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Some Aspects of the Australian Road Research Board's Accident Costs Study

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Abstract:

The Australian Road Research Board (ARRB) project *Accident Costs for Project Planning and Evaluation* has been completed and the reports are progressively being published. This paper outlines the project from inception to completion, touches on the methodology and the rationale and discusses some of the findings and results. The costs that have been derived are costs per accident for a range of 19 accident-type groups and represent the costs of accidents reported to the police. Reported accident data forms the basis of the information used by practitioners for a range of applications. There were four areas in which costs had to be determined. The first was the costs per person related to the five casualty classes that appear on the report form (killed through to not injured). The costs per person were based on lost productivity, medical costs, hospital costs, ambulance, time lost at the scene, and pain and suffering. The second was to determine the casualty outcomes of the 19 accident type groups in urban and rural area and hence the person costs for each of them. The third was the vehicle repairs costs, again for each of the 19 accident-types. These were determined by an extensive surey of individual motor insurance claim forms. The fourth was the costs associated with the accident per se such as delay to other traffic, accident recording by police, attendance of emergency services, legal cost, and value of alternative transport. These cost items are combined to generate the standardised cost for each of the accident-type groups. The costs for the five casualty classes had not previously been estimated in Australia and their absence inhibited the application of previous road accident cost data. The detailed look at the insurance claims is also believed to be the first published report that tackles the topic in such detail.

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Introduction

On the 8th February 1988 a meeting was held at the Australian Road Research Board (ARRB) to discuss the cost of road accidents. It was attended by 30 delegates representing agencies around Australia. The purpose of the meeting was to discuss the state of the art in the costing of road accidents in Australia and ways to proceed with a review of the values of parameters used and the methods of application of the valuations obtained. A report of the meeting is to be found in the June 1988 issue of the ARRB Journal (Andreassen et al 1988).

Among the key items agreed to require attention were:

(1) improved bases for ex-post costing;
(2) better use of unit cost methods for structuring accident costs applications;
(3) systematic use of insurance company and accident compensation data to improve property damage and injury accident relationships and levels;
(4) a short 'how to' manual of application methods.

It was agreed that while the (then) present costs were too low the production of new figures required considerably more than simple updating, the reasons for this being:

(1) Much of the bases of past costing exercises needed amending, many assumptions had not been validated and some were contrary to the findings of in-depth studies;
(2) the items to be included in any costing need to be explored, such as the inclusion of delay and suffering of uninjured persons in various accident severities, including non-injury accidents;
(3) the basis for determining the medical costs for various injury states needs to be resolved;
(4) the intended uses to be made of accident cost figures need to be clearly understood.

There was also a desire expressed that data used should be from at least two States.

History of the project

At the end of 1988 a letter went out to ARRB member authorities advising that a study would start in 1989 and called for contributions of data and/or provision of appropriate resources. The chasing of replies and discussions that followed will not be detailed, suffice to say that it was time consuming and the data available disappointing.

Data and definitions

Step 1: As there was a desire to use data from more than one State, the first step was to establish the compatibility of the coding of accidents into "accident-types". The first data analysed came from the Road Safety Division of the Transport Department (South Australia). Two hundred report forms of each of the thirteen accident classifications on the SA police report form were examined and the accident-types determined from procedures developed within ARRB. These procedures were issued in 1990 as the Model Guidelines for accident data and accident-types, draft for comment, (Andreassen 1990).

Copies of report forms were also obtained from New South Wales and Victoria. In their cases, accident classification systems derived from the 1983 version of the Definitions for Coding Accident (Andreassen 1983) were in use. From NSW, 18 accident-type groups were designated and 200 report forms sampled for each group. In Victoria, 19 accident-type groups were designated and 200 report forms analysed for each group.

Acknowledgements: My thanks to the people who reviewed the paper and gave many useful comments.

The establishment of the levels of coding quality was a learning process in itself and many areas where coders were not given sufficient instructions were identified. The concept of the coding of multiple event accidents was introduced and decision trees devised to aid coders to identify the "correct" code cell rather than the 'bird's eye view' of the code chart approach.

Some of the areas needing improved coding procedures in the States' systems were related to

- the accident being on a straight or a curve;
- a vehicle making a definite lane change or a definite right/left turn;
- a vehicle leaving the 'carriageway';
- a vehicle hitting an 'object' after leaving the carriageway (in NSW 15 per cent, of those coded as not hitting an object actually hit one);
- direction of pedestrian travel when hit;
- getting a sketch even though police did not attend the accident (NSW - 16 per cent had no sketch):
- defining 'permanent obstructions' (in Victoria most were traffic islands and medians which are not obstruction per se).

A number of these difficulties have been addressed in the procedures in the Model Guidelines version 1.1 (Andreassen 1991) viz "object" has been redefined to include drains, ditches etc.; accidents are viewed as curve related if the vehicle is entering a curve, is in a curve, or has just passed out of a curve; a new cell has been added for cases where a vehicle hits and mounts a median, traffic island, etc; three other new cells; more cross-referencing of cells and specific examples included.

The use of the decision trees has been emphasised and have become the primary method of determining the accident-type.

Step 2: In January 1990 the first status report for the Study was issued. This report said the study would produce standardised costs per accident for a range of accident-types based on the "reported" accidents readily available for use by the practitioner. The accident-type groups would be derived from 'the definitions for coding accidents', person costs would be determined for the five casualty classes recommended nationally for the police report forms, and vehicle repair costs determined for each of the selected accident-type groups. The intended outputs were given as:

- standardised per accident costs for 19 accident-type groups. Variation by urban and rural environments to be examined;
- casualty outcomes, vehicle repairs, etc for accidents involving special interest vehicle types (truck, motorcycles, van, 4WD) and hit train;
- Model Guidelines for accident data and accident-types. These also form the reference base on which the data from various sources would be analysed;
- A short 'how to' manual on the use of accident cost data;

Comments were sought on the intended outputs and timelines. Staff were engaged to undertake the data extraction and coding.

The second status report was issued in July 1990 and at that stage the draft of the Model Guidelines had been issued for comment, the first draft of the Use of Cost Data was to go out for comment in August, and the coding compatibility of the accident-types for the three States had been completed and was to be discussed with the individual authorities.

Step 3: In August 1990 a review of techniques and resources for the study was made and an experimental scientist engaged.

The first round of data was obtained from the Transport Accident Commission (TAC) for use in estimating some parts of the costs of the five casualty classes.

In October requests were made for tabulations of mass data from NSW and Victoria to generate the casualty class outcomes by accident-type groups.

A further resource became available toward the end of 1990 and this was used to employ vacation students on the extraction and coding of the vehicle insurance claim files.

The supply of information from the insurance company computer files was used to reduce the amount of information needed to be extracted and greatly speeded up the process. Some 28,000 claims were examined over the period and by the time the data was cleaned up it still resulted in useful data sets for most of the 19 accident-type groups.

The refining of the mass data from NSW and Victoria went through into early part of 1991.

To determine the value of a life in terms of lost productivity and mortality rates a consulting actuary (Richard Cumpston) was engaged.

The Model Guidelines version 1.1 were printed in June 1991 and subsequently distributed.

Step 4: A third status report was dispatched in August 1991 and attached to that was a summary of the preliminary costs for accident-types utilising the casualty outcomes of the mass data from Victoria. By that date the person costs for the five casualty class had been determined for persons involved in road accidents. Vehicle repair costs by accident-type for accidents involving cars had also been completed.

The report giving the background information, assumptions and estimates used was finalised and sent for external review, modified, and finally printed in March 1992. In the intervening period the writing up of the detail of the vehicle repair cost study was completed and that was also printed in March 1992. A start was made on obtaining data on repairs to trucks and motorcycles from specialised insurers and to get the casualty outcomes for these vehicle types from the mass data in Victoria. Acquisition of the mass data related to trucks and motorcycles was subject to unexpected delays and took months instead of the usual weeks. The specialised insurers of trucks and motorcycles were unable to supply other than a crude average of total claims in most instances. It had earlier been decided not to examine the claim forms but it seems that it is the only way to get dependable answers. One of the most promising sources of truck repair costs made repeated promises to supply information so much so that it was decided to conclude the report without the information.

Because all the casualty classes are needed for the persons involved in accidents further work was required on the NSW data to examine a subset of accidents for which the total number of occupants and their casualty classes was known. The accident-types in the mass data systems in NSW and Victoria that had poor matching levels were investigated further to get estimates that related more closely to the Model Guidelines.

A substudy of hospital stay and follow-up treatment by accident-type, which was to be carried out externally to ARRB, was abandoned as the group involved could no longer complete the work within the required time frame.

To gain an idea of car repair costs in other States, substudies of insurance data were made in Queensland and South Australia.

So at the end of period to mid May 1992 the outcomes of nearly 200,000 accidents recorded by the police over two years in two States and the examination of 28,000 insurance claim forms have resulted in the following reports to date.

- Model Guidelines for Accident Data and Accident-types, version 1.1.;
- Preliminary costs for accident types;
- Vehicle repair costs;
- Costs for accident-types and casualty classes;
- Trucks, semi trailers, and motorcycles;
- A Guide to the use of accident cost data in project evaluation and planning.

What went into the costs in this study

Since there is a limit to the size of papers, details have been omitted in a number of areas throughout this paper but they can be found in ARRB Report 217 (Andreassen 1992a).

Many things can be viewed as the consequences of road accidents but the problem is to get cost and frequency information about them. The items that have been included have stayed close to those costed by Thorpe (1970), Atkins (1981), and Steadman and Bryan (1988).

The study differs from the last two mentioned papers by deriving costs for the casualty classes found on police reports rather than AIS (abbreviated injury scale) classes.

Costs per person

The cost per accident was made up of four components. First were the costs per person based on lost productivity, medical costs, hospital costs, ambulance costs, funeral costs, rehabilitation, and pain and suffering (except for those killed). The central view was to consider what items the courts were likely to pay out on for survivors of accidents and extend those aspects to those killed and to those with lesser injuries and no injuries. As the courts (or the no fault compensation schemes) would pay for loss of income, subject to minimum periods off work and limits on the amount paid, then the concept of lost productivity should be applied to all casualty classes. Information on earnings, time-use, and mortality were used to derive productivity (i.e. paid and unpaid work). This resulted in the final values for males and females being little different. An "expected" age distribution of persons involved in road accidents was determined and is given in Table 1 for fourteen age groups.

Table 1 The 'expected' age distribution of road users in accidents

Age group	Per cent
0-4	1.97
5-8	2.24
9-12	2.26
13-17	6.98
18-22	23.26
23-27	14.81
28-32	10.44
33-37	7.51
38-47	11.50
48-57	7.58
58-67	5.33
68-77	3.82
78-98	1.74
99+	.16
	100.00%

The five casualty classes appearing on accident reports in Australia are 1-killed; 2-admitted to hospital; 3-injured, received medical treatment; 4-injured, not requiring medical treatment; and 5-not injured.

The proportion of males and females in accidents varied for each casualty class as is shown in Table 2.

The value of 60 per cent (the Geometric mean) was used for all casualty classes despite the obvious variation. The sensitivity of the resultant productivity costs to varying the proportion was tested and found to be of the order of plus or minus one to two per cent.

Figure 1 shows the variation of future productivity by age for males and females in the general population. As mentioned in the History Section these were determined by the consulting actuary.

Table 2 **Percent male by casualty class, in reported accidents**

Class	K-1	HA-2	MT-3	INT-4	NI-5	Total
Per cent	69.9	59.9 *	51.5	54.1	65.7	63.2

The Geometric Mean for the five classes was 59.7

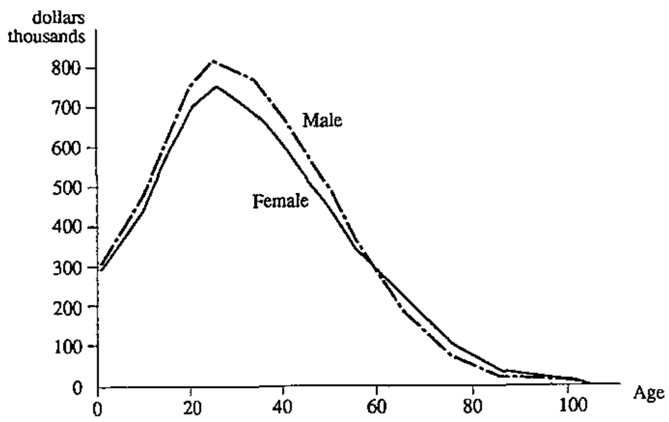

Figure 1 - Future productivity by age, 1991 dollars

The productivity information has to be converted to the persons involved in accidents. This was done by applying the expected age distribution of persons in accidents (Table 1) to the productivity rate. For total loss of future productivity (i.e. a death or permanent total disability) a single value on a 60/40 male to female weighting was calculated at $613,000. Altering the percentage of males over the range 75 to 50 per cent corresponded to values of $620,000 and $608,000 (± one per cent).

Casualty outcomes

The second component was the casualty outcomes for each of the nineteen accident-type groups in urban and in rural areas. The casualty outcome for an accident-type group is the distribution of the persons involved in an accident across the five casualty classes. In this area there are differences between NSW and Victoria in what it classified as a "casualty" accident. In NSW accidents involving a person with an injury of at least class 4 is counted as a casualty accident. In Victoria, only accidents involving injured down to class 3 are

classified as casualty. Fortunately the five classes are recorded for all persons in Victoria and with some further programming and extraction it was possible to get accidents with persons whose injury was class 4. The NSW and Victorian data could then be compared. The casualty outcomes are used with the costs per casualty class to get the "person costs" per accident for each of the accident-type groups.

The person costs for the groups ranged more than eleven fold in Victoria from $13,000 in a rural "hit animal" accident to $143,000 for a rural "head-on" accident. One of the special interest accidents "hit train" had a rural average of $226,000 in person costs.

Vehicle repairs

The third component was the vehicle repair costs. An extensive survey of insurance claim forms was conducted using two major companies in Victoria. The criteria for a claim to be included in the study were:

(1) The claim was finalised;
(2) The insured was comprehensively insured;
(3) The vehicle was not insured under a fleet agreement;
(4) The claim was not made as the result of fire or theft;
(5) The claim was not a report only claim;
(6) The insured was deemed to be at fault;
(7) The claim was not settled on a knock-for-knock basis;
(8) The accident occurred on a 'road'; and
(9) For two vehicle accidents, a cost was recorded for each vehicle.

Insurance companies run their records to suit their own needs and not those of researchers, and the meaning of common words can vary between companies. An example of this was a 'claim'. One accident generates one file but there may be several "claims" on the one file depending on the type of accident and range of repairs necessary. A claim may come from an engine rebuilder, a claim from a trimmer, one from a panel beater, etc. If these claims are filed electronically as claims, then a request for the average 'cost per claim' will get an answer which the inquirer did not actually want. Given the diversity of claim handling, [e.g. comprehensive; third party property; knock-for-knock; fleet; and third party, fire and theft]; any broad statistics from a company could be misleading as to the average repair cost for a vehicle let alone the costs for a two-vehicle accident.

The accident-type was determined for each claim examined by the procedures set out in the Model Guidelines. Although multiple-event accidents were extracted and recorded they have been excluded from the final costs for accident-types as these were restricted to one-vehicle or two-vehicle accidents.

It is believed to be the first time that a survey of this scope and size has been conducted and the results counter some preconceived notions. In some past studies costs per vehicle were derived and for accidents with two vehicles involved the cost per vehicle was doubled. The investigation of the individual vehicle repair costs in two-vehicle accidents showed that there was no relationship between the two costs. High costs for one vehicle often paired with low costs for the second vehicle. The repair costs included the actual repairs, towing, for 'total loss', and payment by the insured of the excess. The costs for the 19 groups ranged more than five fold from an average of $1,340 in a 'hit pedestrian' accident to an average of $7,390 in a head-on accident. There was no reliable way of determining whether the location of the accident was urban or rural or what speeds were involved.

Incident costs

The fourth component was the costs associated with the accident itself. The items valued under this heading were insurance administration (taken as a percentage of the repair costs), accident investigation and reporting by the police, legal costs, delay to other traffic, attendance by emergency services, operating cost of compensation scheme, and the value of alternative transport while vehicles are repaired. For a number of these items the total annual cost was spread over the number of reported accidents as there was no information about variation.

Standardised costs

The four components were then combined to generate the standardised cost per accident for 19 accident-type groups in urban and in rural areas. This is shown in diagrammatic form in Figure 2.

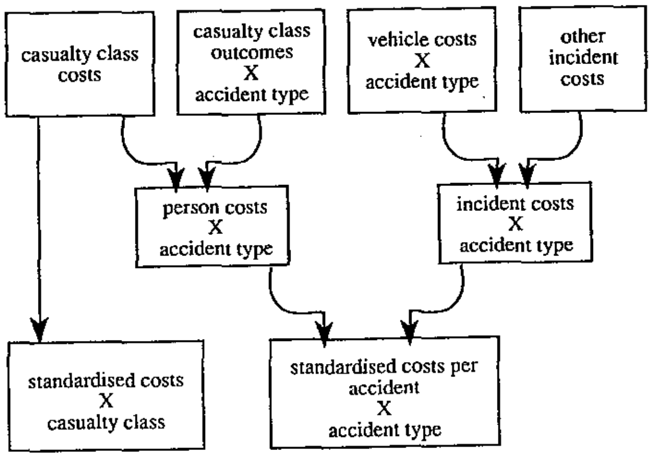

Figure 2 - Assembly of costs

When the incident costs, repair costs, and person costs were combined there was a nine fold range, in Victoria, from $17,000 (hit animal) to $154,000 (head-on). The costs for the accident-type groups in urban and rural areas are shown in Figure 3 for each of the 19 accident-type groups per ARRB Report ARR 217 (Andreassen 1992a). The person costs form the greatest part of the cost of each accident-type.

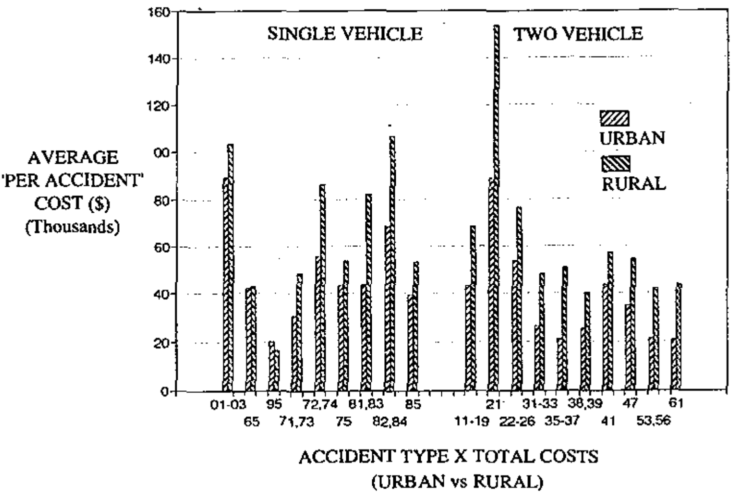

Figure 3 - Accident costs per ARR 217

Why use accident-types

At this stage it might be asked why generate all the costs for all these accident-types. The simple response is that accidents are not all the same and don't all have the same results. Different accident-types, e.g. head-on or rear-end, have their own distinctive expected casualty outcome. Some types are typically low severity while others are typically high severity. The distribution of the outcome for an accident-type is a good way of expressing this aspect. The casualty outcomes have previously been shown to be consistent over time (Andreassen 1986) and thus a reliable framework to use for costing.

Effect of countermeasure

When a countermeasure is applied, say, to an intersection then the various accident-types occurring there are not all affected to the same extent. Some may decrease, some not change and others increase. The value of the countermeasure then needs to be assessed by the significant increases and/or decreases in individual accident-types and the relative severity represented by the cost of those types. The standardised costs of the accident-types should be used for countermeasures which change the frequency of accidents.

For a countermeasure which reduces the severity of outcome without necessarily affecting the frequency, e.g. wearing seat belts, then the change in the distribution across the five casualty classes should be used combined with the cost per person for each class.

In the past the cost of an "average" accident may have been used or the costs of a 'fatal' accident, 'injury' accident, and a 'damage' accident may have been used. When it comes to evaluation there is no such thing as an average accident. With a nine fold range in costs by accident-type, a favourable treatment can be dismissed or a poor one accepted when the cost benefit analysis is done using an overall average.

A countermeasure affects an accident-type/s or the severity of injury within an accident-type. Most countermeasures are intended to reduce accident frequency and it is wrong to expect to see an effect on, say, all fatal accidents except by a reflection of the other processes mentioned.

Example of traffic signals

A comparison of the use of accident severities and the use of accident-types has been made using data from the installation of traffic signals at 19 intersections in Melbourne. The Accident Severity Technique (AST) considers only the changes in the total number of fatal accidents, the total number of injury accidents, and the total number of damage accidents. The Accident-Type Method (ATM) is concerned with the statistically significant changes in the total number of individual accident-types. The data is given in Table 3.

Table 3 Signals at 19 intersections

Table 3(a) Accident severity

	Fatal	Injury	Damage	Total
Before	2	60	44	106
After	3	20	20	43
	+1	-40	-24	-63

Table 3(b) Accident-type

	→ ↑	↓ ←	→ →	Other	Total
Before	87	4	1	14	106
After	23	10	3	7	43
	-64	+6	+2	-7	-63

For the Accident Severity Technique the data in Table 3(a) shows the net change was +1 fatal accident, -40 injury accidents, and -24 damage accidents. The costs given by NAASRA (1989) for accident severities was Fatal accident = $560,000; Injury accident = $22,000; Damage accident = $2,500.

Using those costs a net reduction of $380,000 is obtained for the 19 intersections or an average of $20,000 per intersection per year.

For the Accident Type Method, if only the 'adjacent approaches' accident-type shown in Table 3(b) left hand column are considered then there was an average reduction of 3.37 per intersection. An estimate of the cost of a reported 'adjacent approaches' accident is $45,000 (1991 dollars) (Andreassen 1992a) and thus the average cost saving per intersection is $151,580 which is 7.6 times the benefit resulting from the Accident Severity

Technique. To perform a cost benefit analysis, a capital cost, running costs, an evaluation period and a discount rate are needed. For this example the following were assumed: capital $50,000 per intersection, running costs of $3,000 per intersection per year, a 5 year evaluation period, and 7 per cent discount rate. The results obtained by the two approaches are given in Table 4.

Table 4 Comparison of Methods - Costs per intersection

	(1) Accident Severity Technique	(2) Accident Type Method	Ratio (2) : (1)
<u>Costs</u>			
Capital	$50,000	$50,000	1
Operating	$3,000/year	$3,000/year	1
S.P.V. (5 Years, 7%)	$62,300	$62,300	1
<u>Benefits</u>			
Savings in accidents	$20,000/year	$151,580/year	7.6
S.P.V. (5 Years, 7%)	$82,000	$621,765	7.6
B/C ratio	1.3	9.9	7.6
Net Present Value	$19,700	$559,465	28.4

The ATM gives a clearly better answer than the AST. The ATM is also more appropriate that the AST. The result for the AST is influenced by the chance fluctuation in the number of fatal accidents. Even if the real data is altered so that there was a decrease in fatal accidents instead of an increase, the ATM still gives a better answer than the AST (savings of $156,315 vs $80,000 per intersection per year).

Examples can of course be adjusted to show all sorts of results. If the costs of the signals are increased the AST can result in a negative Net Present Value.

Another benefit of the ATM is that significant increases of one accident-type can be weighed against significant decreases of another accident-type. Also significant decreases (or increases) of many types each of a different cost can be counted. Sometimes it occurs that the change in the total number of accidents is not significant but the change in one of the accident-types contributing to the total is significant.

Some of the results of the Accident Cost Study

The general ranges of person costs, repair costs, and total costs per accident-type group were given earlier but some of the detailed results and findings may be of interest. There is room only to describe some of the findings.

In the tables and figures that follow the following accident-type groups appear as listed below. Code numbers and brief descriptions only are given. The Code Chart is shown in Figure 4. The use of insurance data would be greatly facilitated if companies adopted the Model Guidelines.

(1) *Accident-Type Groups*

One-vehicle types	Description	Two-vehicle types	Description
01-03	pedestrian, crossing carriageway	11-19	Intersection, from adjacent approaches
65	hit permanent obstruction	21	head-on
95	hit animal	22-26	opposing vehicles, turning
71, 73	off carriageway, on straight	31-33	rear-end
72, 74	off carriageway, on straight hit object	35-37	lane change
		38, 39	parallel lanes, turning
75	out of control on straight	41 (27 & 34)	U-turn
		47	vehicle leaving driveway
81, 83	off carriageway, on curve	53, 56	overtaking, same direction
82, 84	off carriageway, on curve, hit object	61	hit parked vehicle
85	out of control, on curve	93	hit railway train

(2) *Casualty Classes of Persons*

K-1 = Killed
HA-2 = Injured, admitted to hospital
MT-3 = Injured, received medical treatment
INT-4 = Injured, not requiring medical treatment
NI-5 = Not injured

The occurrence of "multiple-event" accidents deserves some further comments. When an accident occurs it may involve a single event or several events. An example of a single event is when a vehicle reverses into the front of a parked vehicle and no further vehicle movement or action follows. An example of an accident which has two events is when a vehicle waiting to turn right is hit in the rear (event 1) and as a result is pushed into the opposing traffic stream and hit by a vehicle from the opposite direction (event 2). It is important from both an analysis viewpoint and a costing viewpoint to recognise the multiple events in an accident and record them. In the sample of 3,800 reports from Victoria, at least 17 per cent were multiple event accidents (on the basis of the number of vehicles involved).

Accidents which involve one vehicle according to the coding cell sketch cannot average more than one vehicle per accident without there being multiple event accidents involved. The corollary that one-vehicle code cell multiple event accidents must have more than one vehicle involved is not true. For example, a car may hit an animal on the carriageway (1st event) then lose control and run off the carriageway to the left finishing up in a drain (2nd event).

The mass data used subsequently from NSW and Victoria was for one-vehicle accident-types that involved only one vehicle and two-vehicle accident-types that involved only two vehicles. This was the closest that could be achieved using the computer based data to non-multiple event accidents. When multiple event coding is introduced in State processing it will then be possible to get "cleaner" data. The cost of a multiple event accident is some combination of the costs of each of the accident-types involved.

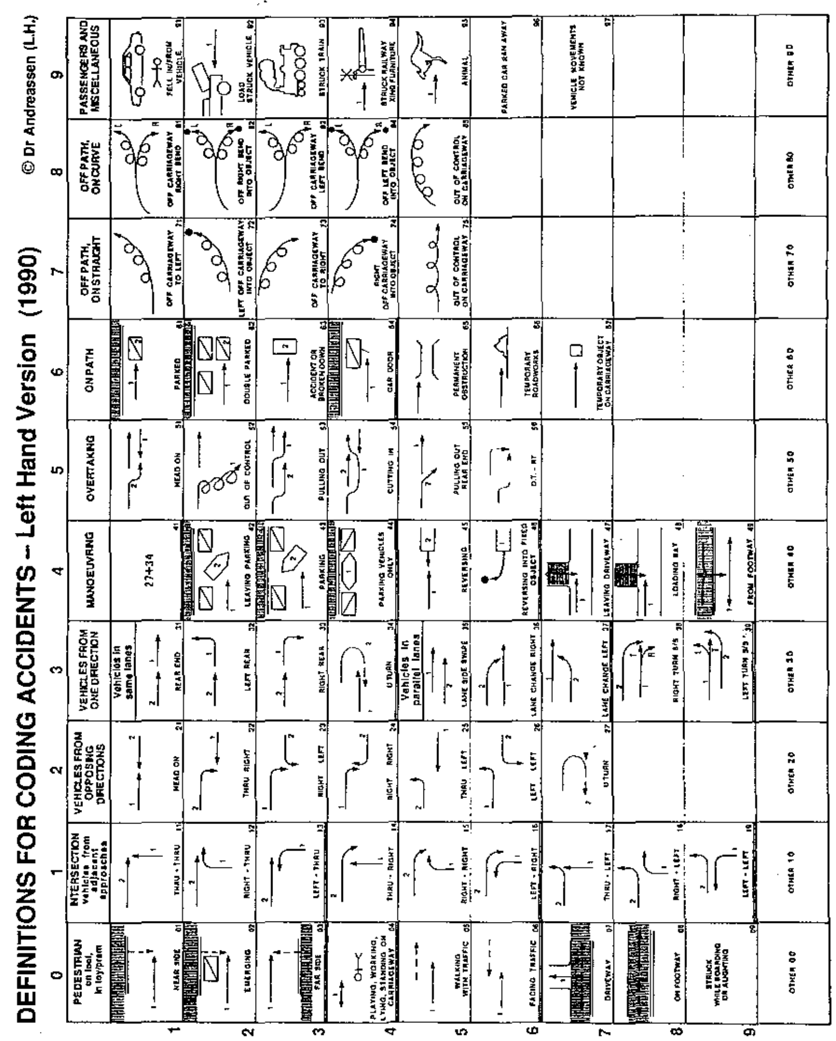

Figure 4 - Coding Chart used in the study

Vehicle repairs

Turning to the relationship of the repair cost of each vehicle involved in two-vehicle accident-types, the scatter plot for one of the most frequent accident-types "intersection, vehicles from adjacent approaches" is shown in Figure 5. The matched pairs of costs from individual accidents have been plotted. The scatter plot shows no obvious relationships between the costs of two vehicles in an accident. Scatterplots for the other nine two-vehicle accident-types were similar.

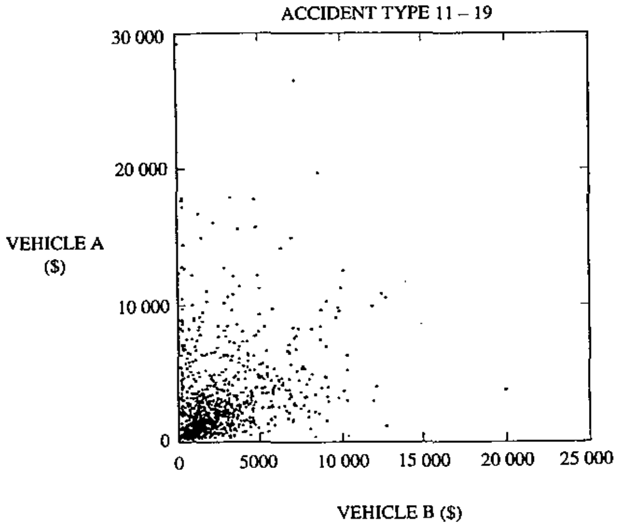

Figure 5 - Intersection, vehicles from adjacent approaches, Code [11-19]

The data for the repair costs can be viewed in many different ways, such as the 3-D plot in Figure 6. This uses the same data as Figure 5 and illustrates the clustering at various points but still no direct relationship.

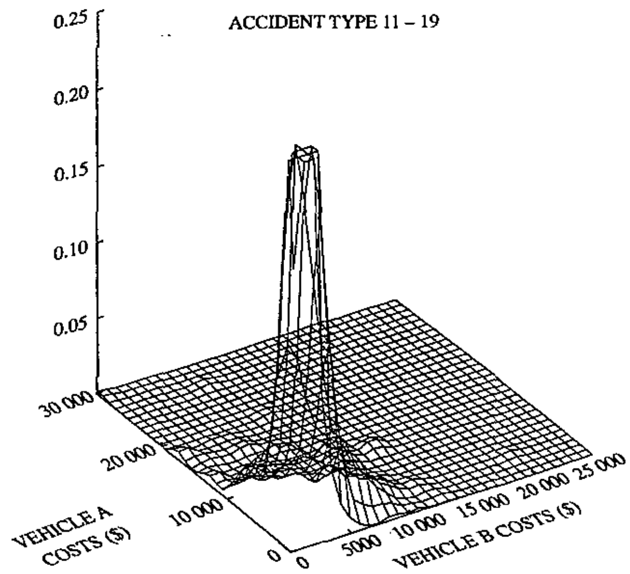

Figure 6 - Accident-type 11-19

Variation of the two costs

There is further analysis that could be conducted which may be more of academic interest. One area is that of the variability between the individual costs of the two vehicles in two-vehicle accidents as exampled in Figures 5 and 6. To explore this, the difference in the costs of the insured vehicle and the second vehicle were plotted against the cost of the accident. As this was in absolute values the difference between the two vehicle costs when the total was small would obviously be over a smaller range than when the total was large. To overcome this, the ratio of the difference in costs of the two vehicles to the total cost was plotted against the total cost. The result is shown in Figure 7. This shows that the variability between the individual costs of the two vehicles is certainly as great for a low total sum as for the high. Further as shown in Figure 7, there are many more accidents where the costs of the two vehicles were not the same than accidents where they were the same. Only the data points on the zero line are those where the two costs were equal. The plots for the other two-vehicle accident-types gave the same form of result.

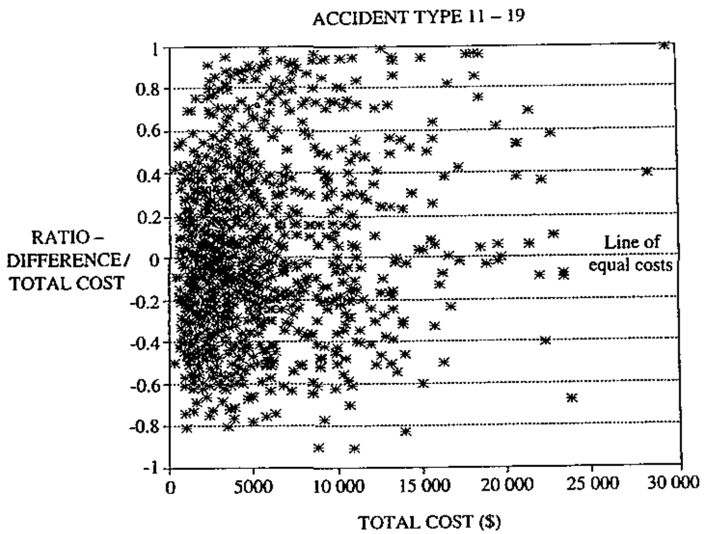

Figure 7 - Ratio [(A-B)/total] vs total cost

As illustrated by Figures 5, 6, and 7 the lack of a relationship between the two costs and the variability of the two costs over the range are major findings. The past practice of getting the cost for one vehicle and doubling it for two-vehicle accidents was certainly inaccurate.

Vehicle-types - trucks, motorcycles, 4WDs

The costs for trucks and motorcycles are for special applications where the countermeasure relates to the specific vehicle type.

Forty five per cent of one-vehicle motorcycle accidents (in Victoria) are "loss of control on carriageway" [Codes 75, 85]. Figure 8 shows the relative involvement of motorcycles in one-vehicle accident-types. The very high involvement in Code 75 relative to all vehicle types is clear but more remarkable is the fact that the number of these motorcycle accidents is 40 per cent of all such accidents involving all vehicle types.

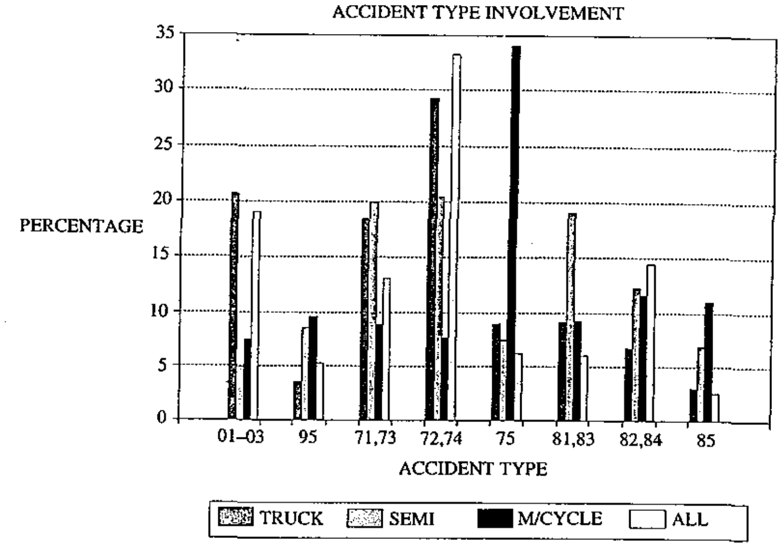

Figure 8 - one-vehicle accident-types

A similar type of accident problem was identified for 4WD vehicles. About 53 per cent of all insurance claims examined for 4WDs involved 'loss of control' [Codes 71-75, 81-85]. The involvement relative to cars is shown in Figure 9 (Andreassen 1992b) for one-vehicle accident-types. The repair costs for 4WD vehicles average twice that of cars.

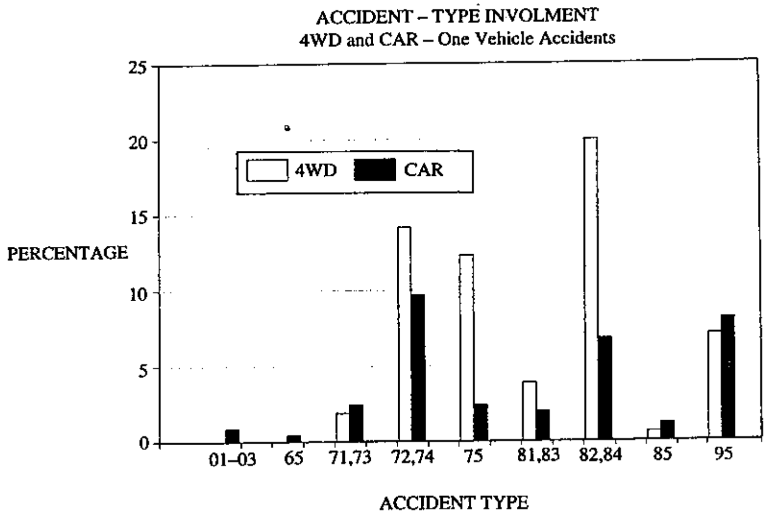

Figure 9 - 4WD vs car

Conclusions

The ARRB Accident Cost Study has produced basically what it set out to do. That is -

- standardised costs per accident for 19 accident-type groups. Variation by urban and rural environments;
- standardised costs per person for five casualty classes;
- casualty outcomes, vehicle repairs, etc for accidents involving special interest vehicle types (truck, motorcycles, 4WD) and hit train;
- Model Guidelines for accident data and accident-types. These also formed the reference base on which the data from various sources was analysed;
- A short 'how to' manual on the use of accident cost data.

Obviously there are areas where data or better data would have improved the result. There are improvements that are needed in State road accident data systems, particularly the adoption of common definitions and coding procedures to allow comparisons and the application of the costing technique.

Further research is needed for truck and motorcycle accidents by way of the examination of police report forms and insurance claim forms.

The adoption of accident-type coding by motor insurance companies would be a great boon to present and future research.

The costs reported are still conservative estimates of the cost to the community of accidents reported to the police.

The use of accident-types and the costs for accident-types gives more appropriate and more accurate results in project evaluation than the accident severity technique.

The use of the data for accident-types should result in more clearly targeted safety programs with higher net present values.

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