness) during model years 1982-98 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). Where exact model decoding was possible from the VIN, without using year of vehicle manufacture, this was used.

Advice had previously been provided by VicRoads 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 4.1.3). Model sharing in the automotive industry has declined in recent years alleviating this as an ongoing problem to a large degree.

As in previous crashworthiness ratings, models were excluded with fewer than 20 injured drivers and/or fewer than 100 involved drivers appearing in the crash data. The same selection criteria were also used for aggressivity ratings except exclusion was based on the number of injured drivers in the vehicles colliding with the focus vehicle model. These selection criteria

were used to ensure stability in fitting the logistic regression models along with suitably small confidence limits on the estimated crashworthiness ratings.

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)

It should be noted that some of the vehicle models identified in the Victorian, NSW and Queensland crash data have optional safety equipment, such as air bags, which could significantly alter the crashworthiness rating of the vehicle model when fitted. Notable examples in local manufacture include the Holden Commodore VR/VS, Toyota Camry 1993-97 and Mitsubishi Magna TR/TS, and TE/TF/TH, all of which have optional air bag fitment. It is, however, generally not possible to identify which particular vehicles of a model series do and do not have such optional safety equipment installed using the model decoding procedures described above. Consequently, for those vehicle models with optional safety equipment, the estimated crashworthiness rating represents an average of the safety performance for vehicles with and without the optional safety equipment weighted by the number of each in the crash data.

4. ANALYSIS

4.1 Overview of the Analysis Methods: Crashworthiness

The crashworthiness rating (C) is a measure of the risk of serious injury to a driver of a car when it is involved in a crash. It is defined to be the product of two probabilities (Cameron et al, 1992):

i) the probability that a driver involved in a crash is injured (injury risk), denoted by R;

and

ii) the probability that an injured driver is hospitalised or killed (injury severity), denoted by S.

That is

$$C = R \times S.$$

Measuring crashworthiness in this way was first developed by Folksam Insurance who publishes the well-known Swedish ratings (Gustafsson et al, 1989).

In the present report, each of the two components of the crashworthiness rating was obtained by logistic regression modelling techniques. 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.

The Logistic Model

The logistic model of a probability, P, is of the form:

$$\log it(P) = \ln\left(\frac{P}{1-P}\right) = \beta_o + \beta_1 X_1 + \ldots + \beta_k X_k = f(X).$$

That is, the log of the odds ratio is expressed as a linear function of k associated variables, $X_i, i = 1, \ldots, k$. Estimates of the parameter coefficients of the logit function, ie the $\hat{\beta}_i$ can be obtained by maximum likelihood estimation (Hosmer & Lemeshow, 1989). The extension of this model to include interaction terms is straightforward.

Logistic Confidence Limits for the Vehicle Models or Year of Manufacture

Whilst it is possible to calculate the variance of $\hat{f}(X)$, in the context of crashworthiness ratings we are only interested in the component of variance due to one factor in $\hat{f}(X)$ with the variance due to the other factors in the model being of no interest. In practice, the component of variance due to the factor representing the vehicle model or year of manufacture is of interest, whilst the variance due to the remaining factors such as driver age and sex is common to all vehicle models or years of manufacture and hence of no interest.

To isolate the component of variance in the logistic model due to only one factor, say factor X_i, the remaining factors were fixed at a predetermined level (their mean value). The variance of $\hat{f}(X)$, considering all factors apart from X_i to be fixed, is then given by

$$Var\left(\hat{f}\left(X_i\right)\right) = X_i^2 Var\left(\hat{\beta}_i\right)$$

In the logistic models of injury risk or injury severity, X_i was a [0,1] indicator function of either a particular vehicle model or market group or year of manufacture, depending on the analysis being performed. Hence the variance function given above equalled the variance of the coefficient $\hat{\beta}_i$.

A 95% confidence interval for the logit function with respect to component X_i is given by

$$\hat{f}(X) \pm 1.96\sqrt{Var\left(\hat{f}\left(X_i\right)\right)}\ .$$

Point estimates and confidence limits in the logistic space were transformed into probability estimates using the inverse logistic transform given by

$$\hat{P} = \frac{e^{\hat{f}(X)}}{1 + e^{\hat{f}(X)}}.$$

4.1.1 Logistic Models for Each Component

Obtaining the Covariate Models

Before adjusted crashworthiness ratings could be obtained it was necessary to consider logistic models of each of the crashworthiness components separately to identify possible factors, other than vehicle design, that might have influenced the crash outcomes. A stepwise procedure was used to identify which factors had an important influence. This was done without considering the type of car or year of manufacture in the model as the aim was to determine which other factors were most likely to have had an influence across a broad spectrum of crashes. Furthermore, the car model variable had to be excluded from the logistic modelling process at this stage because of analysis convergence problems when the car model was competing against the other factors in the stepwise procedure.

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 factors considered during this stage of 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:** state of crash (Victoria, NSW or Queensland)
- **year:** year of crash (1987, 1988, … ,1998)

These variables were chosen for consideration because they were part of the Victorian, Queensland 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.

State of crash was a necessary inclusion in the logistic model because, in comparison to Victoria and NSW, which have similar proportions of crashes at each severity level, Queensland has a higher proportion of severe crashes in their reported data. Including the state factor in the covariate model is necessary to adjust for rating bias towards those vehicle models that are sold and driven more in Queensland. Whether the noted severity difference is because crashes in Queensland are actually more severe on average than in Victoria or NSW or because of some reporting bias towards higher severity crashes in Queensland is unclear. Inclusion of a year of crash indicator in the model is necessary to adjust for the effects of trends in crash severity noted in Victoria, NSW and Queensland (see section 4.1.5 below).

All data was analysed using the LR procedure of the BMDP statistical package (BMDP, 1988). Estimates of the coefficients of the logit function, $\hat{\beta}_i, i = 1, \ldots, k$, together with their associated standard errors, were obtained by maximum likelihood estimation. In the modelling process, design variables for the various factors were chosen in such a way that the estimated coefficients represented deviations of each of the variable levels from the mean (ie. the BMDP LR marginal method for forming design variables was used).

For both injury risk and injury severity, a stepwise procedure was used to identify which factors and their interactions made a significant contribution to these probabilities. All possible first and higher order interactions were considered. A hierarchical structure was imposed so that interaction between two variables was included in the model only when the corresponding main effects were also included. The resultant logistic regression models were referred to as the "covariate" models or equations.

The average value of the injury risk or injury severity, and estimated 95% confidence intervals, were obtained directly from the "covariate" models by substituting mean values of each of the factors and their interactions into the regression equations.

Assessing Car Model or Year of Manufacture Differences

Injury risk and injury severity for individual cars were estimated after adding a variable representing car model or year of manufacture to the respective logistic "covariate" models. The car model or year of manufacture variable was forced into the logistic equation and individual car model or year of manufacture coefficients computed to represent deviations of that car or year from the average. As mentioned earlier, this was to avoid non-convergence problems in the analysis when car model or year of manufacture was allowed to compete with the other factors in the stepwise selection process.

It was important to ensure that the logistic model adequately described the data and did not yield individual car model coefficients that were imprecise or unstable. For this reason, individual car models with small frequencies were pooled with similar car models, if appropriate (see Section 4.1.3) or they were excluded from the analysis. Car models were excluded if, after pooling models, there were either:

i) less than 100 involved drivers; or
ii) less than 20 injured drivers.

After exclusion, the regression analyses were performed on 195 individual car models (or pooled similar models). The variable representing car model was therefore categorical with 195 nominal levels. The choice of the design for the logistic model allowed the injury risk and injury severity estimates for each individual car model to be compared with the overall (average) rating for all cars. No such criteria were necessary for the year of manufacture analysis.

For each car model or year of manufacture, a 95% confidence interval for the logit functions of injury risk and injury severity was obtained after first adjusting for the average value of the "covariate" model and then allowing for the deviation from average for that particular car model.

Estimates of injury risk and injury severity were obtained by de-transforming the logit functions as described above. A 95% confidence interval was determined after adjusting for the average values of the significant factors and their interactions. The precision of the estimates of injury risk and injury severity is measured by the width of these 95% confidence intervals.

Assessing Market Group Averages

A similar approach to that for individual car models was used to assess car market group averages. A variable with 8 nominal levels representing the different market groups (large, medium, small, luxury, sports, 4-wheel drive, passenger vans and commercial vehicles with GVM $\leq$ 3000 kg) was added to each of the "covariate" models. Deviations of each market group from the average were also assessed. Ninety-five percent confidence intervals for the estimates of both injury severity and injury risk were also obtained for each of the market groups.

4.1.2 Combining the Injury Risk and Injury Severity Components

The final combined ratings of vehicle crashworthiness are given by:

Crashworthiness Rating = Injury risk x Injury severity.

For a given model of car or year of manufacture, j, the crashworthiness rating, C_j, was therefore calculated as:

$$C_j = R_j \times S_j$$

where

R_j denotes the injury risk for car model or year of manufacture j, and
S_j denotes the injury severity for car model or year of manufacture j.

Noting the form of the logistic inverse transformation in section 4.1 above, we have

$$R_j = \frac{e^{a_j}}{1+e^{a_j}}, \qquad S_j = \frac{e^{b_j}}{1+e^{b_j}}$$

where a_j and b_j are the values of the logistic regression function $\hat{f}(X)$ for injury risk and injury severity respectively for vehicle model or year of manufacture *j*.

Taking the natural log of the crashworthiness rating and using asymptotic statistical theory, the asymptotic variance of the log of the crashworthiness rating is

$$Var(\log_e C_j) \approx \frac{Var(\alpha_j)}{(1+e^{a_j})^2} + \frac{Var(\beta_j)}{(1+e^{b_j})^2}$$

where the variances of α_j and β_j are as given in section 4.1 and the estimates of α_j and β_j are considered independent.

The 95% confidence interval for the natural log of the crashworthiness rating is then

$$\log_e(C_j) \pm 1.96 \cdot \sqrt{Var\left(\log_e(C_j)\right)}.$$

The 95% confidence limit for the crashworthiness rating is obtained by taking the exponent of the confidence limit of the logged crashworthiness rating shown above.

Because each of the two estimated crashworthiness components have been adjusted for the effect of other factors by logistic regression prior to their incorporation into the combined ratings, the resultant crashworthiness rating is also adjusted for the influence of these factors. It should be noted that the confidence interval for the combined rate reflects the variability in the car model only and not the variability in the other factors included in the logistic models.

The same procedure was used to obtain crashworthiness ratings of each distinct market group and for each year of vehicle manufacture.

4.1.3 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 4.1.1. In order to ensure that the logistic model adequately described the data and did not yield crashworthiness estimates that were imprecise, individual car models with small frequencies were pooled with similar models (Table 2) or excluded from the analysis. The car models that were excluded from the analyses are indicated in Appendix 1.

Table 2: 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
Telstar 92-96	with	Mazda 626 92-96
Falcon EA	with	Falcon EB Series 1
Falcon ED	with	Falcon EB Series 2
Corsair 89-92	with	Pintara 89-92
Commodore VR/VS	with	Lexcen 93-95
Commodore VN-VP	with	Lexcen 89-92
Nova 89-93	with	Corolla 89-93
Nova 95-96	with	Corolla 95-96
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 89-93	with	Suzuki Swift 89-94
Apollo JK/JL	with	Camry 88-92
Apollo JM/JP	with	Camry 93-96
Ford Maverick 88-97	with	Nissan Patrol 88-97
Suzuki Scurry 85-87	with	Holden Carry 85-90
Suzuki Sierra 82-96	with	Holden Drover 85-87
Nissan XFN Utility	with	Ford Falcon Utility

4.1.4 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 4.1.1. The market group analyses provided reference ratings for models in each group.

4.1.5 Trends in the Rating Criteria

In both Victoria and New South Wales there have been major increases in road safety during the 1990s and this may have produced a change in both the risk of serious injury in crashes as well as the number of crashes occurring. There was therefore some concern that there may have been a bias in the crashworthiness ratings given that most vehicles were not on sale, and hence involved in crashes, for the entire period covered by the crash data. If, for example, there had been a general reduction in crash severity over time, the crashworthiness rating of the later model cars would tend to be lower, irrespective of design improvements, than would be expected if the general improvements in road safety had not occurred.

This concern led to a need to investigate whether there were in fact, trends in the risk of driver injury in NSW, and/or driver injury severity in Victoria and NSW over time. If changes were found these would need to be taken into account in the crashworthiness ratings of specific years of the same models.

The file of drivers involved in crashes in NSW used to measure the driver injury rate, the first component of the crashworthiness rating, was analysed by the year in which the crash occurred to assess any trends. There was no real evidence of a consistent trend over the period (Table 3a).

Table 3a: Numbers of drivers of light passenger vehicles manufactured in 1982-98 and involved in tow-away crashes in NSW during each of the years 1987-98.

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Total injured	4249	4814	5307	5573	5410	5678	5843	6135	6490	6859	7408	8070
Total involved	33049	32673	36896	40208	39200	39579	40859	42433	45477	51931	53957	55368
Injury Rate(%)	**12.9**	**14.7**	**14.4**	**13.9**	**13.8**	**14.3**	**14.3**	**14.5**	**14.3**	**13.2**	**13.7**	**14.6**

As for NSW, the file of drivers involved in crashes in Queensland, also used to measure the driver injury rate, was analysed by the year in which the crash occurred to assess any trends. There was strong evidence of a consistent trend over the period (Table 3b), much more than observed in the data from NSW.

Table 3b: Numbers of drivers of light passenger vehicles manufactured in 1982-98 and involved in tow-away crashes in Queensland during each of the years 1991-98.

	1991	1992	1993	1994	1995	1996	1997	1998
Total injured	2565	4580	5298	6265	6984	7101	6052	7131
Total involved	12342	20721	23015	25766	26992	27059	20803	23773
Injury Rate (%)	**20.8**	**22.1**	**23.0**	**24.3**	**25.7**	**26.2**	**29.1**	**29.9**

The file of drivers injured in crashes in the Victoria and NSW combined was used to assess the trend in driver injury severity, the second component of the crashworthiness rating. Again there was evidence of a consistent trend over the period (Table 4a), more so than in the injury risk analysis for NSW above.

Table 4a: Numbers of drivers of light passenger vehicles manufactured in 1982-98 and injured in crashes in Victoria and NSW during each of the years 1987-98.

Year of Crash	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Total killed or admitted to hospital	1380	1499	1664	1644	1735	1772	2008	2221	2438	2670	2945	2901
Total injured	6165	7126	8047	7697	7724	8215	8401	9344	9923	11119	11565	9154
Injury Severity (%)	**22.4**	**21.0**	**20.7**	**21.4**	**22.5**	**21.6**	**23.9**	**23.8**	**24.6**	**24.1**	**25.5**	**31.7**

Similar analysis for trends in driver injury severity recorded in the Queensland crash data was also carried out. Again there was evidence of a consistent trend over the period (Table 4b), although the trend here was in the opposite direction to that observed in the injury risk analysis above. There was particularly large jump in injury severity in 1998, the reason for which was not obvious. Inconsistent trends in the injury severity data by year crash are not a problem for the analysis method. This is because the year of crash variable is treated as categorical in the logistic regression, meaning any pattern in the time series of crash severities by crash year can be represented accurately.

Table 4b: Numbers of drivers of light passenger vehicles manufactured in 1982-98 and injured in crashes in Queensland during each of the years 1991-98.

Year of Crash	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Total killed or Admitted to hospital	918	1506	1708	2044	2168	2049	1491	1905
Total injured	1647	3074	3590	4221	4816	5049	2697	3086
Injury Severity (%)	**55.7**	**48.9**	**47.6**	**48.4**	**45.0**	**40.6**	**55.3**	**61.7**

The driver injury rate (Table 3) and driver injury severity (Table 4), for each crash year during 1987-97, were multiplied separately for Victoria and NSW combined and Queensland to form a Combined Rate (Table 5a,b). The Combined Rate measures essentially the same risk (ie. of death or hospital admission for drivers involved in tow-away crashes) as the crashworthiness rating. However it should be noted that it has not been adjusted for the effect of various factors (eg. driver age and sex, speed zone of the crash, etc.) in the same way as the rating scores.

Table 5a: Combined Rate for drivers of light passenger vehicles manufactured in 1982-98 and involved in tow-away crashes in Victoria and NSW during each of the years 1987-98.

Year of Crash	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Injury Rate (%)	12.9	14.7	14.4	13.9	13.8	14.3	14.3	14.5	14.3	13.2	13.7	14.6
Injury Severity (%)	22.4	21.0	20.7	21.4	22.5	21.6	23.9	23.8	24.6	24.1	25.5	31.7
Combined Rate (%)	**2.89**	**3.09**	**2.98**	**2.97**	**3.11**	**3.08**	**3.42**	**3.45**	**3.51**	**3.18**	**3.49**	**4.63**

Table 5b: Combined Rate for drivers of light passenger vehicles manufactured in 1982-98 and involved in tow-away crashes in Queensland during each of the years 1991-98.

Year of Crash	1991	1992	1993	1994	1995	1996	1997	1998
Injury Rate (%)	20.8	22.1	23.0	24.3	25.7	26.2	29.1	29.9
Injury Severity (%)	55.7	48.9	47.6	48.5	45.0	40.6	55.3	61.7
Combined Rate (%)	**11.6**	**10.8**	**10.9**	**11.8**	**11.6**	**10.6**	**16.1**	**18.4**

It was concluded that there was evidence of consistent trends in the injury risk and injury severity ratios, upon which the crashworthiness analysis is based, over the crash years considered. Consequently, it was necessary to take account in the analysis the fact that later model cars have crashed only in the later years by including a year of crash variable in the covariate models described above.

A further point illustrated by comparison of Tables 5a and 5b is the difference in average injury severity between crashes in NSW and Victoria and crashes in Queensland. The raw injury rate observed in Queensland is of the order of three times higher than that observed in NSW and Victoria. As mentioned, whether this is because crashes in Queensland are actually more severe or because of a reporting bias towards more severe crashes in Queensland is unclear. To compensate for this difference in the analysis in order to avoid a rating bias against those vehicle models driven more in Queensland, it was necessary to include a variable indicating state of crash in the covariate model.

4.2 Overview of the Analysis Methods: Aggressivity

As described above, the measure of aggressivity to drivers of other cars (AO) being considered here is:

$$AO = RO \times SO$$

where

$$RO = \text{Injury risk of other drivers}$$

that is, the probability that the other driver sustains some injury given their vehicle is involved in a crash of tow-away severity or greater with the subject vehicle type, and

$$SO = \text{Injury severity of other drivers}$$

where SO is the probability that the other driver is killed or seriously injured given they sustain some injury in the crash where their vehicle is impacted by a vehicle of the subject vehicle type. The subject vehicle, described by its make and model or market group, is the specific type of vehicle whose aggressivity is being measured in terms of its threat of injury to the driver of the other vehicle with which it impacts.

Each of the two components of the aggressivity rating, RO and SO, were obtained by logistic regression modelling techniques. In the same manner as for the crashworthiness ratings, such techniques are able to simultaneously adjust for the effect of a number of factors, which will be discussed below, on the aggressivity injury risk and injury severity probabilities.

4.2.1 Logistic Models, Confidence Limits and Assessment of Aggressivity of Specific Vehicle Models and Market Groups

A logistic model of the same form used for estimation of vehicle crashworthiness ratings was used for estimation of vehicle aggressivity ratings. The key difference in the logistic models for vehicle aggressivity was that the response variables being modelled was not the injury risk or injury severity of the driver of the focus vehicle, as for crashworthiness. Rather, the injury risk and injury severity of the driver of the other vehicle with which the focus vehicle model collided were modelled as the response variables. Given the similarity of the structure of the aggressivity injury risk, RO, and injury severity, SO, with their crashworthiness parallels, the method of computing confidence limits on each RO and SO was the same as given for the corresponding crashworthiness measures above.

Before adjusted aggressivity ratings could be obtained it was necessary to consider logistic models of each of the aggressivity components, RO or SO separately, to identify possible factors, other than vehicle design, that might have influenced injury outcome to the other driver. As for crashworthiness rating estimation, a stepwise procedure was used to identify which factors had an important influence. This was done without considering the type of car (make/model or market group) in the model as the aim was to determine which other factors were most likely to have an influence across a broad spectrum of crashes. Logistic models were obtained separately for injury risk, RO, and injury severity, SO, because it was likely that the various factors would have different levels of influence on these two component probabilities of the aggressivity measure.

The factors considered in the covariate models for both aggressivity injury risk and injury severity were

- **speedzone** : speed limit at the crash location (<80km/h, >= 80 km/h)
- **agefcd** : age of driver of subject car (<=25 years, 26-59 years, >=60 years)
- **sexfcd** : sex of driver of subject car
- **ageoo** : other car driver age (<=25 years, 26-59 years, >=60 years)
- **sexoo** : other car driver sex
- **state** : state in which the vehicle crashed
- **year** : year in which the vehicle crashed

These variables were chosen for consideration because they were available in each of the New South Wales, Victorian and Queensland crash databases. Logistic regressions were again carried out using the LR procedure of the BMDP statistical package (BMDP, 1988) using maximum likelihood estimation, the marginal method for forming design variables and a hierarchical structure considering all possible interactions in a stepwise procedure.

Aggressivity injury risk and injury severity for individual vehicle models was estimated after adding a variable representing the subject car model to the respective logistic "covariate" models. The car model variable was forced into the logistic equation and individual car model coefficients were computed to represent deviations of that car from the average. In a similar manner to the calculation of crashworthiness ratings, car models were excluded for the calculation of the aggressivity ratings if there were less than 100 vehicles with which they had crashed or there were less than 20 injured drivers in other vehicles with which they had crashed.

After exclusion, the regression analyses were performed on 123 individual car models for calculation of aggressivity ratings. The variable representing car model was therefore categorical with 123 nominal levels. The choice of the design for the logistic model allowed the injury risk and injury severity estimates for each individual car model to be compared with the overall (average) rating for all cars. For each car model in each aggressivity measure, a 95% confidence interval for the logit functions of aggressivity injury risk, and injury severity was obtained after first adjusting for the average value of the "covariate" model and then allowing for the deviation from average for that particular car model. Estimates of injury risk and injury severity were obtained by the reverse logistic transform. A 95% confidence interval was determined after adjusting for the average values of the significant factors and their interactions. Aggressivity by 8 broad market groups, as defined for crashworthiness ratings, was also computed along with 95% confidence limits.

The final combined aggressivity ratings for occupants of other vehicles are given by:

$$AO = RO \text{ x } SO$$

For a given model of focus car, j, the aggressivity rating, AO_j, was therefore calculated as:

$$AO_j = RO_j \times SO_j$$

where RO_j denotes the aggressivity injury risk for car model j and SO_j denotes the aggressivity injury severity for car model j. Computation of the variance and hence confidence limits on the quantity AO are carried out in the same way as for the crashworthiness measure, C.

5. RESULTS

5.1 Vehicle Crashworthiness Ratings

5.1.1 Injury Risk

Injury risk was estimated from the data on 648,829 drivers involved in tow-away crashes in NSW and Queensland (as described in Section 2.4). This data set is referred to as the "involved drivers". Because of missing values in one or more of the covariates driver sex and age, speedzone and number of vehicles involved in the crash amongst the 648,829 involved drivers, the final file used for analysis consisted of the 514,975 drivers for which all the covariate data was complete. The "covariate" model for injury risk was determined from the variables described in Section 4.1.1.

The following terms were significantly associated with injury risk and were included in the logistic model:

Base effect terms	First order interactions	Second order interactions
Sex	Sex*Speedzone	Sex*Age*Nveh
Speedzone	Speedzone*Nveh	Sex*Speedzone*Nveh
Age	Sex*Nveh	Sex*Speedzone*Age
Nveh	Sex*Age	
State	Age*Nveh	
Year	Speedzone*Age	

No other term significantly improved the fit of the logistic model.

The overall (average) injury risk for involved drivers in tow-away crashes in NSW and Queensland, after adjusting for differences in the factors in the “covariate” model given above, was 15.89 per 100 drivers. In other words, the probability that a driver involved in a tow-away crash in NSW or Queensland was injured was 15.89%, after adjusting for other significant factors.

Appendix 2 gives the estimates of injury risk derived by logistic regression for 167 individual car models, or sets of car models. Injury risk ranged from 7.99 % for the Honda Legend to 33.97% for the Subaru Sherpa/Fiori.

An estimate of the variability in the injury risk estimates was calculated from the width of the corresponding 95% confidence intervals. Individual confidence interval widths ranged from 0.93% (Falcon XD-XF) to 11.64% for the 1982-86 Rover Quintet. The small variability for the Falcon X series Sedan is not surprising since there were more cars of this model than any other in the data set and precision is known to improve with increasing sample size.

The estimated injury risk for each market group is also given in Appendix 2. The luxury vehicles had the lowest injury risk (13.08%) and the small car market group had the highest (20.12%).

5.1.2 Injury Severity

The data on "injured drivers" covered 151,354 drivers of 1982-98 model vehicles who were injured in crashes in Victoria, NSW or Queensland during 1987-98 (as described in Section 2.4). Because of missing values in one or more of the covariates amongst the 151,354 injured

drivers, the final file used for analysis consisted of the 101,511 drivers for which all the covariate data was complete. The "covariate" model for injury severity was determined from the variables described in Section 4.1.1.

The following terms were significantly associated with injury severity and were included in the logistic model:

Base effect terms	First order interactions	Second order interaction
Sex	Sex*State	Sex*Age*State
Speedzone	Speedzone*Nveh	
Age	Age*Sex	
Nveh	Nveh*State	
State	State*Speedzone	
Year	Speedzone*Age	
	Age*State	
	Age*Nveh	

No other term significantly improved the fit of the logistic model.

The overall (average) injury severity for injured drivers, after adjusting for differences in the associated factors, was 24.09 per 100 drivers. In other words, the probability that a driver injured in a crash was severely injured was 24.09 %, after adjusting for other significant factors.

Appendix 3 gives the estimates of injury severity derived by logistic regression for 167 individual car models, or sets of combined models. Injury severity ranged from 13.39% for the 1982-91 Holden Jackaroo to 39.81% for the 1991-96 Nissan NX/NX-R.

An estimate of the variability in the estimates of injury severity was calculated from the width of the corresponding 95% confidence intervals. Individual confidence interval widths ranged from 2.63% 1982-88 Ford Laser / Mazda 323 to 42.11% for the 1984-89 Fiat Regata.

The estimated injury severity for each market group is also given in Appendix 3. Luxury vehicles performed best with respect to injury severity, having the lowest average injury severity of 22.86%. The commercial vehicle market group had the highest average injury severity of 25.28%).

5.1.3 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 had been adjusted for the confounding factors, the resultant crashworthiness rating was also adjusted for the influence of these factors.

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

Appendix 4 gives the crashworthiness ratings and the associated 95% confidence intervals for each of the 167 car models included in the analyses. Appendix 4 also gives the crashworthiness ratings with 90% confidence limits for each of the 167 vehicle models. 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.

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 4. 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 4 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 1.6 (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). This exclusion criterion is more stringent than that used by Cameron et al (1994a,b) reflecting the greater accuracy afforded in the current ratings as a result of larger quantities of data.

5.1.4 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. 3.83 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 database did not contain sufficient numbers of these models for the data to represent scientific evidence that this is the case.

Twenty-three models had ratings representing evidence of superior crashworthiness because their upper confidence limits were less than the average rating. Nine of these were large cars, five were luxury models, one was classified as medium car, five were four wheel drives and the last three were commercial vehicles. The specific models were (in order of estimated risk of serious driver injury in a crash, from lowest to highest):

- Nissan Navara (1992-96)
- Toyota Landcruiser (1990-97)
- Volvo 700/900 Series (1984-92)
- Ford Falcon Panel Van (1982-1995)
- Peugeot 505 (1982-93)
- Ford Maverick (1988-97) / Nissan Patrol (1988-1997)
- Honda Accord (1986-90)
- Volvo 200 Series (1982-93)
- Toyota Cressida (1989-93)
- Mitsubishi Magna TE/TF/TH and Verada KE/KF/KH (1996-98)
- Ford Fairlane N series and LTD D series (1988-94)
- Ford Falcon EA/EB Series I (1988-March 1992)
- Ford Falcon Ute (1982-95) / Nissan XFN Ute (1988-90)
- Toyota 4Runner/Hilux (1989-97)
- Holden Commodore VR/VS and Toyota Lexcen (1993-97)
- Toyota 4Runner/Hilux (1986-88)
- Mitsubishi Magna TR/TS and Verada KR/KS (1991-96)

- Ford Falcon EF/EL (1994-98)
- Ford Falcon EB Series II / ED (April 1992-94)
- Holden Apollo JM/JP / Toyota Camry (1993-97)
- Toyota Landcruiser (1982-89)
- Ford Falcon XE/XF (1982-88)
- Holden Commodore VN/VP and Toyota Lexcen (1989-93)

Thirty-five models had ratings representing evidence of inferior crashworthiness because their lower confidence limits were greater than the average rating. Twenty-seven were small cars, three were light commercial vehicles, two were passenger vans, one was a medium car, one was a sports car and one was a four-wheel drive. The specific models were (in order of estimated risk of serious driver injury in a crash, from highest to lowest):

- Subaru Sherpa/Fiori (1989-92)
- Suzuki Hatch (1982-85)
- Nissan NX/NX-R (1991-96)
- Daihatsu Handivan (1982-90)
- Daihatsu Mira (1990-96)
- Suzuki Mighty Boy (1985-88)
- Honda City (1983-86)
- Daihatsu Charade (1982-86)
- Holden Barina (1985-88) / Suzuki Swift (1985-88)
- Daewoo Cielo (1995-97)
- Mazda 121 (1987-90) / Ford Festiva (1991-93)
- Hyundai Excel (1995-98)
- Daihatsu Charade (1993-98)
- Ford Festiva WB/WD/WH (1994-98)
- Holden Barina SB (1995-98)
- Daihatsu Charade (1988-92)
- Subaru Impreza (1993-98)
- Mitsubishi Starwagon / L300 (1982-86)
- Subaru Brumby (1982-93)
- Hyundai Excel (1982-89)
- Mazda 323 (1995-98)
- Holden Barina (1989-93) / Suzuki Swift (1989-98)
- Honda Civic (1984-87)
- Mitsubishi Lancer CE/Mirage (1995-98)
- Hyundai Excel (1990-94)
- Honda Civic (1988-91)
- Mitsubishi Colt (1982-88)
- Holden Astra / Nissan Pulsar (1984-86)
- Suzuki Sierra (1982-97) / Holden Drover (1985-87)
- Mazda 323 / Ford Laser (1982-88)
- Toyota Hiace/Liteace (1982-86)
- Toyota Corolla (1986-88)
- Toyota Tarago (1983-89)
- Holden Astra / Nissan Pulsar/Vector (1988-90)
- Holden Camira (1982-89)

5.2 Aggressivity Towards Other Car Drivers

Using the methods described above, logistic regression models of the injury risk and injury severity of the subject driver (ie. the driver of the "other" vehicle) were built separately as functions of both vehicle model and market group of the vehicle colliding with the vehicle of the focus driver. Variations in the other factors listed in Section 4.2.1 were adjusted in the model by including them as predictors of the injury risk or injury severity of the focus driver, along with the subject vehicle model or market group.

The logistic regression models of the injury risk of focus drivers showed a number of factors to be statistically significant predictors of injury risk. These were focus driver age and sex, state, year and speed zone of crash, along with the interactions between focus driver age and sex, sex and state, driver age and state, and speed zone and state. In addition, the make and model of the subject vehicle was also a statistically significant predictor of focus driver injury risk when added to the logistic model. This indicated that there is differential performance between vehicle models in terms of their aggressivity towards drivers of other vehicles so far as injury risk is concerned. In the same manner, when vehicle market group was substituted for vehicle model in the logistic regression equation, it was also a significant predictor of focus driver injury risk.

The logistic regression models of the injury severity of focus drivers showed the factors focus driver age and sex, state, year and speed zone of the crash site to be statistically significant predictors. The model of the subject vehicle was also a statistically significant predictor of injury severity, as was the vehicle market group when substituted for vehicle model in the logistic regression equation.

Final estimates of vehicle aggressivity towards the drivers of other vehicles were obtained by multiplying the estimated injury risk and injury severity components, described above, for each vehicle. Confidence limits on each of the estimated aggressivity ratings were calculated using the methods described in Section 4.2.1 above.

Accurate aggressivity ratings were obtained for 96 of the 123 different vehicle models that satisfied the inclusion criteria described above. Of the 123 vehicle models satisfying the inclusion criteria for analysis described above, 33 vehicle models were excluded from presentation because of the criteria described immediately below. The estimated aggressivity ratings and their injury risk and injury severity components for individual vehicle models are given in Appendix 5 along with 95% confidence limits on the estimated aggressivity ratings.

The ratings in Appendix 5 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 1.6 (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).

This exclusion criterion is the same as that used in calculating crashworthiness ratings to ensure a minimum level of accuracy in the published aggressivity ratings.

5.2.1 Analysis by Market Groups

Table 6 summarises the estimated injury risk, injury severity and aggressivity ratings by the 8 broad market groups along with the estimated confidence limits on the aggressivity ratings. The

estimated aggressivity rating is the expected number of vehicle drivers killed or seriously injured per 100 involved in two-car tow-away collisions where their vehicle impacts with one of the designated model or market group. Table 6 shows the four-wheel-drive vehicles to be the most aggressive towards drivers of other vehicles, with an average of 3.69 drivers being killed or seriously injured for every 100 tow-away crashes with a four-wheel-drive. Similarly, Table 6 shows small cars to be the least aggressive towards drivers of other vehicles, with an average aggressivity rating of 1.79.

In recent years, a number of smaller and lighter 4WD vehicles on the market has been increasing dramatically. It was of interest to compare the relative aggressivity of these lighter 4WD vehicles with the traditional large 4WD sector. To examine this, the 4WD market group was split into two classes: those 4WD vehicles below 1700kg tare mass and those above 1700kg tare mass. Estimates of aggressivity for each 4WD group was then obtained using the same methods as for the other market groups. Results are presented in Table 6 as sub-categories under the combined 4WD group aggressivity estimate. Table 6 shows the estimated average aggressivity of 4WD vehicles above 1700kg tare mass was 4.63, significantly higher than any of the non 4WD market groups in Table 6. In comparison, those 4WD vehicles with a tare mass less than 1700kg had an estimated average aggressivity of 2.85, similar to the large car market group. Examination of the respective confidence limits showed the aggressivity of the small 4WD group was significantly lower than that of the large 4WD group.

Table 6: Estimated Vehicle Aggressivity Towards Other Drivers by Market Grouping

Market Group	Other Driver Injury Risk (%)	Other Driver Injury Severity (%)	Aggressivity Rating *	Overall rank order	Lower 95% confidence limit	Upper 95% Confidence limit	Width of confidence interval
Overall Average	**14.28**	**18.65**	**2.66**				
4 WHEEL DRIVE	17.49	21.11	3.69		3.30	4.13	0.83
Large 4WD	19.86	23.32	4.63	9	4.05	5.30	1.25
Small 4WD	15.14	18.81	2.85	7	2.50	3.25	0.76
COMMERCIAL	17.32	19.71	3.41	8	3.05	3.82	0.77
LARGE	14.14	19.40	2.74	5	2.57	2.94	0.37
LUXURY	12.99	19.19	2.49	3	2.16	2.88	0.72
MEDIUM	12.90	17.40	2.25	2	2.07	2.44	0.37
PASSENGER VANS	16.54	16.71	2.77	6	2.27	3.37	1.10
SMALL	10.52	17.03	1.79	1	1.65	1.94	0.29
SPORTS	13.55	19.00	2.58	4	2.01	3.30	1.29

* Serious injury rate per 100 drivers of other vehicles involved in collisions with vehicles from the given market group

5.2.2 Statistically Significant Makes and Models

Appendix 5 shows the estimated aggressivity ratings towards drivers of other vehicles for the 96 individual vehicle models rated. Ratings ranged from a minimum of 1.07 serious injuries per 100 tow-away crashes for the 1988-92 Daihatsu Charade to a maximum of 6.22 serious injuries per 100 tow-away crashes for the 1982-85 Holden Rodeo. Of the 96 individual vehicle models for which an aggressivity rating was calculated, 11 models had an aggressivity rating which was significantly less (better) than the overall average of 2.66 serious driver injuries per 100 tow away crashes. These seven vehicle models comprised 8 small car models and 3 medium car models. The models were, in order of increasing aggressivity:

- Daihatsu Charade 1988-92
- Toyota Corolla 1982-84

- Hyundai Excel 1982-89
- Holden Barina 1989-93 / Suzuki Swift 1989-98
- Subaru 1800/Leone 1982-95
- Ford Laser KF/KH 1991-94
- Toyota Corolla 1986-88
- Ford Laser KA-KE / Mazda 323 1982-89
- Mitsubishi Sigma/Scorpion 1982-86
- Mitsubishi Colt 1982-88
- Holden Camira 1982-89

Similarly 12 models had an aggressivity rating which was significantly greater (worse) than the overall average of 2.66 serious driver injuries per 100 tow away crashes. These 12 vehicle models comprised 2 large car models, 5 four-wheel drives models, 4 commercial vehicle models and 1 small vehicle. The models were, in order of decreasing aggressivity:

- Holden Rodeo 1982-85
- Toyota Landcruiser 1982-89
- Toyota Landcruiser 1990-97
- Holden Commodore VT 1997-98
- Mitsubishi Cordia 1982-89
- Ford Maverick / Nissan Patrol 1988-97
- Holden Commodore VR/VS Utility 1994-98
- Toyota Hiace / Liteace 1990-98
- Ford Falcon EF/EL 1994-98
- Toyota 4Runner / Hilux 1982-85
- Ford Falcon 1982-95 / Nissan XFN Utility 1988-90
- Toyota 4Runner / Hilux 1989-97

5.2.3 Relationships Between Aggressivity, Crashworthiness and Vehicle Mass

Broughton (1996) and Cameron et al (1995) have noted a strong relationship between vehicle crashworthiness and mass, with heavier vehicles tending to display better crashworthiness. In the same manner, it might be expected that a mass relationship might exist for aggressivity. Figure 3 plots the estimated aggressivity rating against vehicle mass for the 96 models rated and shows that vehicles with higher mass tend to be more aggressive towards drivers of other vehicles.

In assessing the British vehicle safety indices, Broughton (1996) found a strong inverse relationship between the indices for crashworthiness and aggressivity. Figure 4 shows aggressivity plotted against crashworthiness for those vehicle models with both ratings. As Figure 4 shows, the inverse relationship between the two measures is not particularly strong. The dotted line in Figure 4 represents the nominal inverse relationship between aggressivity and crashworthiness ratings. Points above the line represent vehicles with relatively high aggressivity for their level of crashworthiness and points below the line represent vehicles with relatively low aggressivity for their crashworthiness performance. Four-wheel-drives, passenger vans and commercial vehicles are the groups of vehicles that generally show relatively high levels of aggressivity for their level of crashworthiness.

Figure 3: Estimated Vehicle Aggressivity Towards Other Drivers vs. Vehicle Mass

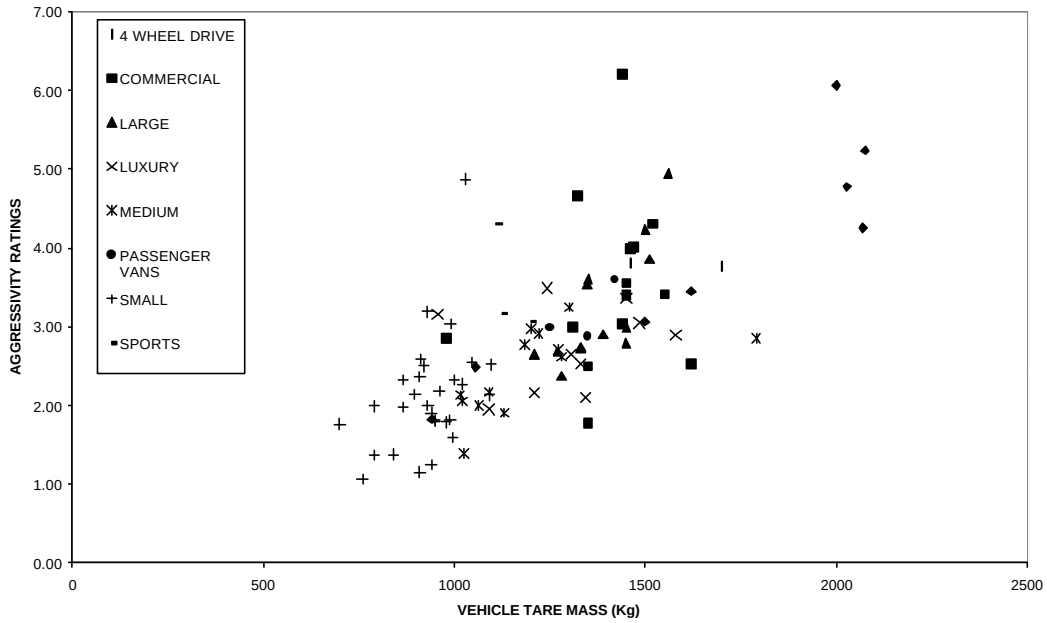
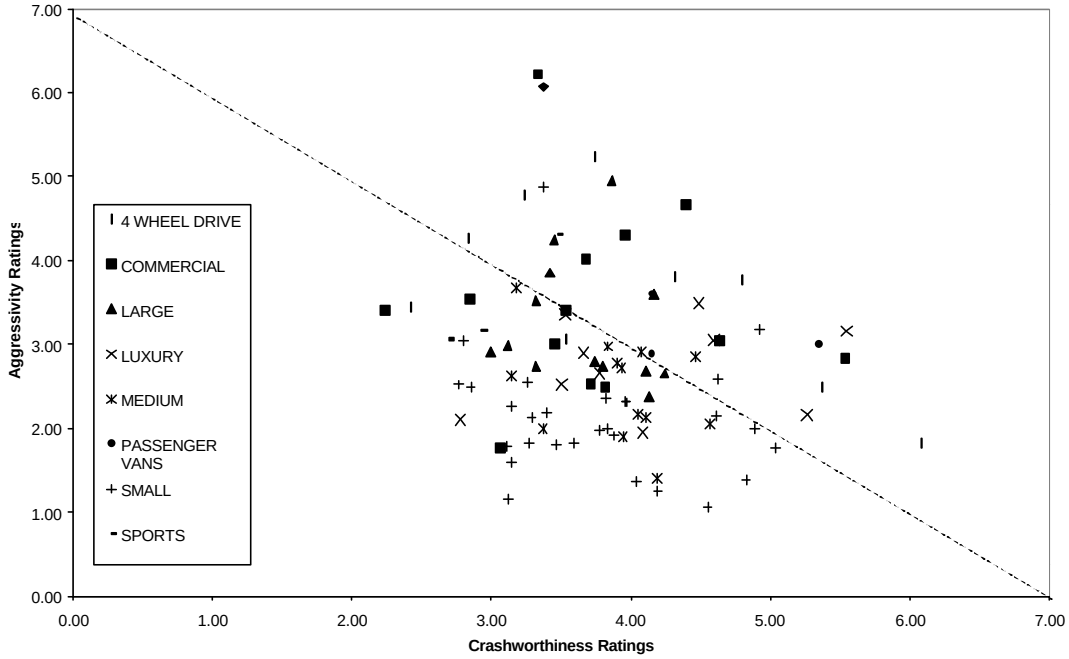


Figure 4: Estimated Vehicle Aggressivity Towards Other Drivers vs. Crashworthiness Rating



Absence of a strong relationship between the measures of aggressivity and crashworthiness suggests that the two quantities considered here are measuring two different aspects of a vehicle's safety performance. Whilst one would expect some relationship between the two measures given their common but opposite relationships with mass, the lack of a strong relationship suggests vehicle mass is only playing a small part in aggressivity rating relative to vehicle total safety design. The independence of these two measures does not seem to have been achieved to the same degree under other systems (UK Department of Transport 1995, Broughton 1996).

5.2.4 Discussion on Aggressivity Ratings

The methods applied in this report have allowed estimation of updated vehicle aggressivity ratings for Australian passenger vehicles with respect to drivers of other vehicles. Aggressivity is an important measure as, in conjunction with crashworthiness ratings, it enables assessment of the total safety of the vehicle fleet from the perspective of the vehicle protecting not only its own occupants in a crash but also the occupants of other vehicles with which it may collide.

Vehicle safety ratings in Australia to date have concentrated primarily on estimating the relative protection a vehicle provides to its own occupants. Consumer information has typically recommended that people purchase vehicles that offer maximum safety benefits to them as occupants without recourse to the risk the specific vehicles may pose to other road users. This study has demonstrated that this advice may not necessarily provide a net gain to society as a whole. One example is a recommendation for people to buy large four-wheel-drive vehicles based on their occupant protection performance without noting that these vehicles pose a high injury risk to other vehicle occupants in a collision. This point is particularly relevant if the vehicle is to be used in an urban environment where the likelihood of a collision with another vehicle is high. Whilst the issue of aggressivity may not be a high priority for vehicle consumers, the information should be valuable to both legislators and those promoting vehicle safety generally. The availability of vehicle aggressivity ratings in conjunction with crashworthiness ratings will allow these groups to focus legislation and consumer advice to achieve better vehicle safety performance overall.

Whilst similar in concept to the aggressivity ratings developed overseas, the ratings developed here appear to be superior in a number of areas. One of the major advantages of the aggressivity ratings developed here, particularly in comparison to those described in Broughton (1994, 1996) is their apparent independence from the crashworthiness ratings. A high level of inverse correlation between crashworthiness and aggressivity ratings would diminish the additional information on safety provided by the aggressivity measure. The aggressivity ratings developed here, however, appear to provide largely independent information on vehicle safety. The reason for the independence of the two measures found in this study is possibly linked to the availability of non injury crash data due to the tow-away crash reporting criteria in both NSW and Queensland. Non injury crash data allows the estimation of the injury risk components of both crashworthiness and aggressivity, a measure not available from the data on injury crashes only, as used by Broughton (1994, 1996). Detailed examination of the crashworthiness and aggressivity analysis results here shows the injury risk measure to be a more powerful discriminator of relative vehicle safety than the injury severity measure based on injury crash data alone.

One slight drawback aggressivity ratings have in comparison to the crashworthiness ratings is that they cover fewer individual vehicle models. Aggressivity ratings estimated here cover only 96 vehicle models, whilst crashworthiness ratings based on the same data cover 167 individual vehicle models. The reason for the reduced model coverage in comparison to crashworthiness ratings stems from the fact that the aggressivity ratings, for reasons described above, are calculated from subsets of the total data used for crashworthiness calculation, namely crashes between two passenger vehicles. To a certain degree, smaller quantities of data also compromise the precision of the aggressivity measures resulting in fewer vehicles which can be differentiated as better or worse than the overall average in comparison to crashworthiness ratings. In comparison to the crashworthiness ratings where 58 of the 167 vehicle models rated (35%) were significantly better or worse than average, of the 96 vehicle models with an aggressivity rating, only 23 (24%) had a rating significantly better or worse than average. This is a substantial improvement over the ratings of Cameron et al (1998) where only 11 of the 56

vehicles rated for aggressivity towards other drivers (20%) had a rating significantly better or worse than average. The improved power of differentiation of the aggressivity ratings presented here, compared with those of Cameron et al (1998) is a result of the inclusion of Victorian and Queensland data for estimation of the ratings.

As with crashworthiness ratings, there is an ongoing need for further updates of the aggressivity ratings with additional years' data as it becomes available. This will enable a greater number of individual vehicle models to be covered with increased accuracy of estimation, thus allowing greater differentiation of safety performance between vehicle models. Updates of aggressivity ratings can parallel those of crashworthiness ratings that are estimated from the same data.

This report has considered only the measure of aggressivity towards drivers of other vehicles. Whilst a measure of aggressivity towards unprotected road users has been developed and estimated in previous work, it was not used here because it was based only on an injury severity index that was felt not to offer sufficient discrimination between the performance of different vehicle models. It may be possible to develop an aggressivity severity index that estimates simultaneously the combined aggressivity of a vehicle towards both unprotected road users and the drivers of other vehicles. Combined with the aggressivity injury risk measure for drivers of other vehicles only, this would give a single aggressivity measure for a vehicle towards both drivers of other vehicles and unprotected road users. Further research would need to be undertaken to develop this combined measure of aggressivity towards all other road users.

5.3 Presentation of Crashworthiness and Aggressivity Ratings for Consumer Information

Discussion in the previous work of Cameron et al (1998) noted, for simplicity of presentation and interpretation, particularly in the area of consumer safety advice, effort needed to be made to find a method of simultaneously using the information on vehicle crashworthiness and aggressivity. Possible solutions discussed included development of a single measure of total vehicle safety or, alternately, development of some other cohesive method of summary presentation that reflects overall vehicle safety. An attempt at the latter approach, using simultaneous display of the estimated crashworthiness and aggressivity estimate for each vehicle model, is considered here.

In presenting the results of the Swedish vehicle crashworthiness ratings from analysis of real crash data, Folksam Insurance has developed a means of presenting the estimated ratings in five broad categories. The estimated crashworthiness rating for each vehicle is compared to the overall average safety rating for the vehicle fleet and put into one of the five categories defined as follows:

- 40% More Safe: if the upper confidence limit on the estimated rating is less than 0.6 times the average rating for the vehicle fleet.
- 20% More Safe: if the upper confidence limit on the estimated rating is less than 0.8 times the average rating for the vehicle fleet.
- Average Car: if the upper confidence limit on the estimated rating is less than the average rating for the vehicle fleet (should in fact be described as better than average).
- 20% Less Safe: if the upper limit on the estimated rating is less than 1.2 times the average rating for the vehicle fleet.
- 40% Less Safe: if the vehicle is not classified into any of the 4 groups above.

Presentation of the ratings in this way has the advantage that it combines information about both the rating point estimate and confidence limit to classify the safety performance of the vehicle. This method of presentation takes the potential emphasis of the consumer off comparison of only the point estimate ratings, an emphasis that can be potentially misleading from the point of view of statistical confidence. Rather, the presentation method categorises vehicles according to the statistical significance of the difference of their estimated safety rating from defined points.

A method of presentation of the estimated crashworthiness ratings for Australian vehicles has been devised that is similar in philosophy to the presentation method devised by Folksam in that it takes into account both the rating point estimate and confidence limits but removes the emphasis from the point estimate. Rated vehicles have been classified into five categories based on the range in which the confidence limits on the estimated ratings lie. The five categories are defined as follows.

- At least 20% safer than average: if the upper confidence limit on the estimated rating is less than 0.8 times the average crashworthiness rating for the vehicle fleet.
- At least safer than average: if the upper confidence limit on the estimated rating is less than the average crashworthiness rating for the vehicle fleet.
- Average: if the confidence interval on the estimated rating overlaps the average crashworthiness rating for the vehicle fleet.
- At least less safe than average: if the lower confidence limit on the estimated rating is greater than the average crashworthiness rating for the vehicle fleet.
- At least 20% less safe than average: if the lower confidence limit on the estimated rating is greater than 1.2 times the average crashworthiness rating for the vehicle fleet.

Presentation of the estimated crashworthiness ratings in this way is shown in Appendix 6. Colour coding of the categories would typically be used with green depicting the safest category through blue, yellow and brown to red depicting the least safe category. 90% two-sided confidence limits have been used to categorise the crashworthiness ratings in Appendix 6. These are equivalent to 95% one-sided confidence limits if a directional hypothesis of crashworthiness greater or less than the average is being assumed.

A single column at the right of the table in Appendix 6 summarises the aggressivity ratings for each vehicle. In a manner similar to the classification of crashworthiness ratings, the estimated aggressivity ratings have been classified into three categories with each represented by a symbol in the final column of the table. These are:

- ✖: More aggressive than average - if the lower confidence limit on the estimated aggressivity rating is greater than the average rating for the vehicle fleet.
- **o**: Average - if the confidence interval on the estimated rating overlaps the average aggressivity rating for the vehicle fleet.
- ✓: Less aggressive than average - if the upper confidence limit on the estimated rating is less than the average aggressivity rating for the vehicle fleet.

Some vehicle models in Appendix 6 have no symbol in the aggressivity rating column. These vehicles have been involved in an insufficient number of two-car crashes to have an aggressivity rating estimated for them. Assignment of vehicle aggressivity ratings to categories in Appendix 6 is based on the 90% two-sided (95% one-sided) confidence limits on the ratings to be consistent with the assignment of crashworthiness ratings to categories.

5.4 Crashworthiness by Year of Manufacture

5.4.1 Injury Risk

Injury risk was estimated from the data on 1,436,517 drivers involved in tow-away crashes in NSW and Queensland (as described in Section 2.4). This data set is referred to as the "involved drivers". Because of missing values of some of the factors to be included in the logistic regression, and the exclusion of pre-1964 vehicles and unknown years, analysis was performed on data relating to 905,470 involved drivers, 149,099 of whom were injured.

The "covariate" model for injury risk was determined from the variables described in Section 4.1.1 The following covariates and interactions were statistically significantly associated with injury risk and were included in the logistic regression model.

Base effect terms	First order interactions
Sex	Sex*Speedzone
Nveh	Speedzone*Nveh
Speedzone	Sex*Nveh
Age	Speedzone*Age
State	Age*Sex
Year (of crash)	Nveh*State
	Age*State
	Age*Nveh
	Speedzone*State

No other variable or interaction term significantly improved the fit of the logistic model.

The overall (average) injury risk for involved drivers in tow-away crashes in NSW, after adjusting for the significant main effects and interactions described above, was 16.03%. In other words, the estimated probability that a driver involved in a tow-away crash in NSW was injured was 16.03%, after adjusting for other significant factors.

Appendix 7 gives the estimates of injury risk derived by logistic regression for the individual years of manufacture. The variability in the injury risk estimates relative to the year of manufacture can be seen from the width of the corresponding 95% confidence intervals.

5.4.2 Injury Severity

The data on "injured drivers" covered 318,209 drivers who were injured in crashes in Victoria or NSW during 1987-98 or Queensland during 1991-98 (as described in Sections 2). Because of missing values of some of the associated crash factors, and the exclusion of pre-1964 vehicles and unknown years, logistic regression was performed on data relating to 217,697 injured drivers 53,745 of whom were severely injured (killed or admitted to hospital).

The "covariate" model for injury severity was determined from the variables described in Section 4.2.1. The analysis identified a number of statistically significant covariate effects. These were:

Base effect terms	First order interactions	Second order interactions
Sex	Speedzone*Nveh	Sex*State*Age
Age	Sex*Age	Age*Nveh*State
Speedzone	Age*State	Speedzone*Nveh*State
Nveh	Nveh*State	
State	Age*Nveh	
Year (of crash)	Speedzone*Age	
	Speedzone*State	
	Sex*State	

No other variable or interaction term significantly improved the fit of the logistic model.

The overall (average) injury severity for injured drivers, after adjusting for differences in the associated factors, was 24.69%. In other words, the estimated probability that a driver injured in a crash was severely injured was 24.69%, after adjusting for the significant factors described above.

Appendix 7 gives the estimates of injury severity derived by logistic regression for the individual years of manufacture. The variability in the estimates of injury severity relative to year of manufacture can be seen from the width of the corresponding 95% confidence intervals.

5.4.3 Crashworthiness by Year of Manufacture

The crashworthiness estimates for each year of manufacture were obtained by multiplying the individual injury risk and injury severity estimates. Because each of the two components has been adjusted for the confounding factors, the resultant crashworthiness estimate is also adjusted for the influence of them.

Appendix 7 gives the crashworthiness estimates and the associated 95% confidence intervals for each of the 35 years of manufacture included in the analysis. Each estimate is expressed as a percentage, representing the number of drivers killed or admitted to hospital per 100 drivers involved in a tow-away crash.

The true risk of a driver being killed or admitted to hospital in a tow-away crash is only estimated by each figure, and as such each estimate has a level of uncertainty about it. This uncertainty is indicated by the confidence limits in Appendix 7. There is 95% probability that the confidence interval will cover the true risk of serious injury (death or hospital admission) to the driver of a vehicle of the particular year of manufacture.

The crashworthiness estimates and their confidence limits are plotted for each year of manufacture in Figure 5. The relatively wide confidence intervals observed on the estimates of crashworthiness for years of manufacture 1964 to 1969 and 1998 are a reflection of the smaller numbers of crashes involving vehicles manufactured in these years appearing in the data.

Figure 5 shows general and significant improvement in vehicle crashworthiness with increasing year of manufacture over the years considered. Specifically, little improvement can be seen in the years 1964 to 1969 followed by rapid improvement over the period 1970 to 1978 with a plateau from 1979 to 1984. There is visual evidence of a decreasing trend in the period after

1984 with vehicles manufactured over the period 1991 to 1997 being statistically significantly safer on average than those manufactured before 1986.

To summarise the magnitude of the improvement in crashworthiness seen in vehicles during the 1970's, the average crashworthiness estimate for the 1978-82 year vehicles was compared with the average for those manufactured during 1964-69. This showed a reduction of approximately 34% in the risk of serious injury for drivers involved in tow-away crashes between these two time periods. Further statistically significant improvements in crashworthiness have also been observed over the period 1986 to 1996. Comparing average crashworthiness of vehicles manufactured in the period 1978-82 with those manufactured from 1991-97 showed a further 26% reduction. 1998 year of manufacture has been excluded from these comparisons because of the relatively wide confidence limits on the crashworthiness estimate for that year.

The injury risk component of the crashworthiness estimate, together with its 95% confidence limits, is plotted in Figure 6. In a similar way, the injury severity component is plotted in Figure 7. Examination of these figures together shows the improvements in crashworthiness with year of manufacture observed in Figure 5 are due largely to a decrease in the probability of any injury given crash involvement (injury risk) with year of manufacture shown in Figure 6. There was a strong downward trend in injury risk with vehicle year of manufacture whilst Figure 7 shows a weaker, but still of the same general trend, effect of vehicle year of manufacture on injury severity.

Figure 5: Crashworthiness by year of manufacture (with 95% confidence limits)

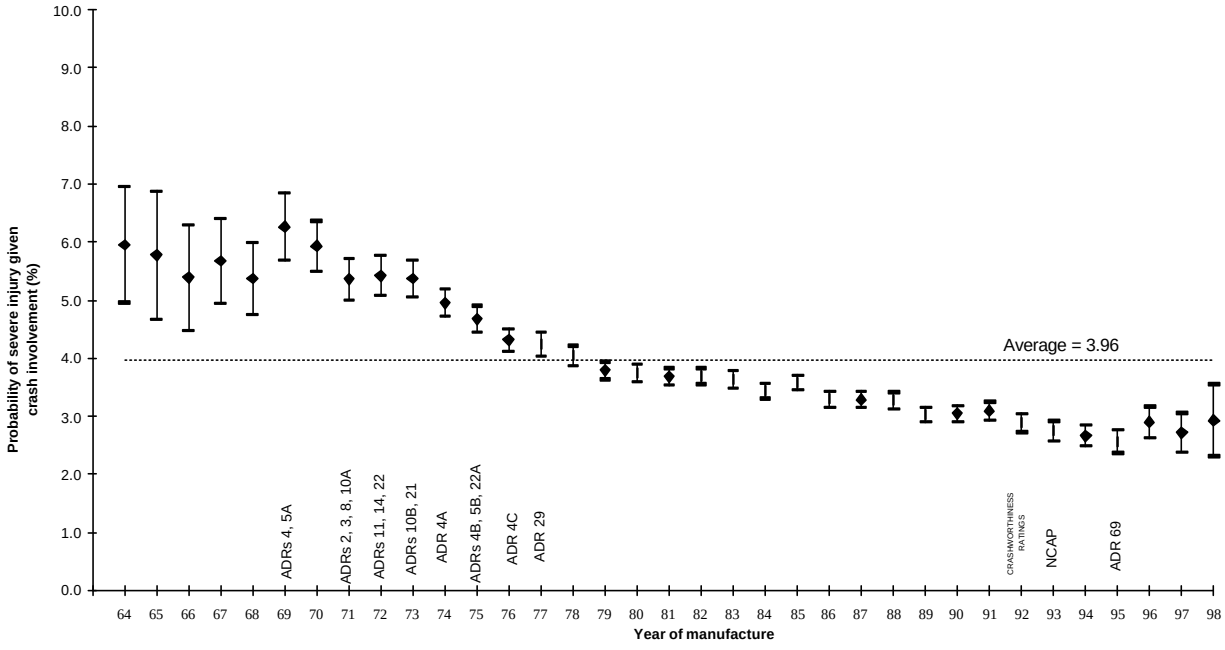


Figure 6: Injury risk by year of manufacture (with 95% confidence limits)

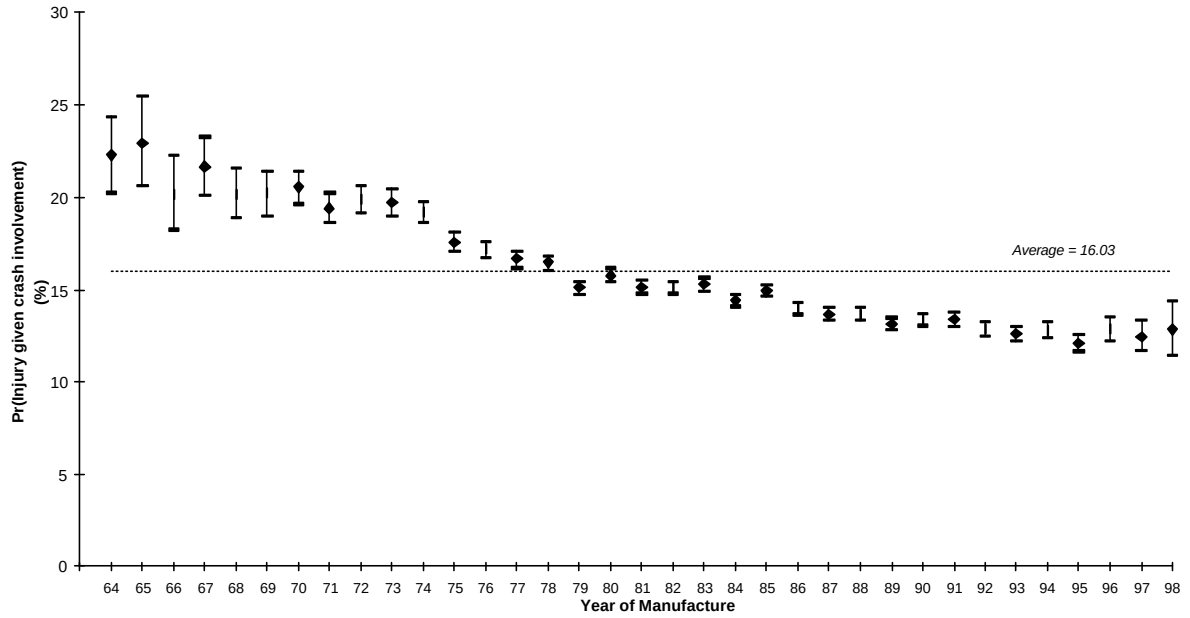
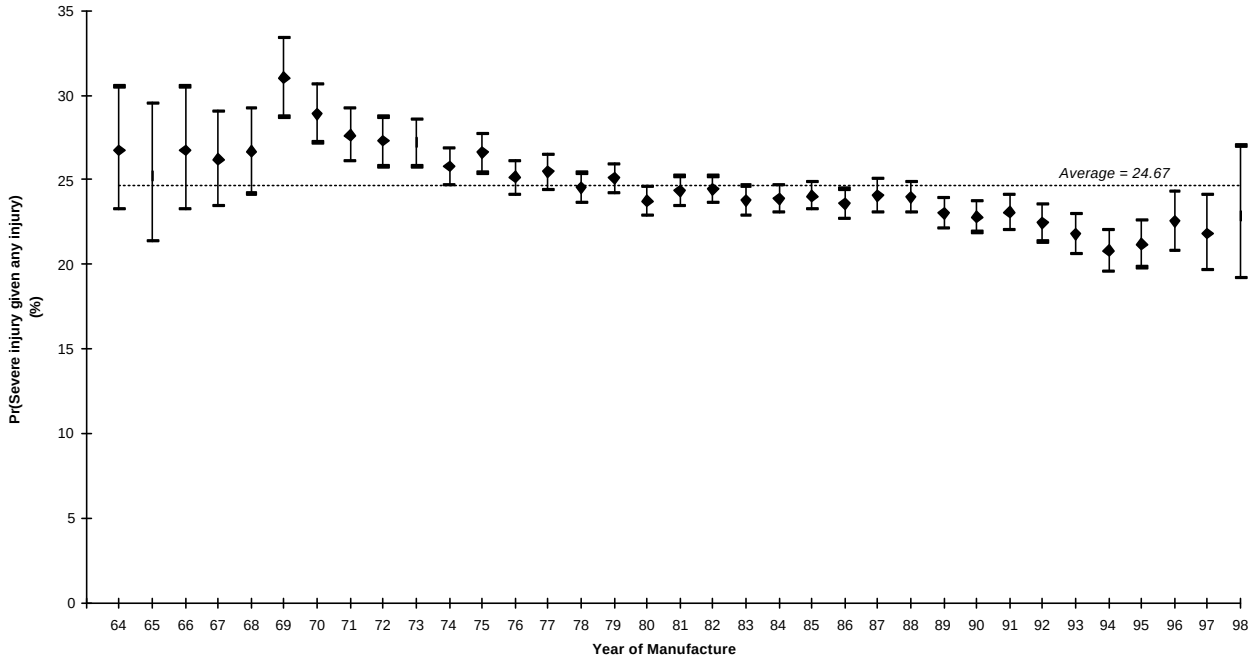


Figure 7: Injury severity by year of manufacture (with 95% confidence limits)



5.4.4 Discussion on the Analysis of Crashworthiness by Year of Manufacture

The findings of this research are closely consistent with those of the original study by Cameron et al (1994a). This is as expected given that the data used in the analysis here is an extension of that used in Cameron et al's study with the addition of crashes occurring in Victoria and NSW during 1993 to 1998 and Queensland during 1991-98. As shown by Cameron et al, after a period

of little change during the late 1960s, there was rapid improvement over the years from about 1970 to 1979. Drivers of vehicles manufactured during these years could be expected to have benefited from the implementation of a number of Australian Design Rules (ADRs) for motor vehicle safety which previous research has shown to be effective in providing occupant protection (Cameron 1987), namely:

- ADR 4 (seat belts fitted in front seats) from January 1969
- ADR 2 ("anti-burst" door latches and hinges) from January 1971
- ADR 10A ("energy-absorbing" steering columns) also from January 1971
- ADR 22 (head restraints) from January 1972
- ADR 10B (steering columns with limited rearward displacement) from January 1973
- ADR 4B (inertia reel seat belts fitted in front seats) from January 1975
- ADR 22A (minimum-height adjustable head restraints) from January 1975
- ADR 29 (side door strength) from January 1977.

In addition, the following ADRs introduced over the same period could also be expected to have provided increased injury protection for drivers:

- ADR 5A (seat belt anchorage points for front seats) from January 1969
- ADR 3 (strengthened seat anchorages) from January 1971
- ADR 8 (safety glass in windscreens and side windows) from July 1971
- ADR 11 ("padded" sun visors) from January 1972
- ADR 14 ("breakaway" rear vision mirrors) from January 1972
- ADR 21 ("padded" instrument panels) from January 1973
- ADR 4A (improved seat belt buckles), effective from April 1974
- ADR 5B (improved location of seat belt anchorages) from January 1975
- ADR 4C (dual-sensing locking retractor inertia reel seat belts) from January 1976.

The years of implementation of these ADRs are shown on Figure 5 for comparison with the crashworthiness estimates for the vehicles manufactured during the 1970s.

This study extends previous work to provide estimates of the relative crashworthiness of vehicles manufactured in 1998. For a number of reasons, it may have been expected that these years of manufacture have shown an improvement in crashworthiness. Improvement may have stemmed from vehicle manufacturer reaction to two areas of activity in vehicle safety which have emerged during the 1990s, namely;

- The introduction of programs to advise consumers of relative vehicle safety. Vehicle crashworthiness ratings ranking vehicles' relative driver protection based on real crash data were first published in 1992 and updated in 1994, 1996 and 1998 (Cameron, Newstead and Le (1998)). The Australian New Car Assessment Program, which rates relative driver and front left passenger protection based on controlled laboratory impact testing of vehicles, first published test results in April 1993 for 9 popular vehicle models. To date ANCAP has published relative safety ratings for over 50 vehicle models (see Figure 5).

- Drafting of Australian Design Rule (ADR) 69 specifying standards for frontal impact occupant protection in passenger cars as part of the Motor Vehicle Standards Act. ADR 69 was approved as a national standard by the Minister for Land Transport on 16th December 1992, coming into effect for all newly released car models on 1st July 1995 and for all new passenger cars sold from 1st January 1996.

It might be expected that consumer vehicle safety advice such as crashworthiness ratings and NCAP, which rate a vehicle's relative occupant protection, may encourage vehicle manufacturers to consider safety as a top priority in vehicle design so as to have their product perform well in these safety ratings. The implementation of ADR 69 occurred at the beginning of the third last year of vehicle manufacture on which this study focuses. It is also possible that manufacturers worked towards meeting this standard in their new vehicles from its approval in December 1992, hence showing benefits over the period 1993 to 1998.

Figure 5 shows general and significant improvement in vehicle crashworthiness with increasing year of manufacture over the years considered. It should be noted that whilst the trend in crashworthiness during the 1990s was not statistically significant, vehicles manufactured over the period 1990 to 1997 have an average crashworthiness statistically significantly better than those manufactured before 1985. The last three points of Figure 5 seem to suggest the downward trend in crashworthiness observed in the early 1990s has reached a plateau or in fact reversed. It should be noted that, based on the confidence limits on these points, there is no statistical support for this suggestion. Further monitoring of trends when additional crash data from later years is available would be necessary to confirm any change in recent years.

Further updates of the study planned for the future and adding additional years' crash data will also improve the statistical accuracy of estimated crashworthiness for the years 1996 onwards. In this study, these years' estimates have relatively wide confidence limits reflecting the smaller quantities of crash data for vehicles manufactured in these years, particularly 1998.

6. CONCLUSIONS

Additional crash data has enabled the crashworthiness ratings to be obtained for a larger range of car models than in previous studies, now covering 167 different vehicle models. 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 58 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles that have superior or inferior crashworthiness characteristics compared with the average vehicle.

Additional crash data also allowed updated estimates of vehicle aggressivity ratings towards drivers of other passenger vehicles for individual makes and models of Australian passenger vehicles to be obtained. Using the methods developed by Cameron et al (1998), the ratings of aggressivity measure the risk of serious injury a vehicle poses to drivers of other cars with which it impacts in crashes of tow-away or greater severity.

Aggressivity ratings were calculated for 96 models of Australian passenger vehicles (passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles) manufactured between the years 1982-98. The degree of accuracy of the aggressivity ratings is 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 23 models of passenger cars, four-wheel drive vehicles, passenger vans and light commercial vehicles that have superior or inferior aggressivity characteristics compared with the average vehicle. Estimated vehicle aggressivity towards drivers of other vehicles was found to have a proportional relationship with vehicle mass. It was also found to have little or no relationship with ratings of vehicle crashworthiness, demonstrating the independence of the two complementary measures.

The crashworthiness of passenger vehicles (cars, station wagons, four wheel drives, vans and taxis), measured by the risk of the driver being killed or admitted to hospital as the result of involvement in a tow-away crash, has been estimated for the years of manufacture from 1964 to 1998. This study further updates the original one by Cameron et al (1994a) for years of manufacture 1964 to 1992. It shows similar patterns of improvements in crashworthiness with the greatest gains over the years 1970 to 1979 during which time a number of new Australian Design Rules aimed at occupant protection took effect. Further gains in crashworthiness have also been observed over the years 1986 to 1998. These results further suggest that the rating of vehicle crashworthiness through analysis of real crash data, as carried out here, and through crash tests carried out by consumer groups such as the Australian New Car Assessment Program has encouraged manufacturers to improve vehicle safety.

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 that the reader should note. These are listed in the following sections.

7.1 Assumptions

It has been assumed that:

- TAC claims records and NSW and Queensland 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, NSW and Queensland vehicle registers.

- The adjustments for driver sex, age, speed zone, the number of vehicles involved and the state and year in which the crash occurred crash removed the influences of the other main factors available in the data that 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.

- Information contained in the Police crash records allowed accurate matching of both vehicles involved in crashes between two passenger cars for the purpose of calculating aggressivity ratings.

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 1982-98 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).

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APPENDIX 1

MAKES AND MODELS OF CARS INVOLVED IN VICTORIAN AND NSW CRASHES DURING 1987-98 AND QUEENSLAND CRASHES DURING 1991-98

FREQUENCY FOR EACH MODEL FOR
ALL TYPES OF CRASHES (NSW/VIC/QLD)

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
UNKNOWN MAKE/MODEL	Z	18941	5784	*0*	
ALFA 164	AL01Z	41	7	0	
ALFA 33	AL02Z	489	76	1	SP
ALFA 75	AL03Z	121	16	0	
ALFA 90	AL04Z	62	7	0	
ALFA GTV	AL05Z	121	12	0	
ALFA SPRINT	AL06Z	106	19	0	
ALFA ALFASUD	AL07Z	103	18	0	
ALFA ALFETTA	AL08Z	51	9	0	
ALFA GUILIETTA	AL09Z	55	6	0	
ALFA QUATTRO	AL10Z	1	1	0	
ALFA OTHERS	AL99Z	57	88	*0*	
AUDI A6/S6	AUD1Z	9	2	0	
AUDI A8	AUD2Z	1	#N/A	0	
AUDI A4	AUD3Z	96	14	0	
AUDI A8/S8/A6	AUD4Z	#N/A	1	0	
AUDI OTHERS	AUDIZ	620	113	0	
BMW Z3	BM10Z	14	1	0	
BMW 3 82-91	BM3 A	1965	287	1	LX
BMW 3 92-98	BM3 B	1028	139	1	LX
BMW 5 82-88	BM5 A	577	63	1	LX
BMW 5 89-95	BM5 B	276	28	1	LX
BMW 5 96-98	BM5 C	47	4	0	
BMW 6 SERIES	BM6 Z	4	#N/A	0	
BMW 7 82-88	BM7 A	163	21	1	LX
BMW 7 89-94	BM7 B	72	8	0	
BMW 7 OTHERS	BM7 Z	16	#N/A	0	
BMW 8 SERIES	BM8 Z	5	1	0	
BMW 3/5 SERIES	BM9 Z	#N/A	9	0	
BMW OTHERS	BM99Z	240	118	*0*	
CHEVROLET	CHEVZ	#N/A	4	0	
VOYAGER	CHR1Z	16	2	0	
NEON	CHR2Z	25	5	0	
CHRYSLER OTHERS	CHRYZ	17	9	0	
CIT BX	CI1 Z	60	8	0	
CIT XM	CI2 Z	3	#N/A	0	
CIT AX	CI3 Z	4	1	0	
CIT XANTIA	CI4 Z	13	3	0	
CIT OTHERS	CI99Z	30	1	*0*	
CHARADE 80-86	D1 A	1658	492	1	S
CHARADE 87	D1 B	220	59	*0*	
CHARADE 88-92	D1 C	3382	788	1	S
CHARADE 93-98	D1 D	1728	355	1	S
DTSU FEROZA	D11 Z	308	56	1	4WD
DTSU HANDIVAN	D12 Z	597	178	1	S

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
DTSU HI-JET	D13 Z	168	59	1	C
DTSU ROCKY F70/75/80/85	D14 Z	350	87	1	4WD
DTSU PYZAR	D15 Z	15	5	0	
DTSU MOVE	D16 Z	7	#N/A	0	
DTSU SIRION	D17 Z	17	1	0	
DTSU TERIOS	D18 Z	11	3	0	
DTSU APPLAUSE	D2 Z	1128	236	1	S
DTSU MIRA	D3 Z	357	118	1	S
DTSU DELTA	D4 Z	1033	142	*0*	
DTSU F20/25/50/55/60/65	D5 Z	84	24	0	
DAIHATSU OTHERS	D99 Z	455	206	*0*	
DAEWOO CIELO	DA03Z	225	113	1	S
DAEWOO ESPERO	DA05Z	54	18	0	
DAEWOO NUBIRA	DA06Z	12	4	0	
DAEWOO LANOS	DA07Z	27	13	0	
DAEWOO LEGANZA	DA08Z	4	1	0	
DAEWOO MUSSO	DA09Z	4	1	0	
DAIMLER	DAIMZ	#N/A	1	0	
LASER/MET 90	F01 B	2865	603	*0*	
LASER/MET 91-94	F01 C	4389	975	1	S
LASER/MET 95-98	F01 D	447	98	1	S
FORD CORTINA	F02 Z	32	40	0	
TELSTAR OTHERS	F04 Z	#N/A	#N/A	0	
FORD ESCORT	F05 Z	19	1	0	
FALCON X SERIES	F06 Z	45097	7769	1	L
FANE Z&LTD F	F07 Z	3526	693	1	LX
FALCON EA/EB S1	F08 C	21215	3284	1	L
FALCON ED/EB S2	F08 D	6856	1077	1	L
FANE N&LTD D 88-94	F09 A	2203	342	1	LX
FANE N&LTD D 95-98	F09 B	241	38	1	LX
FORD MONDEO	F10 Z	242	46	1	M
FORD CAPRI	F43 Z	662	135	1	SP
FORD FESTIVA WB/WD/WH 94-98	F44 B	1661	469	1	S
FORD FALCON PANEL VAN 82-95	F45 A	2451	268	1	C
FORD FALCON PANEL VAN 96-98	F45 B	41	10	0	
FORD FALCON UTE 82-95	F46 A	5736	691	1	C
FORD FALCON UTE 96-98	F46 B	162	19	0	
FORD F-SERIES	F47 Z	599	81	1	C
FORD SPECTRON	F52 Z	#N/A	2	0	
FORD TRADER	F53 Z	369	46	*0*	
FORD COMMERCIALS	F54 Z	5952	1030	*0*	
FORD SIERRA	F55 Z	4	1	0	
FORD BRONCO	F56 Z	97	13	0	
FORD PROBE	F61 Z	35	9	0	
FALCON EF/EL	F62 Z	7666	1283	1	L
FORD TRANSIT	F64 Z	49	4	0	
FORD EXPLORER	F65 Z	10	3	0	

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
FORD FALCON AU	F66 Z	19	6	0	
FORD TAURUS	F67 Z	69	15	0	
FORD OTHERS	F99 Z	13861	5405	*0*	
FERRARI	FERAZ	#N/A	1	0	
FIAT ARGENTA	FI01Z	8	3	0	
FIAT CROMA	FI02Z	19	3	0	
FIAT REGATA	FI03Z	194	20	1	S
FIAT SUPERBRAVA	FI04Z	45	13	0	
FIAT X-1/9	FI05Z	9	3	0	
FIAT OTHERS	FI99Z	30	27	*0*	
FSM	FSM Z	5	5	0	
HOLD COMM VN/VP	H1 Z	23473	4357	1	L
HOLD CALIBRA	H12 Z	122	14	0	
STMAN/CAPRI -->89	H14 A	#N/A	26	0	
STMAN/CAPRI 90-93	H14 B	557	98	1	LX
STMAN/CAPRI 94-98	H14 C	402	65	1	LX
HOLD NOVA 94	H15 B	57	17	0	
HOLD COMM VG/VP UTE	H18 Z	812	122	1	C
HOLD CAMIRA	H2 Z	12971	3249	1	M
JACKAROO 82-91	H21 A	327	70	1	4WD
JACKAROO 92-97	H21 B	97	25	0	
JACKAROO >= 98	H21 C	3	3	0	
HOLD JACKAROO	H21 Z	54	9	0	
HOLD KINGSWOOD	H22 Z	17	5	0	
HOLD PIAZZA	H23 Z	26	6	0	
HOLD RODEO 82-85	H24 A	565	73	1	C
HOLD RODEO 86-88	H24 B	206	33	1	C
HOLD RODEO 89-95	H24 C	2372	348	1	C
HOLD RODEO 96-98	H24 D	283	64	1	C
HOLD RODEO OTHERS	H24 Z	207	41	0	
HOLD SHUTTLE	H26 Z	388	66	1	C
HOLD WB SERIES	H27 Z	1492	186	1	C
HOLD TORANA/SUNBIRD	H28 Z	5	1	0	
GEMINI 75-84	H3 A	4782	1239	1	S
GEMINI 85	H3 B	1114	291	*0*	
GEMINI 86-87	H3 C	440	133	1	S
GEMINI OTHERS	H3 Z	1	#N/A	0	
HOLD COMM OTHERS	H31 Z	15	1	*0*	
HOLD COMM VS/VR	H33 Z	11801	2052	1	L
HOLD COMM VS/VR UTE	H34 Z	1176	166	1	C
HOLD FRONTERA	H35 Z	10	3	0	
HOLD VECTRA	H36 Z	54	13	0	
HOLD COMM VT	H37 Z	660	123	1	L
HOLD SUBURBAN	H38 Z	1	#N/A	0	
ASTRA JAP 87	H4 B	403	124	*0*	
ASTRA TR	H4 D	79	13	0	
ASTRA TS	H4 E	2	1	*0*	

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
ASTRA OTHERS	H4 Z	2	1	*0*	
BARINA JAP 94	H5 C	328	76	*0*	
BARINA COMBO & EURO >=95	H5 D	840	223	1	S
BARINA OTHERS	H5 Z	14	3	0	
HOLD COMM VB-VL	H6 Z	34758	6337	1	L
HOLDEN OTHERS	H99 Z	3807	4112	0	
HYDAI EXCEL 82-89	HY1 A	1451	480	1	S
HYDAI EXCEL 90-94	HY1 B	2989	840	1	S
HYDAI EXCEL 95-98	HY1 C	2790	755	1	S
HYDAI EXCEL/S-COUPE	HY14Z	#N/A	4	0	
HYDAI SONATA EF	HY15Z	3	#N/A	0	
HYDAI SONATA <=97	HY2 Z	739	161	1	L
HYDAI S-COUPE	HY4 Z	421	107	1	S
HYDAI LANTRA 91-95	HY5 A	653	157	1	S
HYDAI LANTRA 96-98	HY5 B	258	44	1	S
HYDAI COUPE	HY7 Z	59	9	0	
HYUNDAI OTHERS	HY99Z	136	37	0	
MITS COLT	I01 Z	8024	2144	1	S
MITS SIGMA/SCORPION	I02 Z	10886	2278	1	M
MITS SIGMA/MAGNA	I03 Z	#N/A	234	0	
MAGNA TN-TP	I04 Z	16678	3043	1	L
MITS CHARGER/VALIANT	I05 Z	32	2	0	
MITS MAGNA VERADA TE-TH/KE-KH	I06 A	857	276	1	L
MITS STARION	I07 Z	143	30	1	SP
MITS CA LANCER 82-92	I09 A	2242	479	1	S
MITS CC LANCER	I09 C	1566	372	1	S
MITS CE LANCER/MIRAGE	I09 D	795	167	1	S
NIMBUS 82-91	I10 A	510	98	1	M
NIMBUS 92-97	I10 B	175	21	1	M
NIMBUS >=98	I10 C	18	3	0	
MITS CORDIA	I12 Z	1316	268	1	S
MAGNA VERADA TR-TS/KR-KS	I15 Z	6875	1180	1	L
MITS GALANT <= 88	I16 A	2	#N/A	0	
MITS GALANT >= 89	I16 B	536	103	1	M
MITS GALANT OTHERS	I16 Z	16	10	0	
MITS COLT/LANCER	I19 Z	#N/A	10	0	
MITS CANTER	I21 Z	465	117	*0*	
MITS STARWAGON/L300 82-86	I23 A	3015	562	1	PV
MITS STARWAGON 87-94	I23 B	3103	520	1	PV
MITS STARWAGON 95-98	I23 C	261	37	1	PV
MITS COMMERCIALS	I24 Z	2157	369	0	
MITS PAJERO 82-90	I25 A	1037	180	1	4WD
MITS PAJERO 91	I25 B	155	19	0	
MITS PAJERO >=92	I25 C	513	82	1	4WD
MITS 3000GT	I26 Z	4	4	0	
MITS CHALLENGER	I30 Z	3	#N/A	0	
MITSUBISHI OTHERS	I99 Z	1616	1439	0	

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
ISUZU NKR SERIES	IS01Z	408	57	0	
ISUZU NPR SERIES	IS02Z	503	35	0	
ISUZU OTHERS	IS99Z	790	84	0	
JAG XJ6 82-86	J01 A	226	24	1	LX
JAG XJ6 87-94	J01 B	241	18	0	
JAG XJ6 >=95	J01 C	19	1	0	
JAG V12 SALOON	J02 Z	13	2	*0*	
JAG XJS	J04 Z	46	6	0	
JAG XJR	J05 Z	3	#N/A	0	
JAG XK8	J07 Z	2	#N/A	0	
JAG OTHERS	J99 Z	39	22	0	
JEEP CHEROKEE	JE01Z	47	7	0	
JEEP CHEROKEE GRD	JE02Z	9	2	0	
JEEP WRANGLER	JE03Z	6	2	0	
JEEP OTHERS	JEEPZ	83	22	*0*	
LADA	LADAZ	88	58	0	
LANCIA	LANCZ	20	2	*0*	
LEYLAND	LEY Z	29	11	0	
LAND ROVER DEFENDER	LRO1Z	38	15	0	
LAND ROVER DISCOVERY	LRO2Z	100	23	1	4WD
LAND ROVER OTHERS	LROVZ	155	39	0	
MAZDA 323 /LASER 82-88	M01 A	29039	7517	1	S
MAZDA 323 89	M01 B	235	65	0	
MAZDA 323 90-93	M01 C	1356	294	1	S
MAZDA 323 94	M01 D	307	59	*0*	
MAZDA 323 95-98	M01 E	585	107	1	S
626/MX6 / TELSTAR 82	M02 A	8809	2086	0	
626/MX6 / TELSTAR 83-86	M02 B	5703	1170	1	M
626/MX6 / TELSTAR 87	M02 C	749	100	0	
626/MX6 / TELSTAR 88-91	M02 D	1625	286	1	M
626/MX6 / TELSTAR 92-97	M02 E	1325	205	1	M
626/MX6 >=98	M02 F	14	1	0	
MAZDA 929 82-90	M03 A	2228	413	1	LX
MAZDA 929 91	M03 B	72	7	0	
MAZDA 929 92-98	M03 C	56	9	0	
MAZDA 121 82-93	M09 A	2318	668	1	S
MAZDA 121 94-96	M09 B	711	175	1	S
MAZDA 121 97-98	M09 C	30	6	0	
MAZDA RX7 80-85	M10 A	448	97	1	SP
MAZDA RX7 86-91	M10 B	149	24	1	SP
MAZDA RX7 92-98	M10 C	23	5	0	
MAZDA MX5 83-97	M11 A	264	39	1	SP
MAZDA MX5 >=98	M11 B	1	#N/A	0	
MAZDA 323/626	M12 Z	#N/A	#N/A	0	
MAZDA CAPELLA/808	M13 Z	2	#N/A	0	
MAZDA COMMERCIALS	M14 Z	3546	628	*0*	
MAZDA MPV	M15 Z	52	1	0	

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
MAZDA EUNOS 30 X	M16 Z	36	16	0	
MAZDA EUNOS 500	M17 Z	24	8	0	
MAZDA EUNOS 800	M18 Z	4	1	0	
MAZDA MX5/323	M20 Z	#N/A	5	0	
MAZDA OTHERS	M99 Z	1039	764	0	
MASERATI	MASRZ	#N/A	1	0	
MERC 100 SERIES	ME1 Z	203	34	0	
MERC C-CLASS W201	ME11Z	244	51	1	LX
MERC C-CLASS W202	ME12Z	206	25	1	LX
MERC CLK W208	ME13Z	1	#N/A	0	
MERC E-CLASS W123	ME14Z	182	25	1	LX
MERC E-CLASS W124	ME15Z	385	56	1	LX
MERC E-CLASS W210	ME16Z	76	10	0	
MERC S-CLASS W107	ME17Z	17	2	0	
MERC S-CLASS W126	ME18Z	300	26	1	LX
MERC S-CLASS W129	ME19Z	19	#N/A	0	
MERC 200 SERIES	ME2 Z	370	57	0	
MERC S-CLASS W140	ME20Z	54	4	0	
MERC SLK W170	ME21Z	4	#N/A	0	
MERC 300 SERIES	ME3 Z	457	48	0	
MERC 400 SERIES	ME4 Z	79	15	0	
MERC 500 SERIES	ME5 Z	43	5	0	
MERCEDES OTHERS	ME99Z	265	84	0	
PSAR/VTOR / ASTRA 82-86	N01 A	6650	1885	1	S
PSAR/VTOR 87	N01 B	855	187	0	
PSAR/VTOR 88-90	N01 C	5964	1237	1	S
PSAR/VTOR 91	N01 D	1192	241	0	
PSAR/VTOR 92-95	N01 E	1768	357	1	S
PSAR/VTOR >=96	N01 F	268	40	1	S
NISS PINTARA <=88	N02 A	2692	510	1	M
NISS PINTARA >=89	N02 B	4757	955	1	M
NISS BLUEBIRD <=88	N03 Z	10090	2023	1	M
NISS SKYLINE	N04 Z	2841	555	1	L
NISS 180B/200B	N05 Z	59	7	0	
NISS 300ZX	N09 Z	295	50	1	SP
NISS STANZA	N10 Z	525	96	1	M
NISS 280C	N11 Z	57	10	0	
NISS GAZELLE	N12 Z	340	368	1	M
NISS 280ZX	N13 Z	75	19	0	
NISS PRAIRIE	N14 Z	314	66	1	M
NISS MAXIMA <=94	N15 A	270	47	1	LX
NISS MAXIMA >=95	N15 B	92	17	0	
NISS EXA 83-86	N16 A	411	84	1	SP
NISS EXA >= 87	N16 B	96	21	0	
NISS NX/NX-R	N17 Z	246	58	1	SP
NISS 300C/BROUGHAM	N20 Z	86	16	0	
NISS 720 UTE	N21 Z	1390	205	1	C

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
NISS B120	N22 Z	103	23	0	
NISS H40	N23 Z	19	3	0	
NISS NAVARA 86-91	N24 A	1989	284	1	C
NISS NAVARA 92-96	N24 B	441	53	1	C
NISS NAVARA >= 97	N24 C	10	2	0	
NISS NAVARA OTHERS	N24 Z	75	13	0	
NISS VANS(NOMAD/URVAN/C22/E24/VANETTE)	N25 Z	2255	410	0	
NISS PATROL <=87	N26 A	699	96	1	4WD
NISS PATROL 88-97	N26 B	2139	343	1	4WD
NISS PATROL 98	N26 C	67	11	0	
NISS PATHFINDER <=94	N27 Z	195	33	1	4WD
NISS SUNNY /120Y	N28 Z	19	4	0	
NISS SERENA	N30 Z	28	8	0	
NISS INFINITY	N31 Z	2	#N/A	0	
NISS BLUEBIRD NEW	N32 Z	350	51	1	M
NISS 200SX	N33 Z	109	14	0	
NISS MICRA	N34 Z	155	41	1	S
NISS PATHFINDER R50 >=95	N36 Z	10	1	0	
NISS PATROL Y61	N37 Z	10	#N/A	0	
NISS TERRANO II	N38 Z	2	1	0	
NISSAN OTHERS	N99 Z	2088	1803	0	
FSM	NIKIZ	27	18	0	
LADA NIVA	NIVAZ	47	23	0	
CIVIC 79-83	O1 A	608	125	1	S
CIVIC 84-87	O1 B	1813	373	1	S
CIVIC 88-91	O1 C	1798	353	1	S
CIVIC 92-95	O1 D	1206	223	1	S
CIVIC >=96	O1 E	296	45	1	S
HONDA CRX 87-91	O10 A	233	41	1	S
HONDA CRX >=92	O10 B	70	13	0	
HONDA CIVIC/CONCERTO	O16 Z	#N/A	2	0	
HONDA ODYSSEY	O17 Z	50	2	0	
HONDA CR-V	O18 Z	11	4	0	
HONDA LEGEND 86-95	O2 B	354	38	1	LX
HONDA LEGEND >=96	O2 C	3	#N/A	0	
ACCORD 82-85	O3 A	1448	274	1	LX
ACCORD 86-90	O3 B	948	145	1	LX
ACCORD 91-93	O3 C	345	35	1	LX
ACCORD 94-98	O3 D	373	37	1	LX
HONDA ACCORD/PRELUDE	O34 Z	#N/A	2	0	
PRELUDE 79-82	O4 A	182	28	1	SP
PRELUDE 83-91	O4 B	1824	277	1	SP
PRELUDE 92-96	O4 C	372	57	1	SP
PRELUDE >=97	O4 D	24	5	0	
INTEGRA 86-88	O5 A	364	65	1	SP
INTEGRA 89	O5 B	184	30	*0*	
INTEGRA 90-92	O5 C	222	47	1	SP

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
INTEGRA 93	O5 D	45	8	0	
INTEGRA >=94	O5 E	125	15	0	
HONDA CONCERTO	O6 Z	207	38	1	M
HONDA NSX	O7 Z	4	#N/A	0	
HONDA ACTY	O8 Z	331	59	1	S
HONDA CITY	O9 Z	331	87	1	S
HONDA OTHERS	O99 Z	282	363	0	
PEUGOT 205	PE1 Z	130	18	0	
PEUGOT 405	PE2 Z	216	41	1	M
PEUGOT 505	PE3 Z	480	86	1	M
PEUGOT 306	PE4 Z	167	27	1	S
PEUGOT 605	PE5 Z	36	3	0	
PEUGOT 406	PE7 Z	12	3	0	
PEUGOT OTHERS	PE99Z	80	26	0	
PORSC 944	PO1 Z	63	10	0	
PORSC 911	PO2 Z	4	2	0	
PORSC 928	PO3 Z	#N/A	2	0	
PORSC 968	PO4 Z	1	#N/A	0	
PORSCH OTHERS	PO99Z	185	30	0	
PONTIAC	PONTZ	#N/A	1	0	
PROTON OTHERS	PROTZ	52	13	0	
RNLT 18GTS	RE Z	#N/A	1	0	
RNLT 20TS	RE1 Z	15	3	0	
RNLT FUEGO	RE2 Z	287	48	1	SP
RNLT 21TXE	RE3 Z	10	2	0	
RNLT 25/25GTX	RE4 Z	33	8	0	
RNLT 19	RE5 Z	78	14	0	
RNLT LAGUNA	RE7 Z	9	2	0	
RENAULT OTHERS	RE99Z	60	17	*0*	
ROVER 3500	RO Z	135	22	1	LX
ROVER 416i/827	RO1 Z	179	18	0	
ROVER QUINTET	RO2 Z	196	65	1	S
ROVER 825	RO3 Z	28	5	0	
ROVER OTHERS	RO99Z	49	48	*0*	
ROLLS ROYCE	ROLLZ	18	3	0	
RANGE ROVER	RROVZ	467	101	0	
SAAB OTHERS	SA00Z	218	59	0	
SAAB 900 82-93	SA1 A	537	99	1	LX
SAAB 900/ 9-3 >=94	SA1 B	256	29	1	LX
SAAB 9000	SA2 Z	349	48	1	LX
SAAB 9-5	SA3 Z	1	#N/A	0	
SAAB 900/9000	SA99Z	#N/A	2	0	
LADA SAMARA	SAMAZ	#N/A	1	0	
SEAT IBIZA	SE01Z	6	5	0	
SEAT CORDOBA	SE02Z	6	4	0	
SUBA 1800/LEONE	SU1 Z	4569	1041	1	M
SUBA LIBERTY <=94	SU2 A	1581	281	1	M

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
SUBA LIBERTY 95-98	SU2 B	294	49	1	M
SUBA VORTEX	SU3 Z	46	9	0	
SUBA SHERPA/FIORI	SU4 Z	547	179	1	S
SUBA SVX	SU5 Z	10	1	0	
SUBA BRUMBY	SU6 Z	1101	289	1	C
SUBA IMPREZA	SU7 Z	415	82	1	S
SUBA FORESTER	SU8 Z	5	1	0	
SUBARU OTHERS	SU99Z	400	314	0	
SWIFT <=84	SZ01A	184	44	1	S
SWIFT/BARINA 85-88	SZ01B	2521	732	1	S
SWIFT/BARINA >= 89	SZ01C	5102	1260	1	S
SUZU VITARA	SZ02Z	1100	232	1	4WD
SUZU HATCH	SZ03Z	893	289	1	S
SUZU CARRY/SCURRY	SZ04Z	385	118	1	C
SUZU ALTO	SZ05Z	87	36	0	
SUZU MIGHTY BOY	SZ06Z	445	134	1	C
SUZU SIERRA/DROVER	SZ07Z	2265	576	1	4WD
SUZUKI BALENO	SZ08Z	140	36	1	S
SUZUKI OTHERS	SZ99Z	588	281	0	
COROLLA 82-84	T01 A	6418	1584	1	S
COROLLA 85	T01 B	2694	686	0	
COROLLA 86-88	T01 C	9012	1987	1	S
COROLLA 89	T01 D	2027	408	0	
COROLLA 90-93	T01 E	8493	1877	1	S
COROLLA 94-98	T01 F	2907	616	1	S
TOY CRNA/CELICA/CMRY	T02 Z	#N/A	67	0	
TOY CORONA	T03 Z	12365	2403	1	M
TOY CAMRY 82-87'	T04 Z	3006	495	1	M
CAMRY/APOLLO 88-92	T05 A	13873	2710	1	M
CAMRY/APOLLO 93-97	T05 B	5266	851	1	M
CAMRY >=98	T05 C	178	24	1	L
CELICA 81-85	T06 A	1637	269	1	SP
CELICA 86-89	T06 B	1226	201	1	SP
CELICA 90-93	T06 C	826	124	1	SP
CELICA >=94	T06 D	183	28	1	SP
CROWN/CRES 80-85	T07 A	1452	288	1	LX
CROWN/CRES 86-88	T07 B	626	70	1	LX
CROWN/CRES >= 89	T07 C	1044	136	1	LX
TOY TERCEL	T09 Z	297	54	1	S
TOY SUPRA	T11 Z	261	45	1	SP
MR2 82-90	T12 A	137	31	1	SP
MR2 >= 91	T12 B	64	14	0	
TOY PASEO	T13 Z	421	114	1	SP
TOY BUNDERA	T14 Z	14	4	0	
TOY HIACE/LITEACE 82-86	T15 A	3796	603	1	C
TOY HIACE/LITEACE 87-89	T15 B	1543	221	1	C
TOY HIACE/LITEACE 90-98	T15 C	2083	259	1	C

MAKE/MODEL	MODEL CODE	No. of involved drivers in NSW (87-98) and Qld (91-98)	No of injured drivers in NSW and Victoria (87-98) and Qld (91-98)	ANALYSIS INCLUSION CRITERIA INV=100 INJ=20	MARKET GROUP
TOY 4RUNNER/HILUX 82-85	T16 A	3888	634	1	4WD
TOY 4RUNNER/HILUX 86-88	T16 B	2558	407	1	4WD
TOY 4RUNNER/HILUX 89-97	T16 C	5484	903	1	4WD
TOY 4RUNNER/HILUX >=98	T16 D	13	5	0	
TOY LEXUS	T17 Z	123	20	0	
TARAGO 83-89	T18 A	3291	637	1	PV
TARAGO 90	T18 B	181	23	0	
TARAGO >= 91	T18 C	712	94	1	PV
TARAGO OTHERS	T18 Z	148	31	0	
TOY COMMERCIALS	T19 Z	2523	324	0	
TOY LANCRUISER <=89	T20 A	3257	519	1	4WD
TOY LANCRUISER 90-97	T20 B	1517	250	1	4WD
TOY LANCRUISER >=98	T20 C	6	3	0	
TOY RAV4	T21 Z	81	32	0	
TOY STARLET	T22 Z	312	66	0	
TOY COROLLA 100 SER	T24 Z	3	1	0	
TOY CAMRY/CORONA	T53 Z	#N/A	91	0	
TOY CAMRY/CELICA	T56 Z	#N/A	47	0	
TOY CELICA/CORONA	T63 Z	#N/A	48	0	
TOYOTA OTHERS	T99 Z	2977	2387	0	
VOLVO 200/700/900	V279Z	#N/A	3	0	
VOLVO 850/S70/V70	V877Z	134	17	0	
VOLVO 200 SERIES OTHERS	VO02Z	2193	277	1	LX
VOLVO 300 SERIES	VO03Z	149	17	0	
VOLVO 700/900 SERIES	VO07Z	1117	159	1	LX
VOLVO 800 SERIES	VO08Z	212	28	1	LX
VOLVO 960/S90/V90	VO10Z	16	3	0	
VOLVO 200/700	VO27Z	#N/A	4	0	
VOLVO V40/S40	VO40Z	26	2	0	
VOLVO OTHERS	VO99Z	413	144	0	
VOLK CARAVELLE/TRANSPORTER	VS01Z	371	44	1	C
VOLK GOLF 82-94	VS02A	69	6	0	
VOLK GOLF 95-98	VS02B	188	18	0	
VOLK KOMBI	VS03Z	1	#N/A	0	
VOLK PASSAT	VS04Z	1	#N/A	0	
VOLK 70E PICK UP	VS07Z	23	6	0	
VOLKS POLO	VS08Z	30	6	0	
VOLKSWAGEN OTHERS	VS99Z	175	18	0	
	Total	**615238**	**135810**	**195**	

APPENDIX 2

LOGISTIC REGRESSION ESTIMATES OF INJURY RISK BY MODEL AND MARKET GROUP

CRASHWORTHINESS INJURY RISK RATINGS

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**15.886**			
4-Wheel Drive Vehicles			**14.429**	**14.029**	**14.831**	**0.802**
Toyota	Landcruiser	90-97	9.767	8.493	11.195	2.702
Holden	Jackaroo	82-91	17.464	13.670	22.026	8.356
Mitsubishi	Pajero	92-98	11.907	9.337	15.079	5.742
Nissan	Patrol	88-97	11.425	10.178	12.795	2.617
Ford	Maverick	88-97				
Toyota	4Runner/Hilux	89-97	13.013	12.140	13.898	1.758
Nissan	Pathfinder	88-94	12.240	8.236	17.783	9.548
Toyota	4Runner/Hilux	86-88	13.890	12.586	15.311	2.725
Toyota	Landcruiser	82-89	12.843	11.752	14.018	2.266
Nissan	Patrol	82-87	12.100	9.891	14.728	4.837
Toyota	4Runner/Hilux	82-85	14.890	13.754	16.113	2.359
Mitsubishi	Pajero	82-90	15.944	13.766	18.433	4.666
Suzuki	Vitara	88-98	18.961	16.678	21.532	4.855
Daihatsu	Rocky	84-98	19.616	15.886	23.941	8.055
Holden	Drover	85-87	23.400	21.631	25.316	3.685
Suzuki	Sierra	82-98				
Daihatsu	Feroza	89-98	15.987	12.302	20.526	8.224
Commercial Vehicles			**14.639**	**14.252**	**15.036**	**0.784**
Nissan	Navara	92-96	9.979	7.620	12.967	5.347
Ford	Falcon Panel Van	82-95	12.215	10.863	13.706	2.843
Ford	Ford F-Series	82-92	13.541	10.966	16.565	5.600
Volkswagen	Caravelle / Transporter	88-98	14.147	10.696	18.540	7.844
Ford	Falcon Ute	82-95	11.537	10.683	12.450	1.767
Nissan	XFN Ute	88-90				
Nissan	720 Ute	82-85	14.162	12.388	16.113	3.725
Holden	Commodore Ute VG/VP	90-93	13.334	11.183	15.771	4.589
Holden	Rodeo	82-85	14.001	11.221	17.345	6.124
Nissan	Navara	86-91	13.406	11.940	14.962	3.022
Holden	Rodeo	82-85	13.086	11.777	14.492	2.715
Toyota	Hiace/Liteace	87-89	16.898	14.962	19.072	4.110
Holden	Rodeo	96-98	20.113	15.771	25.226	9.455
Toyota	Hiace/Liteace	90-98	14.428	12.832	16.227	3.395
Holden	WB Series	82-85	11.979	10.386	13.778	3.392
Holden	Commodore Ute VR/VS	94-98	12.063	10.360	14.018	3.658
Holden	Shuttle	82-87	18.316	14.610	22.803	8.193
Toyota	Hiace/Liteace	82-86	18.850	17.455	20.321	2.866
Subaru	Brumby	82-93	17.917	15.886	20.116	4.230
Suzuki	Mighty Boy	85-88	31.394	26.988	36.166	9.178
Large Cars			**13.943**	**13.735**	**14.154**	**0.420**
Mitsubishi	Magna TE/TF/TH Verada KE/KF/KH	96-98	11.625	9.575	14.018	4.443

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Ford	Falcon EA	88-Mar 92	12.620	12.078	13.186	1.109
	Falcon EB Series I					
Holden	Commodore VR/VS	93-97	13.736	13.040	14.492	1.452
Toyota	Lexcen	93-97				
Mitsubishi	Verada KR/KS	91-96	13.664	12.783	14.610	1.827
	Magna TR/TS	91-96				
Ford	Falcon EF/EL	94-98	13.392	12.586	14.256	1.670
Ford	Falcon EB Series II	Apr 92-94	12.491	11.664	13.368	1.705
	Falcon ED					
Holden	Apollo JM / JP	93-97	13.443	12.450	14.492	2.042
Toyota	Camry	93-97				
Ford	Falcon XE/XF	82-88	13.914	13.441	14.374	0.933
Holden	Commodore VN/VP	89-93	14.048	13.489	14.610	1.121
Toyota	Lexcen	89-93				
Holden	Commodore VT	97-98	17.181	14.492	20.321	5.829
Holden	Commodore VB-VL	82-88	14.841	14.374	15.426	1.052
Nissan	Skyline	82-90	14.777	13.417	16.227	2.810
Mitsubishi	Magna TM/TN/TP	85-90	15.313	14.610	16.000	1.389
Hyundai	Sonata	89-97	17.311	14.610	20.321	5.711
Luxury Cars			**13.081**	**12.682**	**13.481**	**0.799**
Volvo	700/900 Series	84-92	13.566	11.563	15.886	4.323
Honda	Legend	86-95	7.989	5.449	11.563	6.114
BMW	5 Series	82-88	10.772	8.304	13.862	5.559
Nisan	Maxima	90-94	11.850	8.385	16.453	8.068
Honda	Accord	86-90	13.318	11.119	15.886	4.767
Volvo	200 Series	82-93	11.756	10.386	13.284	2.898
Toyota	Cressida	89-93	10.970	9.164	13.089	3.925
Saab	900 Series	82-93	12.582	9.904	15.886	5.982
Ford	Fairlane N & LTD D	88-94	10.507	9.284	11.865	2.581
BMW	3 Series	92-98	12.721	10.696	15.079	4.382
Toyota	Crown/Cressida	86-88	10.200	7.963	12.979	5.016
BMW	5 Series	89-95	10.068	6.926	14.374	7.448
BMW	3 Series	82-91	14.216	12.611	16.000	3.389
Holden	Stateman/Caprice	90-93	11.554	9.164	14.492	5.328
Toyota	Crown/Cressida	82-85	16.228	14.256	18.325	4.070
Ford	Fairlane Z & LTD F	82-88	14.502	13.296	15.771	2.476
Mercedes Benz	E-Class W124	86-93	14.121	10.825	18.217	7.393
Mazda	929	82-90	16.171	14.610	17.892	3.282
Honda	Accord	94-98	10.853	7.771	14.962	7.191
Honda	Accord	82-85	17.930	15.886	20.219	4.333
Holden	Stateman/Caprice	94-98	13.450	10.399	17.234	6.835
Ford	Fairlane N & LTD D	95-98	12.121	8.547	16.901	8.354
Mercedes Benz	C-Class W201	87-94	18.237	13.778	23.753	9.975
Medium Cars			**16.690**	**16.418**	**16.942**	**0.524**
Peugeot	505	82-93	10.396	7.944	13.510	5.565
Nissan	Bluebird	93-98	11.654	8.706	15.419	6.714
Subaru	Liberty	95-98	11.905	8.760	15.971	7.212
Mitsubishi	Galant	89-94	15.286	12.431	18.612	6.181
Ford	Telstar	88-91	14.199	12.563	16.017	3.454
Mazda	626/MX6	88-91				
Subaru	Liberty	89-94	13.873	12.232	15.696	3.464

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Mitsubishi	Nimbus	84-91	18.675	15.342	22.556	7.214
Ford	Telstar	83-86	15.654	14.656	16.711	2.055
Mazda	626/MX6	83-86				
Ford	Mondeo	95-98	12.957	9.313	17.746	8.433
Ford	Telstar	92-97	12.172	10.469	14.103	3.634
Mazda	626/MX6	92-97				
Nissan	Stanza	82-83	17.276	14.150	20.971	6.821
Toyota	Camry	83-86	14.856	13.542	16.260	2.718
Nissan	Prairie	84-86	19.518	15.296	24.572	9.277
Nissan	Pintara	86-88	15.266	13.879	16.771	2.892
Mitsubishi	Sigma/Scorpion	82-86	16.812	16.002	17.658	1.656
Toyota	Corona	82-87	16.691	15.941	17.468	1.527
Holden	Apollo JK/JL	89-92	15.684	15.016	16.381	1.364
Toyota	Camry	88-92				
Nissan	Bluebird	82-86	17.265	16.441	18.181	1.740
Nissan	Pintara	89-92	15.522	14.483	16.606	2.123
Ford	Corsair	89-92				
Holden	Carmia	82-89	19.613	18.755	20.429	1.674
Subaru	1800/ Leone	82-95	18.024	16.890	19.180	2.290
Nissan	Gazelle	84-88	17.516	13.558	22.296	8.738
Passenger Vans			**19.105**	**18.351**	**19.834**	**1.483**
Toyota	Tarago	91-98	12.642	10.331	15.388	5.058
Mitsubishi	Starwagon	95-98	15.025	11.019	20.155	9.135
Mitsubishi	Starwagon	87-94	17.730	16.320	19.180	2.860
Toyota	Tarago	83-89	19.141	17.746	20.565	2.819
Mitsubishi	Starwagon/L300	82-86	21.808	20.155	23.451	3.297
Small Cars			**20.118**	**19.834**	**20.437**	**0.602**
Nissan	Pulsar/Vector	96-98	12.536	8.867	17.453	8.586
Honda	Civic	96-98	14.923	10.951	20.017	9.066
Nissan	Pulsar/Vector	92-95	15.209	13.574	17.009	3.435
Honda	Civic	92-95	14.756	12.744	17.009	4.265
Hyundai	Lantra	91-95	18.903	16.017	22.166	6.149
Daihatsu	Applause	89-98	18.049	15.865	20.429	4.564
Mazda	323	90-93	16.945	14.985	19.039	4.054
Toyota	Corolla	82-84	19.281	18.181	20.429	2.247
Toyota	Tercel	83-88	14.619	10.916	19.321	8.404
Ford	Laser	91-94	17.100	15.956	18.326	2.369
Toyota	Corolla	90-93	16.894	16.047	17.746	1.698
Mitsubishi	Lancer CA / CB	88-92	17.679	16.093	19.321	3.228
Holden	Gemini	82-84	19.412	18.181	20.701	2.520
Honda	Concerto	88-93	14.927	10.728	20.429	9.701
Mitsubishi	Cordia	82-89	18.916	16.711	21.374	4.662
Holden	Astra	88-90	17.586	16.546	18.612	2.066
Nissan	Pulsar/Vector	88-90				
Toyota	Corolla	94-98	17.253	15.865	18.755	2.890
Mazda	121	94-96	19.385	16.576	22.556	5.980
Fiat	Regata	84-89	11.289	7.318	17.024	9.706
Hyundai	Lantra	96-98	15.378	11.393	20.429	9.035
Toyota	Corolla	86-88	18.852	17.892	19.740	1.848
Mitsubishi	Lancer CC	95-96	17.222	15.419	19.180	3.761
Holden	Gemini RB	86-87	24.643	20.701	29.182	8.481

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Honda	Civic	82-83	19.542	16.441	23.070	6.629
Ford	Laser	95-98	17.158	13.831	21.106	7.275
Rover	Quintet	82-86	20.850	15.635	27.294	11.659
Ford	Laser	82-88	20.410	19.740	21.106	1.366
Mazda	323	82-88				
Holden	Astra	84-86	20.101	19.039	21.240	2.201
Nissan	Pulsar/Vector	84-86				
Mitsubishi	Colt	82-88	21.538	20.565	22.556	1.991
Honda	Civic	88-91	16.497	14.750	18.469	3.719
Hyundai	Excel	90-94	20.770	19.321	22.296	2.976
Mitsubishi	Lancer CE/Mirage	95-98	18.924	16.214	22.035	5.820
Honda	Civic	84-87	18.489	16.621	20.565	3.944
Holden	Barina	89-93	21.774	20.565	23.070	2.505
Suzuki	Swift	89-98				
Hyundai	S Coupe	90-96	20.994	17.276	25.302	8.026
Mazda	323	95-98	15.408	12.547	18.755	6.208
Hyundai	Excel	82-89	21.940	19.740	24.202	4.462
Daihatsu	Charade	88-92	21.788	20.292	23.325	3.033
Subaru	Impreza	93-98	16.214	12.925	20.155	7.230
Holden	Barina SB	95-98	22.629	19.879	25.661	5.782
Ford	Festiva WD/WD/WH	94-98	23.202	21.106	25.302	4.196
Daihatsu	Charade	93-98	19.340	17.438	21.374	3.935
Hyundai	Excel	95-98	23.239	21.639	24.939	3.299
Daewoo	Cielo	95-97	25.985	20.971	31.787	10.816
Ford	Festiva WA	91-93	23.960	22.166	25.780	3.614
Mazda	121	87-90				
Holden	Barina	85-88	26.197	24.326	28.083	3.757
Suzuki	Swift	85-88				
Daihatsu	Charade	82-86	24.369	22.166	26.603	4.437
Honda	City	83-86	28.135	23.325	33.452	10.128
Daihatsu	Mira	90-96	30.072	25.422	35.129	9.707
Daihatsu	Handivan	82-90	32.689	28.856	36.809	7.953
Suzuki	Hatch	82-85	33.235	30.037	36.550	6.513
Subaru	Sherpa/Fiori	89-92	33.967	29.931	38.240	8.309
Sports Cars			**16.158**	**15.511**	**16.811**	**1.301**
Renault	Fuego	82-87	13.436	9.702	18.326	8.624
Toyota	Celica	90-93	13.265	11.002	15.910	4.908
Honda	Prelude	83-91	14.407	12.744	16.260	3.515
Toyota	Celica	81-85	16.074	14.246	18.037	3.791
Nissan	300ZX	86-97	12.118	8.724	16.606	7.883
Honda	Integra	90-92	14.711	10.486	20.292	9.805
Mazda	MX5	89-98	15.468	11.342	20.701	9.358
Honda	Integra	86-88	15.782	12.132	20.292	8.159
Toyota	Celica	86-89	15.437	13.364	17.746	4.382
Mazda	RX7	82-85	15.731	12.464	19.740	7.276
Alfa Romeo	33	83-92	16.870	13.590	20.701	7.111
Honda	Prelude	92-96	11.763	8.724	15.681	6.957
Toyota	Supra	82-90	16.145	12.016	21.374	9.358
Ford	Capri	89-94	18.408	15.496	21.772	6.275
Toyota	Paseo	91-98	23.017	19.039	27.521	8.482
Nissan	Exa	83-86	23.608	19.461	28.416	8.956
Nissan	NX/NX-R	91-96	20.246	15.573	25.899	10.325

APPENDIX 3

LOGISTIC REGRESSION ESTIMATES OF INJURY SEVERITY BY MODEL AND MARKET GROUP

CRASHWORTHINESS INJURY SEVERITY RATINGS

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**24.089**			
4-Wheel Drive Vehicles			**23.280**	**22.158**	**24.453**	**2.295**
Toyota	Landcruiser	90-97	20.705	17.872	27.592	9.720
Holden	Jackaroo	82-91	13.389	8.165	24.675	16.509
Mitsubishi	Pajero	92-98	19.966	14.024	31.723	17.699
Nissan	Patrol	88-97	21.795	19.311	28.286	8.975
Ford	Maverick	88-97				
Toyota	4Runner/Hilux	89-97	21.729	20.723	26.525	5.802
Nissan	Pathfinder	88-94	23.144	12.898	42.707	29.809
Toyota	4Runner/Hilux	86-88	21.490	19.377	27.592	8.215
Toyota	Landcruiser	82-89	24.684	22.908	30.615	7.706
Nissan	Patrol	82-87	26.355	20.194	38.210	18.016
Toyota	4Runner/Hilux	82-85	24.815	23.284	30.453	7.169
Mitsubishi	Pajero	82-90	25.386	21.120	34.561	13.441
Suzuki	Vitara	88-98	23.474	19.766	31.723	11.957
Daihatsu	Rocky	84-98	24.264	18.320	35.824	17.504
Holden	Drover	85-87	21.160	19.463	26.705	7.241
Suzuki	Sierra	82-98				
Daihatsu	Feroza	89-98	33.192	23.812	49.049	25.238
Commercial Vehicles			**25.282**	**24.071**	**26.566**	**2.495**
Nissan	Navara	92-96	18.074	11.191	32.033	20.842
Ford	Falcon Panel Van	82-95	18.333	15.386	25.240	9.853
Ford	Ford F-Series	82-92	18.538	12.593	30.453	17.861
Volkswagen	Caravelle / Transporter	88-98	18.508	10.313	35.408	25.096
Ford	Falcon Ute	82-95	24.305	22.849	29.801	6.952
Nissan	XFN Ute	88-90				
Nissan	720 Ute	82-85	21.666	18.007	29.801	11.794
Holden	Commodore Ute VG/VP	90-93	24.767	19.593	35.128	15.535
Holden	Rodeo	82-85	23.649	16.682	36.907	20.225
Nissan	Navara	86-91	25.462	22.409	32.947	10.539
Holden	Rodeo	82-85	26.196	23.519	33.395	9.876
Toyota	Hiace/Liteace	87-89	21.447	17.713	29.635	11.922
Holden	Rodeo	96-98	18.307	11.716	31.567	19.851
Toyota	Hiace/Liteace	90-98	26.209	22.689	34.417	11.728
Holden	WB Series	82-85	33.121	28.628	42.707	14.078
Holden	Commodore Ute VR/VS	94-98	34.060	29.135	44.203	15.067
Holden	Shuttle	82-87	22.743	15.482	36.640	21.158
Toyota	Hiace/Liteace	82-86	24.429	22.609	30.453	7.844
Subaru	Brumby	82-93	31.391	28.286	39.338	11.052
Suzuki	Mighty Boy	85-88	23.917	18.476	34.704	16.228
Large Cars			**23.455**	**22.844**	**24.071**	**1.227**
Mitsubishi	Magna TE/TF/TH Verada KE/KF/KH	96-98	23.382	20.151	31.094	10.943
Ford	Falcon EA Falcon EB Series I	88-Mar 92	21.949	21.882	25.611	3.729
Holden	Commodore VR/VS	93-97	21.453	21.078	25.426	4.348
Toyota	Lexcen	93-97				

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Mitsubishi	Verada KR/KS	91-96	22.024	21.099	26.705	5.606
	Magna TR/TS	91-96				
Ford	Falcon EF/EL	94-98	22.595	21.841	27.062	5.221
Ford	Falcon EB Series II	Apr 92-94	24.507	23.519	29.470	5.950
	Falcon ED					
Holden	Apollo JM / JP	93-97	21.997	19.202	25.052	5.850
Toyota	Camry	93-97				
Ford	Falcon XE/XF	82-88	23.682	24.024	27.062	3.038
Holden	Commodore VN/VP	89-93	23.964	24.102	27.592	3.490
Toyota	Lexcen	89-93				
Holden	Commodore VT	97-98	19.877	14.856	30.128	15.272
Holden	Commodore VB-VL	82-88	24.389	24.675	27.941	3.266
Nissan	Skyline	82-90	24.829	22.928	30.935	8.007
Mitsubishi	Magna TM/TN/TP	85-90	24.309	24.198	28.286	4.088
Hyundai	Sonata	89-97	22.194	17.555	31.723	14.168
Luxury Cars			**22.855**	**21.654**	**24.089**	**2.435**
Volvo	700/900 Series	84-92	15.478	11.349	24.217	12.868
Honda	Legend	86-95	28.747	17.600	48.166	30.566
BMW	5 Series	82-88	22.163	14.442	36.907	22.465
Nisan	Maxima	90-94	20.629	12.567	36.505	23.938
Honda	Accord	86-90	18.709	13.975	28.458	14.483
Volvo	200 Series	82-93	22.232	18.984	29.801	10.817
Toyota	Cressida	89-93	23.984	19.027	34.128	15.101
Saab	900 Series	82-93	21.299	15.506	32.797	17.291
Ford	Fairlane N & LTD D	88-94	26.326	23.558	33.543	9.985
BMW	3 Series	92-98	22.307	17.235	32.493	15.258
Toyota	Crown/Cressida	86-88	28.579	20.596	42.925	22.329
BMW	5 Series	89-95	29.654	16.821	51.760	34.939
BMW	3 Series	82-91	21.364	18.074	28.967	10.893
Holden	Stateman/Caprice	90-93	27.225	20.953	39.214	18.261
Toyota	Crown/Cressida	82-85	20.869	17.894	28.114	10.220
Ford	Fairlane Z & LTD F	82-88	23.632	22.085	29.135	7.050
Mercedes Benz	E-Class W124	86-93	24.582	16.004	40.543	24.539
Mazda	929	82-90	24.795	22.288	31.567	9.279
Honda	Accord	94-98	37.632	24.958	57.211	32.253
Honda	Accord	82-85	23.207	19.787	31.094	11.307
Holden	Stateman/Caprice	94-98	32.984	24.313	47.896	23.583
Ford	Fairlane N & LTD D	95-98	38.509	26.344	57.272	30.928
Mercedes Benz	C-Class W201	87-94	27.045	17.486	44.203	26.716
Medium Cars			**23.330**	**22.635**	**24.034**	**1.399**
Peugeot	505	82-93	22.604	15.122	32.341	17.219
Nissan	Bluebird	93-98	24.371	14.197	38.591	24.394
Subaru	Liberty	95-98	24.456	14.662	37.954	23.292
Mitsubishi	Galant	89-94	19.784	13.201	28.628	15.427
Ford	Telstar	88-91	21.372	16.960	26.525	9.565
Mazda	626/MX6	88-91				
Subaru	Liberty	89-94	21.956	17.532	27.062	9.530
Mitsubishi	Nimbus	84-91	17.773	11.139	27.062	15.924
Ford	Telstar	83-86	21.473	19.049	24.121	5.071
Mazda	626/MX6	83-86				
Ford	Mondeo	95-98	27.259	16.239	42.041	25.802

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Ford	Telstar	92-97	29.127	23.126	35.962	12.835
Mazda	626/MX6	92-97				
Nissan	Stanza	82-83	20.698	13.552	30.291	16.739
Toyota	Camry	83-86	24.131	20.406	28.286	7.880
Nissan	Prairie	84-86	18.547	10.554	30.453	19.899
Nissan	Pintara	86-88	24.048	20.364	28.114	7.750
Mitsubishi	Sigma/Scorpion	82-86	22.245	20.364	24.236	3.872
Toyota	Corona	82-87	22.419	20.575	24.370	3.795
Holden	Apollo JK/JL	89-92	24.095	22.308	25.979	3.672
Toyota	Camry	88-92				
Nissan	Bluebird	82-86	23.865	21.861	25.979	4.118
Nissan	Pintara	89-92	26.884	24.005	29.965	5.960
Ford	Corsair	89-92				
Holden	Carmia	82-89	21.717	20.109	23.422	3.313
Subaru	1800/ Leone	82-95	23.754	21.161	26.525	5.363
Nissan	Gazelle	84-88	27.110	22.589	32.187	9.598
Passenger Vans			**25.178**	**23.369**	**27.075**	**3.706**
Toyota	Tarago	91-98	21.497	14.172	31.252	17.080
Mitsubishi	Starwagon	95-98	23.097	12.259	39.214	26.955
Mitsubishi	Starwagon	87-94	23.627	20.023	27.592	7.569
Toyota	Tarago	83-89	23.609	20.321	27.240	6.918
Mitsubishi	Starwagon/L300	82-86	27.152	23.382	31.252	7.870
Small Cars			**24.382**	**23.758**	**24.992**	**1.234**
Nissan	Pulsar/Vector	96-98	23.762	12.745	39.947	27.201
Honda	Civic	96-98	24.077	13.050	40.067	27.017
Nissan	Pulsar/Vector	92-95	24.408	20.087	29.303	9.216
Honda	Civic	92-95	25.319	19.723	31.879	12.156
Hyundai	Lantra	91-95	19.982	14.320	27.240	12.920
Daihatsu	Applause	89-98	21.150	16.309	26.884	10.575
Mazda	323	90-93	23.385	18.675	28.798	10.123
Toyota	Corolla	82-84	21.483	19.333	23.812	4.478
Toyota	Tercel	83-88	28.213	17.623	41.928	24.305
Ford	Laser	91-94	24.243	21.472	27.240	5.768
Toyota	Corolla	90-93	24.951	22.849	27.240	4.391
Mitsubishi	Lancer CA / CB	88-92	23.917	20.130	28.114	7.984
Holden	Gemini	82-84	22.121	19.701	24.751	5.049
Honda	Concerto	88-93	29.003	16.705	45.424	28.719
Mitsubishi	Cordia	82-89	23.049	18.164	28.798	10.635
Holden	Astra	88-90	24.883	22.328	27.592	5.264
Nissan	Pulsar/Vector	88-90				
Toyota	Corolla	94-98	25.421	21.943	29.303	7.360
Mazda	121	94-96	23.113	17.190	30.291	13.102
Fiat	Regata	84-89	39.252	20.173	62.282	42.109
Hyundai	Lantra	96-98	29.181	17.281	44.820	27.539
Toyota	Corolla	86-88	24.210	22.146	26.344	4.198
Mitsubishi	Lancer CC	95-96	26.501	22.045	31.410	9.365
Holden	Gemini RB	86-87	18.970	12.974	26.884	13.910
Honda	Civic	82-83	23.853	16.844	32.645	15.801
Ford	Laser	95-98	27.229	18.896	37.565	18.670
Rover	Quintet	82-86	22.779	13.950	34.987	21.037
Ford	Laser	82-88	23.373	22.085	24.713	2.627

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Mazda	323	82-88				
Holden	Astra	84-86	24.947	22.789	27.240	4.451
Nissan	Pulsar/Vector	84-86				
Mitsubishi	Colt	82-88	23.558	21.575	25.611	4.037
Honda	Civic	88-91	30.818	25.979	36.234	10.255
Hyundai	Excel	90-94	24.851	21.861	28.114	6.252
Mitsubishi	Lancer CE/Mirage	95-98	27.607	21.036	35.269	14.232
Honda	Civic	84-87	28.459	23.773	33.690	9.918
Holden	Barina	89-93	24.475	21.902	27.240	5.337
Suzuki	Swift	89-98				
Hyundai	S Coupe	90-96	25.516	17.691	35.269	17.578
Mazda	323	95-98	35.014	26.162	45.023	18.861
Hyundai	Excel	82-89	25.413	21.513	29.801	8.288
Daihatsu	Charade	88-92	27.464	24.198	30.935	6.737
Subaru	Impreza	93-98	36.837	26.705	48.166	21.462
Holden	Barina SB	95-98	27.089	21.389	33.690	12.301
Ford	Festiva WD/WD/WH	94-98	26.500	22.449	30.935	8.486
Daihatsu	Charade	93-98	32.697	27.767	38.082	10.316
Hyundai	Excel	95-98	27.983	24.618	31.567	6.949
Daewoo	Cielo	95-97	25.117	17.826	34.128	16.302
Ford	Festiva WA	91-93	27.203	23.695	31.094	7.399
Mazda	121	87-90				
Holden	Barina	85-88	25.052	21.780	28.628	6.849
Suzuki	Swift	85-88				
Daihatsu	Charade	82-86	27.862	23.734	32.341	8.607
Honda	City	83-86	24.812	16.519	35.548	19.028
Daihatsu	Mira	90-96	26.364	18.786	35.686	16.901
Daihatsu	Handivan	82-90	24.306	18.141	31.723	13.582
Suzuki	Hatch	82-85	25.247	20.343	30.935	10.592
Subaru	Sherpa/Fiori	89-92	27.515	21.141	34.987	13.847
Sports Cars			**25.046**	**23.257**	**26.906**	**3.649**
Renault	Fuego	82-87	17.482	9.197	30.775	21.579
Toyota	Celica	90-93	21.646	15.050	30.128	15.079
Honda	Prelude	83-91	21.428	16.752	27.062	10.310
Toyota	Celica	81-85	19.996	15.506	25.426	9.920
Nissan	300ZX	86-97	26.849	16.286	40.896	24.610
Honda	Integra	90-92	23.879	13.302	39.091	25.789
Mazda	MX5	89-98	22.954	11.898	39.704	27.807
Honda	Integra	86-88	22.973	14.049	35.269	21.220
Toyota	Celica	86-89	25.043	19.224	31.879	12.654
Mazda	RX7	82-85	24.820	17.029	34.704	17.675
Alfa Romeo	33	83-92	26.394	17.441	37.825	20.384
Honda	Prelude	92-96	37.998	25.979	51.682	25.703
Toyota	Supra	82-90	30.512	18.742	45.524	26.782
Ford	Capri	89-94	26.965	19.852	35.548	15.696
Toyota	Paseo	91-98	24.414	17.029	33.690	16.662
Nissan	Exa	83-86	24.718	16.192	35.824	19.632
Nissan	NX/NX-R	91-96	39.809	27.767	53.267	25.501

APPENDIX 4

CRASHWORTHINESS RATINGS OF 1982-97 MODELS OF CARS INVOLVED IN CRASHES DURING 1987-97 with (1) 95 % CONFIDENCE LIMITS (2) 90 % CONFIDENCE LIMITS

CRASHWORTHINESS RATINGS
(WITH 95% CONFIDENCE LIMITS)

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**3.827**			
4-Wheel Drive Vehicles			**3.359**	**3.149**	**3.583**	**0.434**
Toyota	Landcruiser	90-97	2.022	1.555	2.630	1.076
Holden	Jackaroo	82-91	2.338	1.268	4.313	3.046
Mitsubishi	Pajero	92-98	2.377	1.468	3.849	2.381
Nissan	Patrol	88-97	2.490	1.984	3.125	1.140
Ford	Maverick	88-97				
Toyota	4Runner/Hilux	89-97	2.828	2.451	3.263	0.812
Nissan	Pathfinder	88-94	2.833	1.362	5.894	4.533
Toyota	4Runner/Hilux	86-88	2.985	2.432	3.663	1.231
Toyota	Landcruiser	82-89	3.170	2.669	3.766	1.097
Nissan	Patrol	82-87	3.189	2.170	4.687	2.517
Toyota	4Runner/Hilux	82-85	3.695	3.153	4.330	1.177
Mitsubishi	Pajero	82-90	4.048	3.024	5.417	2.393
Suzuki	Vitara	88-98	4.451	3.382	5.857	2.474
Daihatsu	Rocky	84-98	4.760	3.188	7.106	3.917
Holden	Drover	85-87	4.951	4.133	5.931	1.798
Suzuki	Sierra	82-98				
Daihatsu	Feroza	89-98	5.307	3.366	8.366	5.000
Commercial Vehicles			**3.701**	**3.501**	**3.912**	**0.411**
Nissan	Navara	92-96	1.804	0.988	3.292	2.304
Ford	Falcon Panel Van	82-95	2.239	1.695	2.958	1.262
Ford	Ford F-Series	82-92	2.510	1.524	4.135	2.611
Volkswagen	Caravelle / Transporter	88-98	2.618	1.310	5.232	3.922
Ford	Falcon Ute	82-95	2.804	2.398	3.278	0.880
Nissan	XFN Ute	88-90				
Nissan	720 Ute	82-85	3.068	2.296	4.101	1.805
Holden	Commodore Ute VG/VP	90-93	3.302	2.334	4.673	2.339
Holden	Rodeo	82-85	3.311	2.084	5.260	3.175
Nissan	Navara	86-91	3.414	2.714	4.293	1.580
Holden	Rodeo	82-85	3.428	2.785	4.219	1.434
Toyota	Hiace/Liteace	87-89	3.624	2.706	4.853	2.146
Holden	Rodeo	96-98	3.682	2.103	6.446	4.343
Toyota	Hiace/Liteace	90-98	3.782	2.965	4.823	1.859
Holden	WB Series	82-85	3.967	3.092	5.091	2.000
Holden	Commodore Ute VR/VS	94-98	4.109	3.157	5.347	2.190
Holden	Shuttle	82-87	4.166	2.537	6.839	4.301
Toyota	Hiace/Liteace	82-86	4.605	3.889	5.453	1.564
Subaru	Brumby	82-93	5.624	4.576	6.913	2.337
Suzuki	Mighty Boy	85-88	7.509	5.256	10.726	5.469
Large Cars			**3.270**	**3.173**	**3.371**	**0.198**
Mitsubishi	Magna TE/TF/TH Verada KE/KF/KH	96-98	2.718	2.028	3.642	1.614
Ford	Falcon EA	88-Mar 92	2.770	2.527	3.037	0.510

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
	Falcon EB Series I					
Holden	Commodore VR/VS	93-97	2.947	2.644	3.285	0.641
Toyota	Lexcen	93-97				
Mitsubishi	Verada KR/KS	91-96	3.009	2.624	3.452	0.828
	Magna TR/TS	91-96				
Ford	Falcon EF/EL	94-98	3.026	2.666	3.435	0.769
Ford	Falcon EB Series II	Apr 92-94	3.061	2.677	3.501	0.824
	Falcon ED					
Holden	Apollo JM / JP	93-97	3.113	2.670	3.630	0.959
Toyota	Camry	93-97				
Ford	Falcon XE/XF	82-88	3.295	3.070	3.536	0.466
Holden	Commodore VN/VP	89-93	3.366	3.105	3.649	0.544
Toyota	Lexcen	89-93				
Holden	Commodore VT	97-98	3.415	2.291	5.091	2.801
Holden	Commodore VB-VL	82-88	3.620	3.364	3.894	0.530
Nissan	Skyline	82-90	3.669	3.062	4.396	1.334
Mitsubishi	Magna TM/TN/TP	85-90	3.722	3.397	4.079	0.681
Hyundai	Sonata	89-97	3.842	2.718	5.431	2.713
Luxury Cars			**2.990**	**2.811**	**3.180**	**0.369**
Volvo	700/900 Series	84-92	2.100	1.384	3.186	1.802
Honda	Legend	86-95	2.297	1.205	4.378	3.174
BMW	5 Series	82-88	2.387	1.381	4.128	2.748
Nisan	Maxima	90-94	2.445	1.281	4.665	3.383
Honda	Accord	86-90	2.492	1.662	3.735	2.072
Volvo	200 Series	82-93	2.614	2.011	3.397	1.386
Toyota	Cressida	89-93	2.631	1.857	3.728	1.871
Saab	900 Series	82-93	2.680	1.708	4.203	2.495
Ford	Fairlane N & LTD D	88-94	2.766	2.221	3.445	1.224
BMW	3 Series	92-98	2.838	1.964	4.100	2.136
Toyota	Crown/Cressida	86-88	2.915	1.854	4.584	2.730
BMW	5 Series	89-95	2.986	1.494	5.965	4.471
BMW	3 Series	82-91	3.037	2.319	3.977	1.658
Holden	Stateman/Caprice	90-93	3.146	2.116	4.676	2.560
Toyota	Crown/Cressida	82-85	3.387	2.608	4.397	1.789
Ford	Fairlane Z & LTD F	82-88	3.427	2.901	4.049	1.148
Mercedes Benz	E-Class W124	86-93	3.471	2.009	5.996	3.987
Mazda	929	82-90	4.010	3.259	4.932	1.673
Honda	Accord	94-98	4.084	2.370	7.038	4.668
Honda	Accord	82-85	4.161	3.205	5.402	2.197
Holden	Stateman/Caprice	94-98	4.436	2.873	6.850	3.977
Ford	Fairlane N & LTD D	95-98	4.667	2.741	7.949	5.208
Mercedes Benz	C-Class W201	87-94	4.932	2.839	8.569	5.730
Medium Cars			**3.894**	**3.762**	**4.030**	**0.268**
Peugeot	505	82-93	2.350	1.476	3.742	2.266
Nissan	Bluebird	93-98	2.840	1.591	5.070	3.478
Subaru	Liberty	95-98	2.911	1.653	5.128	3.475
Mitsubishi	Galant	89-94	3.024	1.954	4.680	2.725
Ford	Telstar	88-91	3.035	2.350	3.919	1.570
Mazda	626/MX6	88-91				

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Subaru	Liberty	89-94	3.046	2.368	3.919	1.551
Mitsubishi	Nimbus	84-91	3.319	2.038	5.406	3.368
Ford	Telstar	83-86	3.362	2.937	3.847	0.910
Mazda	626/MX6	83-86				
Ford	Mondeo	95-98	3.532	1.981	6.298	4.317
Ford	Telstar	92-97	3.545	2.715	4.629	1.913
Mazda	626/MX6	92-97				
Nissan	Stanza	82-83	3.576	2.282	5.604	3.322
Toyota	Camry	83-86	3.585	2.972	4.324	1.351
Nissan	Prairie	84-86	3.620	2.017	6.497	4.480
Nissan	Pintara	86-88	3.671	3.042	4.430	1.387
Mitsubishi	Sigma/Scorpion	82-86	3.740	3.384	4.133	0.749
Toyota	Corona	82-87	3.742	3.400	4.118	0.718
Holden	Apollo JK/JL	89-92	3.779	3.460	4.128	0.668
Toyota	Camry	88-92				
Nissan	Bluebird	82-86	4.120	3.730	4.552	0.822
Nissan	Pintara	89-92	4.173	3.662	4.755	1.093
Ford	Corsair	89-92				
Holden	Carmia	82-89	4.259	3.905	4.646	0.741
Subaru	1800/ Leone	82-95	4.282	3.757	4.879	1.122
Nissan	Gazelle	84-88	4.749	3.494	6.454	2.961
Passenger Vans			**4.810**	**4.427**	**5.226**	**0.799**
Toyota	Tarago	91-98	2.718	1.742	4.239	2.497
Mitsubishi	Starwagon	95-98	3.470	1.791	6.724	4.933
Mitsubishi	Starwagon	87-94	4.189	3.494	5.022	1.528
Toyota	Tarago	83-89	4.519	3.833	5.328	1.496
Mitsubishi	Starwagon/L300	82-86	5.921	5.025	6.977	1.952
Small Cars			**4.905**	**4.761**	**5.054**	**0.292**
Nissan	Pulsar/Vector	96-98	2.979	1.523	5.824	4.301
Honda	Civic	96-98	3.593	1.890	6.830	4.939
Nissan	Pulsar/Vector	92-95	3.712	2.977	4.629	1.652
Honda	Civic	92-95	3.736	2.823	4.944	2.121
Hyundai	Lantra	91-95	3.777	2.635	5.414	2.779
Daihatsu	Applause	89-98	3.817	2.879	5.062	2.183
Mazda	323	90-93	3.963	3.089	5.084	1.996
Toyota	Corolla	82-84	4.142	3.680	4.663	0.983
Toyota	Tercel	83-88	4.125	2.445	6.957	4.512
Ford	Laser	91-94	4.146	3.613	4.757	1.144
Toyota	Corolla	90-93	4.215	3.810	4.663	0.853
Mitsubishi	Lancer CA / CB	88-92	4.228	3.493	5.118	1.625
Holden	Gemini	82-84	4.294	3.769	4.892	1.123
Honda	Concerto	88-93	4.329	2.378	7.880	5.501
Mitsubishi	Cordia	82-89	4.360	3.357	5.662	2.304
Holden	Astra	88-90	4.376	3.873	4.945	1.072
Nissan	Pulsar/Vector	88-90				
Toyota	Corolla	94-98	4.386	3.716	5.177	1.461
Mazda	121	94-96	4.481	3.242	6.193	2.951
Fiat	Regata	84-89	4.431	2.177	9.020	6.843
Hyundai	Lantra	96-98	4.487	2.556	7.879	5.323

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Toyota	Corolla	86-88	4.564	4.127	5.047	0.920
Mitsubishi	Lancer CC	95-96	4.564	3.702	5.627	1.924
Holden	Gemini RB	86-87	4.675	3.121	7.003	3.882
Honda	Civic	82-83	4.661	3.207	6.775	3.567
Ford	Laser	95-98	4.672	3.121	6.993	3.872
Rover	Quintet	82-86	4.750	2.766	8.157	5.391
Ford	Laser	82-88	4.770	4.473	5.088	0.614
Mazda	323	82-88				
Holden	Astra	84-86	5.015	4.520	5.564	1.045
Nissan	Pulsar/Vector	84-86				
Mitsubishi	Colt	82-88	5.074	4.596	5.603	1.007
Honda	Civic	88-91	5.084	4.161	6.211	2.050
Hyundai	Excel	90-94	5.162	4.463	5.969	1.506
Mitsubishi	Lancer CE/Mirage	95-98	5.225	3.867	7.059	3.192
Honda	Civic	84-87	5.262	4.294	6.448	2.155
Holden	Barina	89-93	5.329	4.712	6.028	1.316
Suzuki	Swift	89-98				
Hyundai	S Coupe	90-96	5.357	3.604	7.961	4.357
Mazda	323	95-98	5.395	3.838	7.583	3.745
Hyundai	Excel	82-89	5.576	4.604	6.752	2.147
Daihatsu	Charade	88-92	5.984	5.196	6.892	1.696
Subaru	Impreza	93-98	5.973	4.131	8.636	4.505
Holden	Barina SB	95-98	6.130	4.722	7.958	3.236
Ford	Festiva WD/WD/WH	94-98	6.148	5.111	7.397	2.287
Daihatsu	Charade	93-98	6.324	5.232	7.642	2.410
Hyundai	Excel	95-98	6.503	5.628	7.514	1.885
Daewoo	Cielo	95-97	6.527	4.426	9.623	5.197
Ford	Festiva WA	91-93	6.518	5.583	7.609	2.026
Mazda	121	87-90				
Holden	Barina	85-88	6.563	5.626	7.655	2.029
Suzuki	Swift	85-88				
Daihatsu	Charade	82-86	6.790	5.671	8.129	2.458
Honda	City	83-86	6.981	4.565	10.676	6.111
Daihatsu	Mira	90-96	7.928	5.530	11.366	5.836
Daihatsu	Handivan	82-90	7.946	5.851	10.790	4.939
Suzuki	Hatch	82-85	8.391	6.659	10.573	3.915
Subaru	Sherpa/Fiori	89-92	9.346	7.067	12.360	5.293
Sports Cars			**4.047**	**3.722**	**4.400**	**0.677**
Renault	Fuego	82-87	2.349	1.183	4.664	3.481
Toyota	Celica	90-93	2.871	1.936	4.258	2.322
Honda	Prelude	83-91	3.087	2.361	4.036	1.675
Toyota	Celica	81-85	3.214	2.441	4.233	1.792
Nissan	300ZX	86-97	3.254	1.847	5.732	3.885
Honda	Integra	90-92	3.513	1.861	6.630	4.768
Mazda	MX5	89-98	3.550	1.799	7.008	5.209
Honda	Integra	86-88	3.626	2.134	6.161	4.027
Toyota	Celica	86-89	3.866	2.889	5.173	2.284
Mazda	RX7	82-85	3.905	2.554	5.969	3.415
Alfa Romeo	33	83-92	4.453	2.858	6.937	4.079
Honda	Prelude	92-96	4.470	2.838	7.040	4.202
Toyota	Supra	82-90	4.926	2.892	8.390	5.497

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Ford	Capri	89-94	4.964	3.541	6.957	3.416
Toyota	Paseo	91-98	5.619	3.813	8.282	4.469
Nissan	Exa	83-86	5.836	3.748	9.086	5.338
Nissan	NX/NX-R	91-96	8.060	5.321	12.209	6.889

CRASHWORTHINESS RATINGS
(WITH 90% CONFIDENCE LIMITS)

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**3.827**			
4-Wheel Drive Vehicles			**3.359**	**3.182**	**3.546**	**0.364**
Toyota	Landcruiser	90-97	2.022	1.622	2.522	0.900
Holden	Jackaroo	82-91	2.338	1.399	3.909	2.511
Mitsubishi	Pajero	92-98	2.377	1.587	3.562	1.976
Nissan	Patrol	88-97	2.490	2.058	3.013	0.955
Ford	Maverick	88-97				
Toyota	4Runner/Hilux	89-97	2.828	2.508	3.189	0.681
Nissan	Pathfinder	88-94	2.833	1.532	5.240	3.708
Toyota	4Runner/Hilux	86-88	2.985	2.514	3.545	1.031
Toyota	Landcruiser	82-89	3.170	2.743	3.663	0.919
Nissan	Patrol	82-87	3.189	2.308	4.406	2.097
Toyota	4Runner/Hilux	82-85	3.695	3.234	4.221	0.986
Mitsubishi	Pajero	82-90	4.048	3.169	5.169	2.000
Suzuki	Vitara	88-98	4.451	3.535	5.604	2.069
Daihatsu	Rocky	84-98	4.760	3.400	6.662	3.262
Holden	Drover	85-87	4.951	4.255	5.762	1.507
Suzuki	Sierra	82-98				
Daihatsu	Feroza	89-98	5.307	3.621	7.776	4.154
Commercial Vehicles			**3.701**	**3.533**	**3.877**	**0.345**
Nissan	Navara	92-96	1.804	1.088	2.989	1.900
Ford	Falcon Panel Van	82-95	2.239	1.773	2.828	1.055
Ford	Ford F-Series	82-92	2.510	1.651	3.816	2.165
Volkswagen	Caravelle / Transporter	88-98	2.618	1.464	4.681	3.217
Ford	Falcon Ute	82-95	2.804	2.459	3.197	0.737
Nissan	XFN Ute	88-90				
Nissan	720 Ute	82-85	3.068	2.405	3.914	1.509
Holden	Commodore Ute VG/VP	90-93	3.302	2.468	4.420	1.952
Holden	Rodeo	82-85	3.311	2.245	4.883	2.637
Nissan	Navara	86-91	3.414	2.816	4.138	1.322
Holden	Rodeo	82-85	3.428	2.880	4.081	1.201
Toyota	Hiace/Liteace	87-89	3.624	2.836	4.630	1.794
Holden	Rodeo	96-98	3.682	2.301	5.891	3.590
Toyota	Hiace/Liteace	90-98	3.782	3.083	4.638	1.555
Holden	WB Series	82-85	3.967	3.218	4.891	1.673
Holden	Commodore Ute VR/VS	94-98	4.109	3.294	5.126	1.832
Holden	Shuttle	82-87	4.166	2.748	6.315	3.567
Toyota	Hiace/Liteace	82-86	4.605	3.996	5.307	1.311
Subaru	Brumby	82-93	5.624	4.730	6.687	1.957
Suzuki	Mighty Boy	85-88	7.509	5.566	10.128	4.562
Large Cars			**3.270**	**3.189**	**3.354**	**0.166**
Mitsubishi	Magna TE/TF/TH Verada KE/KF/KH	96-98	2.718	2.126	3.475	1.349

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
Ford	Falcon EA	88-Mar 92	2.770	2.564	2.992	0.428
	Falcon EB Series I					
Holden	Commodore VR/VS	93-97	2.947	2.690	3.228	0.537
Toyota	Lexcen	93-97				
Mitsubishi	Verada KR/KS	91-96	3.009	2.682	3.377	0.695
	Magna TR/TS	91-96				
Ford	Falcon EF/EL	94-98	3.026	2.720	3.366	0.645
Ford	Falcon EB Series II	Apr 92-94	3.061	2.735	3.426	0.691
	Falcon ED					
Holden	Apollo JM / JP	93-97	3.113	2.737	3.541	0.804
Toyota	Camry	93-97				
Ford	Falcon XE/XF	82-88	3.295	3.105	3.496	0.391
Holden	Commodore VN/VP	89-93	3.366	3.146	3.602	0.456
Toyota	Lexcen	89-93				
Holden	Commodore VT	97-98	3.415	2.442	4.775	2.333
Holden	Commodore VB-VL	82-88	3.620	3.404	3.849	0.445
Nissan	Skyline	82-90	3.669	3.152	4.270	1.117
Mitsubishi	Magna TM/TN/TP	85-90	3.722	3.448	4.019	0.572
Hyundai	Sonata	89-97	3.842	2.873	5.137	2.264
Luxury Cars			**2.990**	**2.839**	**3.148**	**0.309**
Volvo	700/900 Series	84-92	2.100	1.480	2.980	1.500
Honda	Legend	86-95	2.297	1.336	3.947	2.611
BMW	5 Series	82-88	2.387	1.508	3.780	2.273
Nisan	Maxima	90-94	2.445	1.421	4.204	2.783
Honda	Accord	86-90	2.492	1.774	3.499	1.725
Volvo	200 Series	82-93	2.614	2.097	3.257	1.160
Toyota	Cressida	89-93	2.631	1.964	3.525	1.561
Saab	900 Series	82-93	2.680	1.837	3.910	2.073
Ford	Fairlane N & LTD D	88-94	2.766	2.301	3.326	1.025
BMW	3 Series	92-98	2.838	2.084	3.865	1.781
Toyota	Crown/Cressida	86-88	2.915	1.994	4.262	2.268
BMW	5 Series	89-95	2.986	1.670	5.337	3.667
BMW	3 Series	82-91	3.037	2.422	3.808	1.386
Holden	Stateman/Caprice	90-93	3.146	2.255	4.388	2.132
Toyota	Crown/Cressida	82-85	3.387	2.720	4.216	1.496
Ford	Fairlane Z & LTD F	82-88	3.427	2.980	3.942	0.962
Mercedes Benz	E-Class W124	86-93	3.471	2.194	5.492	3.298
Mazda	929	82-90	4.010	3.370	4.771	1.401
Honda	Accord	94-98	4.084	2.586	6.449	3.862
Honda	Accord	82-85	4.161	3.342	5.180	1.838
Holden	Stateman/Caprice	94-98	4.436	3.081	6.388	3.307
Ford	Fairlane N & LTD D	95-98	4.667	2.986	7.297	4.311
Mercedes Benz	C-Class W201	87-94	4.932	3.103	7.841	4.738
Medium Cars			**3.894**	**3.783**	**4.008**	**0.225**
Peugeot	505	82-93	2.350	1.590	3.472	1.882
Nissan	Bluebird	93-98	2.840	1.747	4.619	2.872
Subaru	Liberty	95-98	2.911	1.810	4.682	2.872
Mitsubishi	Galant	89-94	3.024	2.096	4.363	2.266
Ford	Telstar	88-91	3.035	2.448	3.761	1.313

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
Mazda	626/MX6	88-91				
Subaru	Liberty	89-94	3.046	2.466	3.763	1.298
Mitsubishi	Nimbus	84-91	3.319	2.204	4.998	2.794
Ford	Telstar	83-86	3.362	3.002	3.765	0.763
Mazda	626/MX6	83-86				
Ford	Mondeo	95-98	3.532	2.174	5.739	3.565
Ford	Telstar	92-97	3.545	2.834	4.435	1.600
Mazda	626/MX6	92-97				
Nissan	Stanza	82-83	3.576	2.453	5.213	2.761
Toyota	Camry	83-86	3.585	3.063	4.195	1.132
Nissan	Prairie	84-86	3.620	2.216	5.914	3.698
Nissan	Pintara	86-88	3.671	3.136	4.298	1.162
Mitsubishi	Sigma/Scorpion	82-86	3.740	3.439	4.067	0.628
Toyota	Corona	82-87	3.742	3.453	4.055	0.602
Holden	Apollo JK/JL	89-92	3.779	3.509	4.069	0.560
Toyota	Camry	88-92				
Nissan	Bluebird	82-86	4.120	3.790	4.479	0.689
Nissan	Pintara	89-92	4.173	3.740	4.656	0.916
Ford	Corsair	89-92				
Holden	Carmia	82-89	4.259	3.960	4.582	0.622
Subaru	1800/ Leone	82-95	4.282	3.837	4.778	0.941
Nissan	Gazelle	84-88	4.749	3.670	6.144	2.473
Passenger Vans			**4.810**	**4.487**	**5.157**	**0.670**
Toyota	Tarago	91-98	2.718	1.871	3.947	2.076
Mitsubishi	Starwagon	95-98	3.470	1.992	6.046	4.054
Mitsubishi	Starwagon	87-94	4.189	3.597	4.878	1.280
Toyota	Tarago	83-89	4.519	3.936	5.189	1.254
Mitsubishi	Starwagon/L300	82-86	5.921	5.160	6.796	1.636
Small Cars			**4.905**	**4.784**	**5.030**	**0.245**
Nissan	Pulsar/Vector	96-98	2.979	1.697	5.229	3.532
Honda	Civic	96-98	3.593	2.096	6.160	4.064
Nissan	Pulsar/Vector	92-95	3.712	3.085	4.468	1.384
Honda	Civic	92-95	3.736	2.953	4.726	1.773
Hyundai	Lantra	91-95	3.777	2.792	5.110	2.318
Daihatsu	Applause	89-98	3.817	3.012	4.837	1.825
Mazda	323	90-93	3.963	3.215	4.885	1.670
Toyota	Corolla	82-84	4.142	3.750	4.575	0.825
Toyota	Tercel	83-88	4.125	2.660	6.397	3.737
Ford	Laser	91-94	4.146	3.693	4.653	0.960
Toyota	Corolla	90-93	4.215	3.873	4.588	0.715
Mitsubishi	Lancer CA / CB	88-92	4.228	3.602	4.963	1.361
Holden	Gemini	82-84	4.294	3.849	4.791	0.941
Honda	Concerto	88-93	4.329	2.619	7.157	4.538
Mitsubishi	Cordia	82-89	4.360	3.501	5.429	1.928
Holden	Astra	88-90	4.376	3.949	4.848	0.899
Nissan	Pulsar/Vector	88-90				
Toyota	Corolla	94-98	4.386	3.816	5.041	1.225
Mazda	121	94-96	4.481	3.415	5.879	2.464
Fiat	Regata	84-89	4.431	2.440	8.046	5.606

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
Hyundai	Lantra	96-98	4.487	2.798	7.197	4.399
Toyota	Corolla	86-88	4.564	4.195	4.966	0.771
Mitsubishi	Lancer CC	95-96	4.564	3.829	5.440	1.612
Holden	Gemini RB	86-87	4.675	3.330	6.562	3.232
Honda	Civic	82-83	4.661	3.406	6.379	2.974
Ford	Laser	95-98	4.672	3.330	6.554	3.224
Rover	Quintet	82-86	4.750	3.017	7.478	4.461
Ford	Laser	82-88	4.770	4.520	5.035	0.516
Mazda	323	82-88				
Holden	Astra	84-86	5.015	4.596	5.472	0.876
Nissan	Pulsar/Vector	84-86				
Mitsubishi	Colt	82-88	5.074	4.669	5.514	0.845
Honda	Civic	88-91	5.084	4.298	6.014	1.717
Hyundai	Excel	90-94	5.162	4.569	5.831	1.263
Mitsubishi	Lancer CE/Mirage	95-98	5.225	4.058	6.726	2.667
Honda	Civic	84-87	5.262	4.436	6.241	1.805
Holden	Barina	89-93	5.329	4.806	5.910	1.104
Suzuki	Swift	89-98				
Hyundai	S Coupe	90-96	5.357	3.841	7.470	3.629
Mazda	323	95-98	5.395	4.054	7.179	3.125
Hyundai	Excel	82-89	5.576	4.748	6.547	1.799
Daihatsu	Charade	88-92	5.984	5.315	6.737	1.422
Subaru	Impreza	93-98	5.973	4.383	8.139	3.756
Holden	Barina SB	95-98	6.130	4.924	7.631	2.707
Ford	Festiva WD/WD/WH	94-98	6.148	5.265	7.181	1.916
Daihatsu	Charade	93-98	6.324	5.394	7.413	2.019
Hyundai	Excel	95-98	6.503	5.760	7.341	1.581
Daewoo	Cielo	95-97	6.527	4.711	9.041	4.329
Ford	Festiva WA	91-93	6.518	5.724	7.422	1.699
Mazda	121	87-90				
Holden	Barina	85-88	6.563	5.767	7.468	1.701
Suzuki	Swift	85-88				
Daihatsu	Charade	82-86	6.790	5.837	7.897	2.060
Honda	City	83-86	6.981	4.887	9.971	5.084
Daihatsu	Mira	90-96	7.928	5.860	10.727	4.867
Daihatsu	Handivan	82-90	7.946	6.146	10.272	4.126
Suzuki	Hatch	82-85	8.391	6.911	10.188	3.277
Subaru	Sherpa/Fiori	89-92	9.346	7.392	11.817	4.425
Sports Cars			**4.047**	**3.773**	**4.341**	**0.568**
Renault	Fuego	82-87	2.349	1.321	4.177	2.856
Toyota	Celica	90-93	2.871	2.063	3.997	1.934
Honda	Prelude	83-91	3.087	2.465	3.866	1.401
Toyota	Celica	81-85	3.214	2.551	4.049	1.498
Nissan	300ZX	86-97	3.254	2.023	5.233	3.210
Honda	Integra	90-92	3.513	2.061	5.986	3.925
Mazda	MX5	89-98	3.550	2.007	6.282	4.276
Honda	Integra	86-88	3.626	2.323	5.658	3.334
Toyota	Celica	86-89	3.866	3.027	4.936	1.909
Mazda	RX7	82-85	3.905	2.734	5.575	2.841
Alfa Romeo	33	83-92	4.453	3.069	6.460	3.391
Honda	Prelude	92-96	4.470	3.053	6.544	3.492

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
Toyota	Supra	82-90	4.926	3.151	7.702	4.551
Ford	Capri	89-94	4.964	3.739	6.590	2.851
Toyota	Paseo	91-98	5.619	4.058	7.781	3.724
Nissan	Exa	83-86	5.836	4.024	8.462	4.438
Nissan	NX/NX-R	91-96	8.060	5.688	11.421	5.733

APPENDIX 5

AGGRESSIVITY INJURY RISK
AGGRESSIVITY INJURY SEVERITY AND
RATINGS OF VEHICLE AGGRESSIVITY
(with 95% and 90% CONFIDENCE LIMITS),
TOWARDS OTHER VEHICLE DRIVERS

AGGRESSIVITY INJURY RISK RATINGS

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**14.276**			
4-Wheel Drive Vehicles			**17.492**	**14.479**	**18.356**	**3.876**
Holden	Drover	85-87	13.762	1.014	3.277	2.263
Suzuki	Sierra	82-98				
Suzuki	Vitara	88-98	17.278	1.261	4.923	3.662
Toyota	4Runner/Hilux	86-88	16.937	1.981	4.728	2.747
Toyota	4Runner/Hilux	89-97	16.026	2.679	4.435	1.756
Mitsubishi	Pajero	82-90	18.629	2.126	6.661	4.535
Toyota	4Runner/Hilux	82-85	18.096	2.767	5.240	2.473
Mitsubishi	Pajero	92-98	16.090	2.263	8.017	5.755
Nissan	Patrol	88-97	22.207	3.544	6.423	2.879
Ford	Maverick	88-97				
Toyota	Landcruiser	90-97	22.993	3.630	7.548	3.918
Toyota	Landcruiser	82-89	22.030	4.693	7.835	3.142
Commercial Vehicles			**17.320**	**16.540**	**18.133**	**1.593**
Nissan	720 Ute	82-85	17.106	0.886	3.551	2.665
Holden	WB Series	82-85	18.215	1.381	4.507	3.127
Holden	Rodeo	82-85	17.107	1.462	4.369	2.907
Subaru	Brumby	82-93	12.919	1.431	5.671	4.240
Holden	Commodore Ute VG/VP	90-93	14.736	1.494	6.024	4.531
Toyota	Hiace/Liteace	82-86	19.939	2.092	4.418	2.327
Ford	Falcon Panel Van	82-95	16.546	2.264	5.117	2.853
Nissan	Navara	86-91	16.857	2.204	5.288	3.084
Holden	Commodore Ute VG/VP	90-93	17.115	2.735	4.602	1.867
Holden	Rodeo	86-88	15.059	2.059	7.713	5.654
Toyota	Hiace/Liteace	87-89	20.521	2.466	6.528	4.062
Toyota	Hiace/Liteace	90-98	21.860	2.982	6.214	3.232
Holden	Commodore Ute VR/VS	94-98	16.389	3.010	7.220	4.209
Holden	Rodeo	82-85	20.593	4.017	9.562	5.545
Large Cars			**14.145**	**13.747**	**14.520**	**0.774**
Mitsubishi	Magna TM/TN/TP	85-90	13.539	1.992	2.832	0.840
Hyundai	Sonata	89-97	12.165	1.388	5.074	3.687
Holden	Commodore VB-VL	82-88	14.364	2.354	3.049	0.695
Holden	Commodore VN/VP	89-93	13.735	2.381	3.134	0.753
Toyota	Lexcen	89-93				
Mitsubishi	Verada KR/KS	91-96	15.798	2.195	3.428	1.233
	Magna TR/TS	91-96				
Ford	Falcon XE/XF	82-88	15.229	2.496	3.117	0.621
Mitsubishi	Magna TE/TF/TH	96-98	18.177	1.810	4.663	2.853
	Verada KE/KF/KH					
Ford	Falcon EA	88-Mar 92	15.000	2.594	3.429	0.834
	Falcon EB Series I					
Holden	Commodore VR/VS	93-97	15.236	3.007	4.138	1.131
Toyota	Lexcen	93-97				
Nissan	Skyline	82-90	16.192	2.567	5.063	2.496
Ford	Falcon EF/EL	94-98	17.792	3.200	4.644	1.445
Ford	Falcon EB Series II	Apr 92-94	15.000	2.594	3.429	0.834

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Holden	Falcon ED Commodore VT	97-98	19.295	2.879	8.497	5.618
Luxury Cars			**12.999**	**12.234**	**13.796**	**1.562**
BMW	3 Series	82-91	13.443	1.090	3.483	2.393
Volvo	700/900 Series	84-92	13.223	1.041	4.237	3.196
Mazda	929	82-90	15.932	1.318	3.539	2.221
Volvo	200 Series	82-93	11.727	1.579	4.038	2.460
BMW	3 Series	92-98	9.864	1.389	5.064	3.675
Ford	Fairlane N & LTD D	88-94	15.372	1.940	4.324	2.385
Ford	Fairlane Z & LTD F	82-88	15.029	2.169	4.286	2.117
Honda	Accord	82-85	12.246	1.852	5.387	3.536
Toyota	Cressida	89-93	14.574	1.912	5.895	3.983
Toyota	Crown/Cressida	82-85	12.364	2.136	5.701	3.565
Medium Cars			**12.902**	**12.477**	**13.348**	**0.871**
Subaru	1800/ Leone	82-95	12.605	0.904	2.152	1.248
Mitsubishi	Sigma/Scorpion	82-86	11.740	1.470	2.469	0.999
Ford	Telstar	83-86	12.902	1.436	2.770	1.335
Mazda	626/MX6	83-86				
Holden	Carmia	82-89	14.966	1.647	2.559	0.913
Nissan	Bluebird	82-86	12.254	1.661	2.732	1.071
Toyota	Corona	82-87	12.197	1.751	2.691	0.940
Subaru	Liberty	89-94	12.608	1.597	4.294	2.697
Nissan	Pintara	86-88	15.511	1.814	4.046	2.232
Ford	Telstar	92-97	11.139	1.620	4.733	3.113
Mazda	626/MX6	92-97				
Nissan	Pintara	89-92	15.411	2.180	3.720	1.539
Ford	Corsair	89-92				
Holden	Apollo JK/JL	89-92	15.229	2.486	3.414	0.929
Toyota	Camry	88-92				
Toyota	Camry	83-86	12.517	1.863	4.744	2.880
Holden	Apollo JM / JP	93-97	14.590	2.550	4.135	1.585
Toyota	Camry	93-97				
Ford	Telstar	88-91	13.922	2.373	5.644	3.272
Mazda	626/MX6	88-91				
Passenger Vans			**16.538**	**15.364**	**17.797**	**2.433**
Toyota	Tarago	83-89	14.992	1.910	4.311	2.400
Mitsubishi	Starwagon/L300	82-86	18.679	1.983	4.503	2.520
Mitsubishi	Starwagon	87-94	19.094	2.545	5.077	2.533
Small Cars			**10.527**	**10.186**	**10.879**	**0.693**
Daihatsu	Charade	88-92	8.591	0.607	1.873	1.266
Toyota	Corolla	82-84	8.997	0.775	1.717	0.942
Hyundai	Excel	82-89	10.875	0.615	2.540	1.925
Holden	Barina	89-93	9.585	0.917	2.042	1.125
Suzuki	Swift	89-98				
Daihatsu	Charade	93-98	10.361	0.690	2.745	2.055
Mitsubishi	Lancer CA / CB	88-92	11.055	0.925	2.737	1.811
Holden	Barina	85-88	8.868	1.027	3.032	2.005

Make	Model of Car	Year of Manufacture	Pr(risk)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Suzuki	Swift	85-88				
Ford	Laser	91-94	10.509	1.248	2.561	1.313
Toyota	Corolla	86-88	10.979	1.353	2.386	1.033
Ford	Laser	82-88	11.442	1.552	2.129	0.577
Mazda	323	82-88				
Holden	Gemini	82-84	12.164	1.238	2.677	1.440
Hyundai	Excel	90-94	11.493	1.263	2.878	1.615
Holden	Astra	84-86	11.222	1.449	2.692	1.243
Nissan	Pulsar/Vector	84-86				
Ford	Festiva WA	91-93	10.788	1.248	3.173	1.925
Mazda	121	87-90				
Mitsubishi	Colt	82-88	11.028	1.518	2.624	1.106
Holden	Astra	88-90	11.881	1.562	2.914	1.352
Nissan	Pulsar/Vector	88-90				
Ford	Festiva WD/WD/WH	94-98	9.562	1.314	3.491	2.177
Mitsubishi	Lancer CC	95-96	12.797	1.308	3.632	2.323
Toyota	Corolla	90-93	11.155	1.788	2.877	1.088
Mitsubishi	Lancer CE/Mirage	95-98	11.872	1.166	4.605	3.439
Honda	Civic	84-87	11.603	1.282	4.213	2.931
Honda	Civic	88-91	11.424	1.402	3.980	2.578
Daihatsu	Applause	89-98	12.612	1.408	4.434	3.026
Nissan	Pulsar/Vector	92-95	12.026	1.548	4.096	2.548
Toyota	Corolla	94-98	12.907	1.760	3.686	1.926
Holden	Barina SB	95-98	14.056	1.345	4.969	3.623
Honda	Civic	92-95	13.909	1.765	5.228	3.463
Hyundai	Excel	95-98	12.555	2.310	4.401	2.091
Mitsubishi	Cordia	82-89	16.305	3.080	7.694	4.614
Sports Cars			**13.548**	**12.260**	**15.004**	**2.745**
Toyota	Celica	90-93	12.921	1.519	6.162	4.643
Toyota	Celica	81-85	15.339	1.903	5.289	3.386
Toyota	Celica	86-89	15.726	2.630	7.069	4.439

AGGRESSIVITY INJURY SEVERITY RATINGS

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**18.653**			
4-Wheel Drive Vehicles			**21.109**	**19.106**	**23.370**	**4.264**
Holden	Drover	85-87	13.245	1.013	3.275	2.262
Suzuki	Sierra	82-98				
Suzuki	Vitara	88-98	14.422	1.262	4.927	3.665
Toyota	4Runner/Hilux	86-88	18.072	1.981	4.728	2.746
Toyota	4Runner/Hilux	89-97	21.508	2.678	4.435	1.756
Mitsubishi	Pajero	82-90	20.202	2.126	6.661	4.535
Toyota	4Runner/Hilux	82-85	21.042	2.767	5.240	2.473
Mitsubishi	Pajero	92-98	26.470	2.263	8.018	5.755
Nissan	Patrol	88-97	21.486	3.546	6.426	2.880
Ford	Maverick	88-97				
Toyota	Landcruiser	90-97	22.766	3.628	7.545	3.916
Toyota	Landcruiser	82-89	27.524	4.695	7.839	3.144
Commercial Vehicles			**19.708**	**17.764**	**21.860**	**4.096**
Nissan	720 Ute	82-85	10.372	0.886	3.548	2.663
Holden	WB Series	82-85	13.696	1.381	4.507	3.127
Holden	Rodeo	82-85	14.776	1.464	4.374	2.910
Subaru	Brumby	82-93	22.046	1.425	5.648	4.223
Holden	Commodore Ute VG/VP	90-93	20.356	1.494	6.027	4.533
Toyota	Hiace/Liteace	82-86	15.247	2.093	4.421	2.328
Ford	Falcon Panel Van	82-95	20.568	2.261	5.110	2.850
Nissan	Navara	86-91	20.251	2.202	5.284	3.082
Holden	Commodore Ute VG/VP	90-93	20.728	2.733	4.600	1.866
Holden	Rodeo	86-88	26.462	2.057	7.706	5.649
Toyota	Hiace/Liteace	87-89	19.552	2.466	6.527	4.061
Toyota	Hiace/Liteace	90-98	19.691	2.981	6.213	3.231
Holden	Commodore Ute VR/VS	94-98	28.445	3.010	7.219	4.209
Holden	Rodeo	82-85	30.095	4.032	9.595	5.564
Large Cars			**19.404**	**18.242**	**20.579**	**2.338**
Mitsubishi	Magna TM/TN/TP	85-90	17.541	1.991	2.831	0.839
Hyundai	Sonata	89-97	21.813	1.386	5.071	3.684
Holden	Commodore VB-VL	82-88	18.652	2.355	3.049	0.695
Holden	Commodore VN/VP	89-93	19.888	2.381	3.134	0.753
Toyota	Lexcen	89-93				
Mitsubishi	Verada KR/KS	91-96	17.364	2.195	3.428	1.233
	Magna TR/TS	91-96				
Ford	Falcon XE/XF	82-88	18.314	2.495	3.116	0.621
Mitsubishi	Magna TE/TF/TH	96-98	15.983	1.809	4.660	2.851
	Verada KE/KF/KH					
Ford	Falcon EA	88-Mar 92	19.883	2.595	3.430	0.835
	Falcon EB Series I					
Holden	Commodore VR/VS	93-97	23.151	3.006	4.136	1.130
Toyota	Lexcen	93-97				
Nissan	Skyline	82-90	22.263	2.566	5.061	2.495
Ford	Falcon EF/EL	94-98	21.667	3.198	4.642	1.444
Ford	Falcon EB Series II	Apr 92-94	19.883	2.595	3.430	0.835

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Holden	Falcon ED Commodore VT	97-98	25.634	2.877	8.493	5.615
Luxury Cars			**19.192**	**16.807**	**21.860**	**5.053**
BMW	3 Series	82-91	14.492	1.089	3.481	2.391
Volvo	700/900 Series	84-92	15.887	1.041	4.235	3.194
Mazda	929	82-90	13.557	1.317	3.537	2.220
Volvo	200 Series	82-93	21.530	1.578	4.037	2.459
BMW	3 Series	92-98	26.883	1.391	5.074	3.682
Ford	Fairlane N & LTD D	88-94	18.840	1.940	4.326	2.386
Ford	Fairlane Z & LTD F	82-88	20.286	2.168	4.284	2.116
Honda	Accord	82-85	25.790	1.853	5.390	3.538
Toyota	Cressida	89-93	23.038	1.910	5.889	3.979
Toyota	Crown/Cressida	82-85	28.222	2.134	5.696	3.562
Medium Cars			**17.397**	**16.103**	**18.805**	**2.702**
Subaru	1800/ Leone	82-95	11.065	0.905	2.154	1.249
Mitsubishi	Sigma/Scorpion	82-86	16.226	1.470	2.469	0.999
Ford	Telstar	83-86	15.457	1.436	2.771	1.335
Mazda	626/MX6	83-86				
Holden	Carmia	82-89	13.717	1.648	2.561	0.914
Nissan	Bluebird	82-86	17.387	1.661	2.732	1.071
Toyota	Corona	82-87	17.795	1.751	2.692	0.941
Subaru	Liberty	89-94	20.769	1.596	4.290	2.695
Nissan	Pintara	86-88	17.466	1.816	4.049	2.233
Ford	Telstar	92-97	24.862	1.620	4.731	3.112
Mazda	626/MX6	92-97				
Nissan	Pintara	89-92	18.481	2.181	3.720	1.539
Ford	Corsair	89-92				
Holden	Apollo JK/JL	89-92	19.129	2.485	3.414	0.929
Toyota	Camry	88-92				
Toyota	Camry	83-86	23.753	1.865	4.748	2.883
Holden	Apollo JM / JP	93-97	22.255	2.550	4.135	1.585
Toyota	Camry	93-97				
Ford	Telstar	88-91	26.285	2.377	5.654	3.277
Mazda	626/MX6	88-91				
Passenger Vans			**16.715**	**13.848**	**19.997**	**6.148**
Toyota	Tarago	83-89	19.140	1.912	4.315	2.403
Mitsubishi	Starwagon/L300	82-86	15.999	1.984	4.505	2.521
Mitsubishi	Starwagon	87-94	18.825	2.547	5.081	2.534
Small Cars			**17.032**	**15.795**	**18.334**	**2.539**
Daihatsu	Charade	88-92	12.410	0.607	1.874	1.267
Toyota	Corolla	82-84	12.820	0.774	1.716	0.941
Hyundai	Excel	82-89	11.487	0.614	2.537	1.923
Holden	Barina	89-93	14.280	0.918	2.043	1.125
Suzuki	Swift	89-98				
Daihatsu	Charade	93-98	13.287	0.691	2.749	2.058
Mitsubishi	Lancer CA / CB	88-92	14.396	0.925	2.736	1.811
Holden	Barina	85-88	19.898	1.026	3.029	2.003

Make	Model of Car	Year of Manufacture	Pr(severe)	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Suzuki	Swift	85-88				
Ford	Laser	91-94	17.009	1.247	2.559	1.312
Toyota	Corolla	86-88	16.368	1.353	2.386	1.033
Ford	Laser	82-88	15.885	1.552	2.130	0.577
Mazda	323	82-88				
Holden	Gemini	82-84	14.966	1.238	2.679	1.440
Hyundai	Excel	90-94	16.590	1.265	2.882	1.617
Holden	Astra	84-86	17.603	1.448	2.690	1.242
Nissan	Pulsar/Vector	84-86				
Ford	Festiva WA	91-93	18.442	1.247	3.172	1.925
Mazda	121	87-90				
Mitsubishi	Colt	82-88	18.097	1.518	2.625	1.106
Holden	Astra	88-90	17.957	1.561	2.912	1.351
Nissan	Pulsar/Vector	88-90				
Ford	Festiva WD/WD/WH	94-98	22.400	1.315	3.493	2.178
Mitsubishi	Lancer CC	95-96	17.033	1.309	3.634	2.325
Toyota	Corolla	90-93	20.332	1.789	2.878	1.089
Mitsubishi	Lancer CE/Mirage	95-98	19.523	1.163	4.591	3.428
Honda	Civic	84-87	20.030	1.282	4.213	2.931
Honda	Civic	88-91	20.681	1.402	3.980	2.578
Daihatsu	Applause	89-98	19.808	1.406	4.428	3.022
Nissan	Pulsar/Vector	92-95	20.939	1.549	4.099	2.550
Toyota	Corolla	94-98	19.736	1.760	3.686	1.926
Holden	Barina SB	95-98	18.394	1.345	4.967	3.622
Honda	Civic	92-95	21.839	1.765	5.228	3.463
Hyundai	Excel	95-98	25.400	2.306	4.393	2.087
Mitsubishi	Cordia	82-89	29.856	3.080	7.694	4.614
Sports Cars			**19.004**	**15.090**	**23.639**	**8.549**
Toyota	Celica	90-93	23.679	1.521	6.169	4.648
Toyota	Celica	81-85	20.682	1.903	5.289	3.386
Toyota	Celica	86-89	27.417	2.632	7.075	4.442

AGGRESSIVITY RATINGS
(WITH 95% CONFIDENCE LIMITS)

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**2.663**			
4-Wheel Drive Vehicles			**3.692**	**3.301**	**4.131**	**0.830**
Holden	Drover	85-87	1.822	1.013	3.275	2.262
Suzuki	Sierra	82-98				
Suzuki	Vitara	88-98	2.494	1.262	4.927	3.665
Toyota	4Runner/Hilux	86-88	3.060	1.981	4.728	2.746
Toyota	4Runner/Hilux	89-97	3.446	2.678	4.435	1.756
Mitsubishi	Pajero	82-90	3.763	2.126	6.661	4.535
Toyota	4Runner/Hilux	82-85	3.808	2.767	5.240	2.473
Mitsubishi	Pajero	92-98	4.259	2.263	8.018	5.755
Nissan	Patrol	88-97	4.773	3.546	6.426	2.880
Ford	Maverick	88-97				
Toyota	Landcruiser	90-97	5.232	3.628	7.545	3.916
Toyota	Landcruiser	82-89	6.067	4.695	7.839	3.144
Commercial Vehicles			**3.413**	**3.052**	**3.818**	**0.766**
Nissan	720 Ute	82-85	1.773	0.886	3.548	2.663
Holden	WB Series	82-85	2.495	1.381	4.507	3.127
Holden	Rodeo	82-85	2.531	1.464	4.374	2.910
Subaru	Brumby	82-93	2.837	1.425	5.648	4.223
Holden	Commodore Ute VG/VP	90-93	3.001	1.494	6.027	4.533
Toyota	Hiace/Liteace	82-86	3.042	2.093	4.421	2.328
Ford	Falcon Panel Van	82-95	3.399	2.261	5.110	2.850
Nissan	Navara	86-91	3.411	2.202	5.284	3.082
Holden	Commodore Ute VG/VP	90-93	3.546	2.733	4.600	1.866
Holden	Rodeo	86-88	3.981	2.057	7.706	5.649
Toyota	Hiace/Liteace	87-89	4.012	2.466	6.527	4.061
Toyota	Hiace/Liteace	90-98	4.304	2.981	6.213	3.231
Holden	Commodore Ute VR/VS	94-98	4.662	3.010	7.219	4.209
Holden	Rodeo	82-85	6.220	4.032	9.595	5.564
Large Cars			**2.745**	**2.566**	**2.936**	**0.371**
Mitsubishi	Magna TM/TN/TP	85-90	2.374	1.991	2.831	0.839
Hyundai	Sonata	89-97	2.651	1.386	5.071	3.684
Holden	Commodore VB-VL	82-88	2.680	2.355	3.049	0.695
Holden	Commodore VN/VP	89-93	2.732	2.381	3.134	0.753
Toyota	Lexcen	89-93				
Mitsubishi	Verada KR/KS	91-96	2.743	2.195	3.428	1.233
	Magna TR/TS	91-96				
Ford	Falcon XE/XF	82-88	2.788	2.495	3.116	0.621
Mitsubishi	Magna TE/TF/TH	96-98	2.903	1.809	4.660	2.851
	Verada KE/KF/KH					
Ford	Falcon EA	88-Mar 92	2.983	2.595	3.430	0.835
	Falcon EB Series I					
Holden	Commodore VR/VS	93-97	3.526	3.006	4.136	1.130
Toyota	Lexcen	93-97				
Nissan	Skyline	82-90	3.603	2.566	5.061	2.495

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Ford	Falcon EF/EL	94-98	3.853	3.198	4.642	1.444
Ford	Falcon EB Series II Falcon ED	Apr 92-94	2.983	2.595	3.430	0.835
Holden	Commodore VT	97-98	4.943	2.877	8.493	5.615
Luxury Cars			**2.495**	**2.161**	**2.880**	**0.719**
BMW	3 Series	82-91	1.947	1.089	3.481	2.391
Volvo	700/900 Series	84-92	2.100	1.041	4.235	3.194
Mazda	929	82-90	2.159	1.317	3.537	2.220
Volvo	200 Series	82-93	2.524	1.578	4.037	2.459
BMW	3 Series	92-98	2.657	1.391	5.074	3.682
Ford	Fairlane N & LTD D	88-94	2.897	1.940	4.326	2.386
Ford	Fairlane Z & LTD F	82-88	3.048	2.168	4.284	2.116
Honda	Accord	82-85	3.160	1.853	5.390	3.538
Toyota	Cressida	89-93	3.354	1.910	5.889	3.979
Toyota	Crown/Cressida	82-85	3.486	2.134	5.696	3.562
Medium Cars			**2.245**	**2.064**	**2.441**	**0.376**
Subaru	1800/ Leone	82-95	1.396	0.905	2.154	1.249
Mitsubishi	Sigma/Scorpion	82-86	1.905	1.470	2.469	0.999
Ford	Telstar	83-86	1.994	1.436	2.771	1.335
Mazda	626/MX6	83-86				
Holden	Carmia	82-89	2.054	1.648	2.561	0.914
Nissan	Bluebird	82-86	2.131	1.661	2.732	1.071
Toyota	Corona	82-87	2.171	1.751	2.692	0.941
Subaru	Liberty	89-94	2.616	1.596	4.290	2.695
Nissan	Pintara	86-88	2.711	1.816	4.049	2.233
Ford	Telstar	92-97	2.768	1.620	4.731	3.112
Mazda	626/MX6	92-97				
Nissan	Pintara	89-92	2.848	2.181	3.720	1.539
Ford	Corsair	89-92				
Holden	Apollo JK/JL	89-92	2.913	2.485	3.414	0.929
Toyota	Camry	88-92				
Toyota	Camry	83-86	2.976	1.865	4.748	2.883
Holden	Apollo JM / JP	93-97	3.247	2.550	4.135	1.585
Toyota	Camry	93-97				
Ford	Telstar	88-91	3.666	2.377	5.654	3.277
Mazda	626/MX6	88-91				
Passenger Vans			**2.764**	**2.266**	**3.372**	**1.106**
Toyota	Tarago	83-89	2.873	1.912	4.315	2.403
Mitsubishi	Starwagon/L300	82-86	2.989	1.984	4.505	2.521
Mitsubishi	Starwagon	87-94	3.597	2.547	5.081	2.534
Small Cars			**1.793**	**1.653**	**1.945**	**0.292**
Daihatsu	Charade	88-92	1.067	0.607	1.874	1.267
Toyota	Corolla	82-84	1.153	0.774	1.716	0.941
Hyundai	Excel	82-89	1.248	0.614	2.537	1.923
Holden	Barina	89-93	1.369	0.918	2.043	1.125
Suzuki	Swift	89-98				
Daihatsu	Charade	93-98	1.379	0.691	2.749	2.058
Mitsubishi	Lancer CA / CB	88-92	1.591	0.925	2.736	1.811

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 95% Confidence Limit	Upper 95% Confidence Limit	Width of Confidence Interval
Holden	Barina	85-88	1.763	1.026	3.029	2.003
Suzuki	Swift	85-88				
Ford	Laser	91-94	1.786	1.247	2.559	1.312
Toyota	Corolla	86-88	1.797	1.353	2.386	1.033
Ford	Laser	82-88	1.818	1.552	2.130	0.577
Mazda	323	82-88				
Holden	Gemini	82-84	1.821	1.238	2.679	1.440
Hyundai	Excel	90-94	1.909	1.265	2.882	1.617
Holden	Astra	84-86	1.974	1.448	2.690	1.242
Nissan	Pulsar/Vector	84-86				
Ford	Festiva WA	91-93	1.989	1.247	3.172	1.925
Mazda	121	87-90				
Mitsubishi	Colt	82-88	1.996	1.518	2.625	1.106
Holden	Astra	88-90	2.133	1.561	2.912	1.351
Nissan	Pulsar/Vector	88-90				
Ford	Festiva WD/WD/WH	94-98	2.143	1.315	3.493	2.178
Mitsubishi	Lancer CC	95-96	2.181	1.309	3.634	2.325
Toyota	Corolla	90-93	2.269	1.789	2.878	1.089
Mitsubishi	Lancer CE/Mirage	95-98	2.310	1.163	4.591	3.428
Honda	Civic	84-87	2.324	1.282	4.213	2.931
Honda	Civic	88-91	2.362	1.402	3.980	2.578
Daihatsu	Applause	89-98	2.495	1.406	4.428	3.022
Nissan	Pulsar/Vector	92-95	2.520	1.549	4.099	2.550
Toyota	Corolla	94-98	2.547	1.760	3.686	1.926
Holden	Barina SB	95-98	2.585	1.345	4.967	3.622
Honda	Civic	92-95	3.037	1.765	5.228	3.463
Hyundai	Excel	95-98	3.183	2.306	4.393	2.087
Mitsubishi	Cordia	82-89	4.868	3.080	7.694	4.614
Sports Cars			**2.575**	**2.012**	**3.294**	**1.282**
Toyota	Celica	90-93	3.063	1.521	6.169	4.648
Toyota	Celica	81-85	3.173	1.903	5.289	3.386
Toyota	Celica	86-89	4.315	2.632	7.075	4.442

AGGRESSIVITY RATINGS
(WITH 90% CONFIDENCE LIMITS)

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
ALL MODEL AVERAGE			**2.663**			
4-Wheel Drive Vehicles			**3.692**	**3.361**	**4.057**	**0.696**
Holden	Drover	85-87	1.822	1.114	2.980	1.867
Suzuki	Sierra	82-98				
Suzuki	Vitara	88-98	2.494	1.408	4.416	3.008
Toyota	4Runner/Hilux	86-88	3.060	2.125	4.409	2.284
Toyota	4Runner/Hilux	89-97	3.446	2.789	4.259	1.469
Mitsubishi	Pajero	82-90	3.763	2.330	6.077	3.746
Toyota	4Runner/Hilux	82-85	3.808	2.913	4.978	2.065
Mitsubishi	Pajero	92-98	4.259	2.505	7.243	4.738
Nissan	Patrol	88-97	4.773	3.719	6.126	2.407
Ford	Maverick	88-97				
Toyota	Landcruiser	90-97	5.232	3.848	7.114	3.266
Toyota	Landcruiser	82-89	6.067	4.893	7.523	2.630
Commercial Vehicles			**3.413**	**3.107**	**3.750**	**0.643**
Nissan	720 Ute	82-85	1.773	0.990	3.174	2.184
Holden	WB Series	82-85	2.495	1.518	4.099	2.580
Holden	Rodeo	82-85	2.531	1.599	4.006	2.407
Subaru	Brumby	82-93	2.837	1.591	5.056	3.465
Holden	Commodore Ute VG/VP	90-93	3.001	1.672	5.388	3.717
Toyota	Hiace/Liteace	82-86	3.042	2.223	4.163	1.941
Ford	Falcon Panel Van	82-95	3.399	2.414	4.786	2.372
Nissan	Navara	86-91	3.411	2.363	4.925	2.563
Holden	Commodore Ute VG/VP	90-93	3.546	2.850	4.411	1.561
Holden	Rodeo	86-88	3.981	2.287	6.930	4.643
Toyota	Hiace/Liteace	87-89	4.012	2.667	6.036	3.370
Toyota	Hiace/Liteace	90-98	4.304	3.163	5.857	2.694
Holden	Commodore Ute VR/VS	94-98	4.662	3.229	6.729	3.500
Holden	Rodeo	82-85	6.220	4.322	8.949	4.627
Large Cars			**2.745**	**2.594**	**2.905**	**0.311**
Mitsubishi	Magna TM/TN/TP	85-90	2.374	2.049	2.752	0.703
Hyundai	Sonata	89-97	2.651	1.539	4.569	3.030
Holden	Commodore VB-VL	82-88	2.680	2.404	2.987	0.583
Holden	Commodore VN/VP	89-93	2.732	2.434	3.066	0.632
Toyota	Lexcen	89-93				
Mitsubishi	Verada KR/KS	91-96	2.743	2.275	3.308	1.032
	Magna TR/TS	91-96				
Ford	Falcon XE/XF	82-88	2.788	2.540	3.061	0.521
Mitsubishi	Magna TE/TF/TH Verada KE/KF/KH	96-98	2.903	1.952	4.319	2.367
Ford	Falcon EA Falcon EB Series I	88-Mar 92	2.983	2.654	3.354	0.700
Holden	Commodore VR/VS	93-97	3.526	3.084	4.031	0.947
Toyota	Lexcen	93-97				

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
Nissan	Skyline	82-90	3.603	2.710	4.792	2.082
Ford	Falcon EF/EL	94-98	3.853	3.295	4.505	1.210
Ford	Falcon EB Series II	Apr 92-94	2.983	2.654	3.354	0.700
	Falcon ED					
Holden	Commodore VT	97-98	4.943	3.139	7.785	4.646
Luxury Cars			**2.495**	**2.211**	**2.814**	**0.603**
BMW	3 Series	82-91	1.947	1.196	3.170	1.975
Volvo	700/900 Series	84-92	2.100	1.165	3.783	2.618
Mazda	929	82-90	2.159	1.426	3.267	1.841
Volvo	200 Series	82-93	2.524	1.702	3.743	2.041
BMW	3 Series	92-98	2.657	1.544	4.573	3.029
Ford	Fairlane N & LTD D	88-94	2.897	2.069	4.056	1.987
Ford	Fairlane Z & LTD F	82-88	3.048	2.290	4.056	1.766
Honda	Accord	82-85	3.160	2.019	4.947	2.928
Toyota	Cressida	89-93	3.354	2.091	5.380	3.289
Toyota	Crown/Cressida	82-85	3.486	2.309	5.263	2.955
Medium Cars			**2.245**	**2.092**	**2.408**	**0.316**
Subaru	1800/ Leone	82-95	1.396	0.970	2.009	1.039
Mitsubishi	Sigma/Scorpion	82-86	1.905	1.533	2.369	0.836
Ford	Telstar	83-86	1.994	1.514	2.628	1.114
Mazda	626/MX6	83-86				
Holden	Carmia	82-89	2.054	1.707	2.472	0.765
Nissan	Bluebird	82-86	2.131	1.729	2.625	0.896
Toyota	Corona	82-87	2.171	1.813	2.601	0.788
Subaru	Liberty	89-94	2.616	1.728	3.963	2.235
Nissan	Pintara	86-88	2.711	1.936	3.796	1.860
Ford	Telstar	92-97	2.768	1.765	4.341	2.575
Mazda	626/MX6	92-97				
Nissan	Pintara	89-92	2.848	2.276	3.564	1.288
Ford	Corsair	89-92				
Holden	Apollo JK/JL	89-92	2.913	2.549	3.328	0.778
Toyota	Camry	88-92				
Toyota	Camry	83-86	2.976	2.011	4.405	2.394
Holden	Apollo JM / JP	93-97	3.247	2.651	3.978	1.327
Toyota	Camry	93-97				
Ford	Telstar	88-91	3.666	2.548	5.274	2.725
Mazda	626/MX6	88-91				
Passenger Vans			**2.764**	**2.340**	**3.266**	**0.926**
Toyota	Tarago	83-89	2.873	2.041	4.042	2.000
Mitsubishi	Starwagon/L300	82-86	2.989	2.119	4.217	2.099
Mitsubishi	Starwagon	87-94	3.597	2.692	4.807	2.115
Small Cars			**1.793**	**1.675**	**1.919**	**0.245**
Daihatsu	Charade	88-92	1.067	0.665	1.712	1.047
Toyota	Corolla	82-84	1.153	0.825	1.609	0.784
Hyundai	Excel	82-89	1.248	0.688	2.264	1.576
Holden	Barina	89-93	1.369	0.979	1.916	0.937
Suzuki	Swift	89-98				

Make	Model of Car	Year of Manufacture	Serious injury rate per 100 drivers involved	Lower 90% Confidence Limit	Upper 90% Confidence Limit	Width of Confidence Interval
Daihatsu	Charade	93-98	1.379	0.772	2.461	1.688
Mitsubishi	Lancer CA / CB	88-92	1.591	1.009	2.507	1.498
Holden	Barina	85-88	1.763	1.119	2.777	1.658
Suzuki	Swift	85-88				
Ford	Laser	91-94	1.786	1.321	2.415	1.094
Toyota	Corolla	86-88	1.797	1.416	2.280	0.864
Ford	Laser	82-88	1.818	1.592	2.076	0.484
Mazda	323	82-88				
Holden	Gemini	82-84	1.821	1.317	2.518	1.200
Hyundai	Excel	90-94	1.909	1.351	2.697	1.346
Holden	Astra	84-86	1.974	1.522	2.560	1.038
Nissan	Pulsar/Vector	84-86				
Ford	Festiva WA	91-93	1.989	1.345	2.943	1.598
Mazda	121	87-90				
Mitsubishi	Colt	82-88	1.996	1.587	2.512	0.925
Holden	Astra	88-90	2.133	1.642	2.770	1.128
Nissan	Pulsar/Vector	88-90				
Ford	Festiva WD/WD/WH	94-98	2.143	1.423	3.229	1.807
Mitsubishi	Lancer CC	95-96	2.181	1.421	3.348	1.927
Toyota	Corolla	90-93	2.269	1.859	2.770	0.911
Mitsubishi	Lancer CE/Mirage	95-98	2.310	1.298	4.111	2.813
Honda	Civic	84-87	2.324	1.411	3.829	2.418
Honda	Civic	88-91	2.362	1.525	3.660	2.135
Daihatsu	Applause	89-98	2.495	1.542	4.038	2.497
Nissan	Pulsar/Vector	92-95	2.520	1.675	3.790	2.115
Toyota	Corolla	94-98	2.547	1.868	3.474	1.606
Holden	Barina SB	95-98	2.585	1.494	4.472	2.978
Honda	Civic	92-95	3.037	1.926	4.791	2.865
Hyundai	Excel	95-98	3.183	2.429	4.171	1.743
Mitsubishi	Cordia	82-89	4.868	3.315	7.149	3.833
Sports Cars			**2.575**	**2.094**	**3.166**	**1.073**
Toyota	Celica	90-93	3.063	1.702	5.512	3.810
Toyota	Celica	81-85	3.173	2.066	4.872	2.806
Toyota	Celica	86-89	4.315	2.850	6.534	3.684

APPENDIX 6

PRESENTATION OF CRASHWORTHINESS AND AGGRESSIVITY RATINGS FOR CONSUMER INFORMATION

			CRASHWORTHINESS					AGGRESSIVITY
Make	**Model of Car**	**Year of Manufacture**	**Significantly better than 20% better than average**	**Significantly better than average**	**Not significantly different from average**	**Significantly worse than average**	**Significantly worse than 20% worse than average**	**Significantly better (✓) or worse (✖) than average. Indistinguishable form average (o)**
4-Wheel Drive Vehicles								✖
Daihatsu	Feroza	89-98						
Daihatsu	Rocky	84-98						
Holden	Jackaroo	82-91						
Holden Suzuki	Drover Sierra	85-87 82-98						o
Mitsubishi	Pajero	82-90						o
Mitsubishi	Pajero	92-98						o
Nissan	Pathfinder	88-94						
Nissan	Patrol	82-87						
Nissan Ford	Patrol Maverick	88-97 88-97						✖
Suzuki	Vitara	88-98						o
Toyota	4Runner/Hilux	82-85						✖
Toyota	4Runner/Hilux	86-88						o
Toyota	4Runner/Hilux	89-97						✖
Toyota	Landcruiser	82-89						✖
Toyota	Landcruiser	90-97						✖
Commercial Vehicles								✖
Ford	Falcon Panel Van	82-95						o
Ford	Ford F-Series	82-92						
Ford Nissan	Falcon Ute XFN Ute	82-95 88-90						✖
Holden	Commodore Ute VG/VP	90-93						o
Holden	Commodore Ute VR/VS	94-98						✖
Holden	Rodeo	82-85						✖
Holden	Rodeo	89-95						o
Holden	Rodeo	96-98						o
Holden	Shuttle	82-87						
Holden	WB Series	82-85						o
Nissan	Navara	92-96						
Nissan	720 Ute	82-85						o
Nissan	Navara	86-91						o
Subaru	Brumby	82-93						o
Suzuki	Mighty Boy	85-88						
Toyota	Hiace/Liteace	82-86						o
Toyota	Hiace/Liteace	87-89						✖
Toyota	Hiace/Liteace	90-98						✖
Volkswagen	Caravelle / Transporter	88-98						
Passenger Vans								o
Mitsubishi	Starwagon	87-94						✖
Mitsubishi	Starwagon	95-98						
Mitsubishi	Starwagon/L300	82-86						o
Toyota	Tarago	83-89						o
Toyota	Tarago	91-98						

Large Cars								o
Ford	Falcon EA Falcon EB Series I	88-Mar 92						o
Ford	Falcon EB Series II Falcon ED	Apr 92-94						o
Ford	Falcon EF/EL	94-98						✖
Ford	Falcon XE/XF	82-88						o
Holden	Commodore VT	97-98						✖
Holden	Commodore VB-VL	82-88						o
Holden Toyota	Commodore VR/VS Lexcen	93-97 93-97						✖
Holden Toyota	Apollo JM / JP Camry	93-97 93-97						o
Holden Toyota	Commodore VN/VP Lexcen	89-93 89-93						o
Hyundai	Sonata	89-97						o
Mitsubishi	Magna TE/TF/TH Verada KE/KF/KH	96-98						o
Mitsubishi	Magna TM/TN/TP	85-90						o
Mitsubishi	Verada KR/KS Magna TR/TS	91-96 91-96						o
Nissan	Skyline	82-90						✖
Luxury Cars								o
BMW	3 Series	82-91						o
BMW	3 Series	92-98						o
BMW	5 Series	82-88						
BMW	5 Series	89-95						
Ford	Fairlane N & LTD D	88-94						o
Ford	Fairlane N & LTD D	95-98						
Ford	Fairlane Z & LTD F	82-88						o
Holden	Stateman/Caprice	90-93						
Holden	Stateman/Caprice	94-98						
Honda	Accord	82-85						o
Honda	Accord	86-90						
Honda	Accord	94-98						
Honda	Legend	86-95						
Mazda	929	82-90						o
Mercedes Benz	C-Class W201	87-94						
Mercedes Benz	E-Class W124	86-93						
Nisan	Maxima	90-94						
SAAB	900 Series	82-93						
Toyota	Cressida	89-93						o
Toyota	Crown/Cressida	82-85						o
Toyota	Crown/Cressida	86-88						
Volvo	200 Series	82-93						o
Volvo	700/900 Series	84-92						o
Medium Cars								✓
Ford	Mondeo	95-98						
Ford Mazda	Telstar 626/MX6	83-86 83-86						✓
Ford Mazda	Telstar 626/MX6	88-91 88-91						o

Ford Mazda	Telstar 626/MX6	92-97 92-97						o
Holden	Camira	82-89						✓
Holden Toyota	Apollo JK/JL Camry	89-92 88-92						o
Mitsubishi	Galant	89-94						
Mitsubishi	Nimbus	84-91						
Mitsubishi	Sigma/Scorpion	82-86						✓
Nissan	Bluebird	82-86						✓
Nissan	Bluebird	93-98						
Nissan	Gazelle	84-88						
Nissan	Pintara	86-88						o
Nissan	Prairie	84-86						
Nissan	Stanza	82-83						
Nissan Ford	Pintara Corsair	89-92 89-92						o
Peugeot	505	82-93						
Subaru	1800/ Leone	82-95						✓
Subaru	Liberty	89-94						o
Subaru	Liberty	95-98						
Toyota	Camry	83-86						o
Toyota	Corona	82-87						✓
Sports Cars								o
Alfa Romeo	33	83-92						
Ford	Capri	89-94						
Honda	Integra	86-88						
Honda	Integra	90-92						
Honda	Prelude	83-91						
Honda	Prelude	92-96						
Mazda	MX5	89-98						
Mazda	RX7	82-85						
Nissan	300ZX	86-97						
Nissan	Exa	83-86						
Nissan	NX/NX-R	91-96						
Renault	Fuego	82-87						
Toyota	Celica	82-85						o
Toyota	Celica	86-89						✖
Toyota	Celica	90-93						o
Toyota	Paseo	91-98						
Toyota	Supra	82-90						
Small Cars								✓
Daewoo	Cielo	95-97						
Daihatsu	Applause	89-98						o
Daihatsu	Charade	82-86						
Daihatsu	Charade	88-92						✓
Daihatsu	Charade	93-98						✓
Daihatsu	Handivan	82-90						
Daihatsu	Mira	92-95						
Fiat	Regata	84-89						
Ford	Laser	91-94						✓
Ford	Laser	95-98						
Ford	Festiva WD/WD/WH	94-98						o
Ford Mazda	Laser 323	82-88 82-88						✓
Holden	Barina SB	95-98						o
Holden	Gemini	82-84						✓
Holden	Gemini RB	86-87						
Holden Nissan	Astra Pulsar/Vector	82-86 82-86						✓
Holden Nissan	Astra Pulsar/Vector	88-90 88-90						o
Holden Suzuki	Barina Swift	85-88 85-88						o
Holden Suzuki	Barina Swift	89-93 89-98						✓
Honda	City	83-86						

Honda	Civic	82-83						
Honda	Civic	84-87						o
Honda	Civic	88-91						o
Honda	Civic	92-95						o
Honda	Civic	96-98						
Honda	Concerto	88-93						
Hyundai	Excel	82-89						✓
Hyundai	Excel	90-94						o
Hyundai	Excel	95-98						o
Hyundai	Lantra	91-95						
Hyundai	Lantra	96-98						
Hyundai	S Coupe	90-96						
Mazda	121	87-93						o
Mazda	121	94-96						
Mazda	323	90-93						
Mazda	323	95-98						
Mitsubishi	Colt	82-88						✓
Mitsubishi	Cordia	82-89						✖
Mitsubishi	Lancer CA / CB	88-92						✓
Mitsubishi	Lancer CC	93-95						o
Mitsubishi	Lancer CE/Mirage	95-98						o
Nissan	Pulsar/Vector	92-95						o
Nissan	Pulsar/Vector	96-98						
Rover	Quintet	82-86						
Subaru	Impreza	93-98						
Subaru	Sherpa/Fiori	89-92						
Suzuki	Hatch	82-85						
Toyota	Corolla	82-84						✓
Toyota	Corolla	86-88						✓
Toyota Holden	Corolla Nova	90-93						o
Toyota Holden	Corolla Nova	94-98						o
Toyota	Tercel	83-88						

APPENDIX 7

CRASHWORTHINESS, INJURY RISK AND INJURY SEVERITY ESTIMATES BY YEAR OF VEHICLE MANUFACTURE

			CRASHWORTHINESS BY YEAR OF VEHICLE MANUFACTURE ESTIMATES				
Year of Manufacture	**Pr(risk)**	**Pr(severe)**	**Serious injury rate per 100 drivers involved**	**Overall rank order**	**LOWER 95% CI CWR**	**UPPER 95% CI CWR**	**Range of CI**
ALL VEHICLES	**16.025**	**24.688**	**3.956**				
AVERAGE							
1964	22.277	26.737	5.956	34	5.019	7.068	2.048
1965	22.919	25.219	5.780	32	4.780	6.990	2.210
1966	20.161	26.737	5.390	29	4.557	6.376	1.819
1967	21.674	26.183	5.675	31	4.978	6.469	1.492
1968	20.149	26.651	5.370	27	4.780	6.033	1.253
1969	20.219	31.021	6.272	35	5.676	6.931	1.254
1970	20.548	28.876	5.933	33	5.513	6.386	0.873
1971	19.407	27.631	5.362	26	5.006	5.744	0.738
1972	19.860	27.301	5.422	30	5.079	5.788	0.710
1973	19.752	27.202	5.373	28	5.057	5.709	0.652
1974	19.187	25.805	4.951	25	4.709	5.206	0.498
1975	17.574	26.619	4.678	24	4.444	4.925	0.481
1976	17.172	25.143	4.318	23	4.117	4.528	0.411
1977	16.651	25.479	4.242	22	4.034	4.462	0.429
1978	16.480	24.553	4.046	21	3.870	4.230	0.360
1979	15.092	25.123	3.791	20	3.632	3.957	0.325
1980	15.779	23.754	3.748	19	3.592	3.911	0.319
1981	15.133	24.336	3.683	17	3.530	3.842	0.312
1982	15.099	24.466	3.694	18	3.548	3.847	0.299
1983	15.277	23.792	3.635	16	3.482	3.794	0.312
1984	14.400	23.880	3.439	14	3.303	3.580	0.276
1985	14.919	24.037	3.586	15	3.450	3.728	0.278
1986	13.988	23.591	3.300	13	3.160	3.446	0.285
1987	13.675	24.056	3.290	12	3.140	3.446	0.307
1988	13.672	23.967	3.277	11	3.133	3.428	0.295
1989	13.151	23.051	3.031	8	2.899	3.170	0.271
1990	13.379	22.816	3.052	9	2.912	3.199	0.287
1991	13.403	23.070	3.092	10	2.929	3.264	0.334
1992	12.876	22.445	2.890	5	2.728	3.061	0.333
1993	12.609	21.811	2.750	4	2.584	2.927	0.343
1994	12.809	20.815	2.666	2	2.496	2.847	0.351
1995	12.113	21.196	2.567	1	2.380	2.770	0.390
1996	12.865	22.546	2.900	6	2.642	3.184	0.543
1997	12.465	21.842	2.723	3	2.415	3.070	0.655
1998	12.838	22.858	2.934	7	2.388	3.606	1.218

INJURY SEVERITY BY YEAR OF VEHICLE MANUFACTURE

Year of Manufacture	Coef of car Model	Std Error of Coef	Pr(severe)	95% LCI Pr(severe)	95% UCI Pr(severe)	Range CI Pr(severe)
AVERAGE CAR	**-1.115**		**24.688**			
1964	0.107	0.094	26.737	23.286	30.520	7.234
1965	0.028	0.110	25.219	21.389	29.557	8.169
1966	0.107	0.094	26.737	23.286	30.520	7.234
1967	0.079	0.075	26.183	23.460	29.066	5.606
1968	0.103	0.066	26.651	24.183	29.231	5.048
1969	0.316	0.056	31.021	28.735	33.402	4.667
1970	0.214	0.044	28.876	27.204	30.678	3.474
1971	0.153	0.040	27.631	26.147	29.231	3.084
1972	0.136	0.038	27.301	25.787	28.735	2.947
1973	0.131	0.035	27.202	25.787	28.568	2.780
1974	0.059	0.029	25.805	24.688	26.855	2.167
1975	0.101	0.029	26.619	25.424	27.721	2.297
1976	0.024	0.027	25.143	24.145	26.147	2.002
1977	0.042	0.029	25.479	24.427	26.502	2.076
1978	-0.007	0.025	24.553	23.651	25.424	1.773
1979	0.023	0.024	25.123	24.239	25.967	1.728
1980	-0.051	0.024	23.754	22.899	24.632	1.733
1981	-0.019	0.024	24.336	23.479	25.242	1.763
1982	-0.012	0.023	24.466	23.651	25.242	1.590
1983	-0.049	0.024	23.792	22.938	24.669	1.732
1984	-0.044	0.023	23.880	23.093	24.688	1.595
1985	-0.035	0.022	24.037	23.267	24.873	1.606
1986	-0.060	0.024	23.591	22.743	24.464	1.722
1987	-0.034	0.026	24.056	23.132	25.058	1.926
1988	-0.039	0.025	23.967	23.074	24.873	1.800
1989	-0.090	0.025	23.051	22.171	23.956	1.785
1990	-0.103	0.026	22.816	21.912	23.747	1.835
1991	-0.089	0.030	23.070	22.032	24.145	2.113
1992	-0.125	0.033	22.445	21.348	23.575	2.227
1993	-0.161	0.035	21.811	20.673	22.996	2.323
1994	-0.221	0.037	20.815	19.649	22.032	2.382
1995	-0.198	0.042	21.196	19.860	22.605	2.745
1996	-0.119	0.051	22.546	20.838	24.333	3.495
1997	-0.160	0.066	21.842	19.713	24.126	4.413
1998	-0.101	0.112	22.858	19.224	27.030	7.806

INJURY RISK BY YEAR OF VEHICLE MANUFACTURE

Year of Manufacture	Coef of car Model	Std Error of Coef	Pr(risk)	95% LCI Pr(risk)	95% UCI Pr(risk)	Range CI Pr(risk)
AVERAGE CAR	**-1.656**		**16.025**			
1964	0.407	0.061	22.277	20.242	24.385	4.143
1965	0.444	0.069	22.919	20.605	25.461	4.856
1966	0.280	0.064	20.161	18.252	22.254	4.002
1967	0.372	0.048	21.674	20.121	23.278	3.158
1968	0.279	0.043	20.149	18.884	21.556	2.671
1969	0.284	0.038	20.219	19.010	21.438	2.428
1970	0.304	0.028	20.548	19.631	21.438	1.807
1971	0.233	0.026	19.407	18.632	20.242	1.610
1972	0.261	0.024	19.860	19.135	20.605	1.470
1973	0.255	0.022	19.752	19.010	20.484	1.475
1974	0.219	0.018	19.187	18.632	19.754	1.121
1975	0.111	0.018	17.574	17.088	18.124	1.036
1976	0.083	0.017	17.172	16.692	17.609	0.917
1977	0.046	0.017	16.651	16.159	17.088	0.929
1978	0.033	0.015	16.480	16.025	16.824	0.800
1979	-0.071	0.014	15.092	14.727	15.456	0.729
1980	-0.018	0.014	15.779	15.415	16.159	0.744
1981	-0.068	0.014	15.133	14.782	15.483	0.701
1982	-0.070	0.013	15.099	14.768	15.442	0.674
1983	-0.057	0.014	15.277	14.920	15.646	0.726
1984	-0.126	0.013	14.400	14.083	14.713	0.629
1985	-0.085	0.013	14.919	14.615	15.237	0.621
1986	-0.160	0.014	13.988	13.659	14.322	0.663
1987	-0.186	0.015	13.675	13.330	14.027	0.697
1988	-0.186	0.014	13.672	13.345	14.013	0.668
1989	-0.231	0.014	13.151	12.840	13.473	0.633
1990	-0.212	0.015	13.379	13.043	13.716	0.673
1991	-0.209	0.017	13.403	13.028	13.787	0.758
1992	-0.256	0.018	12.876	12.491	13.273	0.782
1993	-0.280	0.019	12.609	12.198	13.028	0.831
1994	-0.262	0.020	12.809	12.388	13.244	0.856
1995	-0.325	0.023	12.113	11.650	12.593	0.943
1996	-0.257	0.029	12.865	12.242	13.516	1.275
1997	-0.293	0.039	12.465	11.665	13.316	1.651
1998	-0.259	0.067	12.838	11.441	14.364	2.923