OFFICE OF ROAD SAFETY

DOCUMENT RETRIEVAL INFORMATION

Report No.	Date	Pages	ISBN	ISSN
CR 32	December 1983		0 624 51011 3	0810-770X

Title and Subtitle

Seat belt wearing in the Canberra region - Observations of occupants and interviews with drivers.

Author(s)
D.G. Pederson
H.C. Mahon

Performing Organisation (Name and Address)

Anutech Pty Ltd
GPO Box 4
CANBERRA ACT 2601

Sponsor (Name and Address)

Office of Road Safety
PO Box 594
CIVIC SQUARE ACT 2608

Available from (Name and Address)

Office of Road Safety

Price/Availability/Format

Nil/On request/A4

Abstract

Vehicle occupants were observed at five classes of site (driveway service and self-serve service stations, fast food outlets, parking areas, signalised intersections) in the Canberra region. The rate of seat-belt wearing, the primary variable, varied significantly over the classes of site. The rate was low for occupants with static seat belts, for young occupants, and on days when the road surface was dry.

Drivers were interviewed at four classes of site (signalised intersections were excluded). The wearing rate was low for drivers who travelled 30km or more on their last trip, for drivers who travelled 40km or more on one day or 25,000km or more in one year and for drivers with a formal education of three years or less at High School.

Conclusions are drawn regarding the suitability of the various sites for conducting roadside interviews, and regarding the suitability of roadside interviews for obtaining exposure data.

KEYWORDS: Seat belt usage, Exposure to risk, Roadside survey

NOTES:

(1) ORS research reports are disseminated in the interests of information exchange.
(2) The views expressed are those of the author(s) and do not necessarily represent those of the Commonwealth Government.
(3) The Office of Road Safety publishes two series of research reports
  (a) reports generated as a result of research done within the ORS are published in the OR series;
  (b) reports of research conducted by other organisations on behalf of the ORS are published in the CR series.

SEAT BELT WEARING IN THE CANBERRA REGION -

OBSERVATIONS OF OCCUPANTS AND INTERVIEWS WITH DRIVERS

prepared by

D.G. Pederson

H.C. Mahon

ANUTECH PTY LTD
GPO Box 4
CANBERRA ACT 2601

CR 32

December 1983

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

CHAPTER 1 - INTRODUCTION

1.1 SEAT BELT AVAILABILITY AND WEARING RATE

In each State and Territory of Australia there is legislation dealing with the fitting and wearing of motor vehicle seat belts. Since 1971 it has been necessary to fit seat belts to the seating positions of all new passenger cars and car derivatives, and inertia reel belts have been mandatory for the front outboard positions since 1975. The effect of the legislation has been that almost all current vehicles have seat belts fitted to the front positions, with the majority of these being inertia reel belts, and a high proportion of vehicles also have seat belts fitted to the rear positions. For example, in the Sydney metropolitan area in 1981 Schnerring (1983) found that seat belts were available to 99.2% of front outboard occupants, and 87.7% of rear outboard occupants.

The introduction of seat belt legislation was based on the premise that the wearing of a seat belt is an effective way of reducing injuries in an accident. Subsequent studies on fatality and injury rates have confirmed this belief (6th International Conference of the International Association for Accident and Traffic Medicine 1977; Milne 1979; Milne 1980; Herbert 1980).

However, surveys within Australia have shown that an appreciable percentage of vehicle occupants still do not wear seat belts (Carter 1980; Boughton, Milne and Cameron 1981; Fleming 1980; Schnerring 1983). For front outboard occupants aged at least eight years the percentage of non-wearers has varied between 10% and 20% in recent years, and it has always been found that:

(i) the wearing rate is lower in positions with static belts fitted;

(ii) the wearing rate is lower for rear seat occupants than for front seat occupants;

(iii) static seat belts are often incorrectly adjusted, mainly because of insufficient tightening.

Schnerring (1983) observed a higher wearing rate for males, but the opposite result was reported by Boughton et al (1980). There are likely to be complicating factors in a comparison of the sexes, such as the greater availability of inertia reel belts to males which was observed by Fleming (1980).

Thus the observational surveys have yielded basic information on the characteristics of wearers and non-wearers, and on the external influences likely to affect wearing rate. If future education and enforcement efforts are to be effective, it will be necessary to have more detailed information on the characteristics and attitudes of non-wearers. A major aim of the present study was to investigate ways of obtaining such information.

1.2 SITES FOR SEAT-BELT SURVEYS

The surveys reported by Boughton et al (1980) were carried out at signalised intersections on urban arterial roads with central medians. A further requirement was that the sites should have a heavy traffic flow, and intersections with no turning lanes were preferred. The surveys reported by Fleming (1980) and by Schnerring (1983) were carried out at both signalised intersections and within the traffic entry or parking areas of major shopping centres.

If surveys were carried out in non-metropolitan areas, it is likely that neither signalised intersections with a heavy traffic flow nor major shopping centres would be available. Evaluation of several alternative classes of site was an additional aim in the present study.

1.3 EXPOSURE TO THE LIKELIHOOD OF VEHICLE ACCIDENTS

Stanton (1981) has defined exposure as

> "the opportunity for road users to
> become involved in road traffic accidents".

However, the risk experienced by a particular individual may be measured in a number of ways, including:

(i) time spent on the road
(ii) distance travelled by road
(iii) number of trips made

An extensive vehicle-based survey is carried out periodically within Australia (Australian Bureau of Statistics 1981), giving information on the average distance driven annually and how it depends on a driver's sex, age, driving experience and marital status. Stanton (1981) has prepared a list of other Australian surveys of vehicle occupant exposure, but these were invariably one-off surveys and were specific to a particular geographical area or mode of travel.

The "distance travelled" measure of exposure to risk has been used in the present study. The main choice in obtaining data on exposure is between interviewing vehicle occupants and carrying out off-road interviews of persons who have been vehicle occupants. Roadside interviews have been used in the present study since, subject to careful site selection, information can be obtained more easily for the occupant population or for a specific segment of that population.

1.4 SUMMARY OF THE AIMS OF THIS SURVEY

ANUTECH Pty Ltd was commissioned to undertake a study which had the following aims:

1. To investigate the suitability of several types of site for observing vehicle occupants and interviewing drivers.

2. To prepare and test an observation form and an interview questionnaire.

3. To obtain exposure data, as part of the interview, and test its validity.

4. To obtain estimates of the seat-belt wearing rate for sub-groups of the population of drivers.

5. As a result of 4., to identify sub-groups of drivers with a low wearing rate, to assist future campaigns intended to increase the wearing rate.

6. To carry out a small-scale survey, involving both observation and interview within a rural area to determine the best methodology for such surveys.

CHAPTER 2 - SURVEY DESIGN

2.1 SURVEY SITES AND TIMES

The majority of the survey was carried out in Canberra, the exceptions being two sites in the township of Yass, about 60 kilometres from Canberra. Each interview site was either a service station, a fast food outlet, or a parking area of a major shopping centre. Two types of service station were used, namely those offering driveway service and those operating as self-serve stations. Some observations were carried out at two signalised intersections in Canberra, but these sites were not used for interviews because of the high accident risk to interviewers and the difficulty associated with completing a satisfactory interview in the short time that traffic was at rest.

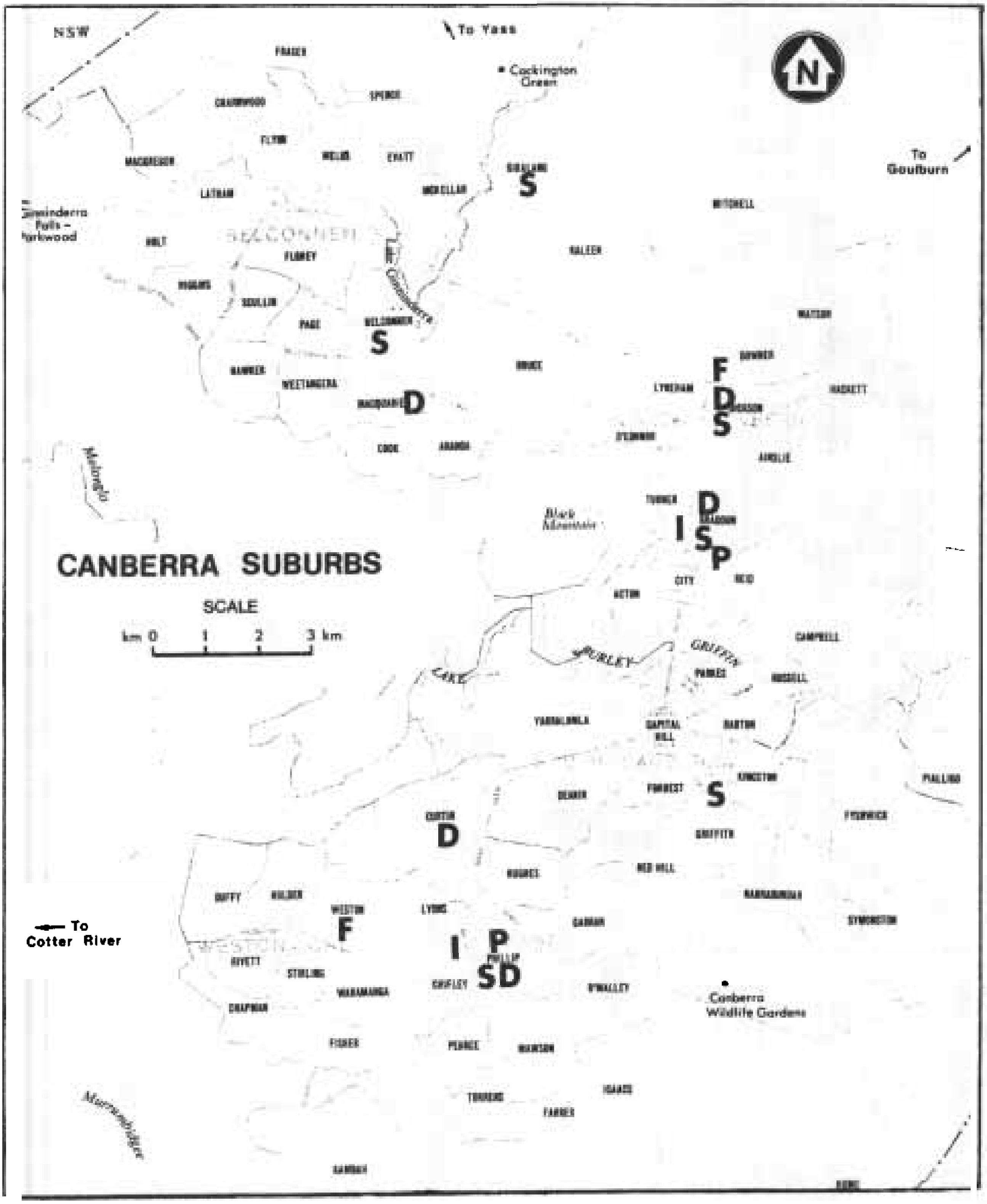
The locations of the 17 Canberra sites are shown in Figure 2.1.1. The two boom-gate parking areas were adjacent to major shopping centres at Civic and Woden, respectively, and each of the fast food outlets was a McDonalds restaurant. No difficulty was experienced in gaining permission to operate at the sites, although minor problems were caused on some occasions because the employee in charge at the time was unaware that permission had been previously granted.

The days and times of manning of the Canberra sites are shown in Table 2.1.1. There was approximately equal representation of the days of the week, and the times were spread between 9am and 6.45pm. Previous surveys have involved a wider time span, but this was not practicable in the present case because of the nature of the sites. For example, parking areas are not used outside of the usual shopping hours, and the rate of traffic flow at fast food outlets is not very great outside of meal hours.

Two service station sites were used at Yass, one within the town centre and the other on the Hume Highway approximately two kilometres west of the town. The days and times of manning of the sites are shown in Table 2.1.2.

FIGURE 2.1.1

Locations of the seventeen observation and interview sites in the Canberra region.



LEGEND

D = driveway-service station

S = self-serve service station

P = parking area

F = fast food outlet

I = signalised intersection

TABLE 2.1.1

Number of observation periods at

five classes of site in the Canberra region

CLASS OF SITE	TIME OF DAY	DAY							TOTAL
		M	T	W	TH	F	SA	SU	
DRIVEWAY	AM *	1	1	2	1	1	0	2	8
SERVICE	PM *	2	1	1	1	1	0	1	7
TOTAL		3	2	3	2	2	0	3	15
SELF-	AM	1	1	1	1	1	2	1	8
SERVE	PM	1	2	1	1	1	1	3	10
TOTAL		2	3	2	2	2	3	4	18
PARKING	AM	1	0	0	1	0	3	0	5
AREA	PM	0	0	1	0	1	0	0	2
TOTAL		1	0	1	1	1	3	0	7
FAST	AM	0	0	1	0	2	0	1	4
FOOD	PM	0	1	0	1	0	1	0	3
TOTAL		0	1	1	1	2	1	1	7
SIGNALISED	AM	0	1	0	0	0	1	0	2
INTERSECTION	PM	1	0	0	0	0	1	0	2
TOTAL		1	1	0	0	0	2	0	4
ALL	AM	3	3	4	3	4	6	4	27
SITES	PM	4	4	3	3	3	3	4	24
TOTAL		7	7	7	6	7	9	8	51

* AM = 11 am to 2 pm, except that Saturday at Parking Area = 9 am to 12 noon.

PM = 3.45 pm to 6.45 pm, except that Parking Area = 2 pm to 5 pm.

TABLE 2.1.2

Number of observation periods at two service station sites in the Yass region.

SITE	TIME OF DAY	DAY	
		FRIDAY	SATURDAY
YASS TOWN	AM *	1	1
YASS HIGHWAY	PM *	1	1

* AM = 10 am to 1 pm

PM = 2 pm to 5 pm

2.2 THE INTERVIEW QUESTIONNAIRE

Only the drivers of vehicles were interviewed, and an important factor was the short time available for interviews. For example, at self-serve stations the customer takes only a short time to complete the transaction, and it may be expected that if the interview length exceeds this time then neither the customer nor the proprietor will be anxious for the interview to continue. At parking areas and fast food outlets the interviews were carried out after the drivers had left their vehicle and were therefore intent on going about their business, often with other persons accompanying them.

As a guide to the time available at service stations, data were obtained on the times from commencement to completion of the serving of petrol. The minimum, median and maximum times are shown in Table 2.2.1, and they suggest that an interview time of approximately two minutes would be acceptable to the interviewee.

TABLE 2.2.1

Service times at two types of service station, during which the driver would be available for interview

TYPE OF SERVICE STATION	SERVICE TIME			NUMBER OF OBSERVATIONS
	MINIMUM	MEDIUM	MAXIMUM	
DRIVEWAY SERVICE	1m 20s	2m 00s	2m 35s	35
SELF-SERVICE	0m 30s	1m 10s	2m 05s	40

An interview questionnaire was prepared and a pilot survey carried out at four sites. As a result, the modified version shown in Appendix A was produced. Each question falls into one of three categories:

(i) questions on distance driven (2, 3, 4, 5), and which therefore deal with "exposure".

(ii) questions on seat belt use (6,7).

(iii) questions on variables which may be related to exposure and seat belt use (1, 8, 9, 10, 11).

Observations 12 to 23 fall into category (iii), with the exception of observation 16 which yields basic information on seat belt use.

Questions 9, 10 and 11 deal with socio-economic status (SES), and were included because it has been suggested that the probability of wearing a seat belt is associated with a person's SES (Boughton et al 1981). Similar questions have been used by Vaughn (1958) to produce a scale for assessing SES in survey research. In the case of the occupation question (9), more detailed questioning would have been preferred. For example, Broom, Duncan-Jones Jones and McDonnell (1977) list eleven questions which allow a person to be classified unambiguously within the Australian Census Classification of Occupations. However, in the present study only a very simple response could be sought, and the resulting classification was into very broad categories.

For each of questions 10 and 11 the drivers were asked to pick one response from several listed on a card. The possible responses are given in Appendix B.

2.3 THE OBSERVATION FORM

The observation form is shown in Appendix C. In line with previous studies of this type, the response of main interest was whether a restraint was worn or not for each occupant of a vehicle. The other responses were possible predictors of whether a restraint was worn or not. The observers were instructed to circle the appropriate responses.

2.4 THE OBSERVATION AND INTERVIEW METHODOLOGY

There were two separate tasks to be performed in the field, namely to observe vehicle occupants and to interview drivers. The decision was made to interview approximately equal numbers of non-wearers and wearers of seat belts, since comparisons were to be made of these two groups and the efficiency of comparisons is maximised if sample sizes are equal. However, non-wearers were expected to comprise only about ten per cent of the driver population, and it was therefore necessary to devise a selection scheme which favoured non-wearers. In particular, it was necessary to ensure that a field worker was not busy with some other task when a non-wearing driver became available for interview. For these reasons it was decided that there should be two field workers at each site, and they were issued with the following instructions:

(a) For each period of one hour, one person will conduct interviews and the other will carry out observations.

(b) For the person carrying out interviews:

  (i) interview drivers until five wearers have been interviewed
  (ii) continue to interview only non-wearers until five non-wearers have been interviewed
  (iii) if five of each category have been interviewed before one hour has elapsed, carry out observations in the remaining time.

(c) For the person carrying out observations:

  (i) observe the first vehicle to enter
  (ii) when the observation has been completed, prepare for the next observation and then observe the next vehicle to enter
  (iii) if, at any time, the driver of the next vehicle to enter is interviewed, still include that vehicle as an observation.

(d) At the end of one hour, switch roles.

If a field worker had attempted to carry out the two tasks simultaneously then the process of selection of drivers for interview would have produced a biased observation set, and the intention of splitting the tasks was to avoid this bias. The number of drivers suggested for interview was based on a traffic flow rate of approximately forty vehicles per hour, which the pilot study had shown to be a reasonable expectation.

CHAPTER 3 - OBSERVATIONS IN THE CANBERRA REGION

3.1 NUMBER OF OBSERVATIONS AND PASSENGERS PER VEHICLE

The number of observations at each class of site is shown in Table 3.1.1.

TABLE 3.1.1

Number of observations on vehicle occupants at each of five classes of site in the Canberra region.

CLASS OF SITE	NUMBER OF VEHICLES OBSERVED	NUMBER OF OBSERVATION HOURS	VEHICLES PER HOUR
DRIVEWAY SERVICE	628	45	14
SELF-SERVE	1157	57	20
PARKING AREA	704	21	34
FAST FOOD	521	21	25
INTERSECTION	1157	24	48
TOTAL	4167	168	141

The observation rates per observer in the last column may be regarded as lower limits because some time was lost due to rain and other uncontrollable factors, but they do give a true indication of the relative rates of traffic flow. The traditional observation site, the signalised intersection, permitted the greatest number of observations per hour, and service stations providing driveway service were relatively unproductive for observations.

The number of occupants per vehicle, including the driver, at each class of site is shown in Table 3.1.2. The distributions differ significantly over the sites (X2=216, 16 d.f. ; $p<0.001$), with the service station sites having the greatest proportion of driver-only vehicles, followed by the parking area and intersection sites. The distinctive feature of the fast food sites was that the majority of vehicles had two or more occupants.

TABLE 3.1.2

Frequency distribution of occupants per vehicle at five classes of site in the Canberra region; percentages of the total per site are shown in parentheses.

SITE	OCCUPANTS PER VEHICLE						AVERAGE NO OF OCCUPANTS
	1	2	3	4	5	6	
DRIVEWAY SERVICE	475	110	26	13	4	0	1.35
	(76)	(18)	(4)	(2)	(1)	(0)	
SELF-SERVE	767	256	77	43	11	3	1.52
	(66)	(22)	(7)	(4)	(1)	(0)	
PARKING AREA	419	230	39	11	5	0	1.51
	(60)	(33)	(6)	(2)	(1)	(0)	
FAST FOOD	208	197	67	32	17	0	1.95
	(40)	(38)	(13)	(6)	(3)	(0)	
INTERSECTION	670	363	83	31	7	3	1.57
	(58)	(31)	(7)	(3)	(1)	(0)	

Seat belts were available to 99.4% of front outboard occupants, and to 92.3% of rear outboard occupants.

3.2 IDENTIFYING EFFECTS VIA THE LOGIT TRANSFORMATION

The seat belt wearing rate is the variable of primary interest for the observational data, and the symbol P will be used for an observed wearing rate. Previous studies have identified factors with an apparent influence on P, but the disentangling of effects is not always easy.

Categorical data involving a binomial proportion are most commonly analysed using the chi-square test statistic. A convenient way of carrying out the analysis, termed the "analysis of deviance", is by way of the logit transformation. Three examples of the analysis of deviance are given in Appendix D, to illustrate the types of conclusion which may be drawn.

Logit analyses were used for the observational data in the present survey, with P as the dependent variable. There were many factors to include in the analyses, but it was not possible to consider these simultaneously because the resulting multiway table would have possessed almost as many cells as there were observations. The factors were therefore separated into five groups, namely:

(i) class of site, day of week, seating position
(ii) class of site, time of day, seating position
(iii) class of site, wetness of the road surface, type of seat belt, seating position
(iv) age of occupant, sex of occupant, type of belt, seating position
(v) age of vehicle, type of vehicle, type of belt, seating position.

Seating position was included in all five groups because, as will be shown later, the effect of seating position on P was of over-riding importance. The analyses of the five groups of data will now be presented in turn.

3.3 RELATIONSHIP OF P TO SITE AND DAY OF WEEK

To simplify the analysis, days of the week were amalgamated into a "weekday" class (Monday to Friday) and a "weekend" class (Saturday and Sunday). Vehicle occupants were classified as being in either the front of the vehicle or the rear of the vehicle. The data are shown in Table 3.3.1.

TABLE 3.3.1

Vehicle occupants in the Canberra region classified according to seat belt wearing, seating position, observation site, and period of the week.

PERIOD OF WEEK	SITE	FRONT OCCUPANT			REAR OCCUPANT		
		WORN	NOT WORN	P	WORN	NOT WORN	P
WEEKDAY	DRIVEWAY SERVICE	481	165	0.74	8	7	0.23
	SELF-SERVE	622	195	0.76	12	28	0.30
	PARKING AREA	441	89	0.83	13	15	0.46
	FAST FOOD	406	116	0.78	23	52	0.31
	INTERSECTION	645	105	0.86	20	38	0.34
WEEKEND	DRIVEWAY SERVICE	93	23	0.80	14	10	0.58
	SELF-SERVE	565	144	0.80	41	82	0.33
	PARKING AREA	351	90	0.80	13	28	0.32
	FAST FOOD	240	53	0.82	35	51	0.41
	INTERSECTION	763	100	0.88	41	81	0.34

The analysis of deviance of the data in Table 3.3.1 is:

MODEL TERM	df	G^2	p
Position	1	561.8	< 0.001
Site	4	60.7	< 0.001
Day	1	5.9	0.02
Site x Day	4	12.8	0.01
Position x Site	4	10.5	0.03
Residual	5	5.2	0.34
Mean	19	656.9	

The column headed "p" gives the probability of exceeding the deviance, assuming that the distribution is a chi-square. There is a significant position effect and sites differ significantly, but the differences between sites depend on both the period of the week and the seating position.

The majority of the data are for front seat occupants, and for these the wearing rate was highest at signalised intersections. The parking area rates were intermediate, and the rates for the other three classes of site were low and relatively similar.

For both front and rear occupants the wearing rate was higher on weekends at service stations and fast food outlets. There was no time period effect at signalised intersections, and the rate was lower at weekends for both front and rear occupants observed at a parking area.

Although the wearing rate was highest at signalised intersections for front seat occupants, there was no tendency for this to be the case for rear seat occupants. Thus the front versus rear differential was greatest for occupants observed at signalised intersections.

3.4 RELATIONSHIP OF P TO SITE AND TIME OF DAY

Occupants were classified according to seating position and observation site, and four time classes were constructed, giving rise to Table 3.4.1. The analysis of deviance of the data in this table is:

MODEL TERM	df	G^2	p
Position	1	541.6	< 0.001
Site	4	47.4	< 0.001
Time	3	9.8	0.02
Site x Time	12	56.0	< 0.001
Residual	19	30.7	0.05
Mean	39	685.5	

The difference between times is on the borderline of being statistically significant, but the highly significant interaction indicates that the effect of time differed for the five classes of site. For example, at signalised intersections P was lowest in the 1pm to 2pm time period, while the opposite is true of observations made at service stations offering driveway service. At self-serve stations and at parking areas P increased steadily over the day, and for fast food outlets there was no smooth trend. Thus there was interaction, but it is not possible to discern any meaningful pattern in the data.

TABLE 3.4.1

Vehicle occupants in the Canberra region classified according to seat belt wearing, seating position, observation site and time of day.

TIME OF DAY	SITE	FRONT OCCUPANT			REAR OCCUPANT		
		WORN	NOT WORN	P	WORN	NOT WORN	P
9 to 12	DRIVEWAY						
	SERVICE	163	64	0.72	9	7	0.56
	SELF-SERVE	285	101	0.74	14	36	0.28
	PARKING AREA	358	85	0.81	13	24	0.35
	FAST FOOD	185	60	0.76	10	30	0.25
	INTERSECTION	583	81	0.88	32	55	0.37
1 to 2	DRIVEWAY						
	SERVICE	204	47	0.81	11	9	0.55
	SELF-SERVE	296	107	0.73	10	27	0.27
	PARKING AREA	214	47	0.82	6	5	0.55
	FAST FOOD	195	29	0.87	24	20	0.55
	INTERSECTION	20	4	0.83	6	28	0.18
3 to 4	DRIVEWAY						
	SERVICE	57	19	0.75	0	11	0.00
	SELF-SERVE	146	37	0.80	3	15	0.17
	PARKING AREA	195	44	0.82	6	13	0.32
	FAST FOOD	48	21	0.70	4	8	0.33
	INTERSECTION	314	50	0.86	16	30	0.35
5 to 7	DRIVEWAY S.	150	58	0.72	2	10	0.17
	SELF-SERVE	461	94	0.83	26	32	0.45
	PARKING AREA	24	3	0.89	1	1	0.50
	FAST FOOD	218	59	0.79	20	45	0.31
	INTERSECTION	168	27	0.86	7	6	0.54

3.5 RELATIONSHIP OF P TO THE WETNESS OF THE ROAD SURFACE

Occupants were classified according to seating position, type of seat belt, class of site, and the condition of the road surface, whether wet or dry. The data are shown in Table 3.5.1.

TABLE 3.5.1

Vehicle occupants in the Canberra region classified according to seat belt wearing, seating position, observation site, type of belt, and wetness of the road surface

BELT	ROAD	SITE	FRONT OCCUPANT			REAR OCCUPANT		
TYPE	SURFACE		WORN	NOT WORN	P	WORN	NOT WORN	P
INERTIA REEL	DRY	DRIVEWAY SERVICE	244	82	0.75	3	1	0.75
		SELF-SERVE	608	149	0.80	15	11	0.58
		PARKING AREA	379	68	0.85	5	10	0.33
		FAST FOOD	247	57	0.81	5	5	0.50
		INTERSECTION	1117	133	0.89	22	15	0.59
INERTIA REEL	WET	DRIVEWAY SERVICE	170	44	0.79	2	5	0.29
		SELF-SERVE	207	29	0.88	1	0	1.00
		PARKING AREA	184	20	0.90	0	0	-
		FAST FOOD	190	37	0.84	14	10	0.58
		INTERSECTION	5	0	1.00	0	0	-
STATIC	DRY	DRIVEWAY SERVICE	94	35	0.73	4	8	0.33
		SELF-SERVE	294	98	0.75	20	5	0.27
		PARKING AREA	160	62	0.72	13	17	0.43
		FAST FOOD	108	24	0.82	22	35	0.39
		INTERSECTION	283	71	0.80	38	88	0.30
STATIC	WET	DRIVEWAY SERVICE	60	21	0.74	13	16	0.45
		SELF-SERVE	73	13	0.85	16	20	0.44
		PARKING AREA	63	11	0.85	8	5	0.62
		FAST FOOD	94	33	0.74	12	32	0.27
		INTERSECTION	1	0	1.00	-	0	-

The analysis of deviance of the data in Table 3.5.1 is:

MODEL TERM	df	G^2	P
Position	1	451.9	< 0.001
Belt type	1	53.8	< 0.001
Site	4	40.2	< 0.001
Road condition	1	14.8	< 0.001
Belt type x Site	4	14.3	0.01
Site x Road condition	4	11.7	0.02
Residual	24	31.0	0.17
Mean	39	617.7	

The wearing rate differed for the two types of belt, but the difference depended on the site. To investigate this further, the difference

P (inertia reel) - P (static),

where P is the observed wearing rate, was calculated for each of the twenty combinations of the other factors, giving the values in Table 3.5.2. The difference is predominantly positive, indicating that the wearing rate was higher for inertia reel belts than for static belts.

TABLE 3.5.2

The difference in wearing rate for inertia reel
and static belts for twenty combinations
of three other factors

		SITE				
OCCUPANT POSITION	ROAD SURFACE	DRIVEWAY SERVICE	SELF SERVE	PARKING AREA	FAST FOOD	INTERSECTION
FRONT	DRY	0.02	0.05	0.13	-0.01	0.09
	WET	0.05	0.03	0.05	0.10	0.00
REAR	DRY	0.42	0.31	-0.10	0.11	0.29
	WET	-0.16	0.56	-	0.31	-
WEIGHTED MEAN		0.03	0.06	0.10	0.07	0.11

A weight was attached to each difference according to the numbers of observations involved. For example, the difference of 0.02 for front occupants at a dry driveway service site was based on 326 and 129 observations, for inertia reel and static belts respectively, and was therefore given a weight of

$$\left(\frac{1}{326} + \frac{1}{129}\right)^{-1} = 92$$

This weighting formula was based on the fact that the variance of an estimated proportion is inversely proportional to the number of observations, and the amount of information in an estimate, in this case the difference in two proportions, is inversely dependent on its variance. The weights were used to calculate the weighted means in Table 3.5.2, which indicate that the inertia reel versus static differential was of the order of 0.07, and was highest for parking area and signalised intersection sites.

The effect of the wetness of the road surface depended on the site, and the difference

$$P\ (\text{wet}) - P\ (\text{dry}),$$

where P is the observed wearing rate, was therefore calculated for each of the twenty combinations of the other factors, giving the values in Table 3.5.3. The overall wet versus dry differential was of the order of 0.06, and was lowest for service stations offering driveway service and for fast food outlets.

TABLE 3.5.3

The difference in wearing rate (%) for a wet road surface and a dry road surface for twenty combinations of three other factors

OCCUPANT	BELT	SITE				
POSITION	TYPE	DRIVEWAY SERVICE	SELF SERVE	PARKING AREA	FAST FOOD	INTERSECTION
FRONT	INERTIA REEL	0.04	0.08	0.05	0.03	0.11
	STATIC	0.01	0.10	0.13	-0.08	0.20
REAR	INERTIA REEL	-0.46	0.42	-	0.08	-
	STATIC	0.12	0.17	0.19	-0.12	-
WEIGHTED MEAN		0.03	0.09	0.08	-0.02	0.13

3.6 RELATIONSHIP OF P TO AGE AND SEX OF OCCUPANT

Occupants were classified according to seating position, type of seat belt, age, and sex, excluding those with no seat belt available. Children were considered only if they were occupying a normal seating position, with no additional seating or support aids. The lowest age group considered was 1 to 7 years. The results are shown in Table 3.6.1.

TABLE 3.6.1

Vehicle occupants in the Canberra region classified according to seat belt wearing, seating position, type of belt, age (years) and sex

BELT	SEX	AGE	FRONT OCCUPANT			REAR OCCUPANT		
TYPE		(years)	WORN	NOT WORN	P	WORN	NOT WORN	P
INERTIA	MALE	1-7	12	9	0.57	9	10	0.47
REEL		8-16	51	20	0.72	10	9	0.53
		17-29	703	163	0.81	11	8	0.58
		30-49	906	167	0.84	3	3	0.50
		50+	205	22	0.90	2	0	1.00
INERTIA	FEMALE	1-7	5	7	0.42	2	5	0.29
REEL		8-16	30	8	0.79	13	8	0.62
		17-29	778	134	0.85	6	11	0.35
		30-49	679	82	0.89	7	5	0.58
		50+	160	19	0.89	8	2	0.80
STATIC	MALE	1-7	1	4	0.20	10	37	0.21
		8-16	18	13	0.58	38	67	0.36
		17-29	360	131	0.73	17	28	0.38
		30-49	262	78	0.77	4	7	0.36
		50+	53	16	0.77	5	1	0.83
STATIC	FEMALE	1-7	3	5	0.38	21	27	0.44
		8-16	8	4	0.67	22	62	0.26
		17-29	300	108	0.74	16	39	0.29
		30-49	199	35	0.85	10	13	0.43
		50+	41	10	0.80	9	5	0.64

The analysis of deviance of the data in Table 3.6.1 is:

MODEL TERM	df	G2	p
Position	1	460.4	< 0.001
Belt type	1	81.4	< 0.001
Age	4	65.0	< 0.001
Sex	1	10.7	0.001
Position x Age	4	20.4	< 0.001
Residual	28	30.1	0.37
Mean	39	668.0	

To investigate the significant sex difference, the difference in P for males and females was calculated for the twenty combinations of belt type, seating position, and age, giving the values shown in Table 3.6.2. The weighted average is 0.03, and the non-significance of the interactions with sex indicates that the tendency for females to have a higher wearing rate was consistent across belt type, seating position, and age of occupant.

The significant position by age effect means that the relationship of P to age must be considered for each seating position separately. The wearing rates in Table 3.6.1 have been plotted in Figure 3.6.1, revealing the nature of the interaction. For both front and rear occupants the rate was low for the youngest age group, and as age increased there was a rapid rise in the wearing rate for front seat occupants but only a slow increase for rear seat occupants. It was only for the oldest age group that the wearing rates were once again approximately equal for front and rear occupants.

FIGURE 3.6.1

The relationship between wearing rate and age for front and rear occupants of vehicles, with either inertia reel or static seat belts

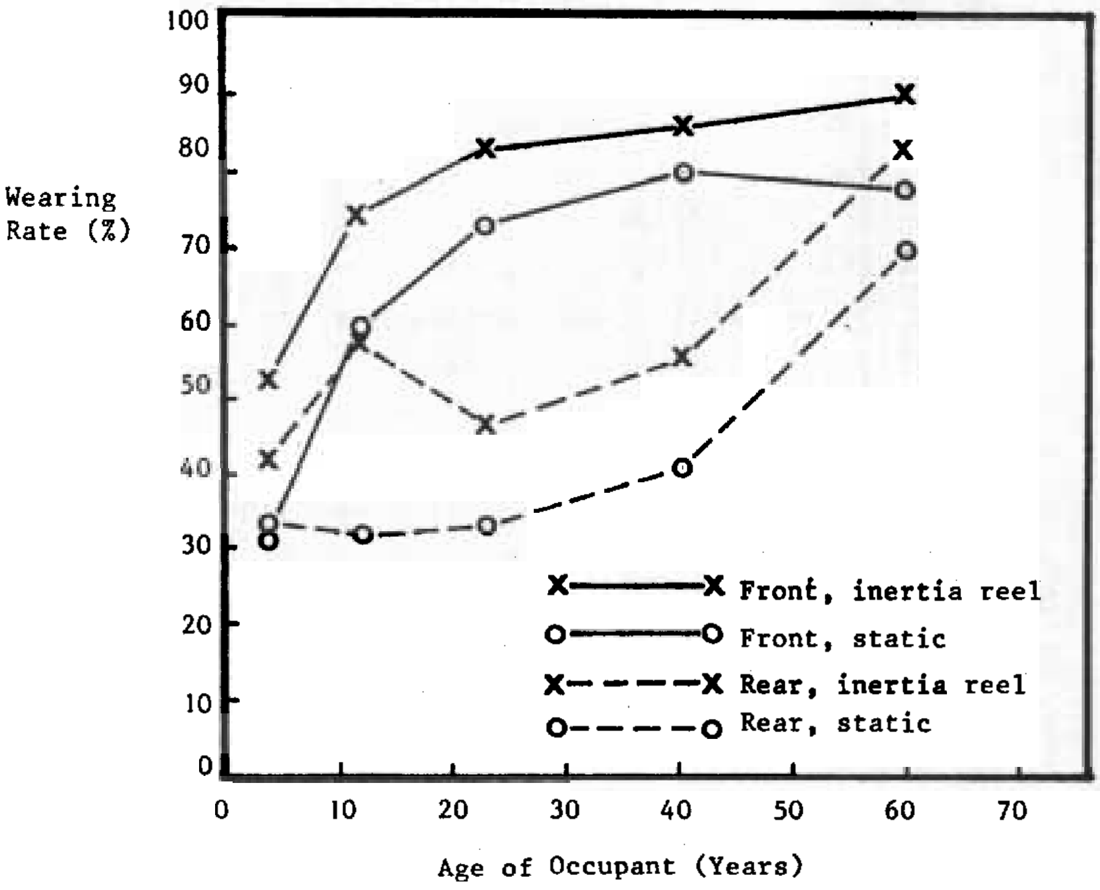


TABLE 3.6.2

The difference in wearing rate for females and males for twenty combinations of three other factors

OCCUPANT POSITION	BELT TYPE	AGE OF OCCUPANT (years) 1-7	8-16	17-29	30-49	50+
FRONT	INERTIA REEL	-0.16	0.07	0.04	0.05	-0.01
	STATIC	0.18	0.09	0.00	0.08	0.04
REAR	INERTIA REEL	-0.19	0.09	-0.23	0.08	-0.20
	STATIC	0.23	-0.10	-0.09	0.07	-0.19

3.7 RELATIONSHIP OF P TO THE AGE AND TYPE OF VEHICLE

Each vehicle was placed into one of three categories. The placement was partly subjective, but the following guidelines were used:

"Small" vehicle:	four cylinders, with seating for four passengers; price less than $10,000 (1983 prices) eg Ford Laser, Holden Gemini.
"Family" vehicle:	usually six cylinders, with seating for five or six passengers; price greater than $10,000 (1983 prices) eg Ford Falcon, Holden Commodore.
"Luxury" vehicle:	usually fully imported, or a large vehicle if locally made; price greater than $15,000 (1983 prices) eg Holden Statesman, Mercedes Benz.

Occupants were classified according to seating position, type of seat belt, year of manufacture of vehicle, and type of vehicle, excluding occupants with no seat belt available. The data are shown in Table 3.7.1.

TABLE 3.7.1

Vehicle occupants in the Canberra region classified according to seat belt wearing, seating position, type of belt, and year of manufacture and type of vehicle

BELT TYPE	TYPE OF VEHICLE	YEAR OF VEHICLE	FRONT OCCUPANT WORN	FRONT OCCUPANT NOT WORN	FRONT OCCUPANT P	REAR OCCUPANT WORN	REAR OCCUPANT NOT WORN	REAR OCCUPANT P
INERTIA REEL	SMALL	PRE 1970	5	0	1.00	0	0	-
		'70-'74	47	20	0.70	0	0	-
		'75-'79	659	98	0.87	9	6	0.60
		'80-'83	680	98	0.87	20	17	0.54
	FAMILY	PRE 1970	4	2	0.67	0	0	-
		'70-'74	48	12	0.80	0	0	-
		'75-'79	374	101	0.79	2	6	0.25
		'80-'83	520	85	0.86	21	13	0.62
	LUXURY	PRE 1970	3	0	1.00	0	0	-
		'70-'74	24	4	0.86	0	0	-
		'75-'79	135	26	0.84	5	1	0.83
		'80-'83	130	18	0.88	5	4	0.56
STATIC	SMALL	PRE 1970	81	18	0.82	5	3	0.63
		'70-'74	241	76	0.76	3	17	0.15
		'75-'79	156	40	0.80	21	40	0.34
		'80-'83	10	3	0.77	16	29	0.36
	FAMILY	PRE 1970	115	49	0.70	2	5	0.29
		'70-'74	189	57	0.77	5	18	0.22
		'75-'79	110	42	0.72	8	49	0.14
		'80-'83	6	8	0.43	24	25	0.49
	LUXURY	PRE 1970	31	9	0.78	3	1	0.75
		'70-'74	31	10	0.76	3	7	0.30
		'75-'79	26	12	0.68	8	7	0.53
		'80-'83	0	0	-	7	5	0.58

The analysis of deviance of the frequencies in Table 3.7.1 is:

MODEL TERM	df	G^2	P
Position	1	342.4	< 0.001
Belt Type	1	68.8	< 0.001
Car Type	2	14.0	< 0.001
Car Year	3	13.4	0.004
Car Type x Car Year	6	17.8	0.007
Residual	34	57.7	
Mean	47	514.1	

Although the analysis of deviance indicates that car type and year effects were significant, an inspection of the wearing rates in Table 3.7.1 revealed no obvious pattern.

The marginal wearing rates for the four periods of vehicle manufacture, from pre-1970 onwards, were 0.74, 0.73, 0.78, and 0.83 respectively, but the analysis of deviance suggests that this trend was almost certainly due to the higher proportion of inertia reel belts in newer vehicles.

3.8 USE OF SPECIAL SEATING BY CHILDREN

The wearing rates for children aged 1 to 7 years who were occupying a vehicle seat have been given in Table 3.6.1. Children who were using a child's harness or some other special purpose device, or who were being nursed by another occupant, will be considered in this section.

The children were classified by age, type of seating, and observation site (Table 3.8.1). Almost one-third of children less than one year old were nursed, with a reasonable consistency across sites. The numbers of observations were too small to test for heterogeneity over sites, with regard to the type of seating.

For children aged 1 to 7 years the majority occupied car seats which were attached to the regular vehicle seats, specifically for use by children. The percentages of children using the various types of seating were very consistent across sites.

TABLE 3.8.1

Child passengers of vehicles in the Canberra region, classified by age, site, and type of seating; percentages of the total are shown in parentheses.

AGE OF CHILD (years)	TYPE OF SEATING	SITE					TOTAL NO. OF CHILDREN
		DRIVEWAY SERVICE	SELF-SERVE	PARKING AREA	FAST FOOD	INTER-SECTION	
1	CAR SEAT	6 (86)	11 (85)	2 (50)	2 (22)	1 (50)	22 (63)
	BASSINETTE	0 (0)	0 (0)	0 (0)	3 (33)	0 (0)	3 (9)
	NURSED	1 (14)	2 (15)	2 (50)	4 (44)	1 (50)	10 (29)
	TOTAL	7	13	4	9	2	35
1-7	CAR SEAT	9 (64)	25 (51)	13 (62)	13 (65)	17 (63)	77 (59)
	HARNESS	2 (14)	6 (12)	1 (5)	0 (0)	0 (0)	9 (7)
	BOOSTER SEAT	2 (14)	3 (6)	1 (5)	0 (0)	0 (0)	12 (9)
	NURSED	0 (0)	4 (8)	0 (0)	2 (10)	3 (11)	9 (7)
	OTHER	1 (7)	11 (22)	6 (29)	3 (15)	3 (11)	24 (18)
	TOTAL	14	49	21	20	27	131
ALL CHILDREN		21	62	25	29	29	166
CHILDREN/VEHICLE		.033	.054	.036	.056	.025	.040

CHAPTER 4 - INTERVIEWS IN THE CANBERRA REGION

4.1 NUMBER OF INTERVIEWS

The numbers of interviews carried out at the four classes of site are shown in Table 4.1.1.

TABLE 4.1.1

Numbers of interviews in the Canberra region according to site and whether a seat belt was worn

	SITE				
SEAT BELT	DRIVEWAY SERVICE	SELF SERVE	PARKING AREA	FAST FOOD	TOTAL
WORN	114	137	45	65	361
NOT WORN	77	162	61	49	349
TOTAL	191	299	106	114	710

The relative lack of interviews with non-wearing drivers at the driveway service sites is a reflection of the low traffic flow at these sites, as was shown in Table 3.1.1.

4.2 AGREEMENT BETWEEN OBSERVED AND STATED WEARING RATE

Each driver was observed to be either a wearer or a non-wearer and was also asked whether he or she sometimes left the seat belt undone while driving. The cross tabulation of these responses for each class of site is shown in Table 4.2.1.

TABLE 4.2.1

Actual wearing behaviour and verbally expressed behaviour for drivers in the Canberra region at four classes of site

WAS BELT UNDONE? (OBSERVED)	IS BELT EVER LEFT UNDONE? (STATED)	SITE				
		DRIVEWAY SERVICE	SELF SERVE	PARKING AREA	FAST FOOD	TOTAL
NO	NO	98	109	37	47	291
	YES	16	28	8	18	70
	% YES	14	20	18	28	19
YES	NO	24	49	25	12	110
	YES	53	113	36	37	239
	% YES	69	70	59	76	68

Of the observed wearers, those at driveway service sites were the least likely to ever leave the seat belt undone. The drivers most likely to do so were at the fast food sites.

Of the observed non-wearers, 32% stated that their seat belt was never left undone. If it is assumed that the observation was not in error, then it can only be concluded that these drivers were being untruthful. Significantly, the percentage of such drivers was highest for parking area sites. For these sites the drivers were observed before entering the parking area and were interviewed after parking their vehicle. The points of observation and interview were therefore some distance apart, and the drivers may not have been aware that they had been observed to be non-wearers.

4.3 RELATIONSHIP BETWEEN SITE AND DISTANCE DRIVEN

The distribution of distance driven on the last trip, for each class of site, is given in Table 4.3.1.

TABLE 4.3.1

Distance driven (km) on the last trip by drivers interviewed in the Canberra region at four classes of site; percentages are shown in parentheses

DISTANCE DRIVEN (km)	SITE				TOTAL
	DRIVEWAY SERVICE	SELF-SERVE	PARKING AREA	FAST FOOD	
0-1	66 (34)	95 (31)	5 (5)	17 (15)	183 (25)
2-3	42 (22)	62 (20)	21 (19)	27 (24)	152 (21)
4-9	50 (26)	57 (18)	33 (30)	33 (29)	173 (24)
10-14	12 (6)	37 (12)	26 (23)	15 (13)	90 (12)
15-29	16 (8)	33 (11)	21 (19)	13 (11)	83 (11)
30 OR MORE	6 (3)	26 (8)	5 (5)	9 (8)	46 (6)
MEDIAN DISTANCE	2.9	3.4	8.2	5.3	4.2

The distribution over all sites shows a marked positive skew. The median distance of 4.2km may be compared with the mean distance of 12.8km.

For the service station sites the majority of the drivers had travelled 3km or less, and this is the main distinguishing feature between these distributions and the distributions for the other two classes of site. The percentage of trips of 14km or less was relatively constant at about 80% across the four classes of site. The medians provide a good measure of the differences between the distributions.

The distances expected to be driven on the day of the interview are shown in Table 4.3.2. There is very little difference between the four distributions, in contrast with the results for distance driven on the last trip. The overall median distance of 28.0km is less than the overall mean distance of 55.2km because of the positive skew of the distribution.

TABLE 4.3.2

Distance (km) expected to be driven on the day of the interview for drivers in the Canberra region; percentages are shown in parentheses

DISTANCE DRIVEN (km)	SITE				TOTAL
	DRIVEWAY SERVICE	SELF-SERVE	PARKING AREA	FAST FOOD	
0-4	17 (9)	18 (6)	8 (7)	12 (11)	55 (8)
5-9	16 (8)	25 (8)	6 (5)	13 (11)	60 (8)
10-19	45 (23)	56 (18)	26 (23)	20 (18)	147 (20)
20-39	66 (34)	92 (30)	37 (33)	28 (25)	223 (31)
40-69	26 (14)	53 (17)	21 (19)	21 (18)	121 (17)
70-199	11 (6)	37 (12)	7 (6)	7 (6)	62 (9)
200 OR MORE	11 (6)	29 (9)	6 (5)	13 (11)	59 (8)
MEDIAN DISTANCE	24.8	30.9	28.1	26.6	28.0

The distances driven in one year are shown in Table 4.3.3. As was the case for the distance driven per day, there is a slight tendency for the distance to have been less for drivers interviewed at driveway service sites, but otherwise the distributions were very similar. The overall median distance of 20,600km may be compared with the overall mean distance of 25,500km.

TABLE 4.3.3

Distance (km) driven per year by drivers interviewed in the Canberra region; percentages are shown in parentheses

DISTANCE DRIVEN (km)	SITE				TOTAL
	DRIVEWAY SERVICE	SELF SERVE	PARKING AREA	FAST FOOD	
0- 9000	19 (11)	26 (9)	13 (12)	14 (13)	72 (11)
10000-14000	41 (23)	53 (18)	18 (17)	18 (17)	130 (19)
15000-19000	26 (15)	45 (16)	17 (16)	19 (18)	107 (16)
20000-24000	40 (23)	67 (23)	17 (16)	17 (16)	141 (21)
25000-34000	28 (16)	45 (16)	26 (24)	22 (21)	121 (18)
35000-59000	17 (10)	31 (11)	7 (7)	9 (9)	64 (9)
60000 OR MORE	6 (3)	22 (8)	9 (8)	7 (7)	44 (7)
MEDIAN DISTANCE	19,800	21,000	21,100	20,100	20,600

The distances driven in one year on highways, outside of towns or cities, are shown in Table 4.3.4. Drivers interviewed at driveway service sites travelled shorter distances than the drivers interviewed at the other three sites, which have similar distributions and almost identical medians. **The overall mean distance was 9,700km.**

TABLE 4.3.4

Distance (km) driven per year on highways by drivers
interviewed in the Canberra region;
percentages are shown in parentheses

DISTANCE DRIVEN (km)	SITE				TOTAL
	DRIVEWAY SERVICE	SELF SERVE	PARKING AREA	FAST FOOD	
0- 1000	36 (21)	42 (15)	31 (29)	13 (12)	122 (18)
2000- 5000	69 (39)	96 (33)	21 (20)	38 (36)	224 (33)
6000-14000	36 (20)	87 (30)	30 (28)	32 (30)	185 (27)
15000-19000	15 (9)	23 (8)	9 (8)	7 (7)	54 (8)
20000-34000	16 (9)	26 (9)	9 (8)	14 (13)	65 (10)
35000 OR MORE	4 (2)	13 (5)	7 (7)	2 (2)	26 (4)
MEDIAN DISTANCE	4500	6100	6100	6200	5400

4.4 ESTIMATION OF P FROM THE INTERVIEW DATA

The sampling technique yielded approximately equal numbers of wearing and non-wearing drivers in the interviews. The drivers were categorised according to a number of factors as a result of the interview, and it was important to be able to estimate the rate of belt wearing within each category, using a technique which compensated for the bias introduced deliberately by the sampling technique.

Consider a factor A which has k categories, and suppose that n_{i1} wearers and n_{i2} non-wearers were observed in the ith category, as in the following table:

CATEGORY	SEAT BELT	
	WORN	NOT WORN
A_1	n_{11}	n_{12}
A_2	n_{21}	n_{22}
A_i	n_{i1}	n_{i2}
A_k	n_{k1}	n_{k2}
TOTAL	n_1	n_2

The observed proportion of category i drivers amongst the wearers is

$$\Pr\ (A_i \mid \text{worn}) = n_{i1}/n1$$

Therefore an estimate of the proportion of the population who are wearers and are in category i is

$$P_{i1} = \Pr\ (A_i \mid \text{worn}).P$$
$$= (n_{i1}\ /\ n_1)\ .P$$

where P is the proportion of wearers in the total population of drivers.

Similarly, an estimate of the proportion of the population who are non-wearers and are in category i is

$$P_{i2} = (n_{i2}\ /\ n_2).P$$

An estimate of the population proportion of wearers within category i is therefore given by

$$P_i = P_{i1}/(P_{i1} + P_{i2})$$

Classification of the drivers by sex and by age will be used to provide examples of the estimation procedure. The following rates of wearing were calculated from the 4,268 drivers observed in the Canberra region:

	AGE (years)			
SEX	17-29	30-49	50 OR MORE	TOTAL
MALE	0.779	0.818	0.871	0.806
FEMALE	0.823	0.867	0.821	0.842
TOTAL	0.797	0.834	0.856	0.819

The value of 0.819 will be used for P. The numbers of wearers and non-wearers among the 707 drivers interviewed were:

SEX	AGE (years)	SEAT BELT WORN	SEAT BELT NOT WORN
MALE	17-29	103	128
	30-49	89	83
	50 +	27	23
MALE TOTAL		219	234
FEMALE	17-29	63	53
	30-49	73	57
	50 +	6	2
FEMALE TOTAL		142	112
BOTH SEXES	17-29	166	181
	30-49	162	140
	50 +	33	25
BOTH SEXES TOTAL		361	346

From these interview data, an estimate of the wearing rate among males is

$$\frac{(219/361)\ 0.819}{(219/361)\ 0.819 + (234/346)\ 0.181} = 0.802$$

This compares favourably with the value of 0.806 for the observation data. The complete set of estimated wearing rates, obtained from the data in the last table is:

SEX	AGE (years)			TOTAL
	17-29	30-49	50 OR MORE	
MALE	0.777	0.823	0.836	0.802
FEMALE	0.838	0.847	0.929	0.846
TOTAL	0.799	0.834	0.851	

A comparison with the table of rates for the observation data reveals excellent agreement for the marginal rates, the greatest discrepancy being 0.005 for the 50 years or more age group. The agreement is not as good within the body of the table, mainly for the cases where very low numbers were interviewed.

The estimation technique given in this section was therefore used to estimate the wearing rates for factors where the ratio of wearers to non-wearers was found to vary significantly across categories.

4.5 RELATIONSHIP BETWEEN P AND DISTANCE OF THE LAST TRIP

Drivers were classified according to type of belt and whether it was worn or not, sex, age, and the distance travelled to the point of interview. The data are shown in Table 4.5.1.

TABLE 4.5.1

Drivers in the Canberra region classified according to type of belt and whether it was worn, sex, age, and distance (km) travelled to the point of interview

		DISTANCE	TYPE OF BELT					
SEX	AGE	TRAVELLED	INERTIA REEL			STATIC		
	(years)	(km)	WORN	NOT WORN	P	WORN	NOT WORN	P
MALE	17-29	0-1	16	22	0.42	10	12	0.45
		2-3	13	9	0.59	4	19	0.17
		4-6	12	17	0.41	8	11	0.42
		7-9	3	3	0.50	4	1	0.80
		10-14	11	5	0.69	5	4	0.56
		15-29	8	9	0.47	4	6	0.40
		30+	5	6	0.45	0	4	0.00
MALE	30+	0-1	15	24	0.38	8	11	0.42
		2-3	15	18	0.45	9	6	0.60
		4-6	14	7	0.67	6	4	0.60
		7-9	8	3	0.73	6	1	0.86
		10-14	14	11	0.56	4	2	0.67
		15-29	9	7	0.56	3	4	0.43
		30+	4	7	0.36	1	1	0.50
FEMALE	17-29	0-1	9	7	0.56	3	7	0.30
		2-3	10	5	0.67	3	8	0.27
		4-6	12	3	0.80	4	4	0.50
		7-9	4	2	0.67	1	0	1.00
		10-14	6	7	0.46	2	0	1.00
		15-29	5	6	0.45	2	0	1.00
		30+	1	4	0.20	1	0	1.00
FEMALE	30+	0-1	16	9	0.64	5	4	0.56
		2-3	14	11	0.56	3	5	0.38
		4-6	11	3	0.79	4	5	0.44
		7-9	3	4	0.43	1	0	1.00
		10-14	9	7	0.56	1	1	0.50
		15-29	5	6	0.45	2	2	0.50
		30+	4	2	0.67	1	0	1.00

The analysis of deviance of the data in Table 4.5.1, with the proportion of belt-wearers as the dependent variable, is:

MODEL TERM	df	G^2	P
Distance	6	13.5	0.04
Sex	1	3.7	0.06
Belt type	1	2.5	0.12
Distance x Belt type	6	10.5	0.11
Residual	41	43.3	0.47
Mean	55	73.5	

The proportion of drivers wearing belts is therefore related to distance travelled, and the relationship depends on the type of belt. The estimated probabilities of wearing a seat belt are:

DISTANCE TRAVELLED ON LAST TRIP (km)	INERTIA REEL	STATIC
0-1	0.80	0.77
2-3	0.84	0.68
4-9	0.87	0.85
10-14	0.85	0.88
15-29	0.81	0.80
30 OR MORE	0.76	0.72

Drivers who had travelled a short distance to the interview site were less likely to be wearing a seat belt, particularly those with static belts. The wearing rates for both types of belt declined as the distance increased beyond 14km.

4.6 RELATIONSHIP BETWEEN P AND DISTANCE TRAVELLED ON ONE DAY

Drivers were classified according to type of belt and whether it was worn or not, sex, age, and the distance expected to be travelled on the day of the interview. The data are shown in Table 4.6.1.

The analysis of deviance of the data in Table 4.6.1, with the proportion of belt-wearers as the dependent variable, is

MODEL TERM	df	G^2	P
Distance (linear)	1	7.1	0.007
Distance (quadratic)	1	11.9	0.001
Belt type	1	4.0	0.02
Residual	60	63.6	0.36
Mean	63	86.6	

The proportion of drivers wearing belts is therefore strongly related to the distance expected to be travelled on the day of the interview. The estimated probabilities of wearing a seat belt are:

DISTANCE TRAVELLED ON DAY OF INTERVIEW (km)	P
0-4	0.87
5-9	0.86
10-19	0.86
20-39	0.83
40-69	0.75
70-199	0.70
200 OR MORE	0.78

TABLE 4.6.1

Drivers in the Canberra region classified according to type of belt and whether it was worn, sex, age, and distance (km) expected to be travelled on the day of the interview

			TYPE OF BELT					
SEX	AGE	DISTANCE	INERTIA REEL			STATIC		
	(years)	TRAVELLED (km)	WORN	NOT WORN	P	WORN	NOT WORN	P
MALE	17-29	0-4	5	3	0.63	3	3	0.50
		5-9	6	5	0.55	3	3	0.60
		10-19	18	9	0.67	8	13	0.38
		20-29	11	12	0.48	7	5	0.58
		30-39	6	9	0.40	6	4	0.60
		40-69	10	19	0.34	6	17	0.26
		70-199	5	5	0.50	0	8	0.00
		200+	7	9	0.44	2	5	0.29
MALE	30+	0-4	4	3	0.57	4	0	1.00
		5-9	5	5	0.50	4	3	0.57
		10-19	14	13	0.52	9	4	0.69
		20-29	17	11	0.61	6	3	0.67
		30-39	12	13	0.48	6	9	0.40
		40-69	10	11	0.48	2	8	0.20
		70-199	8	8	0.50	4	1	0.80
		200+	9	13	0.41	2	1	0.67
FEMALE	17-29	0-4	2	2	0.50	1	1	0.50
		5-9	5	2	0.71	0	1	0.00
		10-19	11	2	0.85	4	7	0.36
		20-29	11	9	0.55	6	2	0.75
		30-39	5	3	0.63	2	2	0.50
		40-69	9	7	0.56	3	4	0.43
		70-199	1	8	0.11	0	1	0.00
		200+	3	1	0.75	0	1	0.00

TABLE 4.6.1 (Cont.)

SEX	AGE (years)	DISTANCE TRAVELLED (km)	TYPE OF BELT					
			INERTIA REEL			STATIC		
			WORN	NOT WORN	P	WORN	NOT WORN	P
FEMALE	30+	0-4	11	8	0.58	3	1	0.75
		5-9	8	4	0.67	4	2	0.67
		10-19	17	5	0.77	4	8	0.33
		20-29	6	6	0.50	2	2	0.50
		30-39	10	9	0.53	1	2	0.33
		40-69	6	3	0.67	2	1	0.67
		70-199	1	5	0.17	1	1	0.50
		200+	3	2	0.60	0	0	0.00

A similar analysis could have been carried out for distance travelled per year, and for distance travelled per year on highways. However, each of these variables is highly correlated with distance travelled in one day and the conclusions from the analyses were therefore predictable. The estimated probabilities of wearing a seat belt were calculated, and are:

DISTANCE TRAVELLED IN ONE YEAR ('000 km)	P	DISTANCE TRAVELLED IN ONE YEAR ON HIGHWAYS ('000 km)	P
0-9	0.85	0-1	0.86
10-14	0.87	2-5	0.83
15-19	0.82	6-14	0.81
20-24	0.82	15-19	0.80
25-34	0.80	20-34	0.75
35-59	0.73	35+	0.73
60+	0.80		

In each case there is a steady decline in the estimated probability as the distance increases. The only notable exception is the high probability for the largest distance travelled in one year, a similar result to that obtained for distance in one day.

4.7 RELATIONSHIP BETWEEN P AND SOCIO-ECONOMIC STATUS

The data relating to each driver's income, level of education, and employment are given in Table 4.7.1. In the occupation categories, few individuals were classified as unskilled manual and this class has therefore been amalgamated with skilled and semi skilled to produce a general "manual worker" category. As a guide to the method of classification, the four occupation categories included the following stated occupations, among others:

OCCUPATION CATEGORY	STATED OCCUPATION
No job	student, housewife, unemployed, retired, pensioner
Manual	labourer, shop assistant, welder, electrician, typist, nurse, real estate salesman
White Collar	clerk, armed services, police, computer programmer
Managerial and Professional	shop proprietor, teacher, farmer, research scientist

TABLE 4.7.1

Drivers in the Canberra region classified according to whether a seat belt was worn or not, annual income ($), level of education, and class of employment

EMPLOYMENT	LEVEL OF EDUCATION	ANNUAL INCOME ($)								
		<14,000			14,000-21,000			> 21,000		
		WORN	NOT WORN	P	WORN	NOT WORN	P	WORN	NOT WORN	P
NO JOB	3 YEARS H.S.	7	11	0.39	3	0	1.00	0	1	0.00
	5 YEARS H.S.	38	20	0.66	2	3	0.40	1	1	0.50
	APPRENTICESHIP	6	5	0.55	2	2	0.50	1	0	1.00
	DEGREE	29	16	0.64	5	3	0.63	7	1	0.88
MANUAL	3 YEARS H.S.	7	9	0.44	8	16	0.33	2	2	0.50
	5 YEARS H.S.	14	14	0.50	21	24	0.47	4	5	0.44
	APPRENTICESHIP	6	10	0.38	19	19	0.50	3	5	0.38
	DEGREE	1	2	0.67	5	4	0.56	3	5	0.38
WHITE COLLAR	3 YEARS H.S.	0	2	0.00	3	1	0.75	1	0	1.00
	5 YEARS H.S.	5	6	0.45	26	18	0.59	6	10	0.38
	APPRENTICESHIP	0	3	0.00	3	4	0.43	2	2	0.50
	DEGREE	3	1	0.75	6	4	0.60	16	6	0.73
MANAGERIAL/PROFESSIONAL	3 YEARS H.S.	2	0	1.00	1	1	0.50	1	4	0.20
	5 YEARS H.S.	0	0	-	0	4	0.00	5	5	0.50
	APPRENTICESHIP	0	0	-	5	2	0.71	1	1	0.50
	DEGREE	2	1	0.67	11	4	0.73	28	34	0.45

The analysis of deviance of the data in Table 4.7.1 is:

MODEL TERM	df	G^2	P
Occupation	3	11.5	0.009
Education	3	5.5	0.15
Residual	41	47.6	0.20
Mean	47	64.6	

The probability of wearing a seat belt therefore depends on occupation, and once this effect has been accounted for there is a small residual dependence on level of education.

The estimated probabilities of wearing a seat belt are:

OCCUPATION	P	LEVEL OF EDUCATION	P
No job	0.87	3 years H.S.	0.75
Manual	0.77	5 years H.S.	0.82
White collar	0.84	Apprenticeship	0.79
Managerial/ Professional	0.80	Degree	0.86

The more definite trend is for level of education, for which the probability of wearing a seat belt shows a steady increase as the number of years of formal education increases.

4.8 REASON FOR NOT WEARING A SEAT BELT

Drivers who agreed that their seat belt was occasionally left undone were asked the reason for that behaviour. The interview form included twelve possible responses, but the frequencies for only five responses will be reported because of the relatively small numbers in eight cases. The data are set out in Table 4.8.1. In the "other" category a high proportion of the responses were that a seat belt is "ineffective", and this could be included in future studies.

For the data in Table 4.8.1 the variable of interest is not a proportion, as it has been in the previous analyses of P. Instead, the interest is in whether the reason for not wearing a belt is dependent on any of the other four factors. An analysis of deviance was therefore carried out using a loglinear model (Bishop, Fienberg and Holland 1975), commencing at a minimal model which included reason, belt type, sex, age, and whether a belt was worn or not, and all possible interactions between the last four factors. The analysis of deviance is:

MODEL TERM	df	G^2	P
Age x Reason	4	18.1	0.005
Belt Type x Reason	4	13.2	0.01
Age x Belt Type x Reason	4	10.2	0.04
Residual	48	54.0	0.42
Minimal Model	60	95.5	

A simple interpretation is that the reason for not wearing a belt depends on age and belt type, with a slight indication of interaction between these two factors.

TABLE 4.8.1

Reason for not wearing a seat belt, for drivers in the Canberra region, classified according to type of belt, sex, age (years), and whether the belt was worn or not

REASON	AGE (years)	SEX	TYPE OF BELT INERTIA REEL WORN	 NOT WORN	 STATIC WORN	 NOT WORN
UNCOMFORTABLE	17-29	MALE	2	12	3	13
		FEMALE	1	7	2	6
	30+	MALE	0	6	3	1
		FEMALE	0	5	1	4
FORGETS	17-29	MALE	1	10	2	5
		FEMALE	0	3	1	2
	30+	MALE	0	6	4	3
		FEMALE	1	3	0	4
COULDN'T BE BOTHERED	17-29	MALE	2	19	5	12
		FEMALE	5	10	0	5
	30+	MALE	3	11	0	4
		FEMALE	1	7	0	2
DRIVING SHORT DISTANCE	17-29	MALE	5	10	1	7
		FEMALE	1	1	2	3
	30+	MALE	7	11	4	4
		FEMALE	1	5	1	2
OTHER	17-29	MALE	0	3	3	5
		FEMALE	0	4	3	1
	30+	MALE	0	12	1	5
		FEMALE	1	5	0	1

The number of responses classified by age, with percentages shown in parentheses, are:

REASON	AGE (years)		TOTAL
	17-29	30 +	
Uncomfortable	46 (26)	20 (16)	66 (22)
Forgets	24 (14)	21 (16)	45 (15)
Couldn't be Bothered	58 (33)	28 (22)	86 (28)
Driving Short Distance	30 (17)	35 (27)	65 (21)
Other	19 (11)	25 (19)	44 (14)

Overall, the responses were fairly evenly spread across the five categories of response. Younger people were more likely to give the responses "uncomfortable" and "couldn't be bothered", and older people were more likely to give "driving short distance" as a reason.

The number of responses classified by type of belt, with percentages shown in parentheses, are:

	BELT TYPE	
	INERTIA REEL	STATIC
Uncomfortable	33 (18)	33 (26)
Forgets	24 (13)	21 (17)
Couldn't be Bothered	58 (32)	28 (22)
Driving Short Distance	41 (23)	24 (19)
Other	25 (14)	19 (15)

Static belts were therefore more likely to be considered "uncomfortable", and the proportion of respondents in the "couldn't be bothered" category was markedly greater for inertia reel belts.

CHAPTER 5 - OBSERVATIONS AND INTERVIEWS IN THE YASS REGION

5.1 OBSERVATIONS ON VEHICLE OCCUPANTS

Sixty five vehicles were observed at the Yass Town site and ninety seven vehicles at the Yass Highway site. The number of occupants per vehicle is shown in Table 5.1.1.

TABLE 5.1.1

Number of occupants per vehicle at two sites in Yass; percentages are shown in parentheses

SITE	OCCUPANTS PER VEHICLE							AVERAGE
	1	2	3	4	5	6	7	NUMBER
YASS TOWN	26 (40)	25 (38)	7 (11)	6 (9)	1 (2)	0 (0)	0 (0)	1.94
YASS HIGHWAY	32 (33)	41 (42)	14 (14)	7 (7)	2 (2)	0 (0)	1 (1)	2.07

There is a slight, non-significant tendency for the number of occupants to be greater at the Yass Highway site.

The observed rate of belt-wearing is set out in Table 5.1.2. Overall, the rates were higher than those for the Canberra region. The numbers are not sufficiently large to detect any difference between the two Yass sites in the rate of belt-wearing.

TABLE 5.1.2

Vehicle occupants in the Yass region classified according to site, type of belt, and whether the belt was worn or not

SEATING POSITION	TYPE OF BELT	SITE					
		YASS TOWN			YASS HIGHWAY		
		WORN	NOT WORN	P	WORN	NOT WORN	P
FRONT	INERTIA REEL	72	5	0.94	61	9	0.87
	STATIC	88	9	0.91	14	4	0.78
REAR	INERTIA REEL	1	1	0.50	6	4	0.60
	STATIC	5	6	0.45	4	8	0.50

The observations were not classified according to any other criteria since their low number did not permit any useful cross-tabulations.

5.2 INTERVIEWS WITH DRIVERS

Thirty three interviews were carried out at the Yass Town site and twenty six at the Yass Highway site. The distances driven to the interview site, the distances expected to be travelled on the day of the interview, and the distances travelled in one year are shown in Table 5.2.1. There is a clear separation of the two sites, in that a high proportion of the drivers interviewed at the Yass Town site had only driven a short distance on that trip, and expected to drive a relatively short distance on the day of the interview. It is only for the distance driven per year that the two sites are in reasonable agreement.

TABLE 5.2.1

Distance (km) travelled by drivers interviewed at two sites in the Yass region; percentages are shown in parentheses.

			DISTANCE MEASURE					
LAST TRIP			DAY OF INTERVIEW			ONE YEAR		
DISTANCE (km)	YASS TOWN	YASS HIGHWAY	DISTANCE (km)	YASS TOWN	YASS HIGHWAY	DISTANCE ('000 km)	YASS TOWN	YASS HIGHWAY
0-1	7	2	0-9	4	0	0-9	2	5
	(21)	(8)		(12)	(0)		(7)	(20)
2-3	7	2	10-19	3	0	10-14	4	1
	(21)	(8)		(9)	(0)		(13)	(4)
4-9	1	1	20-39	1	0	15-19	3	1
	(3)	(4)		(3)	(0)		(10)	(4)
10-14	1	0	40-69	1	1	20-24	5	7
	(3)	(0)		(3)	(4)		(17)	(28)
15-29	2	0	70-199	10	6	25-34	6	4
	(6)	(0)		(30)	(23)		(20)	(16)
30+	15	21	200+	14	19	35-59	8	6
	(46)	(81)		(42)	(73)		(27)	(24)
						60+	2	1
							(7)	(4)
MEDIAN DISTANCE	13	125		135	310		29,500	21,000

No attempt will be made to calculate wearing rates for various categories of driver because of the small numbers available. Some comparisons with the data for the Canberra region are instructive, however. For example, the percentages observed in the education categories were:

LEVEL OF EDUCATION	YASS (%)	CANBERRA (%)
3 YEARS H.S.	25	13
5 YEARS H.S.	41	38
APPRENTICESHIP	12	16
DEGREE	22	33

The Yass sample therefore included a lower proportion of drivers who had completed tertiary education, and a correspondingly higher proportion who had completed only three years of high school.

The Yass sample included 76% of males compared with 64% for the Canberra sample, and the age distributions differed:

AGE (years)	YASS (%)	CANBERRA (%)
17-29	41	49
30-49	32	42
50 or more	27	9

CHAPTER 6 - DISCUSSION

6.1 CHOOSING SITES FOR OBSERVATIONS AND INTERVIEWS

A number of factors are involved in the suitability of a site, and the requirements of an observation site differ from the requirements of an interview site.

The rate of traffic flow is an important factor, since a low rate of flow means that field workers are not fully occupied. Of the five classes of site used in the present survey, service stations offering driveway service had the lowest rate of flow, a rate so low that the use of these sites must be open to question. For self-serve service stations the rate was acceptable, although only one-half of that at signalised intersections, and of the sites used for interview the parking areas offered the most vehicles per hour (Table 3.1.1).

To be acceptable, a site must be available for a wide range of hours of the day, preferably for all days of the week. This requirement was met by signalised intersections, although it was not practicable to carry out interviews there. Each of the other classes of site suffered from some disadvantage. Chief among these was the restriction of parking area sites to the main shopping hours. The useful time period ended at about 5.30pm on each weekday, and weekend use was limited to Saturday morning. The fast food sites were open for a wide range of times, but the traffic was light outside of meal times. The most acceptable sites were the service station sites, although even these were sometimes limited by early closing.

Observations were made easily at each class of site except the fast food sites, for which vehicles could only be observed in motion. Interviews were most easily carried out at the service stations, since the driver was either idle (at a driveway service site) or occupied with a task (at a self-serve site) which did not demand his or her full cttention. For the parking area and fast food sites the interview was preventing the driver from going about some other business, which sometimes made the driver less than willing to co-operate. However, the overall rate of refusal was low. In the pilot study, the refusal rate was approximately 5%.

The proportion of occupants wearing a seat belt differed significantly between the sites (Section 3.3). The highest proportion was for signalised intersections, closely followed by parking areas. The proportions were lower for the other three classes of site, at least for front seat occupants. There was a complex interaction between site and time, with no discernible pattern (Table 3.4.1). Other measures for which there were differences between the sites were the daily and yearly distances driven (Tables 4.3.2 and 4.3.3), for which the driveway service station averages were less than for the other sites. This indicates that the drivers interviewed at service stations offering driveway service were not representative of drivers as a whole.

The conclusion is that signalised intersections represent the most suitable sites for observation of vehicle occupants. For interviews, parking areas offer the highest rate of traffic flow and, probably, a more representative sample of drivers than is available at other classes of site. If the restricted number of hours per day and days per week is thought to limit the usefulness of parking area sites, then self-serve service stations offer the best alternative.

6.2 OBSERVATION AND INTERVIEW METHODOLOGY

The observers reported that the observation form (Appendix C) was easy to use. One observer consistently switched left and right, but this error was easily detected in the editing process because all of the driver-only vehicles were "left-hand-drive".

During the interview, drivers often found it difficult to answer question 7, which asked the main reason for not wearing a seat belt. The intention in leaving this as an open answer question was to allow the respondent a completely free choice, but, in practice, the interviewer often found that some words of prompting were necessary. The conclusion is that this question should be presented as a multiple choice question where the respondent is given the list of choices. The time required to answer such a question may be too long for it to be included in an on-road survey, but an off-road survey has the disadvantage that no observations can be made of the seat-belt wearing habits of the respondents. This may not be a severe disadvantage, since in the present study it was found that the reason for not wearing a seat belt was not related to whether a seat-belt was worn or not.

The intention of the survey design for interviews (Section 2.4) was to maximise the number of non-wearers interviewed. In the event, 349 non-wearers were interviewed, in a total sample size of 710, in the same period of time that the occupants of 3010 vehicles were observed. 640 of the 3010 drivers observed were not wearing a seat belt. If drivers for interview had been selected at random, it would therefore have been necessary to interview approximately (349 x 3010/640) = 1641 drivers to obtain 349 non-wearers in the sample. This would have meant an interview rate of approximately 14 per hour, which is probably beyond the capacity of one interviewer. In practice, the difficulty is that vehicles do not arrive evenly spaced in time, and it is therefore not possible to interview the drivers of all vehicles.

It is concluded that the system of selection of drivers for interview was efficient, in that it yielded more non-wearing drivers than would have been obtained if selection had been completely at random.

6.3 OBTAINING EXPOSURE DATA

Both the median annual distance driven (20,600km) and the average annual distance driven (25,500km) were considerably in excess of the average of 9,800km found for residents of the Australian Capital Territory by the Australian Bureau of Statistics for the year ended 30 September 1979 (Australian Bureau of Statistics 1981). Both of these estimates were dependent on driver recall, although there was less time for recall in the present survey, and it is therefore surprising that there was such a discrepancy.

The most probable reason is that the sampling design used in the present study produced a non-random sample of drivers. Presumably, the probability that a driver was included in the sample was proportional to the distance driven annually, assuming that the distance driven within the Canberra region is the same proportion of annual distance for all drivers. Drivers with a short annual distance were therefore under-represented, and drivers who drove many kilometres annually were over-represented.

A crude correction may be applied to the distribution of distance driven annually (Table 4.3.3), in the following manner:

Let

d_i = mid-point of the ith distance class

f_i = proportion of interviewed drivers in the ith distance class

g_i = proportion of the population of drivers in the ith distance class

Table 4.3.3 shows estimates of f_i , when what are required are estimates of g_i.

Now

f_i is proportional to $g_i d_i$

so that

g_i is proportional to f_i/d_i

An estimate of g_i is therefore given by

$$g_i = \frac{f_i/d_i}{\sum_i f_i/d_i}$$

The following distribution was obtained from the data in Table 4.3.3:

DISTANCE DRIVEN (km)	f_i	g_i
0 - 9 000	0.11	0.36
10 000 - 14 000	0.19	0.23
15 000 - 19 000	0.16	0.14
20 000 - 24 000	0.21	0.14
25 000 - 34 000	0.18	0.09
35 000 - 59 000	0.09	0.03
60 000 or more	0.07	0.01
MEAN DISTANCE (km)	25,500	14,600
MEDIAN DISTANCE (km)	20,600	11,500

Both the median and the mean are now closer to the A.B.S. mean of 9,800km (Australian Bureau of Statistics 1981).

The only distance measure not likely to be subject to bias is the distance driven to the point of interview. The distributions for the other distance measures may be adjusted, as outlined above, but the assumptions necessary to make the adjustment are quite severe. The conclusion is that on-road interviews are not suitable for obtaining information on distance driven.

Estimates of distance driven annually obtained by recall in off-road interviews have been found to be subject to large sampling errors (White 1976). Distances were over-estimated on low usage vehicles and under-estimated on high usage vehicles. However, these effects cancelled out and the mean distance was found to be reliable. Callaghan (1980) also found that recall methods gave accurate means.

Recently, the preferred technique has been to determine the distance driven on one day, or in one week, for a random sample or motorists, and to do this over a wide period of time (Foldvary 1975; Lawson 1982). Self-administered, mail-back surveys with a minimum of interviewer participation have been found to give a response rate of at least 60% (Lawson 1982; Brog, Meyburg, Stopher, and Wermuth 1983), and it has been claimed that the cost per respondent is approximately one-third of the cost for interviewer-administered surveys (Brog et al 1983).

6.4 MEASUREMENT OF THE RATE OF BELT-WEARING

Since occupants who travel long distances will be over-represented in any on-road survey, individuals who exhibit a characteristic which is associated with travelling long distances will also be over-represented.

For example, it has been found that the distance driven annually is greater for males than for females (Australian Bureau of Statistics 1981, Callaghan 1980). On-road surveys will therefore include a higher proportion of males than are present in the population of drivers.

In the present study, it was found that the probability that a driver was wearing a seat belt declined with distance driven per day and with distance driven annually (Sections 4.5 and 4.6). Non-wearers were therefore over-represented in the sample. Estimates of P are applicable to the "on-road" population of drivers, and may be viewed as the proportion of drivers wearing a seat belt at any instant in time. It would be wrong to interpret P as the probability that a randomly chosen driver from the population of "off-road" drivers wears a seat belt, or as the proportion of such drivers who wear a seat belt while driving.

It is the population of "on-road" drivers who are being exposed to risk, and the parameter of practical interest is therefore the proportion of drivers who are wearing a seat belt at any instant in time. Fortunately, it is this parameter which is easily estimated from the usual type of on-road survey.

Conditional rates of belt-wearing are also applicable to the population of on-road drivers. For example, the rate of 0.86 for drivers with a university or college degree must be interpreted as "the estimated probability that a seat belt is worn by an on-road driver who has a university or college degree".

6.5 FACTORS AFFECTING THE RATE OF BELT-WEARING

The wearing rate over all vehicle occupants in the Canberra region was approximately 0.77 (Table 3.3.1). The wearing rate for occupants was found to be:

(i) higher for front seat occupants than for rear seat occupants, the differential being approximately 0.45 (Section 3.3)

(ii) higher for persons equipped with inertia reel belts than for persons equipped with static belts, the differential being approximately 0.07 (Section 3.5)

(iii) higher when the road surface was wet than when it was dry, the differential being approximately 0.06 (Section 3.5)

(iv) higher for females than for males, the differential being approximately 0.03 (Section 3.6)

(v) 0.57 or less for front seat occupants aged 7 years or less, and 0.62 or less for rear occupants aged 49 years or less (Section 3.6).

The wearing rate for all drivers was approximately 0.82 (Section 4.4. The wearing rate for drivers was found to be:

(i) 0.80 for drivers whose last trip did not exceed 1km, and 0.76 or less for drivers who travelled 30km or more on their last trip

(ii) 0.78 or less for drivers who travelled 40km or more in one day

(iii) 0.80 or less for drivers who travelled 25,000 km or more in one year, or who travelled 10,000km or more on highways in one year

(iv) 0.77 for manual workers, and 0.75 for drivers with a formal education of three years or less at high school

Previous surveys in Canberra (Boughton et al 1981) have produced wearing rates of 0.80 (1975), 0.81 (1976), and 0.81 (1978) for all occupants, and 0.83 (1975), 0.84 (1976), and 0.83 (1978) for drivers. The rates for the present survey were slightly lower, but this is probably because the previous surveys were all carried out at signalised intersections. At those sites in the present survey the wearing rates were 0.82 for all occupants and 0.89 for drivers.

The factors with the major effects on wearing rate have all been identified in past surveys. Fleming (1980), Milne (1980), and Schnerring (1983) have all reported higher wearing rates for front seat occupants and for occupants equipped with inertia reel belts. The wearing rate was found to be the same for males and females by Fleming (1980), greater for females by Boughton et al (1981), and greater for males by Milne (1980) and Schnerring (1983). The greater wearing rate for females found in the present study can now be added to the list. Although there has been no consistent finding, it should be noted that comparisons have usually been based on the overall rates for males and females. As was pointed out in Section 3.2, these marginal rates may not afford the best comparison.

Boughton et al (1981) found there to be no consistent effect of weather on wearing rate in the Canberra region. The higher rate when the road surface was wet, which was found in the present study (Section 3.5), was only detected after adjustment for the effects of other factors.

The wearing rate increased with age, particularly for rear occupants (Figure 3.6.1). Milne (1980) reported a similar increase for front seat occupants, the most marked effect being for occupants observed in three rural cities in the State of Victoria, but the rate for rear seat occupants was low and apparently unrelated to age. For front outboard occupants Boughton et al (1981) reported a slight decrease in wearing rate as age increased, for the combined results of 19 surveys carried out in Australian capital cities. No general pattern has therefore emerged from the studies which have been carried out to this time.

Jonah and Dawson (1982) found that the wearing rate increased with an increasing number of years of formal education. In a study of occupant protection for children, Freedman and Lukin (1977) found that an approved restraint was more often available when the mother's income was high, when the family income was high, or when the father's occupation level was high on the scale of prestige. However, the frequency of use of available restraints was unrelated to any of these factors. In both of these cases the rate of wearing was determined from the results of an off-road questionnaire. The validity of the rates must be questioned in view of the poor agreement between stated and observed belt-wearing behaviour (Section 4.2).

Thus there is general agreement that the rate of belt wearing depends on such factors as level of education and occupational status, although the data have not always been collected in the same manner.

The overall conclusion is that there are many factors related to the rate of wearing of seat belts. Major factors such as seating position, type of belt and sex have been identified in this and previous studies, and any minor factors such as level of education are likely to have such a small effect that it is not possible to utilise the relationship in a campaign to promote the wearing of seat belts.

6.6 SURVEYS IN RURAL AREAS

The relatively few observations carried out in the Yass region were sufficient to demonstrate the heterogeneity of the occupant population in the region. Drivers interviewed at the highway site had usually travelled long distances and were therefore likely to be in transit, while drivers interviewed at the town site were more likely to be local residents (Section 5.2). A survey carried out in a rural area would have to take this heterogeneity into account, particularly if the city or town was based on a main inter-city highway.

The other feature to emerge from the Yass survey was the different constitutions of the driver populations in the Yass and Canberra regions. If a larger survey were to confirm this finding then the implication would be that comparisons of the wearing rates for Yass and Canberra should take these differences into account. This is generally true for any comparison between cities or between regions.

An example of this effect is seen in the survey reported by Milne (1980). The age distributions of occupants observed in Melbourne and in the three Victorian rural cities were:

AGE (years)	MELBOURNE (%)	RURAL CITIES (%)
8-13	5	5
14-29	42	48
30-49	38	36
50+	15	11

The relative lack of older persons in the rural cities may go some way towards explaining the higher overall wearing rate in Melbourne.

CHAPTER 7 - RECOMMENDATIONS

TITLE	RECOMMENDATION NUMBER	RECOMMENDATION
Analysis of data on seat belt wearing rates Page 14	1	Complete analyses of multi-way tables should be carried out, rather than simple inspections of marginal proportions.
Sites for observing vehicle occupants Page 55	2	Observations of vehicle occupants should continue to be carried out at signalised intersections
Sites for interviewing vehicle occupants Page 55	3	On-road interviews of vehicle occupants should be carried out at parking areas of major shopping centres (if the time restriction is unimportant) or, otherwise, at self-serve service stations.
Sample design for selection of occupants for interview Pages 10, 56	4	To increase the proportion of non-wearing drivers in the sample, a strategy such as that used in the present study should be employed.

Calculating unbiassed estimatesof seat belt wearing rate Page 34	5	When the sample design proposed in Recommendation 4 is used, an estimation procedure which allows for the bias in selecting respondents should be employed.
Determining reasons why seat belts are not worn Page 56	6	Reasons why seat belts are not worn should be sought in off-road surveys, using a multiple-choice question where the respondent is given a list of choices.
Obtaining information on distance driven per day or per year Page 59	7	On-road surveys should not be used because of the unavoidable bias in the selection of respondents. Self-administered, mail-back surveys of distance travelled in one day or one week provide the best alternative.
Future campaigns to promote the wearing of seat belts Page 60	8	Campaigns to promote the wearing of seat belts should concentrate on persons aged 16 years or less,

		occupants of rear seats, and occupants of seating positions fitted with static belts.
Relationship of seat belt wearing rate to level of education and occupational status Page 46	9	Further data should be obtained on the relationship of seat belt wearing rate to level of education and to occupational status, to determine whether differentials are so large as to provide a focus for future promotional campaigns.
Surveys of seat belt wearing rate in rural areas Page 62	10	Surveys of seat belt wearing rate in rural areas should recognise that traffic may be made up of two components, transient tourists and local residents. Comparisons of capital city and rural wearing rates should allow for possible differences in the characteristics of the two populations.

CHAPTER 8 - REFERENCES

Australian Bureau of Statistics (1981) 'Survey of Motor Vehicle Usage Accident Exposure Data'. Australian Bureau of Statistics Publications, Catalogue No. 9210.0.

Bishop, Y.M.M., Fienberg, S.E., and Holland P.W., (1975) 'Discrete Multivariate Analysis: Theory and Practice'. MIT Press, Cambridge, Massachusetts.

Boughton, C.J., Milne, P.W., and Cameron, M.H., (1981) 'Compulsory Seat Belt Wearing in Australia: Characteristics of Wearers and Non-wearers'. Publication OR 6, Office of Road Safety, Department of Transport, Australia.

Brog, W., Meyburg, A.H., Stopher, P.R., and Wermuth, M.J., (1983) 'Collection of Household Travel and Activity Data: Development of an Instrument'. Paper presented at New Survey Methods in Transport, Second International Conference, Australia.

Broom, L., Duncan-Jones, P., Lancaster Jones, F., and P. McDonnel, (1977) 'Investigating Social Mobility'. Monograph 1, Department of Sociology, Research School of Social Sciences, Australian National University, Canberra, Australia.

Callaghan, W., (1980) 'Vehicle/driver exposure surveys - comparison of daily trip record and annual recall survey results'. Working Document 13, Office of Road Safety, Department of Transport, Australia.

Carter, A.J., (1980) 'Effect of Seat Belt Design Rules on Wearing Rates'. Publication OR 5, Office of Road Safety, Department of Transport, Australia.

Fleming, D., (1980) 'Availability, Wearing and Adjustment of Seat Belts 1980'. National Roads and Motorists Association, Sydney, Australia.

Foldvary, L.A., (1975) 'Road Accident Involvement per Miles Travelled'. Accident Analysis and Prevention 7, 191-205.

Freedman, K., and Lukin, J., (1977) 'Occupant Protection for Children: A survey of Restraint Usage, Attitudes and Knowledge'. Traffic Accident Research Unit Publication 8/77, Department of Motor Transport, New South Wales, Australia.

Herbert, D.C., (1980) 'Road Safety in the Seventies: Lessons for the Eighties'. Traffic Accident Research Unit Publication 4/80, Department of Motor Transport, New South Wales, Australia.

Jonah, B.A., and Dawson, N.E., (1982) 'The National Vehicle Occupant Restraint Survey: Attitudes Towards and Use of Restraints by Canadians'. Road and Motor Vehicle Traffic Safety Branch, Transport Canada.

Lawson, J.J., (1982) 'Canadian Department of Transport National Driving Survey 1978-79'. Accident Analysis and Prevention 14, 371-380.

Milne, P.W. (1979) 'Fitting and Wearing of Seat Belts in Australia: The History of a Successful Countermeasure'. Publication OR 3, Office of Road Safety, Department of Transport, Australia.

Milne, P.W., (1980) 'Seat Belts - The Benefits Gained and Challenges Remaining'. Paper presented at Road Safety Initiatives - 1980 Commemorative Conference, Melbourne, Australia.

Schnerring, F., (1983) 'Surveys of Seat Belt Wearing in New South Wales, 1970 to 1981'. Traffic Accident Research Unit Publication RN 5/83, Department of Motor Transport, New South Wales, Australia.

Stanton, H.G., (1981) 'Inventory of Exposure Data'. Publication CR 18, Office of Road Safety, Department of Transport, Australia.

Vaughn, C.L., (1958) 'A Scale for Assessing Socio-Economic Status in Survey Research'. Public Opinion Quarterly 22, 19-34.

White, S.B., (1976) 'On the Use of Annual Vehicle Miles of Travel Estimates from Vehicle Owners'. Accident Analysis and Prevention 8, 257-261.

APPENDIX A

INTERVIEW FORM

VI SION 3

1. How long have you held a car driver's licence?.............	YEARS =	1
2. How far do you drive in one year?........................	KM/MILES =	2
3. How many of those km/miles are highway driving, outside of towns or cities?......................km/miles	PROPORTION =	3
4. How far did you drive to get here, since you last got into the car?..	KM/MILES =	4
5. How far did you expect to drive today?..................	KM/MILES =	5
6. When you are driving, do you sometimes leave your seat belt undone? 1. Yes 2. No 3. No belt to wear	BELT USE =	6
7. When you don't wear a seat belt, what is your main reason for not wearing it? Belt is 1. INEFFECTIVE 2. dangerous-FIRE 3. dangerous-DROWNING 4. UNCOMFORTABLE 5. DIFFICULT to do up 6. Hard on CLOTHING Driver 7. Forgets belt 8. couldn't be bothered 9. will drive SHORT DISTANCE or 10. belt DAMAGED 11. driver SICK or EXEMPT 12. Other	REASON =	7
8. Do you live in the Canberra Region? 1. Yes 2. No	REGION =	8
9. What is your occupation?	OCCUPATION =	9
10.Here is a card with 5 levels of education listed. What level have you reached so far? 1. 2. 3. 4. 5.	EDUCATION =	10
11.Here is a card with 3 groups for annual income. Into which group does your personal income fall? 1. 2. 3.	INCOME =	1
12.Age: 1. 17-29 2. 30-49 3. 50+	AGE =	2
13.Sex: 1. Male 2. Female	SEX =	3
14.Drink: 1. Yes 2. Maybe 3. No	DRINK =	4
15.Belt type: 1. Inertia reel 2. Static 3. None	TYPE =	15
16.Belt use: 1. Worn 2. Not worn	WEARING =	16
17.Make and model of vehicle	VEHICLE =	7
18.Year of manufacture of vehicle	YEAR =	8
19.Time of day:	TIME =	9
20.Day of Week: 1.Mon 2.Tues 3.Wed 4.Thurs 5. Fri 6.Sat 7.Sun	DAY =	0
21.Road surface: 1.Dry 2.Wet	ROAD =	1
22.Site number:	SITE =	2
23.Interviewer's number:	INTERVIEWER =	3

APPENDIX B

CARDS SHOWN TO RESPONDENT FOR QUESTIONS 10 AND 11 OF THE INTERVIEW

LEVEL OF EDUCATION

Level 1	Completed Primary School
Level 2	Completed three years of High School
Level 3	Completed five or six years of High School
Level 4	Completed Apprenticeship or Trade Certificate
Level 5	Completed University or C.A.E. Degree

ANNUAL HOUSEHOLD INCOME

1. Less than $15,000
2. $15,000 - $30,000
3. More than $30,000

APPENDIX C

OBSERVATION FORM

VERSION 3

A. STANDARD SEATING:

1-4 FRONT LEFT

Belt use	Sex
1.WORN	1.MALE
2.NOT WORN	2.FEMALE

Belt type	Age
1.INERTIA REEL	1. 1-7
	2. 8-16
2.STATIC	3.17-29
3.NONE	4.30-49
	5.50+

5-8 FRONT MIDDLE

Belt use	Sex
1.WORN	1.MALE
2.NOT WORN	2.FEMALE

Belt type	Age
1.INERTIA REEL	1. 1-7
	2. 8-16
2.STATIC	3.17-29
3.NONE	4.30-49
	5.50+

9-12 FRONT RIGHT

Belt use	Sex
1.WORN	1.MALE
2.NOT WORN	2.FEMALE

Belt type	Age
1.INERTIA REEL	1. 1-7
	2. 8-16
2.STATIC	3.17-29
3.NONE	4.30-49
	5.50+

13-16 REAR LEFT

Belt use	Sex
1.WORN	1.MALE
2.NOT WORN	2.FEMALE

Belt type	Age
1.INERTIA REEL	1. 1-7
	2. 8-16
2.STATIC	3.17-29
3.NONE	4.30-49
	5.50+

7-20 REAR MIDDLE

Belt use	Sex
1.WORN	1.MALE
2.NOT WORN	2.FEMALE

Belt type	Age
1.INERTIA REEL	1. 1-7
	2. 8-16
2.STATIC	3.17-29
3.NONE	4.30-49
	5.50+

1-24 REAR RIGHT

Belt use	Sex
1.WORN	1.MALE
2.NOT WORN	2.FEMALE

Belt type	Age
1.INERTIA REEL	1. 1-7
	2. 8-16
2.STATIC	3.17-29
3.NONE	4.30-49
	5.50+

B.CHILDREN NOT INCLUDED BOVE:

25-27 CHILD 1

Where	Seating	Age
1.F/L	1.CHILD'S SEAT	1.UNDER 1
2.F/M	2.HARNESS	2.1-7
3.R/L	3.BOOSTER SEAT	
4.R/M	4.BASSINETTE	
5.R/R	5.NURSED	
	6.OTHER	

28-30 CHILD 2

Where	Seating	Age
1.F/L	1.CHILD'S SEAT	1.UNDER 1
2.F/M	2.HARNESS	2. 1-7
3.R/L	3.BOOSTER SEAT	
4.R/M	4.BASSINETTE	
5.R/R	5.NURSED	
	6.OTHER	

31.Make and model of vehicle ....

32.Year vehicle manufactured ....

33.Time of day ....

34.Day of week 1.Mon 2.Tues 3.Wed 4.Thurs 5.Fri 6.Sat 7.Sun

35.Road Surface 1.Dry 2.Wet

36.Site number ....

37.Observer's number ....

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

APPENDIX D

ANALYSIS OF FREQUENCY DATA USING THE LOGIT TRANSFORMATION

Suppose that a simple survey is carried out in which vehicle occupants are classified according to sex and seating position (front or rear of the vehicle), and that the following numbers are observed:

	MALE			FEMALE			TOTAL		
	WORN	NOT WORN	P	WORN	NOT WORN	P	WORN	NOT WORN	P
Front	80	20	0.80	24	6	0.80	104	26	0.80
Rear	6	4	0.60	30	20	0.60	36	24	0.60
TOTAL	86	24	0.78	54	26	0.68	140	50	0.74

The wearing rate is P = 86/110 = 0.78 for males, and P = 54/80 = 0.68 for females, indicating a significant sex difference. However, the rate for both sexes is 0.8 in the front of the vehicle and 0.6 in the rear of the vehicle, so that there is, in fact, equality of the sexes. The overall rate for females has been lowered by the tendency for females to be seated in the rear of a vehicle, where the wearing rate is lower.

A method of analysis which analyses the effects of one or more factors on a binomial proportion is the analysis of deviance (Nelder and Wedderburn 1972) on the logit scale (Bishop, Fienberg and Holland 1975). The variability in P is partitioned sequentially, according to the magnitudes of the effects of the factors involved, and for the foregoing data the following analysis of deviance was obtained:

MODEL TERM	df	G2
Position	1	8.14
Sex	1	0.00
Position x Sex	1	0.00
Mean	3	8.14

Terms were added to the model successively, from the top down, and each G2 may be interpreted as a chi-square with the indicated number of degrees of freedom. The analysis suggests that P differs significantly between seating positions, but once the effect of seating position has been removed there is no residual sex difference or position by sex interaction.

Consider a second set of data, as shown in the following table:

	MALE			FEMALE			TOTAL		
	WORN	NOT WORN	P	WORN	NOT WORN	P	WORN	NOT WORN	P
Front	80	20	0.80	20	10	0.67	100	30	0.77
Rear	6	4	0.60	12	16	0.43	18	20	0.47
	86	24	0.78	32	26	0.55	118	50	0.70

There is an overall sex difference, with P = 0.78 for males and P = 0.55 for females, and part of this difference is attributable to seating position. However, there is also a sex difference within seating positions, with P = 0.8 for males and 0.67 for females in the front of a vehicle, and P = 0.6 for males and 0.43 for females in the rear of a vehicle. The analysis of deviance is:

MODEL TERM	df	G2
Position	1	11.5
Sex	1	3.1
Position x Sex	1	0.0
Mean	3	14.6

Thus the sex difference is shown to exist, but there is no interaction between position and sex. The latter result may not have been expected because of the sex difference of 0.13 for the front of a vehicle and 0.17 for the rear, an indication of what would normally be thought of as "interaction". In a logit analysis, interaction is based on odds ratios, and in the present example there is no interaction because

$$\underset{\text{(males)}}{\frac{80/20}{6/4}} = \underset{\text{(females)}}{\frac{20/10}{12/16}} = \frac{8}{3}$$

Thirdly, consider the data in the following table:

	MALE			FEMALE			TOTAL		
	WORN	NOT WORN	P	WORN	NOT WORN	P	WORN	NOT WORN	P
FRONT	80	20	0.80	20	10	0.67	100	30	0.77
REAR	6	4	0.60	4	24	0.14	10	28	0.26
TOTAL	86	24	0.78	24	34	0.41	110	58	0.65

The analysis of deviance is:

MODEL TERM	df	G^2
Position	1	32.3
Sex	1	7.0
Position x Sex	1	2.5
Mean	3	41.8

There is now a position by sex interaction, due to the inequality of the odds ratio for males and females:

$$\text{Males:} \quad \text{odds ratio} = \frac{80/20}{6/4} = 2.67$$

$$\text{Females:} \quad \text{odds ratio} = \frac{20/10}{4/24} = 12.00$$

The sex difference of 0.13 for front-seat occupants and 0.46 for rear seat occupants are more unequal than was the case for the second data set. There will usually be a definite inequality of this type when factors interact, even though the lack of interaction does not necessarily mean that sex differences are exactly equal.

REFERENCES

Bishop, Y.M.M., Fienberg, S.E. and Holland, P.W., (1975) 'Discrete Multivariate Analysis: Theory and Practice'. MIT Press, Cambridge, Massachusetts.

Nelder, J.A., and Wedderburn, R.W.M., (1972) 'Generalised Linear Models'. Journal of the Royal Statistical Society, A., 135, 370-384.