ADELAIDE IN-DEPTH ACCIDENT STUDY

1975-1979

PART 1: AN OVERVIEW

by

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KEYWORDS : Accident/on the spot accident investigation/Adelaide, South Australia*/ sampling/data acquisition/drunkenness/speed/skill (road user)/pedestrian/motor cyclist

ABSTRACT : This report is a general introduction to, and review of, an in-depth study of road accidents to which an ambulance was called in the metropolitan area of Adelaide, South Australia. A representative 8% sample, comprising 304 accidents, was investigated in the 12-month period commencing March 23rd 1976. The general aims of this study are presented followed by a detailed description of the sampling procedure which was adopted. The method of operation is then described, and the types of accidents investigated are presented in form of the general characteristics of the accidents and of the drivers, riders, and pedestrians, together with a review of the consequences of these accidents. The major conclusions drawn from the results of the study are described briefly, including the ways in which factors such as alcohol and inexperience affect the safety of road users, the role played by vehicle factors and aspects of the road and traffic environment in accident causation, the main causes of injury to each class of roaduser and the value of helmets and seatbelts. The companion reports on specific aspects of the accidents investigated are listed in the final section.

*Non IRRD Keywords

The views expressed in this publication are those of the authors and do not necessarily represent those of the University of Adelaide, the Commonwealth Government or the Australian Road Research Board.

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FOREWORD

This study was conducted by the Road Accident Research Unit of the University of Adelaide and was jointly sponsored by the Office of Road Safety, Commonwealth Department of Transport and the Australian Road Research Board.

The general aims were to evaluate the effectiveness of many existing safety measures and to identify other factors related to accident or injury causation in road accidents in metropolitan Adelaide. The areas studied included characteristics of road users, the vehicles and the road and traffic environment.

To achieve these aims a representative sample of all road accidents to which an ambulance was called in the Adelaide metropolitan area was studied in the 12 months from March 1976. Two teams, each comprising a medical officer, an engineer and a psychologist attended 304 randomly selected accidents and collected medical, engineering and sociological data.

The findings are presented in a series of reports, each covering a specific topic. Part 1 provides an overview, and is followed by reports dealing with pedestrians, pedal cyclists, motorcyclists, commercial vehicles, passenger cars and road and traffic factors. The final report in the series provides a summary of the findings and recommendations.

Basic data from the study are held on computer by both the Road Accident Research Unit, University of Adelaide and the Australian Road Research Board. Access to these data can be arranged for bona fide research workers on application to the Australian Road Research Board. Further copies of this report and copies of other reports in the series are available from the Office of Road Safety, Commonwealth Department of Transport.

ACKNOWLEDGEMENTS

The collection of data at the scene of the accident and in the follow-up investigations was performed by:

H.S. Aust and C.T. Hall
(Engineers)

N.D. Brewer and B.L. Sandow
(Psychologists)

J.R. Lipert and P.J. Tamblyn
(Medical Officers)

The completion of this study was due mainly to the willingness of these team members to work exceptionally long hours under difficult and often hazardous conditions.

Much of the road and traffic data was collected by W.J. Offler, who also attended the scenes of the accidents during the final three months.

The recorded information was processed by the above personnel, assisted by J.K. Darwin, G.M. Haymes, O.T. Holubowycz and C.A. Latta.

This report was prepared by the authors, with the assistance of D. Murray of the Office of Road Safety.

The Steering Committee for the study provided valuable assistance and advice. Its members were: Professor R.E. Luxton (Chairman), Professors: I.D. John, R.B. Potts, J.S. Robertson, A.T. Welford, Drs.: B.L. Cornish (representing the Director-General of Medical Services), I.R. Johnston (D.O.T.), J.B. Metcalf (A.R.R.B.), G. Sved, A.P. Vulcan (D.O.T.), and Messrs. J.F.M.Bryant (A.R.R.B.), R. Culver, H.E. Roeger (later R.W. Scriven and then M. Knight) (representing the Commissioner for Highways), R. Ungers (D.O.T.) and F.E. Yeend (D.O.T.). The first Chairman was the late Professor N.T. Flentje.

The St. John Ambulance Transport Division played an essential role in the conduct of this study by notifying the Road Accident Research Unit when an ambulance was called to attend a road accident. The South Australian Highways Department, the Road Traffic Board, and the Police Department cooperated in many ways in the execution of this study, as did the Hospitals Department. The proprietors and operators of towing services and crash repair shops facilitated inspections of the damaged vehicles.

The sponsorship and advice of the Office of Road Safety of the Commonwealth Department of Transport and the Australian Road Research Board are gratefully acknowledged.

The final acknowledgement is due to the persons who were involved in the accidents studied and who cooperated freely with the members of the research teams.

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1. INTRODUCTION

The term In-depth Study refers to investigations of road traffic accidents which are conducted by professionally qualified investigators who attend the accident at the scene and who conduct such follow-up investigations as may be necessary to enable them to assemble a comprehensive and detailed account of the crash events, circumstances and consequences. The term 'Level 3' is often used as a more specific reference to this type of study.

The earliest studies of this type were attempted in the United States about twenty years ago, but one of the first projects to obtain a representative sample of crashes from a defined population was conducted in Adelaide from 1962 to 1965 under the direction of Professor J.S. Robertson and with the sponsorship of the Australian Road Research Board (McLean, 1973 and Robertson, McLean and Ryan, 1966). In concept, the investigation which is reviewed in this report was similar to the previous Adelaide study but it covered in greater detail a wider range of characteristics of the road users, the vehicles and the road and traffic environment.

The success of the first Adelaide In-depth Study was due in part to the fact that the Adelaide metropolitan area is particularly suitable for the conduct of an in-depth investigation by virtue of its population size (900,000) and its topography. The study area, which comprised the major part of the metropolitan area, is a flat coastal plain bounded on one side by the sea, on another side by a range of hills and defined on the third side by a major arterial road. There are few natural features on this coastal plain which interrupt the basic rectangular grid of the road network (Figure 1).

The emergency services and other public authorities are organised and function in ways which also facilitate the conduct of research work of this type. One ambulance service, the St. John Ambulance Transport Division, covers the entire area and operates under the direction of a central radio controller. This centralised service permitted a means of immediate notification to the research team of the occurrence of an accident to which an ambulance was called. The area is also covered by one police authority and the regulation of the road and traffic system is in general the responsibility of a centralised body, the Road Traffic Board. All of these factors and, in particular, the willing cooperation offered by these and other organisations greatly reduced the difficulties associated with the development and conduct of a large scale study of this type.

This study was confined to accidents to which an ambulance was called. This was done for two reasons: there was particular concern that most of the cases investigated should yield information relevant to the study of injury causation, and a reliable and rapid method of notification of the occurrence of an accident was essential. The sampling criteria that were used to decide which accidents should be investigated are described in detail later in this report.

The proposal for this study was prepared in 1974 (McLean, 1974a), and much of 1975 was spent in planning, in particular further developing and refining the lists of data items to be collected and procedures to be followed. During these two years a series of workshops was convened by the Department of Transport with the aim of ensuring that a common core of data would be collected in each of the three in-depth studies that were envisaged at that time: one in Melbourne, a rural study near Brisbane, which did not take place, and the Adelaide study.

When the lists of data items, including these core items, had been finalised for the Adelaide study a start was made on developing the computer codes. The GM Long Form, a code widely used in North America and in Europe, was taken as a basis for the passenger car and crash injury codes, together with an injury coding system developed by Marsh (1972). A modified vehicle damage index (VDI) was developed (McLean, 1975) from the SAE Recommended Practice (1972), the modification being introduced mainly to allow more detailed coding of damage to the side of the passenger compartment.

Two team members, Hall and Sandow, were recruited in mid-1975, and the remaining team members: Aust, Brewer, Lipert and Tamblyn, were hired during the six months following the formal commissioning of the study in August 1975. Equipment was acquired during these six months, and the working procedures were established. From March 23, 1976, two teams each comprising a medical officer, an engineer and a psychologist were on call at pre-determined times to go directly to the scene of a road accident on being notified by the ambulance radio controller that an ambulance had been requested to attend. The data collection phase began on March 23rd, 1976 and continued for 12 months, during which time 304 accidents were investigated at a cost per case of just under $1400.

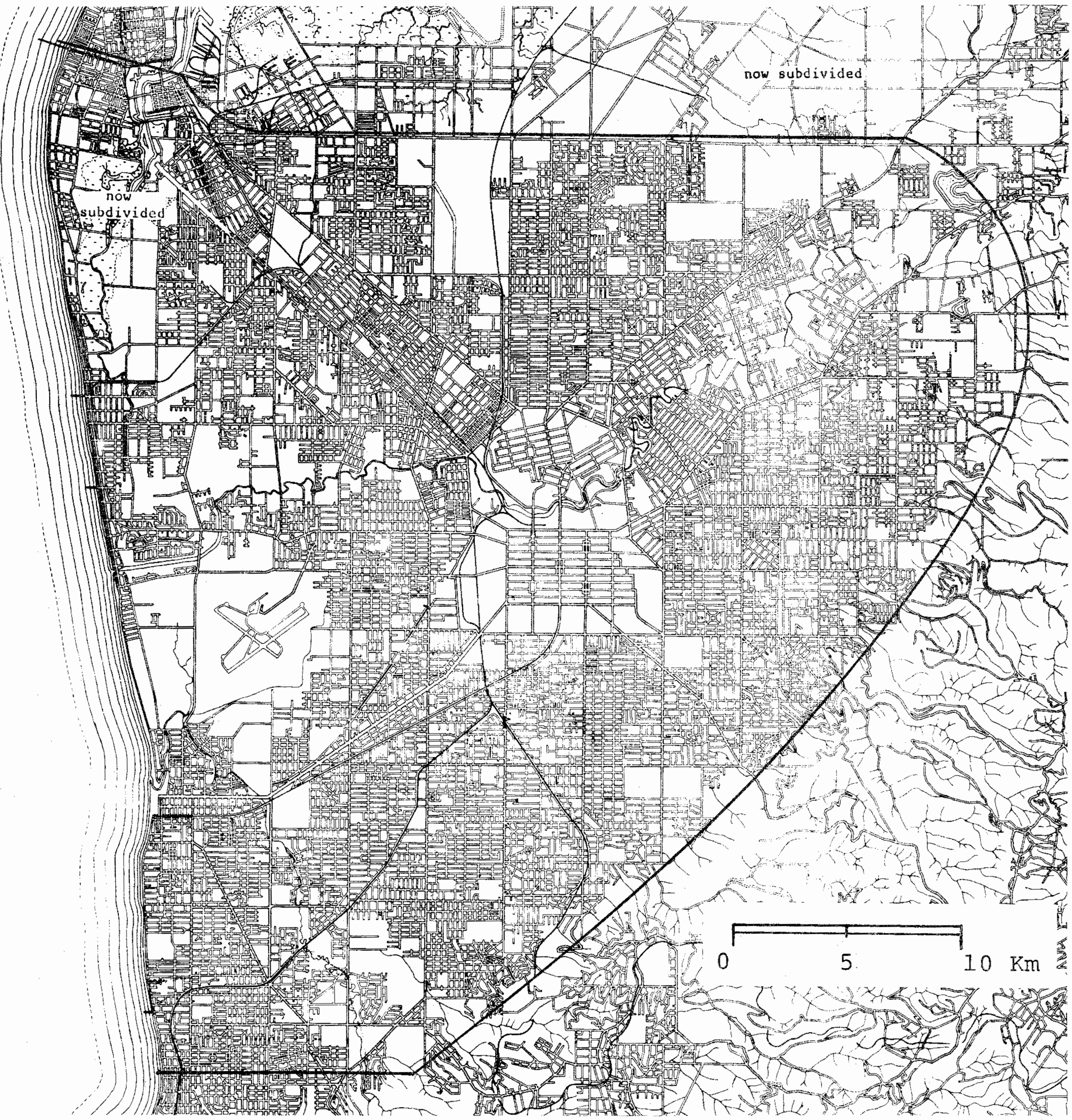


FIGURE 1: Adelaide metropolitan area showing study boundaries.

The very detailed investigation of a relatively small number of accidents as they occur using this approach is complementary to investigations based on so-called "mass" accident data, such as are contained in police reports on road accidents. An obvious benefit of the in-depth study approach is that it yields a wide range of information that can be obtained in no other way, but the high cost of such an investigation restricts the sample size and this means that some evaluations which can be conducted using mass data cannot reasonably be attempted using this approach. Conversely, the amount of information that can be listed in a police report on a road accident is necessarily very limited and many of the items that are included are required for purposes other than research and evaluation. At the present time, mass accident data files in Australia lack some of the information which is necessary for investigations aimed at identifying the role of the vehicle in accident and injury causation, to take one example (McLean, 1974b).

While the unique contribution which can be made by an in-depth study is associated with the wide range of detailed information which can be produced, it primarily derives from 'the productive synthesis of material not previously recognised as related' and from 'the open-ended observation and description of phenomena to discover variables which deductively seem to be of importance' (Haddon, Suchman and Klein (1964)). In other words, the in-depth study has the potential to bring about a more intimate understanding of the nature of the road accident problem and this leads, in turn, to the generation of new hypotheses.

Some of the conclusions and recommendations in this series of reports are presented on the basis of very few cases. Their value depends on the accuracy and relevance of the insights which we have gained from our participation in this study, and so they should be regarded as suggestions for further investigation rather than as definitive statements. Some other recommendations we believe to be readily-supportable solely by the data which we have collected.

Finally, many of the variables on which information was obtained in this study have either not been mentioned in the text or have been reported on in isolation, with no reference to their interactions with other variables. Consequently these reports do not exhaust the possibilities for analysis of these data, or for comparisons with additional data on relevant control groups or with data from similar studies, notably the first Adelaide in-depth study. It is our hope that we will have the opportunity to continue working with the information that we have collected, and we offer our assistance to other research workers who may be interested in doing so.

2. PURPOSE OF THE STUDY

GENERAL AIMS

The general aims of this project were to evaluate the effectiveness of many existing safety measures and to identify other factors related to accident or injury causation in road accidents in metropolitan Adelaide. The areas which were covered included characteristics of the road users, the vehicles, and the road and traffic environment.

SPECIFIC AIMS

1. To evaluate those Australian Design Rules for Motor Vehicle Safety that are directly related to accident or injury causation.

2. To identify aspects of vehicle design that are related to injury causation and were not then covered by an Australian Design Rule.

3. To identify aspects of vehicle design, construction and maintenance that are related to the causation of road accidents.

4. To evaluate the effectiveness of standard traffic engineering practices aimed at reducing the frequency or severity of road accidents.

5. To identify aspects of the design and construction of urban traffic routes and residential streets that are related to the causation of road accidents.

6. To evaluate the effectiveness of measures intended to minimize the risk of injury to occupants of vehicles which strike roadside objects.

7. To assess the extent and significance of the use of alcohol by the drivers, riders and pedestrians involved in accidents.

3. SAMPLING PROCEDURE

This discussion of the sampling procedure which was developed for the study is presented here in detail because it is not dealt with in any of the other reports in the series.

3.1 THE DESIGN OF THE SAMPLING PROCEDURE

We chose to study a sample of accidents because it was clearly impractical to investigate every accident. The sample was selected in two stages: the population to be sampled was defined, then a sampling procedure was developed to provide a sample representative of the whole, by time of day and day of week.

THE POPULATION SAMPLED

This population was defined as all road accidents to which an ambulance was called in the central section of metropolitan Adelaide in the twelve-month period from March 23,1976.

Accidents to which an ambulance was called were chosen for two reasons. The first was that an efficient notification system was available. As soon as an ambulance was dispatched to the site of a road accident our research team was notified. The second reason was that one of the purposes of the study was to investigate injury-producing accidents, and the ambulance-attended cases were well suited to this purpose. As it happened, the ambulance was not required at 22 per cent of the accidents to which it was called in the study area during the year of data collection. This meant that some accidents which essentially resulted only in damage to property were included in the study, thereby minimizing the risk of underestimating the value of some safety devices, such as seat belts, which can, by virtue of their effectiveness in preventing injury, 'select themselves out' of an investigation which relies solely on the presence of at least one injured person for an accident to be included in the study.

The second stage of the sampling procedure involved the selection of a representative sample of the accidents to which an ambulance was called. The criteria for representativeness were time of day and day of week. This information was obtained from the log sheets maintained by the St. John Ambulance radio controllers for the years 1973 and 1975, and an on-call schedule was developed to obtain a ten per cent sample which would have a time distribution similar to that of the population of accidents which was to be sampled. The way in which this sampling procedure was developed, the recognized likely sources of bias, and the characteristics of the resulting sample, are discussed in the following section.

PRACTICAL LIMITATIONS

In general, it is desirable to attempt to obtain a statistically random sample because it is then possible to make valid use of statistical theory to assess the degree of reliability of any estimates that may be based on the data from that sample. In a study of this type, however, there are several practical considerations which prevent the adoption of random sampling techniques.

1. The research team cannot be expected to be on call 24 hours a day for a full year, consequently there is a need to give the research personnel advance notice of their working hours.

2. When a team is on call it must decide immediately whether an accident that has been reported to the ambulance is eligible for inclusion in the study. The average time taken for a team to reach the scene of the crash after having been notified by the ambulance radio was about eleven minutes.

3. It can take up to two hours to collect the necessary information at the scene of an accident and during this time it is entirely possible that other accidents may occur. These other accidents, therefore, cannot be sampled.

4. The accident rate varies by time of day, day of week and with weather conditions, among other factors. Some allowance can be made for variation by time of day and day of week, as was done in this study in the manner described later in this section. There will, of course, still be chance variation in the accident rate by time of day and day of week, and any variations due to changes in weather conditions are almost impossible to predict.

5. With a research team comprising three professionally-qualified members the standby cost is very high. It is therefore inefficient to go on call at times of low accident frequency, and it is also bad for the morale of the members of the team.

6. Despite the willing cooperation of the St. John Ambulance Radio Controllers there are times when they forget to notify the research team that a relevant accident has occurred.

7. Minor accidents, usually those at which the ambulance is not required, may be cleared up before the research team arrives at the scene. (In such cases the team abandoned its attempt to investigate the accident.)

8. Because it takes the research team longer to travel to accidents which occur close to the boundaries of the study area, minor accidents, of the type mentioned in 7. above, are more likely to be missed in those localities than they are if they occur close to the centre of the study area.

9. Objective selection criteria are essential if the researchers, however well motivated, are to avoid the natural tendency to bias their selection of accidents to be investigated towards those which are either interesting or convenient.

SAMPLING AREA

The geographical area covered by the survey was the central part of the metropolitan area, as described in the introduction, and, as such, was only part of the area served by the ambulance. This meant that the ambulance radio controller, on receiving a call for an ambulance to attend at the scene of a road accident, had to decide whether or not the accident was located within the research team's study area. There were several reasons why the study area was restricted in this way, but the two main ones were to ensure that the team would be able to arrive at the scene of the accident before, in most cases, the vehicles had been moved so that as few cases as possible would have to be abandoned for the reason noted in 7. above. The second reason, which is related to the first, was that the previous in-depth study covered the same area.

DEVELOPMENT OF A WORKING SCHEDULE

The sampling procedure which was adopted produced a schedule of working periods, or shifts, during which one of the two research teams was to be on call. An example of such a schedule is shown in Table 1. In general, for about the first six months of the study the teams were instructed to investigate only the first accident which occurred during the time period of that shift. For the remainder of the study they were instructed to investigate the first accident and then the next accident to occur after their on site investigation of the first accident had been completed. If the stipulated number of accidents to be investigated (one or two) did not occur by the end of the time period specified in the shift then the team went off duty. If an accident occurred towards the end of a shift, then the team continued working until they had completed their investigations at the scene.

The on call shifts were selected in a manner which it was calculated would result in a sample which was representative of the population of accidents by time of day and day of week. The theoretical model which was assumed as a basis for the selection of these shifts was that accidents occur as a Poisson process with a known time-dependent rate. If the rate is denoted by $\lambda(t)$ then the probability of an accident in the time period from t to $t + \delta t$ is approximately $\lambda(t)\delta t$ when δt is small.

A shift was specified by the time period when it was to be worked and the maximum number of accidents which were to be investigated during the time period. Given an assumed accident rate and a distribution of the length of time required to complete an on site investigation of an accident, the expected accident sampling rate could be computed for any series of shifts. In this way a schedule of shifts was selected so that the expected distribution of times of accidents in the sample was similar to that in the accident population, and thereby representative according to the stated criteria. A computer programme was written in BASIC to perform this task by means of discrete approximations.

Some insight into these calculations can be gained by considering an example. For accident rates of .1, .1, .1, .1, .2, .2, .2, .1, .1, .1 per quarter hour for successive quarter hour periods together with equal probability for service times (times to complete the on site investigations) of 1, 1¼ and 1½ hours, then the probabilities that the first accident occurs in the sequential quarter-hour periods are .1, .09, .081. .0729, .1312, .1050, .0840, .0302 and .0272. The probability that an accident has occurred and been investigated can be computed for each time interval and then the probability of a second accident being investigated can be computed. The expected numbers of accidents which are likely to be attended in these quarter hour periods, if a maximum of two accidents per shift are to be attended, are .1, .09. .081, .0729, .1312, .1116, .1020, .0498, .0530 and .0572.

Expected rates for the study period were estimated in advance from 1973 and 1975 data on ambulance calls. The time required to complete an on site investigation was taken to be two hours, with no variability. The theoretical model is not very sensitive to variations in this service time and precise data on such variations was not available before the study started.

It was decided not to sample accidents at times when the accident rate could be expected to be very low. The times which were not sampled were changed

TABLE 1: EXAMPLE OF WORKING SCHEDULE

TEAM 'A'	OCTOBER	TEAM 'B'
FOLLOW UP	MON 4	1245 - 1745
OFF	TUES 5	0700 - 1230/1245 - 1815
1615 - 1915/2000 - 0100	WED 6	FOLLOW UP
1215 - 1645/1700 - 2030	THURS 7	OFF DUTY
2000 - 2330	FRI 8	0700 - 1300
OFF DUTY	SAT 9	OFF DUTY
OFF DUTY	SUN 10	OFF DUTY
OFF DUTY	MON 11	2230 - 0200
FOLLOW UP	TUES 12	1745 - 2245
2015 - 0145	WED 13	FOLLOW UP
2345 - 0400	THURS 14	OFF DUTY
OFF DUTY	FRI 15	2230 - 0130
1600 - 1900/1930 - 2300	SAT 16	/0145 - 0500
1030 - 1630	SUN 17	OFF DUTY
FOLLOW UP	MON 18	1500 - 1830
OFF DUTY	TUES 19	1645 - 2145
1930 - 2400	WED 20	1000 - 1600
OFF DUTY	THURS 21	2245 - 0400
0700 - 1200	FRI 22	2030 - 2400
1300 - 1630	SAT 23	OFF DUTY
0030 - 0600/1445 - 1945	SUN 24	2130 - 0200
FOLLOW UP	MON 25	OFF DUTY
FOLLOW UP	TUES 26	2000 - 0200
0830 - 1430/1500 - 1900	WED 27	FOLLOW UP
2030 - 0100	THURS 28	OFF DUTY
OFF DUTY	FRI 29	OFF DUTY
0045 - 0500/1845 - 2145/ 2245 - 0215	SAT 30	0700 - 1230/1230 - 1630
OFF DUTY	SUN 31	1130 - 1630/1630 - 2130
	NOVEMBER	
OFF DUTY	MON 1	FOLLOW UP
FOLLOW UP	TUES 2	2100 - 0300
1145 - 1715/2030 - 0330	WED 3	OFF DUTY
OFF DUTY	THURS 4	OFF DUTY
1045 - 1545	FRI 5	1945 - 0115
2015 - 0015/	SAT 6	0130 - 0500/1800 - 2100
/0030 - 0600	SUN 7	1745 - 2345

TABLE 2: TIME PERIODS NOT SAMPLED

Day of Week	Time Period Not Sampled
Sunday	6.00 a.m. - 9.00 a.m.
Monday	1.00 a.m. - 6.45 a.m.
Tuesday	1.30 a.m. - 6.45 a.m.
Wednesday	2.00 a.m. - 6.45 a.m.
Thursday	2.30 a.m. - 6.45 a.m.
Friday	3.00 a.m. - 6.45 a.m.
Saturday	4.00 a.m. - 6.45 a.m.

slightly during the period of the study, but in general, accidents were not sampled during the early morning periods.

PERFORMANCE OF PLANNED WORKING SCHEDULE

Initially a list of 420 shifts was drawn up. This number was selected largely because it was intended to investigate 400 accidents during the one year period. Most of these shifts were ones where a maximum of one accident was to be sampled. However, as the study progressed it became apparent that the accident rate was not as high as had been expected. This meant that no accident was investigated in many more shifts than had been predicted by the theoretical model. This was probably due mainly to a reduced frequency of accidents, possibly associated with the fact that the study was conducted during a particularly dry year, but also, in part, to the occasional failure of the ambulance radio controller to notify the study team of the occurrence of an accident. Midway through the study an assessment was made of the frequency with which accidents which should have been investigated were missed and an attempt was made to find out why this had happened. The results are shown in Table 3.

TABLE 3: REASONS FOR FAILURE TO INVESTIGATE AN ACCIDENT*

Reason for Failure to Investigate Accident	No. of Accidents	
Research Team Not Notified:		43
Accident close to start of shift	8	
Ambulance despatched by phone call from central controller	13	
Accident occurred at change of shifts for radio operators	9	
Accidents occurred in quick succession	10	
Accident occurred near boundary of study area	3	
Reason Unknown:		3
Total		46

* Based on the first half of the survey.

When a team was on call they continuously monitored the ambulance radio, and generally heard the radio controller despatch an ambulance to an accident before the controller called them specifically. At nights and weekends, when relatively few ambulances are on the road at any given time, it is usual for an ambulance to be despatched from one of the depots and this is done by telephone and not by two-way radio. This meant that it was possible for an ambulance to be despatched to an accident without the research team knowing, even though they may have been monitoring the radio transmission. Accidents which occurred near the start of an on call period or near the change of shift for the ambulance radio operators were missed when the radio controller either failed to realise that the team had come on duty or the outgoing controller failed to advise his replacement to call the research team should an accident occur. Accidents near boundaries of the survey area were found to have been missed because some radio controllers were either not clear about the precise definition of these boundaries or the information which they had received on the location of the accident was not sufficiently precise. When a number of accidents occurred in quick succession the radio controller is, naturally enough, extremely busy and under such circumstances it is not surprising that some of them did not remember to notify the research team. The accidents which were missed for no known reason may have been ones in which the radio controller simply forgot to notify the team who, in turn, were not monitoring the ambulance radio carefully enough, or they may have been cases at which the research team arrived too late to be able to commence an at-the-scene investigation.

After approximately six months a revised list of shifts, with most shifts being for a maximum of two accidents, was substituted. This list of shifts was used for the remainder of the survey.

3.2 CHARACTERISTICS OF THE SAMPLE

Overall, the sampling scheme proved to be satisfactory, with 304, or 8.0 per cent, of the 3,820 ambulance-attended accidents being investigated. Figures 2 and 3 show the distributions by time of day and day of week of all such accidents which occurred during the study period and of those which were investigated by the research teams. The time of day, for all days of the week, distributions are shown in Figures 4 and 5. The information shown in these figures is presented in tabular form, in greater detail, in Appendix A, together with the day of week distributions. Chi-square tests indicate that the sample obtained can reasonably be assumed to have been drawn at random from the population of accidents. A random sample is not necessarily adequately representative, but apart from an excess of accidents sampled on Mondays the aim of achieving a time distribution in the sample which was similar to that in the population was satisfied.

UNRECORDED ACCIDENTS

The ambulance radio operator's log sheets contained no record of 20 vehicle accidents which were attended by the Road Accident Research Unit. Some of these accidents were recorded on the log sheets as other types of accidents rather than as vehicle accidents, and others were not recorded at all. The omission of any record is entirely possible in the situation in which an ambulance happens across an accident which it reports but at which its assistance is not required to transport people to hospital, or when an ambulance is despatched to an accident and is then diverted to another job on finding that it is not required at the accident scene.

PUBLIC HOLIDAYS

The research teams generally did not work on public holidays. It was considered that the sample of accidents on public holidays would be too small for any inferences to be made about differences between the types of accidents which may occur on public holidays and those which may occur on other days. Of the 3,820 accidents to which an ambulance was called during the period of the study, 80 (2.1 per cent) were on public holidays, so 6.4 accidents would be expected to be included in a random sample of 304 accidents. However, only two accidents on public holidays were included in the sample.

WET WEATHER ACCIDENTS

It was anticipated that the sampling procedure would tend to include fewer wet weather accidents than would be expected for a random sample. This was because an artificial, but necessary, limitation was placed on the number of accidents which could be investigated in any shift. This limitation could cause the increase in the rate of accident investigation during wet weather to be less than the increase in the accident rate. In order to evaluate the effect of this possible source of bias, data on hourly rainfall for central Adelaide was obtained from the Commonwealth Bureau of Meteorology. Rainfall was recorded for 415 of the 8,780 hours of the 365 days from the 23 March, 1976, to the 22 March, 1977. There were 240 accidents during these hours of rainfall and twelve of these accidents were included in the sample of 304 accidents. That 240 out of 3,820 accidents occurred during 415 out of 8,780 hours indicates that the accident rate was slightly higher during hours in which rainfall was recorded. This increase of 35 per cent in accident frequency in wet weather is unlikely to have been due to chance. The proportion of wet weather accidents in the sample (3.9 per cent) is lower than that in those accidents which were not included in the

FIGURE 2: Accident population by time of day and day of week.

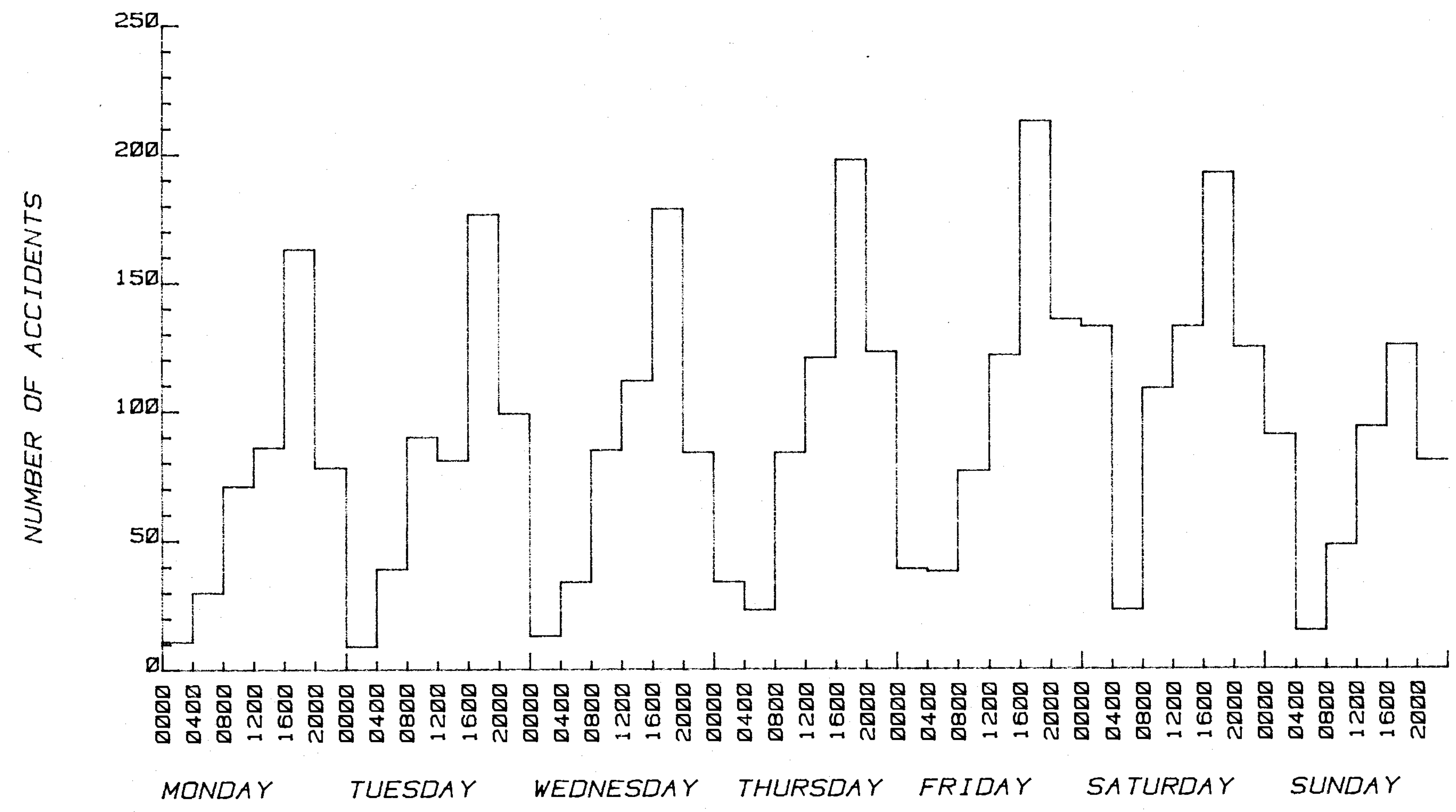


FIGURE 3: Accident sample by time of day and day of week.

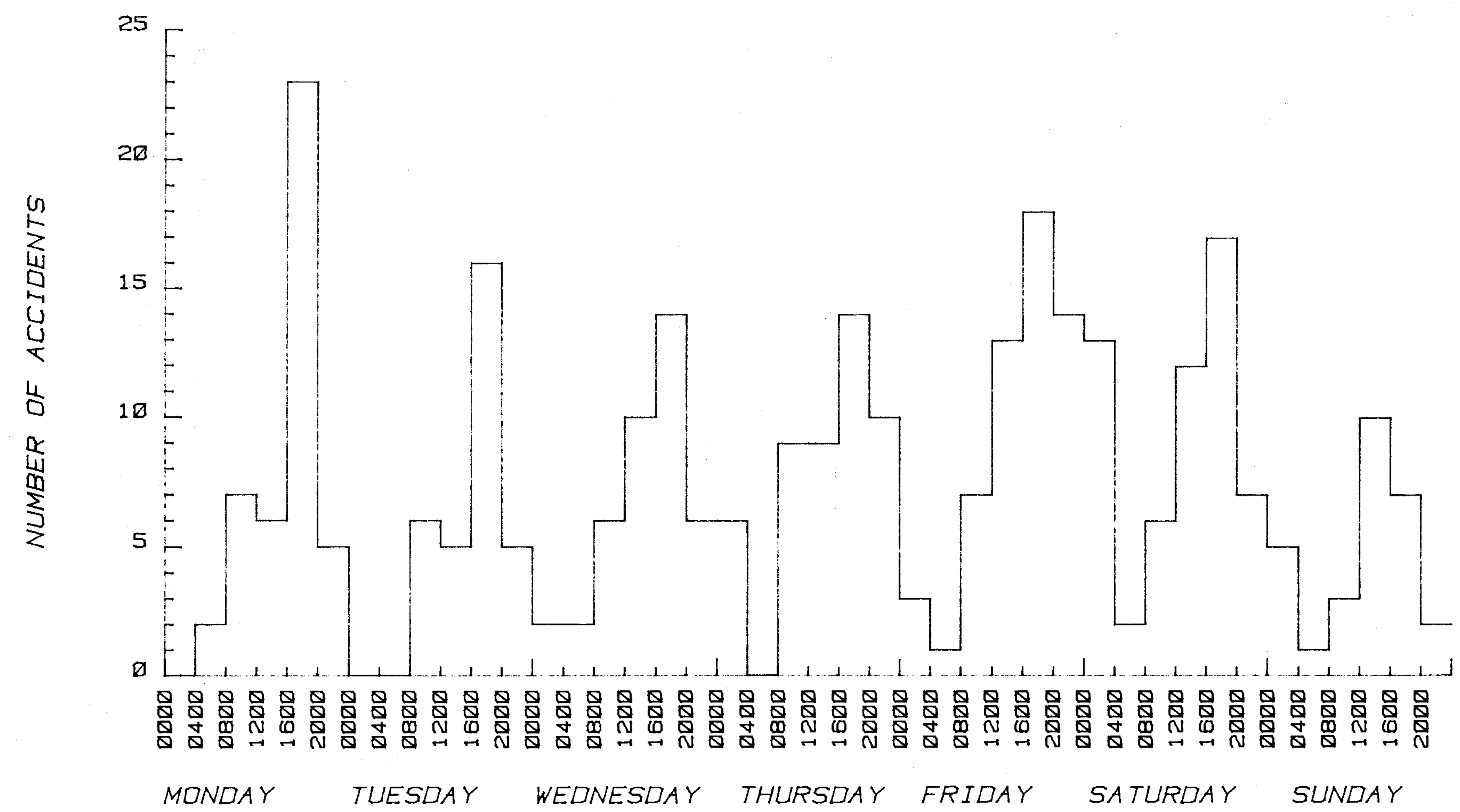


FIGURE 4: Accident population by time of day.

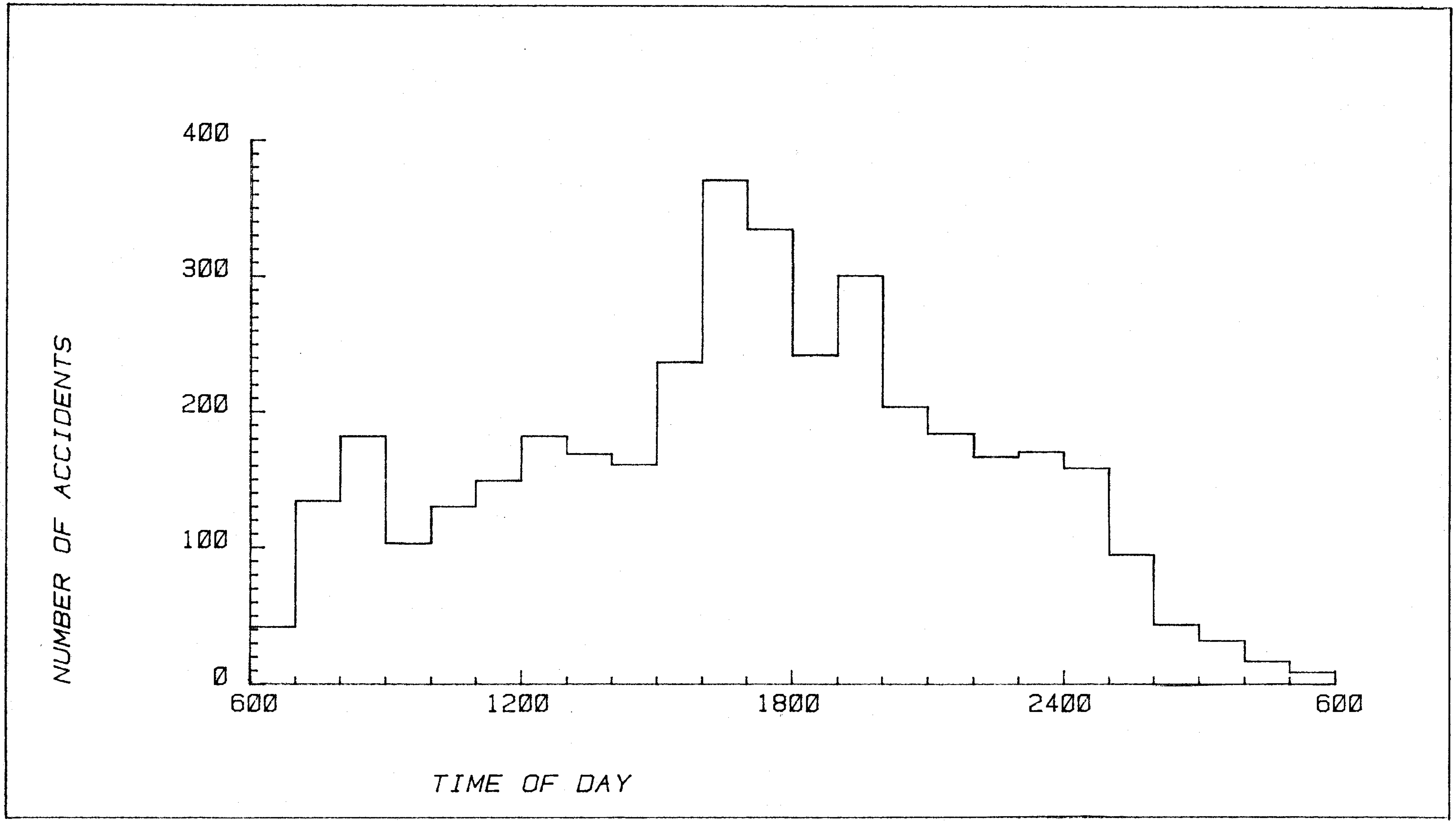
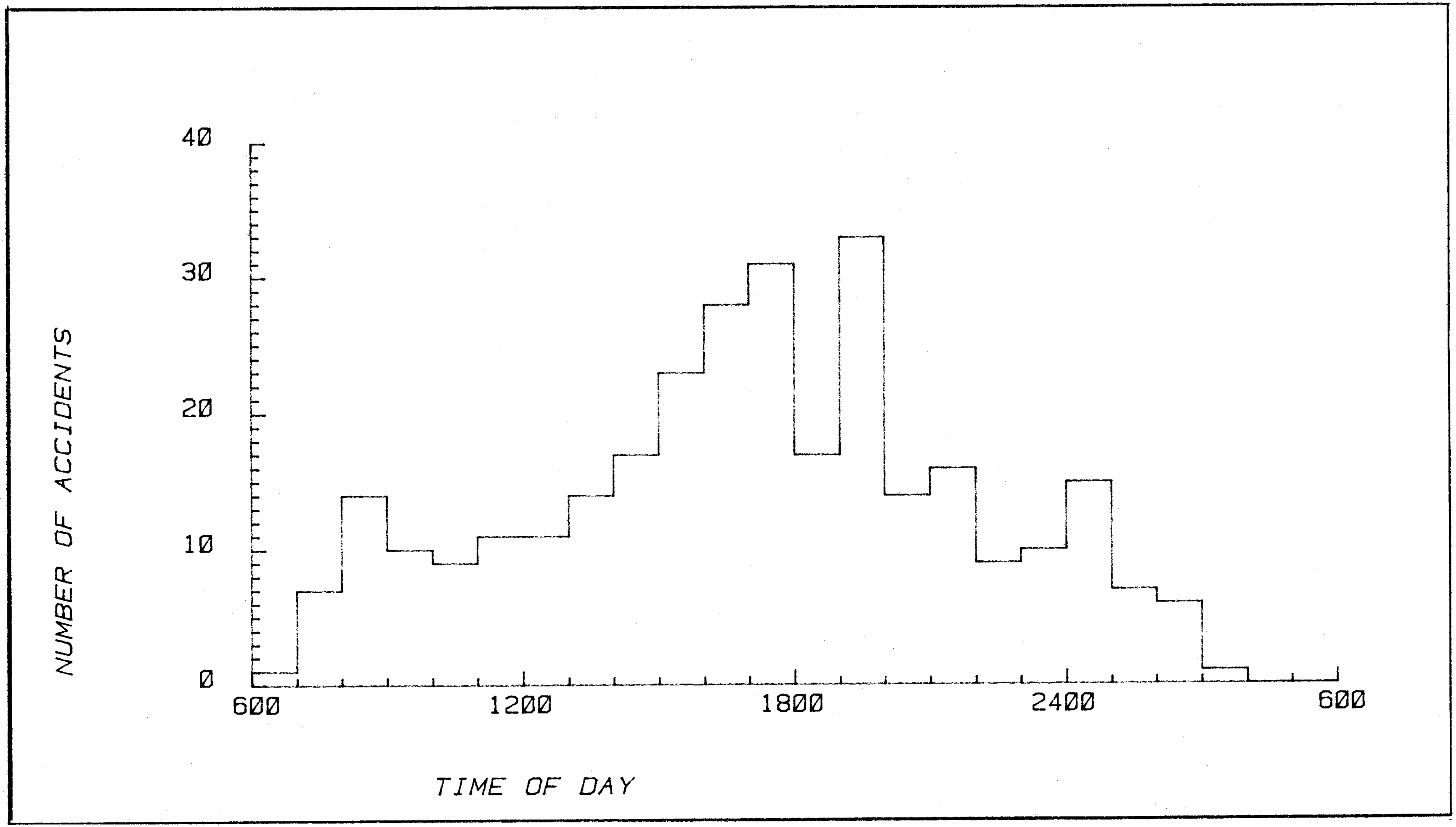


FIGURE 5: Accident sample by time of day.



sample (6.5 per cent), but this difference is not statistically significant (Table 4).

3.3 CONCLUSIONS ON THE NATURE OF THE SAMPLE

Although there are many other comparisons which could be made between the sample and the population of accidents, the results of the above tests suggest that the sampling procedure achieved its aim of yielding a representative sample and one which may, without risk of serious error, be analysed as if it were a random sample of accidents to which an ambulance was called.

TABLE 4: NUMBER OF ACCIDENTS DURING HOURS IN WHICH RAINFALL WAS RECORDED FOR THE SAMPLE AND THE POPULATION

	Number of Accidents		Total Number of Accidents
	Rain Recorded	No Rain Recorded	
In Sample	12 (3.9%)	292	304
Not in Sample	228 (6.5%)	3288	3516
TOTAL	240 (6.3%)	3580	3820

Chi-square = 3.06, $p > .05$.

4. METHOD OF INVESTIGATION

4.1 FIELD WORK

The investigation of an accident at the scene was carried out by one of two teams each of which comprised a medical officer, an engineer and a psychologist. These teams were on call for accidents according to the sampling schedule which has been described in the preceding section of this report. After a team went on duty the ambulance radio controller notified them of the first vehicle accident to occur.

AT THE SCENE

On arriving at the scene of the accident, an average of 11 minutes after the call was received, the medical officer first checked to ensure that the ambulance attendants did not require his assistance (Figure 6) and then, together with the psychologist, located those people who were involved in the accident but who were not injured. Having identified each participant in the accident the investigators then asked them to describe the events leading up to the crash. Their age, height and weight, where they were seated in the car, and whether they claimed to be wearing seat belts were also noted.

Both the psychologist and the medical officer talked with each of the drivers at the scene in order to get a clear understanding of what each driver thought had happened immediately before the crash and also to observe his physical condition. In particular, they tried to identify those persons whose driving ability may have been affected by alcohol or other drugs, including prescription drugs, or by sickness or fatigue. Each uninjured driver was asked to blow into a breath alcohol meter, and arrangements were made for the psychologist to interview him in his home at a later date.

The psychologist also examined the general accident scene, looking for any factors, particularly those related to the road traffic environment, which may have had some bearing on the causation of the accident or on the resulting injuries and property damage.

The engineering member of the team on arriving at the accident site first photographed the general scene, and, having marked the rest positions of the vehicles on the roadway, photographed both the exterior and the interior of each vehicle (Figures 7, 8 and 9). The make, model, and registration number were recorded, together with the name of the towing service which was given the authority to remove the vehicle from the scene of the accident. The engineer then conducted an initial examination of each vehicle paying particular attention to recording the condition of those features which could change either with time or during the removal of the vehicle from the scene.

When the crashed vehicles and general debris had been removed and the accident site had been cleared a plan was then made of the location showing the principal roadway and traffic control features and the skid marks and rest positions of the vehicles. During daylight hours overhead photographs were taken of the scene often before the vehicles were moved by means of a camera mounted on the top of a 12 metre high telescopic mast (Figure 10). This mast which is air actuated can be erected in less than 2 minutes. In the case of a night-time accident in which there were relatively complex road markings, such as skid marks and gouge marks in the road surface, the engineer returned on the following day to obtain an overhead photograph, having marked the outline of the skid marks with yellow crayon during his first visit to the scene immediately after the crash.

FOLLOW-UP INVESTIGATIONS: IN HOSPITAL

In most of the accidents one or more of the participants was taken to a hospital by ambulance. The medical officer followed them to the Casualty Department where he examined them and, with their permission, photographed their injuries. When X-Rays were taken photographic records were made of these also. The treatment required by each person was noted and if they were admitted to hospital their progress through to the time that they were discharged was monitored by the medical officer.

Each person over the age of 14 years who was taken to hospital for treatment of injury sustained in a road accident is by law required to allow a blood sample to be taken so that a blood alcohol estimation can be made. The results of these blood alcohol analyses were made available to the research team.

FOLLOW-UP INVESTIGATIONS: INTERVIEWS

The follow-up interview which the psychologist conducted with the drivers, riders or pedestrians included a review of the person's recollection of the events leading up to the accidents, and his understanding of and attitudes towards various safety measures. Self-reported accident and violation records, licensing status and driving experience were other items of information obtained during the interviews, together with the results of tests for colour blindness and static visual acuity.

FOLLOW-UP INVESTIGATIONS: THE VEHICLE

The engineer conducted a follow-up examination of each vehicle, usually in the towing service's depot or a crash repair shop within 24 hours of the crash. These examinations usually took 2 to 3 hours per vehicle and included the making of a detailed record of the specifications and conditions of the equipment on the vehicle and of the damage to the vehicle structure resulting from the accident. Overhead photography was used again here (Figure 11). A careful search was also made of the interior of the passenger compartment to identify any evidence of occupant contact. This was done in order to enable each individual injury to be related to the part of the vehicle which caused it.

FOLLOW-UP INVESTIGATION: ROAD AND TRAFFIC ENVIRONMENT

In addition to the investigation of road and traffic features at the time of the accident, further visits were made to inspect the characteristics of each location and to observe customary traffic behaviour. Such observations are not possible immediately after a crash because the accident itself is often a considerable disturbance to the usual traffic conditions. Wherever relevant, normal traffic speeds were measured using a radar meter, and locked wheel skid tests were performed with a vehicle at most of those sites at which skidding had occurred.

Towards the end of the data collection period additional funds were made available to permit the recruitment of a traffic engineer who attended the remaining accidents with the research team and then returned to each of the sites of the accidents which had been investigated previously in order to gather additional information relating to road and traffic factors.

4.2 DATA RECORDING AND PROCESSING

The information collected as described above was recorded on data sheets in one of three files: Medical, Psychological or Engineering. These files, together with an average of 40 colour slides, formed the basic record of each accident.

Much of the data which was recorded by the investigators was then coded in a form suitable for computer storage, retrieval and analysis. Seven codes were developed for this purpose. The first code, the General Accident Record, contains information relating to the type of accident, the time at which it occurred, lighting and weather conditions. The second code was developed for use primarily as a means of identifying cases in which certain road and traffic factors were relevant to either the causation or the consequences of the accident rather than as a means of recording the presence of such factors regardless of whether or not they were relevant in that particular case. The third code contains information relating to passenger cars and passenger car derivatives, such as utilities and panel vans. Information relating to both accident and injury causation is included in this code. The fourth code contains a separate record for each person who is involved in each accident. It is primarily concerned with crash injury factors, and each injury is described in terms of the body region and organ affected, the nature and severity of the lesion and the object which caused the injury. Some basic descriptors of each individual such as age, sex, height and weight are also included together with what type of road user they were (pedestrian, motorcyclist, car occupant etc.), their seated position in the vehicle, if relevant, and whether or not safety devices were available and were used. The consequences of their injuries are also recorded in terms of hospitalization, temporary restriction of activities and any residual disability. The fifth code deals with the characteristics of the active participants, a term which is used in this study to identify those whose actions could have played a role in the causation of the crash in the sense that they were nominally at least in control of a vehicle or were a pedestrian. Most of this information was collected by the psychologist or by the medical officer, either at the scene of the crash or during the follow-up interview, and a separate record was created for each active participant. The remaining two codes are analogous to the code for passenger cars and passenger car derivatives. One of these codes deals with commercial vehicles, a term which is used in a very general sense to include a wide range of vehicles other than passenger cars; from multi-purpose passenger vehicles such as the Land Rover or Volkswagen Kombi Van through to heavy trucks, semi-trailers and metropolitan transit buses. The final code deals with motorcycle data and covers a similar range of information to that in the car code. Each of these codes, together with a listing of the coded data, are assembled in another report in this series, and the items of information covered by each code are presented in Appendix B of this report.

More than 1,000 separate items of information can be coded in this way, and the coded record for a two-car collision with four persons involved can contain over 1,700 data items.

The results of much of the work of the traffic engineer are presented in the form of scale plans of each accident site showing also the positions of the vehicles before, during and after the collision (Figure 12). Some of these plans are reproduced in the accompanying series of reports dealing with the specific type of accidents or with selected aspects of these accidents, and a separate report in this series contains, for each accident, a

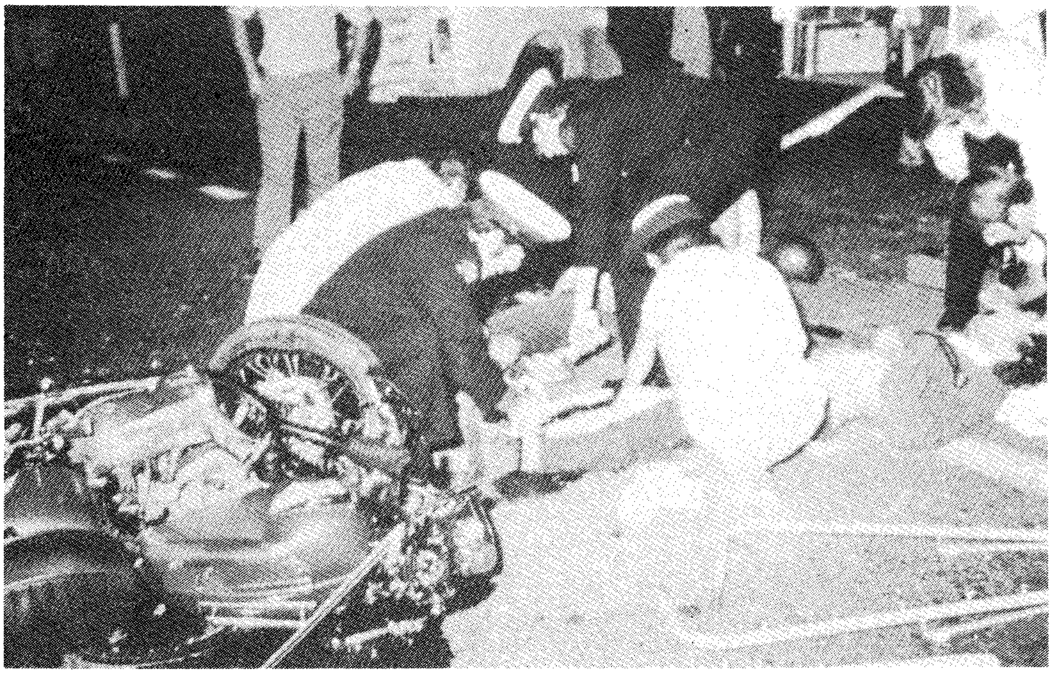


FIGURE 6: Research Unit Medical Officer working with St. John Ambulance personnel at the scene of a motorcycle/car collision.

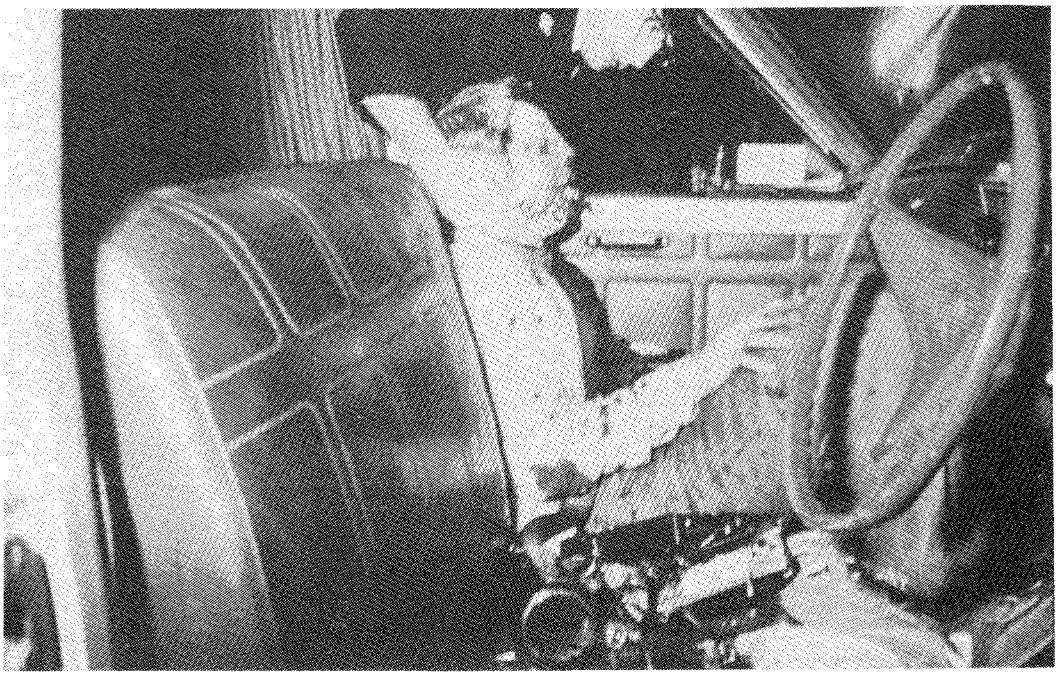


FIGURE 7: St. John Ambulance Officer maintaining an airway for a passenger with severe facial injuries. Accident 096.

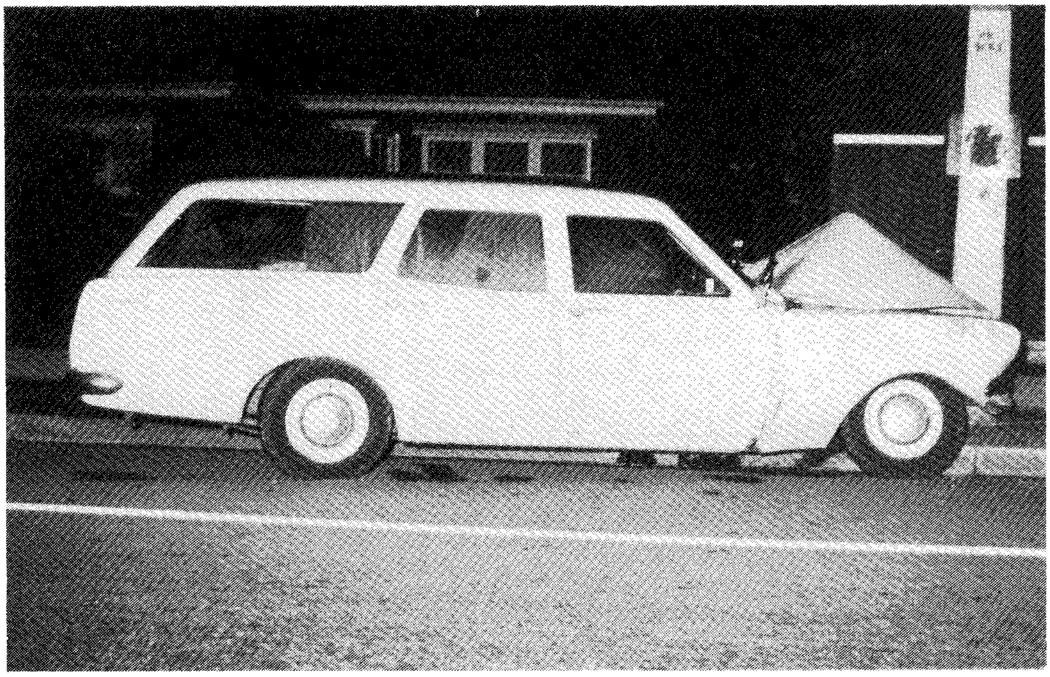


FIGURE 8: Collision with utility pole.
Accident 096.

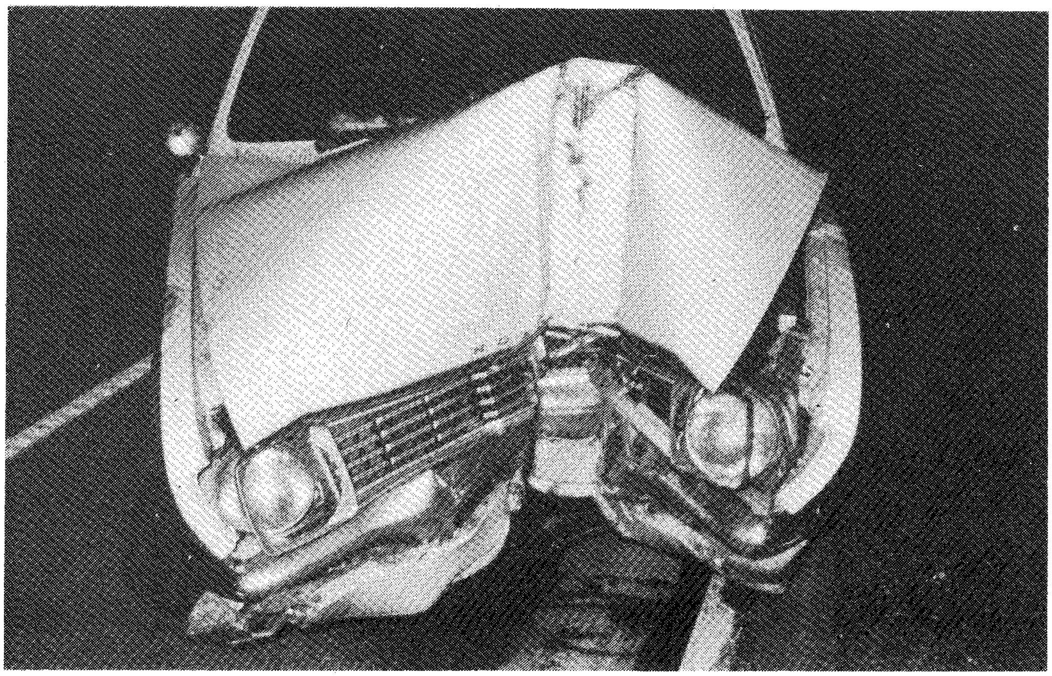


FIGURE 9: Damage to car shown in Figure 8.
(See also Figure 11.)

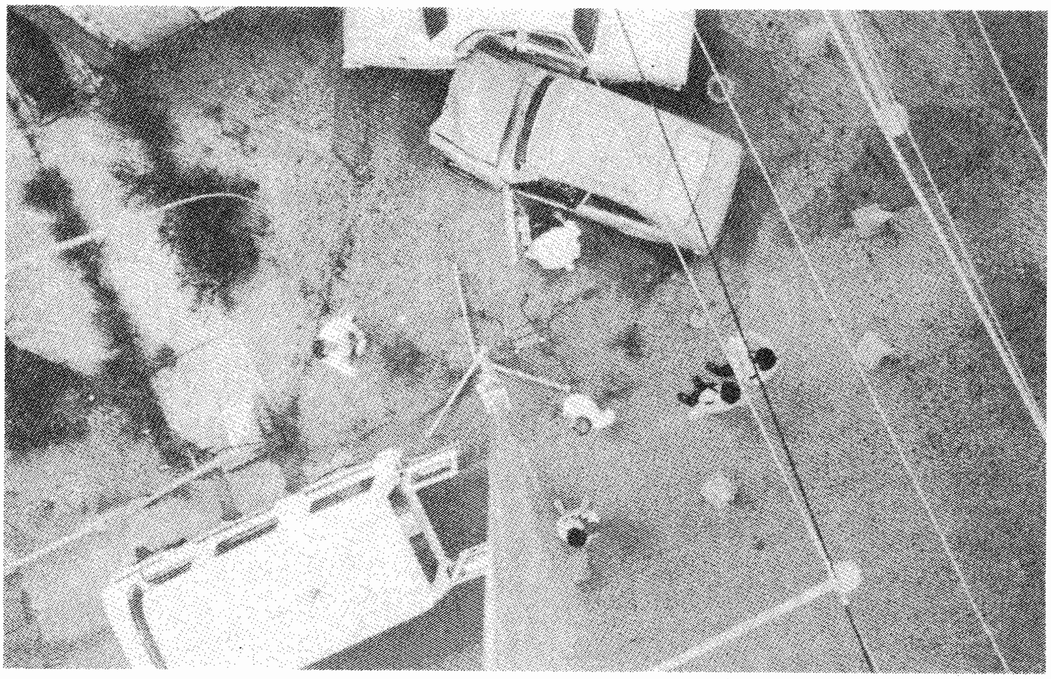


FIGURE 10: Cars in final rest positions following a collision at an uncontrolled intersection. Accident 017.

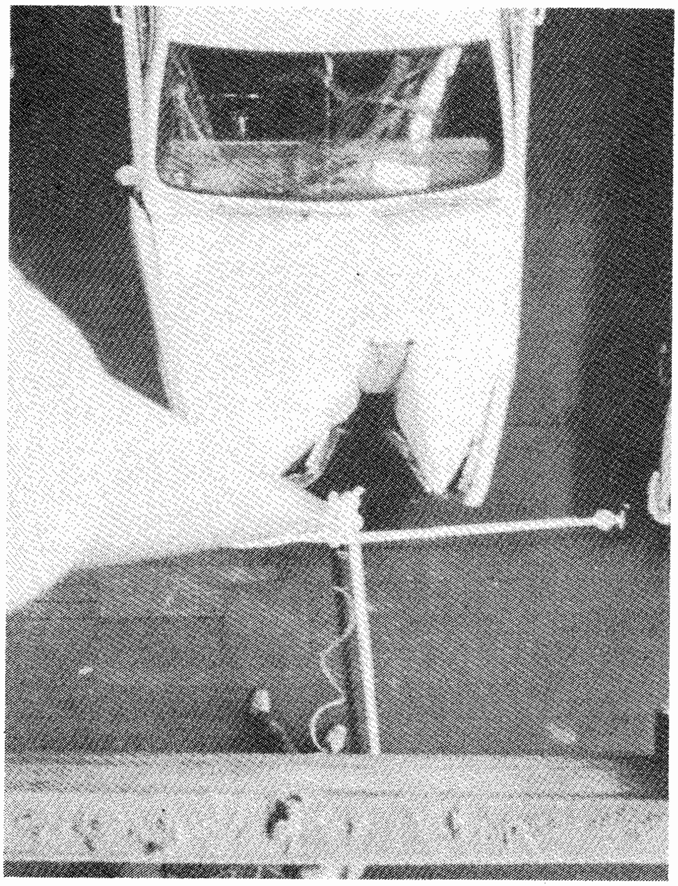


FIGURE 11: Overhead photograph taken in crash repair shop of the car shown in Figures 7,8 and 9.

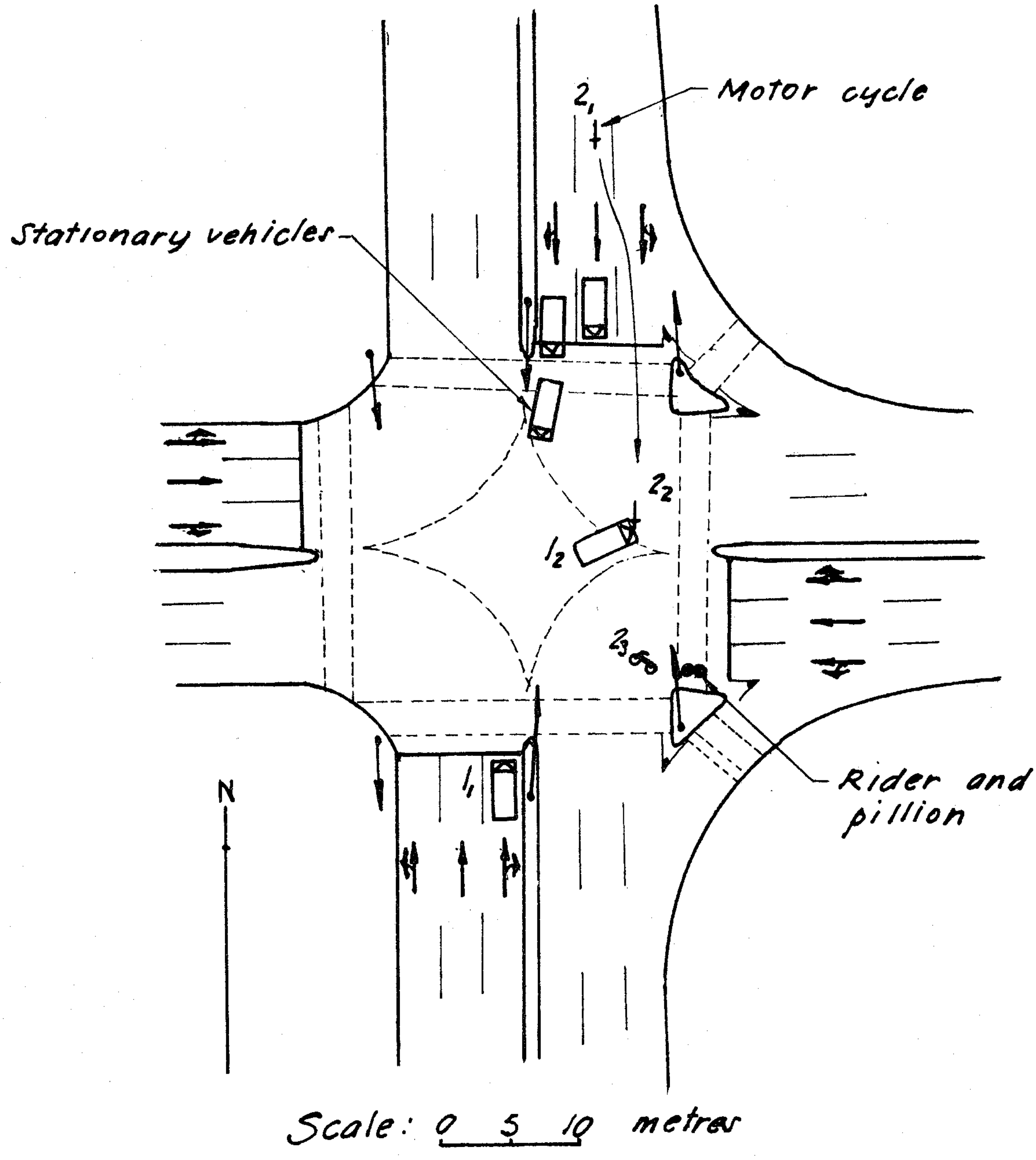


FIGURE 12: Accident 095.

scale plan together with a brief summary of the accident.

4.3 EQUIPMENT

VEHICLES

Two vehicles were used by the team which was on-call, to enable the medical officer to proceed independently to the hospital before the other team members had completed their investigations at the scene of the accident (Figure 13).

All of the equipment, other than some of the first aid supplies, was carried in a Bedford van in such a way that it was readily accessible at the scene of an accident (Figure 14).

Two other vehicles, a station wagon and a small car, were used by the staff members when out on follow-up investigations. The station wagon was fitted out to carry a telescopic mast and mounting tripod, as was the van, for use in overhead photography.

PHOTOGRAPHY

Four 35mm cameras were used: two Minolta (SRT 100 and 101), a Topcon Super DM and a Topcon IC-1. One Minolta, fitted with a Tamron 38-100mm zoom lens, was used at the scene of the accident, and the Topcon IC-1 was carried by the medical officer for use in the hospital.

The Topcon Super DM, fitted with a 28mm lens, was used solely for overhead photography and was carried already attached to the mounting bracket for the telescopic mast. This camera has a motor drive, which meant that the film was advanced one frame after the shutter was released by means of a bulb at the end of a 12 metre long plastic tube. This eliminated the need to lower the mast to advance the film (which was necessary when the second Minolta was used for overhead photography in follow-up investigations). By photographing a horizontal square grid with the camera mounted at the same angle as it was on the mast, a slide was obtained which showed the perspective distortion, and any lens distortion, which also affected photographs of skid marks, etc. on the road surface. This distortion could then be allowed for by mounting the two transparencies, the grid and the site photograph, together in the same mount and projecting this slide at an angle onto a white-board such that the image of the grid on the board was not distorted. The image of the skid marks and other site features could then be traced over on the white board and so a scale plan was obtained which, in turn, was photographed for storage and subsequent reproduction. This process proved to be far less time-consuming, more accurate, and much safer than conventional surveying methods.

Three electronic flash units were used: a National PE5650 at the scene of the accident, a Metz 218TR on follow-up investigations (for use inside crash repair shops and for interior views of vehicles) and a Sunpak Auto 28B for use in the hospital.

High-speed Ektachrome (ASA 160) was used throughout. It was chosen because of the speed of the film and because half-day processing was available.

The telescopic mast (Clark QT3/HP) is pneumatically operated, using a hand pump which is attached to the mast. Folding tripods were made to enable them to be stowed easily in the vehicle and also to facilitate the rapid erection of the mast (which can be done in less than two minutes). The camera could be raised to a height of 12 metres in calm conditions, but a height of about 8 metres was more often used.

BREATH ALCOHOL METERS

Two Alcolmeters, each the size of a pocket transistor radio, were used at the scene of the accident. These meters take a breath sample as the subject exhales through an open-ended plastic tube, and provide a read-out of the estimated blood alcohol level in 0.01 mgm per cent intervals up to 0.30.

MISCELLANEOUS EQUIPMENT

A comprehensive tool-kit and a trolley-style jack were carried in the van, together with safety equipment such as orange plastic cones which were illuminated internally at night.

FIGURE 13: Research vehicle: a Bedford CFS van.

FIGURE 14: Equipment stowed in Bedford van. Telescopic mast is on floor to right of centre, with its tripod strapped to the right side of the van. Step ladder was used to mount the camera on the mast. Miscellaneous items were carried in centre boxes.

5. TYPES OF ACCIDENTS INVESTIGATED

The aim in this section is to describe the ways in which certain terms are used when describing the results of the study and to give some indication of the nature and range of the items of information which are discussed in detail in other reports in the series. The term 'Traffic Unit' refers to any vehicle, including a pedal cycle, or to a pedestrian, and so reference is often made to 'Unit 1' or 'Unit 2', meaning 'Traffic Unit 1', etc. The word 'Participant' refers to any person who was physically involved in the accident. 'Active Participant' refers only to a participant who was in control of a vehicle, or who was a pedestrian.

5.1 TYPES OF TRAFFIC UNITS

The various types of traffic unit were categorised as follows:

Pedestrian
Pedal Cycle
Motorcycle
Light Truck
Medium Truck
Heavy Truck
Articulated Vehicle
Bus
Car or Car-Derivative
Other Type of Traffic Unit.

The category 'motorcycle' included motor scooters as well as the conventional motorcycle. Categories 'light, medium and heavy trucks' were defined by a combination of driver's licence requirements in South Australia and the weight categories for compliance with the Australian Design Rules for heavy vehicles. Consequently a light truck is defined as one of less than 1780 kg. and a heavy truck as being one which has a Gross Vehicle Mass of greater than 4,500 kg. The articulated vehicles in this study were all semi-trailers, and the vehicles categorized as 'bus' were all metropolitan transit buses. The category of 'car' or 'car-derivative' is again based on the classification used for determining the need for compliance with the relevant Australian Design Rules for Motor Vehicle Safety. A 'car-derivative' is, in general, a utility or panel van which is based on a passenger car. Only one vehicle was coded under the heading of other type of traffic unit and that was a commuter train. Table 5 lists the total numbers of these various types of traffic units which were included in the accidents investigated in this survey together with the number of accidents which included 1,2 or 3 or more of each type of traffic unit. Units per accident are listed in Table 6.

TABLE 5: TYPE OF TRAFFIC UNIT BY FREQUENCY OF ACCIDENT INVOLVEMENT

Type of Traffic Unit	Number of Units	Number per Accident 1	2	3	4	5	Total Accidents
Pedestrian	44	36	4	-	-	-	40
Pedal Cycle	22	22	-	-	-	-	22
Motorcycle	69	67	1	-	-	-	68
Light Truck	8	8	-	-	-	-	8
Medium Truck	8	8	-	-	-	-	8
Heavy Truck	6	6	-	-	-	-	6
Articulated Vehicle	5	5	-	-	-	-	5
Bus	3	3	-	-	-	-	3
Car	386	148	106	7	-	1	262
Train	1	1	-	-	-	-	1

TABLE 6: NUMBER OF TRAFFIC UNITS PER ACCIDENT

Number of Traffic Units	Number of Accidents
1	56 (18.4%)
2	230 (75.7%)
3	14 (4.6%)
4	3 (1.0%)
5	1 (0.3%)
TOTAL	304 (100.0%)

Information was coded on a traffic unit only if it was physically involved in the accident. There were some accidents in which another traffic unit played a role either as an obstruction to vision or by forcing one of the vehicles involved in the resulting accident to take avoiding action. Where this occurred it is indicated on the scale plan and summary for each accident.

5.2 TYPE OF ACCIDENT

The type of accident is classified, for most purposes in these reports, by using the same categories as were used for the type of traffic unit, with the addition of a ranking system. If a pedestrian is involved in the accident it is classified as a pedestrian accident regardless of the other type or types of traffic unit involved. The next category in the ranking is pedal cycle followed by motorcycle, light truck etc. through to car accident. The category 'other types of traffic unit' is not used when defining the type of accident. This method of classification is intended primarily to enable the ready identification of different classes of road user, but the ranking system is also derived from a consideration of the probability of injury to individuals associated with that particular type of traffic unit.

Table 7 shows the association between the type of accident, as categorized in this way, and the first significant event in the accident. For example there were three accidents in which a pedestrian was struck by a motorcycle, and six accidents in which a motorcycle slid down without any prior collision. The events listed as 'other non-collision' comprise three accidents in which a pedal cyclist fell off, one in which the load shifted on a semi-trailer resulting in the vehicle rolling over, and two accidents involving cars. In one of these car accidents a passenger fell from the back of a panel van and in the other a modified rear suspension failed resulting in loss of control of the vehicle and subsequent rollover.

CLASSIFICATION BY LOCATION AND TYPE OF TRAFFIC CONTROL

The type of accident can also be classified according to the characteristics of the location and of the traffic controls, if any. Table 8 lists the frequency with which selected categories of location and traffic control appeared in the accidents in this survey.

Forty-seven per cent of the 304 accidents occurred in a midblock section of road. These accidents included almost all of the pedestrian accidents in this series and one accident which was in effect in a cul-de-sac created by a construction of a road closure. Accidents at uncontrolled intersections were the next most common type, using this classification. There were 64 collisions between vehicles at uncontrolled intersections or junctions and 1 single vehicle accident. These 65 accidents comprise 21 per cent of the study sample. The 50 accidents at signalised intersections include 2 single vehicle accidents and one collision between a car and a train at a level crossing. Three of the 46 accidents at intersections controlled by either a STOP or a GIVE WAY sign were single vehicle crashes, all involving motorcycles. The remainder were all collisions between vehicles.

CLASSIFICATION BY TRAFFIC UNIT MOVEMENTS

The most common type of traffic unit movement in these 304 accidents was a collision at a four-way intersection between two vehicles proceeding straight ahead but on intersecting paths. This category was followed by collisions at intersections in which one vehicle turns right across the path of an oncoming through vehicle. These two groups of traffic unit movements

TABLE 7: FIRST EVENT BY TYPE OF ACCIDENT

First Event	Type of Accident									Total
	Pedestrian	Pedal Cycle	Motor-Cycle	Light Truck	Medium Truck	Heavy Truck	Articulated Vehicle	Bus	Car or car derivative	
Rollover (or slide down)			6						2	8
Other Non-Collision Events		3					1		2	6
Collision with:										
Motorcycle	3	2	1							6
Light Truck	2									2
Medium Truck	1									1
Heavy Truck	1		2							3
Articulated Vehicle	1							1		2
Bus	1									1
Car or Car-derivative	31	16	48	4	3	6	3	1	125	237
Utility Pole			1						17	18
Tree									10	10
Other roadside object		1	3						3	7
Train									1	1
Other collision event			2							2
TOTAL	40	22	63	4	3	6	4	2	160	304

TABLE 8: TYPE OF LOCATION AND TRAFFIC CONTROLS

Type of Traffic Control	Type of Location Midblock	Intersection	Total
None	140	65	205
Sign	-	46	46
Signals	3	50	53
TOTAL	143	161	304

comprise more than one-third of all of the accidents in the study. Single vehicle crashes in which the vehicle ran off the road to the left were the next most common type of accident, followed by collisions between two vehicles at four-way intersections with one vehicle turning right and colliding with a vehicle entering the intersection from its right, and then pedestrian accidents in which the pedestrian enters the roadway on the driver's left.

5.3 CHARACTERISTICS OF THE ACTIVE PARTICIPANTS

As has been noted previously, the term 'active participant' is used here to denote a participant who was in control of a vehicle, whether it was a pedal cycle, motorcycle, car or heavy vehicle, or who was a pedestrian. Table 9 shows the frequency with which the various categories of active participants were represented in this survey. The three most common categories were car drivers 70.4%, motorcyclists 12.8% and pedestrians 8%. The age and sex distributions for each of these types of active participants, grouping together drivers of heavy trucks, articulated vehicles, buses and the one driver of a train are also shown in this Table. The active participants under the age of sixteen years were, of course, almost all pedestrians or pedal cyclists. The motorcyclists were predominantly males under 30 years of age, and the drivers of the heavy vehicles which were involved in accidents in this survey were all males with none being over 35 years of age.

ALCOHOL INTOXICATION

Alcohol intoxication is recognized as being one of the most important factors in the causation of road accidents, and so the information collected in this study on blood alcohol levels of the active participants (drivers, riders and pedestrians) is of particular interest.

Alcohol Involvement on an Accident Basis:

In at least 28 per cent of the 304 accidents one or more of the active participants had been drinking (Table 10). There were 48 accidents in which a BAC reading was not obtained for all of the persons actively involved, and in which the BAC levels which were obtained were zero. However, as noted at the foot of Table 10 subjective assessment of many of these drivers for whom a BAC reading was not obtained suggests that the percentages listed in that Table are a slight under-estimate of the true percentage of drinking drivers in this sample of crashes.

Of those accidents for which the BAC levels were known for all active participants 29 per cent had one or more participants above .05, 24 per cent had one or more above .08 and 13 per cent had at least one participant above .15. The involvement of alcohol was least marked in pedal cycle accidents in which 16 per cent of the drivers or cyclists involved had been drinking and none of these persons had a BAC level above .05. This is partly a reflection of the fact that young children are frequently involved as cyclists in this type of accident. Nineteen per cent of the pedestrian accidents involved a driver or a pedestrian whose BAC level was above .08. This percentage is higher than the corresponding figure of 15 per cent for drivers involved in multi-vehicle crashes, which are defined here as crashes involving two or more vehicles other than pedal cycles or pedestrians.

Alcohol involvement in multi-vehicle crashes tends to be at somewhat lower BAC levels than for pedestrian accidents or single vehicle crashes. The single vehicle crash, which in the Adelaide metropolitan area involves a collision with a parked car or with a utility pole or tree at the roadside, can be characterised as the intoxicated driver's accident. Fifty-five per cent of the drivers in these single vehicle crashes had a BAC level above .05, 50 per cent above .08 and 33 per cent above .15. These accidents tend

TABLE 9: TYPE OF ACTIVE PARTICIPANT BY AGE AND SEX

Age (years)	Sex	Type of Active Participant: Pedestrian	Pedal Cyclist	Motorcyclist	Car Driver	Commercial Vehicle Driver	Totals: M/F	Overall
0 - 5	M	4	-	-	-	-	4	
	F	1	-	-	-	-	1	5
6 - 10	M	3	4	-	-	-	7	
	F	1	-	-	-	-	1	8
11 - 15	M	3	4	-	1	-	8	
	F	2	1	-	1	-	4	12
16 - 20	M	2	3	35	69	4	113	
	F	2	2	3	20	1	28	141
21 - 25	M	3	2	17	52	10	84	
	F	2	-	3	19	-	24	108
26 - 35	M	-	-	9	68	6	83	
	F	3	2	1	28	-	34	117
36 - 50	M	3	1	1	29	5	39	
	F	2	-	-	12	-	14	53
51 - 65	M	6	1	-	35	2	44	
	F	2	-	-	12	-	14	58
Over 65	M	2	2	-	21	1	26	
	F	2	-	-	3	-	5	31
Age not known	M	-	-	-	3	-	3	
	F	-	-	-	1	-	1	4
TOTALS	M:	26	17	62	278	28	411	
	F:	17	5	7	96	1	126	
Overall:		43	22	69	374	29	537	

TABLE 10: ALCOHOL INVOLVEMENT ON AN ACCIDENT BASIS

Type of Accident	Blood Alcohol Level						Total Accidents
	Zero	.01-.04	.05-.07	.08-.15	.15+	Unknown[1]	
Pedestrian[2]	28 78%[4]	1 3%	- -	3 8%	4 11%	4	40
Pedal Cycle	16 84%	3 16%	- -	- -	- -	3	22
Motorcycle:							
Single Vehicle[3]	9 50%	- -	- -	3 17%	6 33%	-	18
Multi Vehicle	27 71%	2 5%	2 5%	5 13%	2 5%	7	45
Commercial Vehicle:							
Single Vehicle[3]	1 100%	- -	- -	- -	- -	2	3
Multi Vehicle	9 82%	2 18%	- -	- -	- -	5	16
Car:							
Single Vehicle[3]	20 43%	- -	3 6%	8 17%	16 34%	4	51
Multi Vehicle	61 71%	3 3%	8 9%	9 10%	5 6%	23	109
TOTAL: Single Vehicle[3]	30 45%	- -	3 5%	11 17%	22 33%	6	72
TOTAL: Multi Vehicle	97 72%	7 5%	10 7%	14 10%	7 5%	35	170
TOTAL: All Accidents	171 67%	11 4%	13 5%	28 11%	33 13%	48	304

Notes:

1 BAC is noted as Unknown if no reading was available for at least one active participant in the accident and no other active participant had a positive BAC level, e.g.: for an accident involving two active participants, such as a pedestrian and a car driver, the following BAC readings would be entered in this Table as shown:
Zero and Unknown; entered as Unknown.
Zero and .05; entered as .05.
.05 and Unknown; entered as .05.
.05 and .20; entered as .20.

2 The data for pedestrian accidents include both the pedestrian and the driver or rider of the striking vehicle. This applies in a similar way to pedal cycle, motorcycle and commercial vehicle accidents. Car Accidents include only passenger cars.

3 Single Vehicle Accidents exclude collisions with a pedestrian or a pedal cyclist and also accidents involving a pedal cycle alone.

4 Percentages omit the BAC Unknown accidents. Subjective assessment of many of the BAC Unknown drivers, etc. suggested that the above percentages slightly underestimate the frequency of alcohol involvement in these crashes.

FIGURE 15: Alcohol Involvement by Age of Driver.
Adelaide In-depth Study.

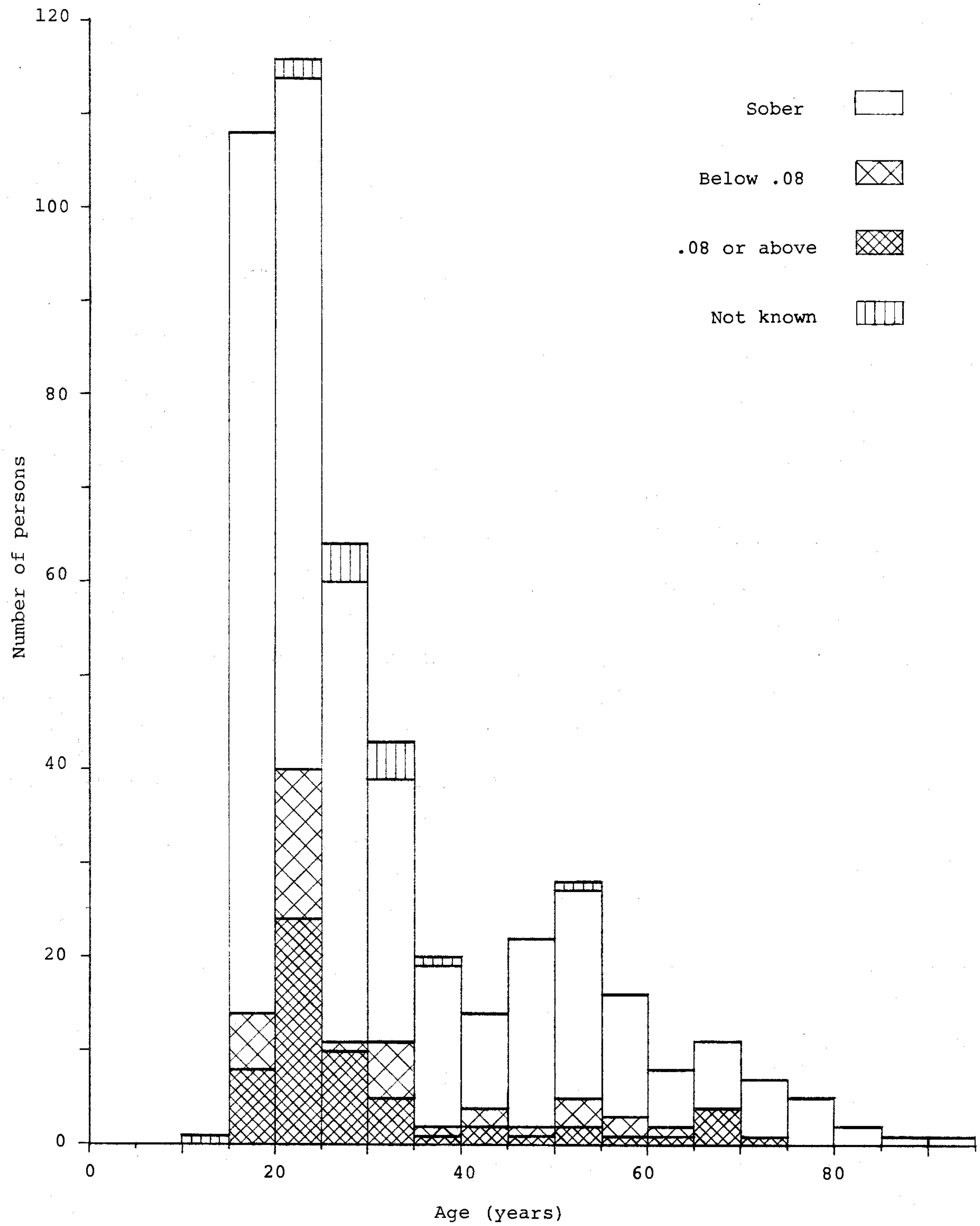


FIGURE 16: Alcohol Involvement by Time of Day.
Adelaide In-depth Study.

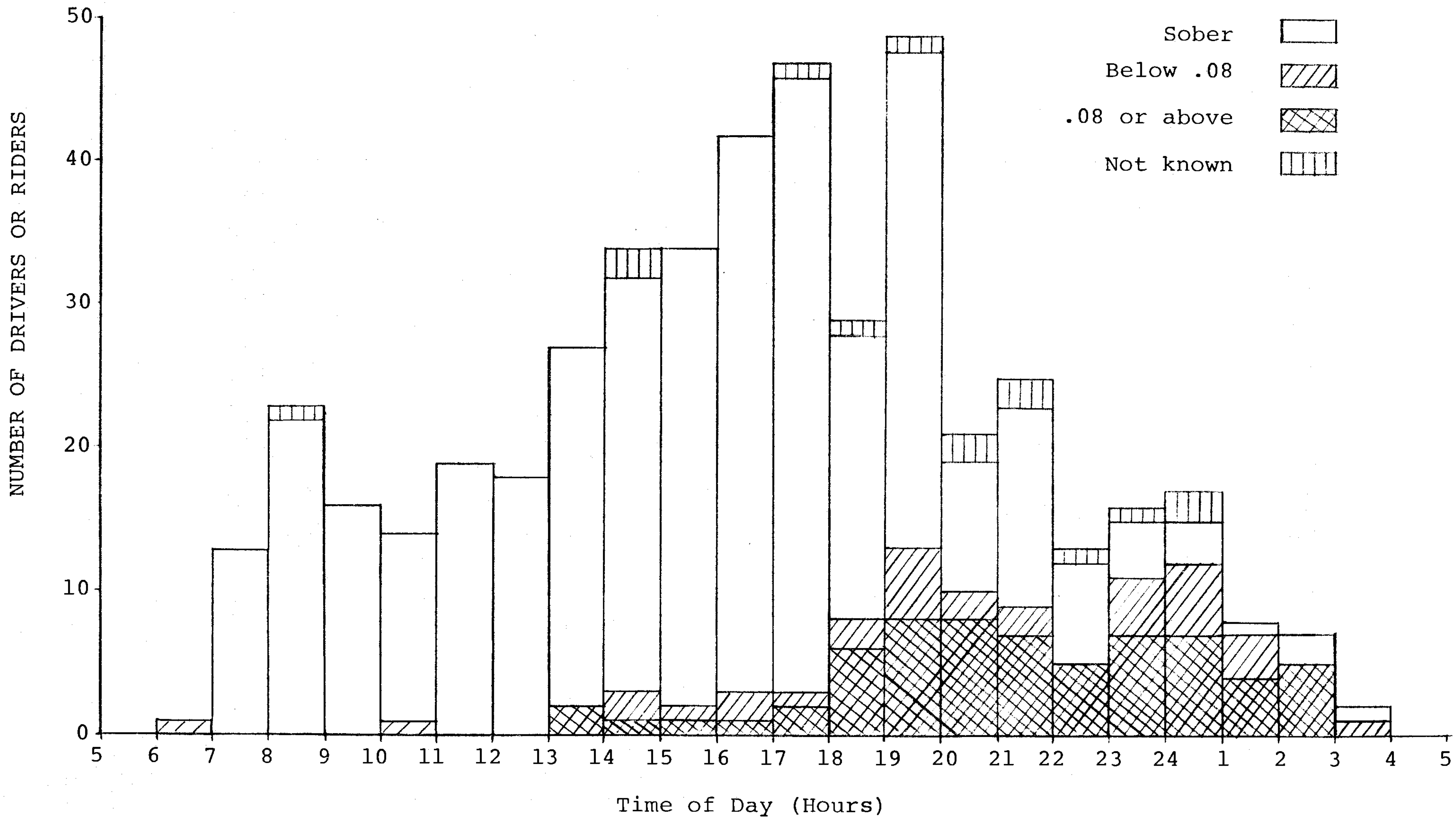


TABLE 11: ALCOHOL INVOLVEMENT BY TYPE OF ROAD USER

	Blood Alcohol Level (BAC)						
	Zero	.01-.04	.05-.07	.08-.14	.15+	Unknown	Total
Pedestrian	32 84% [2]	1 3%	-	2 5%	3 8%	5	43 [1]
Pedal Cyclist	20 95%	1 5%	- -	- -	- -	1	22
Motorcycle Rider	52 76%	1 1%	2 3%	5 7%	8 12%	1	69
Commercial Vehicle Driver	23 92%	2 8%	- -	- -	- -	4	29
Car Driver	254 80%	7 2%	13 4%	22 7%	22 7%	56	374
All Active Participants	381 81%	12 3%	15 3%	29 6%	33 7%	67	537

Notes: [1] An infant being carried in a baby pusher is not included.

[2] Percentages omit the BAC Unknown cases. Subjective assessment of those cases suggested that the above percentages slightly underestimate the frequency of alcohol involvement.

to occur late at night, at times when drivers are most likely to have been drinking. Because a collision with a utility pole or tree is often very severe even at normal traffic speeds in the metropolitan area, these drivers and their passengers are often very badly injured and so a close association is found between the severity of the crash measured in terms of the injuries sustained by the persons involved and the BAC level of the driver.

Alcohol Involvement by Type of Road User:

Table 11 lists the BAC readings for four categories of road users and for all road users combined. Only one pedal cyclist had been drinking and his BAC level was .01. Sixteen per cent of the 38 pedestrians whose BAC was measured had a positive reading but, unlike the pedal cyclist, their BAC levels were relatively high. The information for motorcyclists may come as a surprise to many people who find it difficult to believe that a person can ride a motorcycle when intoxicated, and yet 19 per cent of these riders were above .08 and 12 per cent above .15 with the two highest readings being .22. These last two cases both resulted in the rider being killed in the accident. Overall 19 per cent of the road users for whom a BAC reading was obtained had been drinking, 16 per cent were above .05 and 13 per cent above .08.

Alcohol Involvement by Age of Driver:

Figure 15 shows the estimated blood alcohol levels in five-year age groups for the drivers or riders of motor vehicles in the accidents in this survey. This figure includes a subjective assessment of those persons for whom a BAC reading was not obtained. Based on these data it appears that alcohol is more likely to be a factor in the accident involvement of drivers or riders aged from 20 to 25 than in any other, including the younger, age group.

Very few female drivers were found to have a positive BAC level in these accidents.

Alcohol Involvement by Time of Day:

Figure 16 shows the distribution of alcohol involvement among the motor vehicle operators involved in these accidents. As in Figure 15, this information includes a subjective assessment of those drivers for whom a BAC reading was not available. It is apparent in this figure that alcohol involvement becomes prominent after 6 p.m. and the percentage of impaired drivers steadily increases until, in the early hours of the morning over half of the drivers involved in these crashes were above .08. As noted earlier in this section, many of these accidents were single vehicle crashes.

TABLE 12: INJURY STATUS BY BELT USE AND ADR CLASSIFICATION: CAR DRIVER AND LEFT FRONT PASSENGER

		Type of Occupant and Injury Status						
		Driver				Left Front Passenger		
Belt Use and ADR Classification	No. of Drivers	Not Injured or First Aid at Scene	Medical Attention	Hospital Admission	No. of Passengers	Not Injured or First Aid at Scene	Medical Attention	Hospital Admission
Belt Available: Not Used	38	45%	32%	24%	27	33%	30%	37%
Pre-ADR Belt Used	37	59%	24%	16%	19	47%	37%	16%
ADR4/4A Belt Used	69	65%	23%	12%	19	53%	26%	21%
ADR4B/4C Belt Used	21	71%	14%	14%	12	58%	33%	8%

Note: Accidents involving a collision with a pedestrian, pedal cycle or motorcycle are not included in this Table.

5.4 VEHICLE FACTORS

The following topics have been selected for brief review in this section. More comprehensive and detailed presentations are contained in other reports in the series.

VEHICLE DEFECTS

Although many of the vehicles involved in these accidents had one or more defects which could have been related to the causation of an accident, very few of these defects appeared to have played a role in the accidents which were investigated. For example, 45 per cent of the 372 passenger cars which were inspected in detail (out of a total of 386 cars) had at least one defect, but there were only three accidents in which the defect, or combination of defects, was the predominant cause of the accident. In a further 16 accidents a vehicle defect played a role in the causation of the accident, but the accident may still have occurred even had the vehicle not been defective. Mismatching of tyre types and worn treads were the most common relevant defects.

MOTORCYCLE BRAKING

Almost half (14/31) of the riders who braked immediately before the crash did not use the front brake. This meant that the full braking potential of the motorcycle was not being used, and there were at least four collisions that were not avoided for this reason. Some inexperienced riders never used the front brake because they believed that the motorcycle would become unstable if they did so, but even experienced riders often did not use the front brake in an emergency situation.

THE AUSTRALIAN DESIGN RULES FOR MOTOR VEHICLE SAFETY

The Australian Design Rules (ADRs) can not be evaluated fully in a statistical sense in a study of this type, but we are able to comment on the performance of vehicles which comply with these rules and, to some extent, on the relevance of the individual ADRs. It should be noted that relatively few of the passenger cars in this study were involved in very severe crashes and so the value of some of the ADRs may not be fully apparent for this reason.

ADR4 (through to 4C)defines standards for seat belts and, as such, proved to be the most valuable design rule in the accidents covered by this study. Table 12 lists the injury status of drivers and left front passengers of cars by whether or not they were wearing a seat belt, and by the ADR classification of the belt system. (Belts which comply with ADR 4B or 4C have an inertia reel mechanism.) Accidents involving a collision with a pedestrian, pedal cycle or motorcycle are not included in this Table.

Cars in which a belt was available, but not used, have been selected for this comparison because they are similar in many other respects to cars in which belts were worn. Cars which were not fitted with seat belts were generally much older. The generally superior performance of the inertia reel belts (ADR 4B/4C) appears to be due to the fact that these belts are self-adjusting, whereas some of the other belts were not correctly adjusted. This matter is discussed in greater detail in the companion report on car accidents.

Cars which listed compliance with ADR2 (Door Latches and Hinges) had fewer failures of door latches or hinges than did those cars which were manufactured before that design rule was introduced (Table 13), but some of the failures of

TABLE 13: PERFORMANCE OF DOOR LATCHES AND HINGES BY TYPE OF LOADING AND ADR2 COMPLIANCE

Door Component	Type of Loading[1]	ADR2 Compliance Yes		No	
LATCH	From inside car	(0/45)[2]	-	(4/76)	5.3%[3]
	From outside car	(3/49)	6.1%	(33/85)	38.8%
HINGES	From inside car	(0/45)	-	(0/76)	-
	From outside car	(1/49)	2.0%	(7/85)	8.2%

Notes: [1] Data relate only to doors which were subjected to direct impact loading.

[2] Number of failures (of latch or hinge/s) over number of doors.

[3] Per cent failed.

ADR latches suggest that a change in the compliance test may be desirable.

Because few of the cars in this study were involved in severe collisions there were few cases in which a frontal crash was severe enough for any benefit from ADR10A/10B (Steering Columns) to be demonstrated. The driver's chest contacted an ADR steering assembly in five crashes and there were 12 cases of chest contact with pre-ADR assemblies. The resulting chest injuries were less severe in the former group than in the latter, but head or face contact with the steering wheel rim remains a significant problem.

ADR21 (Instrument Panels) is based on a United States rule which assumes that only laminated glass is used for windscreens and that the area of the upper surface of the instrument panel at the base of the screen is therefore unlikely to be struck by the head or face of an occupant of the vehicle. Toughened glass windscreens, which are more common in Australia, do not prevent the head from striking the part of the panel because the glass shatters into small fragments when struck.

The introduction of some of the other design rules could not be expected to have resulted in marked changes because prior practice was already in compliance with the requirements of these rules. ADR8 (Safety Glass) is one example. ADR3 (Seat Anchorages) is in a similar category except that the requirements for compliance with the rule do not appear to be adequate because failure of ADR seats and seat anchorages was observed in some of the crashes in this study and these failures appeared to be associated with an increase in the severity of the injury.

None of the cars in these accidents complied with ADR29 (Side Door Strength), which was introduced less than three months before the end of the data collection period.

CRASH HELMETS FOR MOTORCYCLISTS

While not a vehicle-related factor, crash helmets are analogous to seat belts in that they are both protective devices that are required, by law, to be used.

Only one of the 80 motorcycle riders and pillion passengers was known to have not been wearing a crash helmet. The efficacy of these helmets may be indicated by the fact that motorcyclists were the only road users in this study for whom the head was not the most severely injured body region, although the very severe leg injuries these riders received is a partial explanation of this result.

As noted above, intoxicated riders often did not secure the chin strap on their crash helmet, and so the helmet came off during the crash.

5.5 ROAD AND TRAFFIC FACTORS

The frequencies of various types of locations, traffic controls and traffic unit movements in these accidents are presented in Section 5.2. The road and traffic factors that were most often relevant to accident causation are listed in Table 14, and to the consequences of the accident in Table 15.

The factors listed in Table 14 and, to a lesser extent, in Table 15, were rarely the only ones of importance in an accident. A particular characteristic of the road layout which confused an intoxicated driver might not have been a significant hazard for a sober driver, for example.

The significance of factors listed in Tables 14 and 15 very often were influenced by some characteristic of the driver, such as intoxication. This does not necessarily diminish the importance of these road and traffic factors however, because they may be able to be changed in such a way as to make the roads safer for all road users, including those who may be intoxicated.

Many of the accidents at uncontrolled intersections, which rarely involve intoxicated drivers, could be prevented by installing STOP or GIVE WAY signs. This matter is discussed in detail in the companion report on road and traffic factors.

Roadside objects were factors in both the causation and consequences of these accidents: in the former case primarily as obstructions to vision; in the latter as objects struck, of which the utility pole is particularly hazardous. Parked vehicles also figure prominently in Tables 14 and 15, for similar reasons to roadside objects.

The road surface was rarely a causal factor, partly because of generally good construction and maintenance, but mainly because of the very dry conditions which prevailed during the data collection period, as noted in the following section.

5.6 ENVIRONMENTAL FACTORS

LIGHTING CONDITIONS

Fifty-seven per cent of the accidents attended occurred in daylight, 37 per cent at night and five per cent at dusk with the remaining two cases being investigated at dawn. Dusk and dawn were defined on the basis of the prevailing lighting conditions at the time that the team was called to attend the accident, and these lighting conditions were, of course, affected by the weather conditions. Information on the time of notification of the accident and the time of first light or last light is included in the coded data of the General Accident Record.

TABLE 14: ROAD AND TRAFFIC FACTORS IN ACCIDENT CAUSATION

Road or Traffic Factor		Relevant to Accident Causation	
		Yes	Possibly
Traffic rules:	priority	54%[1]	2%
	other	7	-
Traffic Flow Characteristics		19	5
Traffic control device:	signals	1	8
	sign	1	3
	geometric	1	2
	road markings	-	1
	absence of control[2]	16	2
Road layout:	in general area	2	0[3]
	at accident site	11	8
Road surface		2	3
Road works		1	0[3]
Parked vehicles		12	4
Roadside:	on or beyond property boundaries	15	4
	between property boundaries	5	12
Artificial lighting		5	9

Notes:
1 Percentage of 304 accidents.
2 Refers to uncontrolled intersections.
3 Percentage is greater than zero but less than 0.5.

(More than one of the listed factors may have been relevant in a given accident.)

TABLE 15: ROAD AND TRAFFIC FACTORS IN THE CONSEQUENCES OF THESE ACCIDENTS

Road or Traffic Factor		Relevant to Accident Consequences	
		Yes	Possibly
Roadside:	on or beyond property boundaries	9%[1]	-
	between property boundaries	20	0[2]
	(utility pole)	(11)	-
	(road sign)	(5)	(0)[2]
	(signal installation)	(1)	-
Road layout at accident site		3	1
Geometric traffic control		2	0[2]
Road surface		1	1
Road works		0[2]	-
Parked vehicles		8	-

Notes: [1] Percentage of 304 accidents.

[2] Percentage is greater than zero but less than 0.5. (More than one of the listed factors may have been relevant in a given accident.)

WEATHER CONDITIONS

The relationship between accident frequency and rainfall has been discussed in the section on sampling procedure in this report. The twelve month period during which the study was conducted was one of relatively low rainfall for the Adelaide metropolitan area. During the 1976 calendar year the total rainfall was 367mm compared to an annual average of 530mm. The road surface was dry for 282 accidents, damp for nine, and wet for thirteen. Six of the accidents investigated occurred in light rain and seven in heavy rain. As is apparent from these figures Adelaide has both a dry climate and one in which the periods of rain are concentrated.

5.7 CONSEQUENCES OF THE ACCIDENTS

Over half of the persons who were involved in these accidents were injured, although most of the injuries were relatively minor (Table 16). The frequency of injury was greatest for pedestrians, motorcyclists and pedal cyclists. Almost all of them were injured and their injuries were often severe and, for some, fatal. Car occupants were much less likely to be injured, partly because their risk of injury was negligible if their car hit a pedestrian, for example, and severe, or worse, injuries were rare. The sole fatal injury to a car occupant was in a collision with a commuter train at a level crossing.

The duration of hospital stay is another measure of the severity of an injury, and one which may be more meaningful as a general description than the severity rating scale of Table 16. As shown in Table 17, about one-fifth of the participants in these accidents were admitted to hospital, most of them for a period of one to seven days. Twenty-nine persons were hospitalized for more than a month and three were still in hospital three months after being admitted.

Apart from the eight fatalities, at least 68 persons were left with a permanent physical disability as a consequence of being involved in one of these accidents (Table 18). Ten of these people were severly disabled and one infant was totally incapacitated.

TABLE 16: OVERALL INJURY SEVERITY FOR EACH TYPE OF ROAD USER

Type of Road User	Overall Injury Severity (Per Cent)*							Total Number of Cases
	Nil	Minor	Moderate	Severe	Serious	Critical	Fatal	
Pedestrian	2.3	25.0	20.5	29.5	11.4	4.5	6.8	44
Pedal Cyclist	4.3	21.7	39.1	21.7	8.7	4.3	-	23
Motorcyclist	3.7	37.5	30.0	16.2	7.5	-	5.0	80
Car Occupant	52.0	32.9	11.0	2.1	1.1	0.8	0.1	727
Occupant of Light Commercial Vehicle	53.3	20.0	26.7	-	-	-	-	15
Occupant of Heavier Commercial Vehicle	81.0	14.3	4.8	-	-	-	-	21
Bus Occupant	18.2	72.7	9.1	-	-	-	-	11
All Road Users	44.5	32.5	13.9	5.0	2.3	1.0	0.9	921

*Note: The figures for bus occupants show a higher average severity of injury than was actually the case. This is because in one accident the bus was carrying a large number of passengers, possibly as many as sixty, and when the bus stopped after the collision almost all of these passengers transferred to a following bus within a minute or so. Ten car occupants are also not represented in this Table because we were unable to examine them after the accident. One of them probably was injured, the others almost certainly were not.

TABLE 17: DURATION OF HOSPITAL STAY

Length of Stay	Number of Persons
Not injured	410
Not admitted	316
Admitted, stay was:	
Less than 24 hours	29
One to 7 days	101
8 to 30 days	31
31 to 96 days	29
Other than the above (e.g. interrupted hospitalisation)	5
Not known if injured	10
TOTAL	931

TABLE 18: SEVERITY OF RESIDUAL DISABILITY

Severity	Number of Persons
No disability	813
Minor disability	57
Major disability	10
Totally disabled	1
Fatally injured	8
Not known if disabled	42
TOTAL	931

6. COMPARISON WITH THE FIRST ADELAIDE IN-DEPTH STUDY

As noted in the introduction to this report, the first in-depth study of road accidents in Adelaide was conducted under the direction of Professor J.S. Robertson from 1962 to 1965. Although more information was recorded in the second study, particularly on the characteristics of the active participants, there are many comparisons, relating to both accident and injury causation, which can usefully be made between the two sets of data. Both studies covered the same geographical area and sampled accidents to which an ambulance was called, although the sampling techniques differed, as noted below. The population of the metropolitan area increased between 1963 and 1976, but much of the increase was located outside the area covered by the studies.

Several important changes occurred in the intervening period. Seat belt availability improved, followed by compulsory belt wearing, and similar changes occurred with crash helmets for motorcyclists. Hotels closed at 6 p.m. in the early 1960's and at 10 p.m. in 1976, with apparently dramatic effects on the distribution of accidents by time of day. Traffic management moved to a far greater reliance on signalised controls and regulatory signs, accompanied by an increase in traffic volumes. A detailed comparison of these two studies is not included in this series of reports, but the following general observations give some indication of the potential value of such a comparison.

The percentages of the various types of accidents in the two studies are listed in Table 19. The increase in the proportion of accidents that involved motorcycles is to be expected because the first study was conducted at a time when motorcycles were relatively unpopular, but the decrease in the proportion of pedestrian accidents is not so easy to explain. Most of the pedestrian accidents were on arterial roads in the first study, as in the present one. The decrease in the proportion of accidents involving commercial vehicles may be due largely to differences in the sampling procedures used in the two studies, notably the bias towards weekday accidents in the earlier study.

In the first study no accidents were attended between 11 p.m. and 10 a.m., very few Sundays were sampled and only alternate Saturdays. The distribution of accidents, as defined here, also differed markedly between the two studies, as shown in Table 20, and so a meaningful comparison between the temporal distributions of the two samples is not possible. The change in hotel closing hours, noted above, may explain the reduction in both the proportion and the actual frequency of accidents on Saturday from 4p.m. to 8 p.m. but the reasons for the shift from accidents at weekends to during the week are not apparent.

The effects of improvements in crash injury protection, such as the increased availability and wider use of seat belts, and of crash helmets for motorcyclists, are unlikely to be reflected accurately by the changes in the percentage injured for each class of road user in these two studies. This is because the occurrence of an injury is the main, but not the only, criterion for an ambulance to be called and hence for an accident to be included in a study of this type. Once injured, however, it is not unreasonable to expect that the injuries should, in general, be less severe among the car occupants in the later study. This was in fact the case, with the percentage of injured car occupants who were hospitalized, or fatally injured, being 42 in the first study and 29 in the second (Table 21). This difference is statistically significant (Chi square = 13.0, $p < .001$).

There was only a slight improvement, if any, for motorcyclists, even though almost all of them were wearing a crash helmet in the second sample of accidents compared to only 30 per cent in the first sample. This small change probably reflects the severity of the leg injuries sustained by the motorcyclists in the second survey, and should not be taken as a measure of the efficacy of crash helmets. (As noted in Section 5.4 of this report, motorcyclists were the only category of road user in the second study for whom the head was not the body region that was most often severely injured.)

Injured pedestrians and pedal cyclists were less likely to have been hospitalized, or fatally injured, in the second study. This may indicate a reduction in the injury potential of the fronts of cars over the period between the two studies, but a far more detailed examination of these changes in injury severity is needed before the validity of such a conclusion can be assessed.

The value of comparisons such as these lies as much, if not more, in the perspective which they provide for the interpretation of the results of the second study as in the demonstration of the changes which occurred between 1963 and 1977.

TABLE 19: TYPES OF ACCIDENTS: ADELAIDE IN-DEPTH STUDIES

Type of Accident	First Study 1963-64		Second Study 1976-77	
	No.	%	No.	%
Pedestrian	79	19	40	13
Pedal Cycle	43	11	22	7
Motorcycle	58	14	63	21
Commercial Vehicle	45	11	19	6
Car	183	45	160	53
TOTAL	408	100	304	100

TABLE 20: TEMPORAL DISTRIBUTION OF ACCIDENTS TO WHICH AN AMBULANCE WAS CALLED: ADELAIDE, 1963[1] AND 1976,77[2]

Period of Week	Time of Day	Accidents Attended by Ambulance			
		Number		Percent of Total	
		1963	1976,77	1963	1976,77
Monday - Friday	0000 to 2359	790	2649	47.1	69.3
Saturday	0000 to 0359	35	133	2.1	3.5
	0400 to 0759	18	23	1.1	0.6
	0800 to 1159	69	109	4.1	2.9
	1200 to 1559	88	133	5.3	3.5
	1600 to 1959	241	193	14.4	5.1
	2000 to 2359	111	125	6.6	3.3
Sunday	0000 to 0359	93	91	5.5	2.4
	0400 to 2359	231	364	13.8	9.5
TOTAL	-	1676	3820	100.0	100.1

Notes: [1] Source: Robertson, McLean and Ryan, 1966.

[2] Twelve months commencing March 23, 1976.

TABLE 21: PERCENTAGES OF ROAD USERS INJURED AND HOSPITALIZED OR KILLED: ADELAIDE IN-DEPTH STUDIES

Type of Road User	First Study 1963 - 1964			Second Study 1976 - 1977		
	Total No.	% Injured	% of Injured who were Hospitalized [1]	Total No.	% Injured	% of Injured who were Hospitalized [1]
Pedestrian	82	99	83	44	98	67
Pedal Cyclist	44	86	82	23	96	64
Motorcyclist	74	96	48	80	96	45
Commercial Vehicle Occupant	85	22	? [2]	47	43	25
Car Occupant	1029	36	42	737	48	29
TOTAL	1314	44	51 [3]	931	55	37 [3]

Notes:

1 Includes persons fatally injured.

2 Data not available in published report.

3 Excludes commercial vehicle occupants.

7. GENERAL CONCLUSIONS

As noted in the introduction to this report, the unique contribution which can be made by an in-depth study is the extent to which it can provide additional insight into the nature of the problem of road traffic accidents. Some previously unrecognized variables or risk factors may be identified, but the value of an in-depth study is more likely to lie in the clearer understanding which it gives into how some risk factors operate. This usually leads to the formulation of new hypotheses, which are best tested in specially-designed experiments or other investigations. While some of the results from an in-depth study may be sufficient basis for the direct introduction of new or modified counter-measures such output is not a direct study objective.

In this section we present a selection of the general conclusions from the study. As was done in the earlier section on the types of accidents investigated, the aim here is to give some indication of the nature of the conclusions which can be found in the other reports in the series. Recommendations for further investigations or for action based on these conclusions are not presented here; they appear in the other reports, and are brought together in the report entitled "Summary and Recommendations". The final part of this section is an assessment of what we have learned about the feasibility of this type of investigation.

7.1 CHARACTERISTICS OF THE ACCIDENTS

Most of the accidents involved ordinary drivers behaving in an ordinary way. There were some others who were intoxicated, or inexperienced, or who were speeding, and the role that they played is noted briefly below. But it would be wrong to assume that the road accident problem can be solved by concentrating solely on these few well-recognized risk factors, important though they are. In the other reports in this series we have attempted to describe the often complex interaction of factors which can result in an accident, and to suggest ways in which driving, or walking, might be made easier and hence safer.

INTOXICATION

Alcohol intoxication was a major factor in these accidents. Blood alcohol (BAC) levels were obtained for 88 per cent of all of the active participants (drivers, riders and pedestrians) and for all such persons in 84 per cent of the accidents.

One or more of the active participants had a BAC above .08 in at least 24 per cent of the accidents. The frequency of alcohol involvement was highest in single vehicle crashes, in which at least 50 per cent of the drivers or riders were above .08. These crashes usually involved a collision with a roadside object such as a tree or a pole, and the resulting injuries were often severe.

The percentage of intoxicated road users was highest among motorcyclists (19 per cent were above .08). Some of these intoxicated riders apparently failed to fasten the chin straps on their crash helmets correctly, the helmets came off in the crash, with fatal consequences in one case. Thirteen per cent of both the drivers, of cars and commercial vehicles, and the pedestrians had a BAC level above .08. Only one pedal cyclist had been drinking and his BAC level was .01.

Intoxication by drugs other than alcohol appeared to be a relatively minor problem, even allowing for the fact that no quantitative tests were available.

INEXPERIENCE

Child pedestrians and cyclists are obviously inexperienced in dealing with urban traffic, and they were usually involved in accidents as a consequence of impulsive and careless behaviour. These behavioural characteristics are very difficult to modify, and so changes in the traffic conditions may be necessary if the frequency of these accidents is to be reduced.

Inexperience was very apparent as a factor in motorcycle accidents. Many inexperienced riders never used the front brake, believing that it was unsafe to do so, and so their stopping distances were much greater than would have been the case had they used both brakes. Even experienced riders rarely used the front brake in an emergency (in almost three quarters of the collisions involving motorcycles it was the other vehicle which failed to give way).

EXCESSIVE SPEED

Seven per cent of the drivers and motorcycle riders were travelling at a speed which was obviously above the legal limit and which was a factor in their being involved in these accidents. Almost all of the drivers whose vehicles were involved in collisions at uncontrolled four-way intersections (at which they should have given way) and for whom a speed estimate was available were travelling at an excessive speed, even though it was usually below the 60 km/h speed limit. Subsequent investigations revealed that about three-quarters of all non-accident-involved drivers were also exceeding the safe approach speeds at these uncontrolled intersections. In about one-third of the collisions at sign-controlled intersections there was some evidence that the vehicle on the through road was exceeding the speed limit. The drivers on the through roads were four times more likely to have had at least one prior conviction for speeding than were the drivers who moved off from the STOP or GIVE WAY signs in these collisions.

VEHICLE FACTORS

Forty per cent of the cars in this study had one or more defects, but it was exceptional for a vehicle defect to play a role in the causation of an accident.

The braking system of motorcycles, which requires separate actuation of the front and rear brakes, was not used efficiently by almost half of the riders who braked immediately before the accident.

The Australian Design Rules (ADRs) for Motor Vehicle Safety which relate to seat belts and door hinges and latches appeared to be of most value in the accidents studied. Few of the crashes involving passenger cars were severe, and so the potential performance of ADR10A and 10B (steering columns) could not be assessed adequately. The performance of some other of the ADRs differed little from that of pre-ADR components probably because the introduction of those ADRs, such as the one relating to safety glass, largely confirmed existing practice. Some deficiencies were noted in the design rules for instrument panels and seat anchorages.

ROAD AND TRAFFIC FACTORS

The absence of controls such as STOP or GIVE WAY signs at four-way intersections was a factor in about one-seventh of the accidents in this study.

Objects at the roadside, and parked vehicles, played important roles in the causation of some of these accidents, either by obstructing vision or simply by being hit and so preventing a straying vehicle from regaining the roadway safely. Collisions with utility poles were particularly severe; they usually involved an intoxicated driver whose car veered off to the left on a straight road.

Almost all of the pedestrian accidents in the study were on busy traffic routes, most of which were undivided multi-lane roads. Some measures designed to increase the rate of flow of vehicular traffic are detrimental to the safety of the pedestrian.

Skidding was a minor problem, primarily because of the very dry climate in Adelaide.

ENVIRONMENTAL FACTORS

Relatively mild and very dry weather prevailed through most of the year in which the study was conducted and so there were very few cases in which rain or a wet road surface was a factor in the causation of the accident. Glare from the sun may have been present in some instances but none of the road users acknowledged it as a problem, whereas glare from oncoming headlights was mentioned by one driver who hit a pedestrian who was standing in the centre of the road.

THE INJURIES

Pedestrians and pedal cyclists were almost always injured and their injuries were often severe, with a head injury usually being the worst. The front of the striking car was the direct cause of the majority of the severe injuries sustained by pedestrians and cyclists. The motorcyclist, probably because of the protection afforded by his crash helmet, was more likely to sustain a severe leg injury as his worst injury. It was unusual for a car occupant to be severely injured; those who were tended to be unrestrained occupants of cars which crashed into a tree or utility pole.

Twenty per cent of the 931 persons involved in these accidents were admitted to hospital, 68 (or 7 per cent) were left with a permanent physical disability, and eight were killed.

COMPARISON WITH THE FIRST ADELAIDE IN-DEPTH STUDY

There were relatively more motorcyclists and fewer pedestrians, pedal cyclists and commercial vehicles in the present study than in the one conducted 13 years earlier. These differences may be due to both differences in sampling schedules and to changes in the temporal distribution of accidents to which an ambulance is called.

Overall, 55 per cent of the participants were injured in the accidents in the second sample compared to 44 per cent in the first. This result may be largely an artifact associated with the reasons why an ambulance is called to an accident, but it may also be that the accidents in the second sample were somewhat more severe.

When comparing the percentages of injured persons who were admitted to hospital or who were fatally injured, there was a reduction observed between the two studies for car occupants, from 42 to 29 per cent, and even greater reductions for pedestrians and pedal cyclists. The wider use of seat belts appears likely to have been the major cause of the lower average severity of injury among car occupants. The average injury severity, as measured in this way, did not change significantly for motorcyclists despite the almost universal use of crash helmets in the second study, because many leg injuries were severe enough to require hospitalization.

There is considerable potential for detailed comparison between the two studies of factors relating to both accident and injury causation.

7.2 THE IN-DEPTH STUDY TECHNIQUE

Our experience in the study has demonstrated that the method of investigation is viable, with some important qualifications which are noted below.

The sample procedure which was developed for the study produced a sample which was adequately representative of the population of accidents that was being investigated. These accidents, to which an ambulance was called, included a high proportion (about one-fifth) of cases in which the ambulance was not required, and so the bias which can arise when studying only accidents which result in injury was to some extent avoided. The success of this sampling procedure depended largely on the willing cooperation of the radio controllers of the St. John Ambulance Transport Division.

The method of investigation, as it existed at the end of the project, was also satisfactory. Funds were not available in the early stages to cover the salary of a traffic engineering member of the research teams and so much of the basic data in this area had to be collected at a later date, a procedure which proved to be complicated by the fact that this person had not attended the accidents at the scene.

Response times for the team to reach the scene of the accident after being notified of the call for an ambulance to attend averaged about 11 minutes. The team had no authority to exceed the speed limit, and we consider such an exemption to be neither necessary nor desirable.

The team members were able to collect the necessary information at the scene of the accidents without interfering with the police or ambulance officers in the execution of their duties, and a high level of cooperation was maintained with these personnel. Almost all of the people who were involved in the accidents were willing to talk with the research workers at the scene, in hospital, and later at their homes in the case of drivers, riders and pedestrians. The follow-up interviews were very time-consuming, largely because repeated visits had to be made before the person was found to be at home in many instances. This work mostly had to be conducted at night, which meant that, in addition to the irregular on-call hours, these investigators were working almost every night during the week. The engineering members of the team often found it necessary to work continuously for several days to keep up with the need to conduct a detailed examination of the crashed vehicles before repair work commenced. This work load was unreasonably severe, and it is to the great credit of the team members that they were both willing and able to carry out their duties for the full twelve months of data collection. In any future study the case collection rate should be reduced to no more than 100 accidents per team per year.

A large amount of very detailed information can be collected in this way (Appendix B). In the study the processing of this information was delayed until after the data collection period because some of the data codes had not been finalized. It is much easier to develop a satisfactory data code after the data has been collected, simply because there is no longer any uncertainty about the items which will be available to be coded, but it is obviously more efficient to be able to code data as soon as possible after the investigation of an accident has been completed. From the experience which we have gained in this study, we believe that we are now in a much better position to be able to develop useful data codes during the planning stages of an investigation of this type.

The point has been made that one of the major attributes of the in-depth study approach is that it yields greater insight into how recognized risk factors operate. Much of this insight can be presented in formal reports, but a great deal of the return on the investment in a in-depth study depends on the use which the research workers are able to make of the experience which they have gained.

The final observation in this overview report is one made 15 years ago by Haddon et al., 'Without continuing research of this type there can often be no assurance that variables more formally investigated have been realistically or wisely chosen.'

8. OTHER REPORTS ON THIS IN-DEPTH STUDY

This is the first of a series of reports on the results of this in-depth study. The other reports cover the following areas:

- Pedestrian Accidents
- Pedal Cycle Accidents
- Motorcycle Accidents
- Commercial Vehicle Accidents
- Car Accidents
- Road and Traffic Factors
- Summary and Recommendations.

In addition to these reports, much of the information which has been collected is presented in two separate volumes. One of these contains a scale plan and brief summary for each accident and the other presents the listings of all of the coded data, together with a copy of each of the codes.

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APPENDIX A: COMPARISON OF ACCIDENT FREQUENCIES IN SAMPLE AND POPULATION

TABLE A1: ACCIDENT FREQUENCY IN SAMPLE AND POPULATION BY TIME OF WEEK

Time of Week		Number of Accidents in:		
Day	Time	Sample	Population-Sample	Population
Monday	00.00-03.59	0	11	11
	04.00-07.59	2	28	30
	08.00-11.59	7	64	71
	12.00-15.59	6	80	86
	16.00-19.59	23	140	163
	20.00-23.59	5	73	78
Tuesday	00.00-	0	9	9
	04.00-	0	39	39
	08.00-	6	84	90
	12.00-	5	76	81
	16.00-	16	161	177
	20.00-	5	94	99
Wednesday	00.00-	2	11	13
	04.00-	2	32	34
	08.00-	6	79	85
	12.00-	10	102	112
	16.00-	14	165	179
	20.00-	6	78	84
Thursday	00.00-	6	28	34
	04.00-	0	23	23
	08.00-	9	75	84
	12.00-	9	112	121
	16.00-	14	184	198
	20.00-	10	113	123
Friday	00.00-	3	36	39
	04.00-	1	37	38
	08.00-	7	70	77
	12.00-	13	109	122
	16.00-	18	195	213
	20.00-	14	122	136
Saturday	00.00-	13	120	133
	04.00-	2	21	23
	08.00-	6	103	109
	12.00-	12	121	133
	16.00-	17	176	193
	20.00-	7	118	125
Sunday	00.00-	5	86	91
	04.00-	1	14	15
	08.00-	3	45	48
	12.00-	10	84	94
	16.00-	7	119	126
	20.00-23.59	2	79	81
TOTAL		304	3516	3820

Chi-square (41 d.f.) = 38.26, $p > 0.5$.

TABLE A2: ACCIDENT FREQUENCY IN SAMPLE AND POPULATION BY TIME OF DAY

Time of Day	Number of Accidents in: Sample	Population-Sample	Population
00.00 - 00.59	15	144	159
01.00 - 02.59	7	88	95
02.00 -	6	38	44
03.00 -	1	31	32
04.00 -	0	17	17
05.00 -	0	9	9
06.00 -	1	41	42
07.00 -	7	127	134
08.00 -	14	168	182
09.00 -	10	93	103
10.00 -	9	121	130
11.00 -	11	138	149
12.00 -	11	171	182
13.00 -	14	155	169
14.00 -	17	144	161
15.00 -	23	214	237
16.00 -	28	343	371
17.00 -	31	304	335
18.00 -	17	225	242
19.00 -	33	268	301
20.00 -	14	190	204
21.00 -	16	168	184
22.00 -	9	158	167
23.00 - 23.59	10	161	171
TOTAL	304	3516	3820

Chi-square (23 d.f.) = 20.68, p > 0.6.

TABLE A3: ACCIDENT FREQUENCY IN SAMPLE AND POPULATION BY DAY OF WEEK

Day of Week	Number of Accidents in: Sample	Population-Sample	Population
Monday	43	396	439
Tuesday	32	463	495
Wednesday	40	467	507
Thursday	48	535	583
Friday	56	569	625
Saturday	57	659	716
Sunday	28	427	455
TOTAL	304	3516	3820

Chi-square (6 d.f.) = 6.47, p > 0.3.

APPENDIX B: VARIABLES LISTINGS FOR THE DATA CODES

GENERAL ACCIDENT RECORD

Case Number
File Number
Team Members
Type of Accident
Type of Collision
Number of Traffic Units
Number of Pedestrians
Number of Pedal Cycles
Number of Motorcycles
Number of Light Trucks
Number of Medium Trucks
Number of Heavy Trucks
Number of Articulated Vehicles
Number of Buses
Number of Cars or Car-Derivatives
Number of other types of traffic unit
Number of Participants
Number of Motorcyclists
Number of Light Truck Occupants
Number of Medium Truck Occupants
Number of Heavy Truck Occupants
Number of Articulated Vehicle Occupants
Number of Bus Occupants
Number of Occupants of Cars or Car-Derivatives
Number of Participants Associated with other types of Traffic Unit
Year of Accident
Day of Month of Accident
Day of Week of Accident
Day of Year of Accident
Holiday on day of Accident
Hour ambulance called to Accident
Minutes after hour Ambulance called
Time ambulance called to accident
Hour Research Team called to accident
Minutes after Hour Research Team called
Time Research Team called to accident
Hour Research Team arrived at scene
Minutes after hour Research Team arrived at scene
Time Research Team arrived at scene
Hour Research Team went on call
Minutes after hour Research Team went on call
Police attendance
Police Report on Accident
Natural lighting conditions at scene of accident
Hour of first light
Minutes after hour of first light
Time of first light
Hour of last light
Minutes after hour of last light
Time of last light
Predominant type of artificial lighting in vicinity of accident site
General quality of artificial lighting in vicinity of accident site
Street lights: Operating?
Weather conditions: precipitation at time of accident?
Road Surface condition in vicinity of accident site
Ambient temperature at time of accident

ROAD AND TRAFFIC CODE

File Number
Case Number
Accident categorized by type of traffic unit
Type of collision etc. experienced in the initial event by the traffic unit referenced in previous variable

Road and Traffic:

Was any aspect of the general area road layout a relevant factor?
Was any aspect of the road layout at the accident site relevant to the causation of the accident?
Was any aspect of a geometric traffic control installation relevant?
Was any characteristic of the road surface relevant?
Were any road markings relevant?
Was any feature of the roadside relevant to the causation of the accident?
Were there any obstructions or distractions located on or beyond the property boundaries that were relevant to the causation of this accident?
Was a parked vehicle relevant to the causation of this accident?
Were any characteristics of the artificial lighting relevant?
Were any characteristics of road signs relevant?
Was any characteristic of a signal installation relevant?
Was the absence of a traffic control device relevant?
Were any factors associated with road works (construction, repairs or maintenance) relevant?
Was any characteristic of the pedestrian or vehicular traffic flow a relevant factor?
Was any priority rule relevant in the causation of this accident?
Were any other rules from the Road Traffic Act relevant to the causation of this accident?
Was there a relevant factor in this category other than the above?
Was any aspect of the road layout at the accident site relevant to the consequences of this accident?
Was any aspect of a geometric traffic control installation relevant to the consequences of this accident?
Was any characteristic of the road surface relevant to the consequences of this accident?
Was any feature of the roadside (up to the property boundaries) relevant to the consequences of this accident? (Includes utility poles.)
Was any feature located on or beyond the property boundaries relevant to the consequences of this accident?
Did a parked vehicle play a significant role in the consequences of this accident?

Was a utility pole relevant to the consequences of this accident? (Includes utility poles carrying street lights.)
Was any road sign, or support, relevant to the consequences of this accident?
Was any component of a signal installation relevant to the consequences of this accident?
Were any factors associated with road works relevant to the consequences of this accident?
Was any characteristic of the pedestrian or vehicular traffic flow a relevant factor?
Was any other factor in this category relevant to the consequences of this accident?
Traffic characteristics - estimated speed of Unit 1 prior to taking avoiding action
Traffic characteristics - estimated speed of Unit 2 prior to taking avoiding action
Speed limit at accident site
Mean travelling speed of traffic at this site at this time of day, on a later date, in direction of Unit 1
Mean travelling speed of traffic at this site at this time of day, on a later date, in direction of Unit 2
Critical speed for this approach to this intersection (if applicable)
Average daily traffic on this road (from records) for Unit 1
Average daily traffic on this road (from records) for Unit 2
Any regulatory signs relevant to Unit 1? (on its intended path)
Any regulatory signs relevant to Unit 2? (on its intended path)
Were any warning signs in the field of view of Unit 2?
Is the road travelled by Unit 1 classed as a traffic route or as a minor street?
Is the road travelled by Unit 2 classed as a traffic route or as a minor street?
Did any traffic unit leave the carriageway in this initial deviation?
Predominant land use in general area
Previous accident record: number of accidents at this site in the previous 3 whole calendar years
Accident at an intersection? (within 10m of property boundaries)
Road Layout at accident site
Geometric treatment of the above intersection
Type of traffic control at the above intersection
Is there a pedestrian crossing in the vicinity of the accident site? (midblock, not incorporated into intersection signals)
Type of pedestrian crossing

CAR/CAR DERIVATIVE DATA CODE

File Number
Case Number
Vehicle Number
Make
Model
Compliance plate fitted?
"Year of Manufacture" as listed on the compliance plate
Body Style
Accident categorized by type of traffic unit
First event for this vehicle
Second event for this vehicle

First Event:

Point of contact on this vehicle
If the first event was a collision with another car what was the point of contact on that vehicle
Alignment of the above vehicle to the case vehicle
Estimated speed of other vehicle (if any) in this first event
Estimated speed of this vehicle on involvement in the first event
If the first event was a collision with a fixed object: what was direction of impact relative to the case vehicle?
Modified (RARU)VDI for the case vehicle for damage sustained in the first event
Direction of deformation
General location of deformation
Horizontal location of deformation
Vertical location of deformation
Nature of deformation
Extent of deformation
Traffic Unit Movements (vehicle specific) in this event

Second Event:
(as for First Event)

Deformation of passenger compartment (after all events)
Rollover (if occurred): extent of roll
Rollover (if occurred): properties of ground surface for majority of roll
Rollover (if occurred): collision during roll
Did the load of this car contact any participants in this accident?
Engine malfunction: relevant to the causation of this accident?
Brake implication: on at impact?
Brakes: skidding due to braking?
Brake malfunction relevant to accident?
Internal sunvisors:Subject to ADR11?
Internal sunvisor: driver's side, occupant contact?
Internal sunvisor: passenger's side, occupant contact?
Glove compartment door: occupant contact?
Glove compartment door: opened in crash?
Glove compartment door: subject to ADR21?
Parcel shelf: occupant contact?
Parking brake handle: occupant contact?
Wiper blade: RH side
Wiper blade: LH side
Wiper and washer - subject to ADR16?
Glare in field of view: vehicle subject to ADR12?
Heater or fresh air ducts: occupant contact?
Airconditioner ducts: occupant contact?
Instruments or Controls: occupant contact?
Radio: occupant contact?
Tape player: occupant contact?
External rear vision mirror, driver's side: contact by other road users?
Instrument panel ash tray: occupant contact?

Back of front seat ash tray - occupant contact?
Ignition key: occupant contact?
Foot controls: occupant contact?
Gear Selector: occupant contact?
Rear Vision Mirror (internal): occupant contact?

Rear vision mirror - subject to ADR14?
Steering wheel rim: occupant contact?
Steering wheel spokes: occupant contact?
Steering wheel: horn ring damage and cause
Steering wheel: hub: occupant contant?
Steering column: occupant contact?
Steering assembly: subject to ADR10?
"A" Pillar: driver's side: occupant contact?
"B" Pillar: driver's side: occupant contact?
"C" pillar: driver's side: occupant contact?
Seat belt upper anchorage: driver's side occupant contact?
Passenger's side:
"A" pillar contact
"B" pillar contact
"C" pillar contact
Seat belt anchorage: occupant contact?
Instrument panel - subject to ADR21?
Instrument panel: upper: occupant contact?
Instrument panel: middle: occupant contact?
Instrument panel: lower: occupant contact?
RH roof rail: damage: occupant contact?
LH roof rail: damage: occupant contact?
Windscreen header rail: occupant contact?

Seat Belt Data: Driver's Seat:

Seat belt availability: driver's seat
Seat belt worn? driver's seat
Restraint performance of seat belt: driver's seat
Seat Belt Data - Centre Front Seat - as above
Seat Belt Data - Left Front Seat - as above
Seat Belt Data - Right Rear Seat - as above
Seat Belt Data - Centre Rear Seat - as above
Seat Belt Data - Left Rear Seat - as above
Seat belts - subject to ADR?
Seat belt anchorage - subject to ADR5?
Seats - subject to ADR3?
Head Restraint - subject to ADR22?

Seat Data: Driver's Seat

Structural damage to seat?
Damage to latch of folding seat?
Damage to recliner mechanism?
Head restraint, evidence of occupant contact?
Back of seat (other than head restraint) evidence of contact by rear seat occupant or object
Seat Data - Left Front Passenger - as above

Doors - Subject to ADR2?

Door Data - Driver's Door:

Door damaged?
Door opened in crash?
Operation of door after crash
Door latch: damage and separation
Door hinges: damaged?
Occupant contact with interior of door?

Door Data - Right Rear Door - as above
Door Data - Left Rear Door - as above
Door Data - Left Front Door - as above

Glazing - subject to ADR8?

Windscreen - occupant contact with glass?
Windscreen - misting relevant?
Windscreen - demisting subject to ADR15?
Window Glass: driver's vent window - occupant contact?
Window Glass - right front window - occupant contact?
Window Glass - right rear window - occupant contact?
Window Glass - right rear vent - occupant contact?
Window Glass - back window - occupant contact?
Window Glass - left rear vent - occupant contact?
Window Glass - left rear window - occupant contact?
Window Glass - left front window - occupant contact?
Window Glass - left front vent - occupant contact?

Tyres - subject to ADR23?
Tyres - subject to ADR24?
Tyres - incorrect specification relevant (size, carcass)
Tyres - incorrect operation relevant (pressure, tread -depth)
Suspension - modification relevant
Suspension - condition relevant (worn shock absorbers, joints)
Fuel Leakage - source of fuel leakage
Fire - any person burnt by fire?
Bonnet/Windscreen penetration - bonnet elevation of rear edge

Lighting:

Reversing lamps - subject to ADR1?
Turn signal lamps - subject to ADR6?
Parking lamps - operation relevant?
Headlamps - operation relevant?
Stop (Brake) lamps - operation relevant?
Turn Signal Lamps - operation relevant?
Towing - trailer - relevant factor?

Child Restraint:

Child Restraint occupied

Year of Registration of vehicle

CRASH INJURY CODE

File identification
Case Number
Unit number
Subject number
Age
Sex
Height
Weight
Neck length
Upper arm length
Forearm length
Upper leg length
Lower leg length
Type of unit

Subject location-vehicle occupant:

Seat location
Position on seat
Posture
Position inside vehicle after the accident
Degree of ejection
Area of ejection
Position outside the vehicle after the accident - if ejected

Subject location - other road user:

Posture (pedestrian)
Location (cyclist)
Location (motorcyclist)
Participant associated with other class of traffic unit
Position after the accident (no other vehicle involved)
Position after the accident (other vehicle involved)
First fixed object contacted
Second fixed object contacted
Third fixed object contacted
Fourth fixed object contacted

Protective devices - vehicle occupants:

Seat belt available for this occupant?
Type of restraint if fitted
Seat belt claimed to have been worn?
Investigators' judgement of belt wearing
Evidence of wearing - belt damage
Evidence of wearing - belt-induced injuries
Evidence of wearing - statements from witnesses
Adjustment of static belt - occupant's statement
Adjustment of static belt - investigator's opinion
Inertia reel belt - occupant's reported posture on impact
Inertia reel belt - physical evidence of reelout prior to impact
Inertia reel belt - occupant's report of retractor locking
Inertia reel belt - physical evidence on webbing of retractor locking

Seat belt mountings struck by this occupant?
Effectiveness of restraint by seat belt - physical evidence of contact with other objects
Effectiveness of restraint by seat belt - occupant's report of contact with other objects
Effectiveness of restraint by seat belt - physical evidence of partial or total ejection from belt
Effectiveness of restraint by seat belt - occupant's report of partial or total ejection from belt

Child restraints: (occupant aged between 10 months and 8 years)

Child restraint available for this occupant?
Type of child restraint, if available
Location of this child restraint, if available?
Available child restraint - SAA approved?
Available child restraint - make and model
Effectiveness of child restraint, if used
Damage to child restraint, if used

Infant Carrier: (occupant aged less than 10 months or in an infant carrier)

Infant carrier available for this occupant?
Type of infant carrier, if available
Location of infant carrier, if available
Effectiveness of infant carrier, if used
Damage to infant carrier - if used

Motorcyclist only:

Helmet wearing
Helmet type
Helmet make
Helmet model
Helmet, chin strap buckle type
Helmet, chin strap done up?
Helmet, visor condition
Helmet, subjective assessment of helmet condition prior to accident
Helmet, contact with any objects during crash?
Helmet, damage severity
Helmet damage, location on helmet?
Helmet: Approved for SHCA?
Helmet: Approved for SNELL?
Helmet: Approved for E33?
Helmet: Approved for E43?
Helmet: Approved for AS1698?
Helmet: Approved for BS1869?
Helmet: Approved for BS2495?
Helmet: Approved for Z90?
Motorcyclist's clothing - protective properties
Motorcyclist's footwear
Motorcyclist's gloves

Injury Status:

Status of traumatic injuries
Overall severity of traumatic injuries
Injury Severity Score
Status of non-traumatic medical condition
Autopsy
Duration of stay in hospital
Duration of restriction of normal activities (work, school, etc.)
Permanent disability resulting from this accident

Transportation of Injured:

Destination on departure from scene of accident
Subsequent destination (transfer on same day)
Mode of transport from scene
Time period from call to arrival of ambulance
Time ambulance spent at the scene of the accident
Time in ambulance from scene to hospital

Characteristics of Specific Injuries:

Most Severe Injury:

Body region
Aspect
Lesion
System/Organ
Abbreviated Injury Scale
First object contacted (for this injury)

Probability of contact with the above object
Second object contacted (for this injury)
Probability of contact with the above object
Third object contacted (for this injury)
Probability of contact with the above object
Fourth object contacted (for this injury)
Probability of contact with the above object

Second Most Severe Injury - as for most severe injury
Third Most Severe Injury - as for most severe injury
Fourth Most Severe Injury - as for most severe injury
Fifth Most Severe Injury - as for most severe injury
Sixth Most Severe Injury - as for most severe injury
Seventh Most Severe Injury - as for most severe injury
Eighth Most Severe Injury - as for most severe injury
Ninth Most Severe Injury - as for most severe injury

ACTIVE PARTICIPANT CODE

File Identification
Case Number
Unit Number
Subject number for active participant in this unit
Type of active participant
Age
Sex
Height
Weight
Marital Status
Educational level
Occupation (former occupation if retired, usual occupation if unemployed)
Employment Status
Clothing (pedestrian, cyclist, motorcyclist)
Conspicuity under conditions prevailing at accident (pedestrian, cyclist, motorcyclist)
Footwear

Vision and Hearing:

Static visual acuity - right eye
Static visual acuity - left eye
Visual field
Colour vision
Glasses normally worn (to correct listed condition)
Glasses worn at accident (to correct listed condition)
Period glasses worn (excluding sunglasses)
Lens mounting
Restriction of peripheral visual field by glasses
Lens tinting
Sunglasses only
Hearing

Sleep Pattern:

Hours slept previous night
Average hours slept per day
Recent hours slept per day
Nature of sleep
Usual nature of sleep
Recent nature of sleep
Recent sleep pattern (compared to usual)

Smoking:

Predominant type of tobacco product used
Average daily cigarette consumption
Cigarette consumption on day of accident
Average daily tobacco consumption (other than cigarettes)
Tobacco consumption on day of accident (other than cigarettes)
Smoking at time of accident?

Alcohol:

Usual frequency of alcohol consumption
Predominant type of alcoholic beverage consumed
Usual amount of alcoholic beverage consumed
Amount of alcoholic beverage consumed during 12 hours preceding accident
Started drinking how long before accident?
Stopped drinking how long before accident?
Place of alcohol consumption on this occasion
Subjective assessment of intoxication at scene of accident or soon after
Breath sample taken by research team
Breath sample taken by police
Blood alcohol estimate from research team sample
Blood alcohol estimate from police sample
Blood sample taken at hospital?
Blood alcohol reading from hospital sample

Other Drugs, Intoxicants:

Carbon Monoxide poisoning
Current medication: prescription drugs, effects on response
Current medication: predominant non-prescription drug
Current medication: other non-prescription drug
Are any of the above drugs incompatible with alcohol?

Health:

General health: condition
General health: type of current illness, if any
Relevance of current illness to performance
History of illness
Family history of illness
Time to next menstrual period
Dysmenorrhea
Pre-menstrual tension

Driving record:

Type of first licence obtained
Type of current licence
Current relevant licence status
Place first licence obtained
Time since first obtained any class of licence
If licence held for less than one year code period in months
Time since first obtained relevant licence
If relevant licence held for less than one year, code period in months

Licence restriction?
Licence restriction: compliance at accident?
Licence suspension or revocation in force at time of accident?
Total period of licence suspension on this occasion
Period between start of licence suspension on this occasion and date of accident
If licence suspended at time of accident was driver continuing to drive regularly
Reason for licence suspension
Licence ever suspended or revoked? (apart from any current suspension or revocation)
If licence suspended previously, for what period? (most recent suspension other than any in force at time of accident)
Did driver continue to drive during the above licence suspension?
Reason for the above licence suspension?
Period of next most recent licence suspension
Did driver continue to drive during the above licence suspension
Reason for the above licence suspension
Predominant type of driving instruction
Other type of driving instruction
Number of moving violations in the past 5 years (excluding any relating to this accident)
Type of most recent moving violation
Fine for most recent moving violation (excluding costs)
Type of moving violation prior to the above
Charges for moving violations arising from this accident (fatals and juveniles included in non-charged group)
Fine for the above moving violation
Licence suspension or revocation as a consequence of this accident?
Period of licence suspension
Number of previous accidents (when an active participant)
Nature of most recent previous accident
Party most at fault in the above accident
Injury to self in the above accident
Most severe injury to other party in the above accident
Penalty arising from the above accident
Nature of the next most recent accident - as above (to a total of 4 accidents)
Nature of the most severe (in terms of injuries) previous accident other than the above
Most severe injury to self in an accident in which not actively involved as a driver, etc.
Most severe injury to other party in an accident in which this driver was involved, but not as an active participant
Accident History of friends and family
History of injury-producing accidents involving friends and family

Vehicle Experience:

Ownership of accident vehicle
Length of ownership (or use if driving company car regularly)
Frequency of use of accident vehicle
Average distance driven per week
Recent driving experience
Possible confusion arising from recent experience in another vehicle
Source of possible confusion

Vehicle Experience - motorcyclist only:

Type of motorcycle previously ridden (most recent)
Experience on above motorcycle
Capacity of above motorcycle
Type of motorcycle most often ridden previously (or second most recent)
Experience on above motorcycle
Capacity of above motorcycle
Usual method of brake application
Method of brake application in this accident
Reason for not using front brake in this accident
Accustomed to location of rear brake pedal
Motorcyclist also drives car

Vehicle experience - pedal cyclist:

Accustomed to riding a pedal cycle?
Accustomed to riding this pedal cycle?

Pre-accident Factors:

Origin of journey: type
Origin of journey: suburb
Destination of journey: type
Destination of journey: suburb
Running to schedule at time of accident?
Purpose of journey
Social interactions prior to journey
Emotional state prior to journey
Emotional state prior to accident
Mental activity prior to accident
Preoccupation prior to accident
Recent preoccupations (previous few days or weeks)
Incidents during journey
Visual distractions at time of accident
Predominant visual restrictions outside vehicle (or for pedestrian, etc.)
Second most significant visual restriction outside vehicle
Third most significant visual restriction outside vehicle
Fourth most significant visual restriction outside vehicle
Predominant visual restriction within vehicle
Second most significant visual restriction within vehicle
Third most significant visual restriction within vehicle
Primary activity (vehicle operator)
Primary activity (pedestrian)
Predominant secondary activity within vehicle (or of pedestrian, etc.)
Second most significant secondary activity within vehicle (or of pedestrian, etc.)
Third most significant secondary activity within vehicle (or of pedestrian etc.)
Predominant secondary activity outside vehicle
Second most significant secondary activity outside vehicle
Relationship to passengers

Accident Environment:

Frequency of exposure to accident site
Familiarity with accident site
Familiarity with manoeuvre attempted at this location

Familiarity with accident environment under prevailing conditions (if unfamiliar, predominant reason)
Second most significant reason for unfamiliarity with accident environment under prevailing conditions
Awareness of movement or location of traffic unit contacted in accident
Awareness of impending accident
Precautionary action attempted before any emergency action (vehicle operator)
Avoiding action by vehicle operator
Awareness of relevant traffic control device
Understanding of traffic control device
Reaction to traffic control device
Awareness of relevant traffic rules (apart from these relating to the above device)
Understanding of relevant traffic rules
Action in relation to relevant traffic rules

Accident Causation:

Participant's opinion on predominant cause of accident
Participant's opinion on other cause of accident
Participant's opinion on predominant contributing aspect of own driving
Participant's opinion on second most significant contributing aspect of own driving
Participant's opinion on third most significant contributing aspect of own driving
Participant's opinion on fourth most significant contributing aspect of own driving
Interviewer's opinion on above response
Interviewer's opinion on predominant,second, third and fourth contributing aspects of this participant's driving
Participant's opinion re major contributing aspect of other participant's driving
Participant's opinion re other contributing aspect of other participant's driving
Interviewer's opinion re above responses
Interviewer's opinion re contributing aspect of uninvolved participant's driving

Attitudinal Factors:

Participant's opinion on major cause of accidents
Participant's opinion on second most significant cause of accidents
Participant's opinion on third, fourth and fifth most significant cause of accidents
Participant's opinion on severity of penalties for traffic offences
Participant's opinion on consistency of penalties for traffic offences
Participant's opinion on seat belt wearing (or helmet use, if motorcyclist)
Participant's general behaviour re seat belt wearing when seat belt available (or helmet use, if motorcyclist)
Was participant wearing belt (helmet) at time of accident?
Participant's reason for not wearing seat belt
Participant's reason for not wearing helmet
Participant's attitude to drinking and driving (vehicle operator)
Participant's behaviour re drinking and driving (vehicle operator)
Amount of alcoholic beverage participant can consume and still drive capably (vehicle operator)
Participant's major interest in vehicles
Participant's other interest in vehicles
Predominant reason for owning vehicle used in accident
Other reason for owning vehicle used in accident
Concern about road safety
Opinion on road safety propaganda
Follow up interview completed?
Interview conducted how many days after accident
Reason for non-completion of follow up interview
Number of attempts to obtain an interview
Person with whom follow up interview conducted
Confidence re source of follow up information

TRUCK, BUS AND MULTI-PURPOSE PASSENGER CAR DATA CODE:

File Number
Case Number
Vehicle Number
Make
Model
Compliance plate fitted
"Year of Manufacture" as listed on the compliance plate
"Year of Manufacture" as registered
Type of vehicle
Cab style
Cargo area description
Number of axles
Number of axles with dual wheels
Accident categorized by type of traffic unit
First event for this vehicle
Second event for this vehicle

First Event:

Point of contact on this vehicle
If the first event was a collision with another truck or bus, what was the point of contact on that vehicle
Alignment of the above vehicle to the case vehicle
Estimated speed of other vehicle (if any) in this first event
Estimated speed of this vehicle on involvement in the first event
If the first event was a collision with a fixed object, what was the direction of impact relative to the case vehicle
Use SAE Collision Damage Classification VDI for damage sustained in the first event:
Direction of deformation
General location of deformation
Horizontal location of deformation
Vertical location of deformation
Nature of deformation

Extent of deformation
Traffic unit movements (vehicle specific) in this event
Second event - as for first event
Rollover (if occurred): extent of roll
Rollover (if occurred): properties of ground surface for majority of roll
Rollover (if occurred) collision during roll
Unladen mass
Gross vehicle mass
Gross combination mass
Mass of vehicle at impact
Was the loading of the vehicle relevant to the accident
Was the manner of loading or construction of the vehicle relative to the consequences of the accident
Did the load of this vehicle contact any participant in this accident
Engine malfunction: relevant to the causation of this accident
Brake application: on at impact
Brakes: skidding due to braking
Brake malfunction relevant to accident
Internal sunvisors: subject to ADR11
Internal sunvisor: driver's side, occupant contact
Internal sunvisor: passenger's side, occupant contact
Glove compartment door: occupant contact
Glove compartment door: opened in crash
Parcel shelf - occupant contact
Parking brake handle - occupant contact
Wiper blade: RH side
Wiper blade: LH side
Wiper and washer: subject to ADR16
Glare in field of view: ADR12 applicable to vehicle
Heater or fresh air ducts: occupant contact
Airconditioner ducts: occupant contact
Instruments or Controls: occupant contact
Radio: occupant contact
Tape player: occupant contact
External rear vision mirror, driver's side: contact by other road user
External rear vision mirror, passenger's side: contact by other road user
Instrument panel ash tray: occupant contact
Back of front seat ash tray: occupant contact
Ignition key: occupant contact
Foot controls: occupant contact
Gear selector: occupant contact
Rear vision mirror, internal: occupant contact
Rear vision - subject to ADR14
Steering wheel trim: occupant contact
Steering wheel spokes: occupant contact
Steering wheel: horn ring damage and cause
Steering wheel: hub: occupant contact
Steering column: occupant contact
Steering assembly: subject to ADR
'A' pillar driver's side: occupant contact
'B' pillar, driver's side: occupant contact
'C' pillar, driver's side: occupant contact
Seat Belt upper anchorage: driver's side: occupant contact
Passenger's side: as for driver
Instrument panel: lower: occupant contact
Instrument panel: middle: occupant contact
Instrument panel: upper: occupant contact
RH roof rail: damage: occupant contact
LH roof rail: damage: occupant contact
Windscreen header rail: occupant contact

Seat Belt Data - Driver's Seat

Seat belt availability - driver's seat
Seat belt worn? Driver's seat
Restraint performance of seat belt: driver's seat
Seat belt data - centre front seat
Seat belt data - left front seat
Seat belt data - right rear seat
Seat belt data - centre rear seat
Seat belt data - left rear seat
Seat belt anchorage - subject to ADR?
Seats - subject to ADR3?
Head restraint - subject to ADR?

Seat Data: Driver's Seat:

Structural damage to seat
Damage to latch of folding seat
Damage to recliner mechanism
Head restraint, evidence of occupant contact
Back of seat (other than head restraint) evidence of contact by rear seat occupant or object
Seat Data: Left Front Passenger - as for Driver's Seat

Door Data: Driver's Door:

Door damaged
Door opened in crash
Operation of door after crash
Door latch: damage and separation
Door hinges: damaged
Occupant contact with interior of door
Door Data, Right Rear Door, Left Rear Door and Left Front Door - as for Driver's Door

Glazing - Subject to ADR8

Windscreen: occupant contact with glass

Windscreen - misting relevant
Windscreen - demisting subject to ADR15
Window glass: Occupant contact - Driver's Vent Window, Right Front Window, Right Rear Window, Right Rear Vent, Back Window, Left Rear Window, Left Rear Vent, Left Front Window, Left Front Vent

Tyres - subject to ADR23
Tyres - subject to ADR24
Tyres - Incorrect specification relevant (size, carcass)
Tyres - incorrect operation relevant (pressure, tread depth)
Suspension - modification relevant
Suspension - condition relevant (worn shock absorbers, joints)

Fuel leakage:

Fuel tank - subject to ADR17
Source of fuel leakage
Fire
Any person burnt by fire

Bonnet/Windscreen Penetration:

Bonnet: elevation of rear edge

Lighting:

Reversing lamps - subject to ADR1
Turn signal lamps - subject to ADR6
Parking lamps - operation relevant
Headlamps - operation relevant
Stop (Brake) lamps - operation relevant
Turn signal lamps - operation relevant

Towing: Trailer - relevant factor?

Child Restraint:

Child restraint occupied

Reversing lamps - operating mode relevant

MOTOR CYCLE DATA CODE

File Number
Case Number
Vehicle Number
Motorcycle Type
Make of motorcycle
Model of motorcycle
Predominant colour of motorcycle
Initial Event for this unit
Second event for this unit

Initial Event:

Initial point of contact on motorcycle, if a collision
Alignment of other vehicle, or direction of impact if collision with a fixed object or a pedestrian
Point of contact on this other vehicle, if a car, in the initial event
Estimated speed of the motorcycle in the first event in this accident
Estimated speed of other involved vehicle in the first event
Traffic unit movements for this event
Second event - as for initial event

Descriptive items:

Compliance plate fitted
Compliance with ADR7
Compliance with ADR28
Compliance with ADR33
Was a pillion passenger carried?
Engine: capacity
Headlight: day glow cover fitted?
Front suspension type
Handlebar type
Handlebars: standard equipment
Handlebars: damaged?
Handlebars: rider contact?
Front brake: type
Front brake: actuation
Front brake: adjustment
Rear brake: type
Rear brake: actuation
Rear brake: adjustment
Crash bars: fitted?
Crash bars: damaged?
Rear view mirror: rider contact?
Windscreen or fairing: rider contact?
Petrol tank and fittings: rider contact?
Crash bars: rider contact?
Headlight: operational at time of accident?
Stop light: operational at time of accident?
Skidding?
Skidding started on painted road marking?
Front tyre: tread type
Front tyre: tread condition
Rear tyre: tread type
Rear tyre: tread condition
Fuel leakage from motorcycle?
Fire?

Crash Helmet Data: Rider

Helmet type
Predominant colour of helmet
Condition of helmet
Rider: head injury and helmet contact
Visor properties

Crash Helmet Data: Pillion Passenger: as for rider

General condition of motorcycle
Motorcycle defect or modification relevant to accident?
Modification directly responsible for injury to any party?