Accident risk and behavioural patterns of younger drivers

AA Foundation for Road Safety Research

Accident risk and behavioural patterns of younger drivers

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> To carry out, or procure, research into all factors affecting the safe use of public roads;
>
> To promote and encourage the safe use of public roads by all classes of users through the circulation of advice, information and knowledge gained from research; and
>
> To conceive, develop and implement programmes and courses of action designed to improve road safety, these to include the carrying out of projects or programmes intended to educate young children or others in the safe use of public roads.

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Executive summary

Introduction

Road accidents occur to all types of road user. However, it is well established that younger car drivers are over-represented in the accident statistics.

The main objective of the study, which was undertaken at the University of Southampton by the Transportation Research Group and the Department of Psychology, was to identify those aspects of driver performance, attitudes and behaviour that relate to accident involvement, using comparative groups of young (17-25 years) and mature drivers (31-40 years) with differing amounts of driving experience.

Size and scope of the study

The study involved 439 drivers including male and female drivers in three age groups: 17-20 years, 21-25 years and 31-40 years. Two measures of driving experience were used: career mileage and number of years since obtaining a full licence. Levels of driving experience overlapped across age groups in order to facilitate the investigation of the effect of driving experience **between** as well as **within** age group. A good spread of all social backgrounds was obtained, with the youngest age group containing a proportion of people still in full-time education.

The main stages in the study were:
- a review of available background information
- construction of the subject database using categories of young and older drivers. This involved three main survey elements for each subject:
  (i) an evaluation of the subject's driving on a selected route
  (ii) a diary/logsheet of car journeys made by the subject
  (iii) interview/questionnaire on the subject's attitudes to driving
- analysis, conclusions and implications

Methods employed in the study

(i) The route survey

All drivers drove their cars around a pre-determined 40 km route. The drives took place between June 1989 and June 1990 on weekdays or Saturdays between 8am and 9pm. The route was chosen in collaboration with Hampshire Police Driving School guided by the need to include as many different road types, junction types and environments as possible in both rural and urban areas. Drivers were accompanied by a front seat passenger (the "route director") who gave directions and a rear seat passenger (the "observer") who assessed driver performance and behaviour. All of the observers were qualified driving instructors with considerable experience. Individual driver errors and their location on the route were recorded as well as an overall assessment of driver performance in terms of driving ability, safety, anticipation,

concentration, observation and car control. At the end of the drive, the drivers also provided overall ratings of their performance on these criteria.

(ii) Driving diaries

The use of driving diaries enabled a record of driving patterns to be drawn. The diaries were designed to include every journey undertaken in the specified time period (at least one week). Each journey was entered and standard information obtained including origin and destination, time, distance, purpose of journey, details of passengers and some scales reflecting the driver's perception of the journey (for example, enjoyable, risky, tense, hurried).

(iii) Interviews and questionnaires

The interviews and questionnaires were used to assess driver attitudes and opinions, and to obtain self-reports on various aspects of driving behaviour including errors and violations.

Summary of the results

The large database and multi-disciplinary approach has developed valuable insights into behaviour and performance of younger drivers. The study indicates that there are various factors which contribute to the over-representation of younger drivers in the accident statistics.

Driver performance on the route surveys

The average number of driver errors committed by males fell as age increased (17-20 year olds = 95 errors, 31-40 year olds = 57 errors). The number of female driver errors remained fairly high across age (female = >80 errors). Steering, speeding, mirror and positioning errors were the most frequently committed errors in the order given.

The number of dangerous errors (defined as "a driver error involving particular liability or exposure to harm") fell as age increased for both groups. Speeding errors comprised 90% of all dangerous errors across all groups.

The locations with the highest number of errors per driver per km (shown in parentheses) were the 30 mile/h sections in both shopping (1.53) and residential areas (2.28), right turns both at roundabouts (1.58) and traffic lights (1.08).

All of the age and sex groups rated themselves as being more able and safer at driving than they were assessed by the observers. This was much more pronounced in the 17-20 year old male group.

The distribution of error scores and observed ratings showed quite wide variation within age and sex group. 34% of the 17-20 year old males were rated "bad" on safety (scored two or less on the seven point scale) with only 7% of the 17-20 year old males rated "good" on safety (six or above). By comparison, 11% of the 31-40 year old males were rated "bad" on safety and 29% were rated "good" on safety. Thus, by no means all 17-20 year old male drivers were "unsafe" drivers and nor were all 31-40 year old male drivers "safe" drivers.

Why and when do drivers drive?

Male drivers, on average, drove higher weekly mileages (221 miles) than females (163 miles) who tended to make more journeys (male = 24 journeys, female = 27 journeys).

Younger drivers (17-25 year olds) used the car at least 10% more often for leisure purposes than work purposes, whereas 31-40 year old drivers used the car at least 10% more often for work purposes than leisure.

The 17-20 year olds drove for over 20% of their time accompanied by friends compared to only about 5% of the time for 31-40 year old drivers. Older females (31-40 year olds) drove for 20% of their time accompanied by children.

A higher percentage of journeys for the 17-25 year old groups took place between 10pm and 4am compared to the 31-40 year old groups. In addition more of these night time journeys were accompanied by friends for the 17-25 year old groups than the 31-40 year old groups.

All age and sex groups, except the 31-40 year old female group, rated journeys with two or more passengers as more risky than when alone or carrying one passenger.

All groups, except the 31-40 year old male group, rated journeys with friends as slightly more risky than when accompanied by their partner or spouse. Drivers who carried children as passengers, most often females, assessed these journeys as the most tense.

What were the driver attitudes and opinions?

Considerably higher proportions of males (15%) than females (7%) had driven illegally prior to obtaining their provisional driving licence.

Over half the drivers (54%) indicated that their driving had become worse since passing their test with only 22% stating that their driving had improved.

Males placed a higher importance on the type of car they drove than females. For all drivers, comfort, price and reliability were the most important qualities to look for, **in general**, when buying a car. Reliability was of increasing importance for women as age increased. Males placed more importance on speed, acceleration and engine size. As age increased speed and acceleration tended to become less important factors. The importance of safety increased with age but was higher for females than males regardless of age. The 17-20 year old male group rated car appearance as important as safety.

The 17-20 year old male group reported the largest effect of passengers on their driving behaviour. This was an adverse effect with peer group passengers, but a beneficial effect when accompanied by parents and other older people.

There were four types of passengers which particularly affected driving style. These were friends, children, partner/spouse or boyfriend/ girlfriend and parents. The effects varied across age and sex.

- The presence of friends as passengers seemed to affect adversely the 17-20 year old males more than other driver groups.

- The effect of children as passengers can lead to either improved or worse driving behaviour, and is possibly linked to whether the driver is able to fully concentrate on the driving situation.

- For males, their driving is more likely to improve when accompanied by their partner/spouse or girlfriend. This finding is not so strong for females and indeed for older female drivers the presence of their partner/spouse or boyfriend is more likely to adversely affect their driving.

- The effects of parents as passengers are generally beneficial for all age and sex groups. However, the reasons for the change in driving behaviour varies across age. Younger drivers most commonly state that they want their parents to think they drive safely, whereas older drivers state they drive more carefully with their parents because these relatives were old or in poor health.

Male drivers in the 17-20 year old age group were three to five times more likely to have an "own fault" accident per year than the 31-40 year old age groups. As age increased the number of "own fault" accidents per year decreased for both sexes.

Factors relating to accidents

A significant correlation was found between the error total and accident frequency on each section of the route, while that between accidents and total dangerous errors was highly significant (at 1% level) supporting the assertion that the observed assessments do reflect the level of safety in varying conditions and provide an indicator of accident potential.

The observers' overall assessment ratings were all significantly correlated with accident frequency variables.

Greater experience measured in terms of years of driving or total driving mileage were negatively correlated with the accident frequencies and total error scores.

Sex of the driver did not correlate significantly with the accident frequencies or error scores.

A driver's rating of the importance of the car's speed, acceleration and engine size were highly correlated together; safety correlated highly with reliability. The former group correlated positively with the accident frequencies, while significant negative correlations with accident frequency were found for safety and reliability.

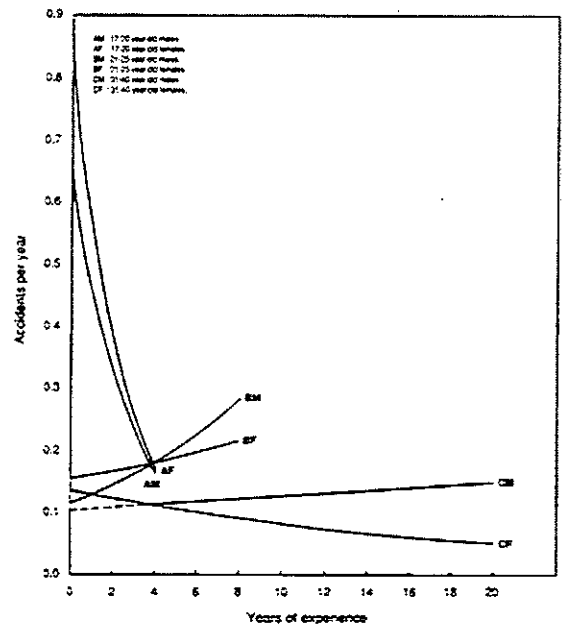
Nearly all of the driver violation ratings correlated with accident frequency particularly those for "racing for a gap" and "crossing red traffic signals" both of which were positively correlated.
Multivariate analysis methods were used to simultaneously explore the

effects of significant variables on the level of reported accident frequency and "at fault" accident frequency. Results showed:-

The accident frequencies increased with exposure, measured in terms of average mileage per year, at a rate slightly lower than a square root relationship. The youngest drivers with little experience gave rise to particularly high levels of accident frequency at high levels of exposure. The total accident frequency for the 17-20 year olds with one year's experience was three and a half times that of the 21-25 year olds and four times that of the 31-40 year olds with the same level of experience; similarly the "at fault" accident frequency for the youngest group was five times that of the 21-25 year olds and nine times that of the oldest group, again for the same one year's experience.

For the same level of exposure, the youngest age group (17-20 years) has a very high initial accident frequency at low experience, but this falls rapidly with increasing experience. The 21-25 year old group, however, has a low initial accident frequency which rises modestly with increased experience. It may be that drivers in this age group become over confident as experience increases. For the oldest group (31-40 years) experience has little effect on accident frequency.

Figure 7.2 – The predicted effect of experience on accident frequency



These relationships represent the average values within age bands.

There is only a small difference in the predicted effect of accident frequency for men and women, although it must be noted that type of accident or accident severity were not recorded and there may be important sex differences in these respects.

The reported average frequency rating for driver violations was highly correlated with total accident frequency and "at fault" accident frequency. Thus, those who perceive themselves as making more violations of traffic law are more likely to be involved in an accident.

The observers' overall assessment ratings of the drivers' performance was also a good explanatory variable of accident frequency, with drivers assessed as being better having lower total accident frequencies and lower "at fault" accident frequencies.

Drivers who were observed frequently to "follow traffic too closely" had a higher total accident frequency and those who continually drove too fast were associated with a higher "at fault" accident frequency.

Drivers who were frequently accompanied by friends as passengers were associated with higher "at fault" accident frequencies; this most affects the youngest age group (17-20 years) who spent much more of their driving time with friends.

Implications

This study set out to explore the reasons why young drivers are particularly over-represented in current accident statistics. The large database and multi-disciplinary approach has developed valuable insights into behaviour and performance of young drivers. These insights, and the research findings discussed previously lead to implications for action, and also give guidance for future studies.

In 1987, the Department of Transport outlined an objective to reduce road casualties by one-third by the year 2000 (using the average for the years 1981-1985 as a base figure) (Department of Transport, 1987). In order to assist this objective and extend it beyond the year 2000, new initiatives particularly related to road user behaviour have to be introduced which are based on, and developed from, empirical research. This study is, therefore, particularly important because it has as its main focus younger car drivers.

- There are many factors which contribute to the over-representation of younger drivers in the accident statistics. The complex nature of this problem suggests that the multi-method approach that has been adopted is essential in order to gain an insight into young car driver behaviour. Use of a single methodology might find important differences between less safe, younger drivers and safer, older drivers but it would be impossible to work out how much weight such differences could contribute to the overall picture. The significant interaction between the data in the study collected through different research methods adds weight to the current findings.

- The data obtained from the route survey component of the study suggest that a substantial minority of younger drivers, particularly 17-20 year old males (but not **all** 17-20 year old males), does not possess the skills or, more likely, does not use them in as responsible a way as generally displayed in the other age and sex groups. Evidence for this is shown by the high number of speeding errors and violation errors which are committed.

- Attention on high risk drivers could focus on the possibility of targeted measures emphasising social factors. Passenger presence has been shown to affect driver behaviour, especially violations and this reinforces the view that attention should be given to some of the influential social aspects of car driving. It has been shown that

for all age groups and that dangerous errors were found to be correlated to reported accident frequency suggests that the problem of drivers' speeding, particularly on urban, residential roads, should be given attention. Whether this could best be done by further enforced legislative measures, by greater traffic calming programmes or by educative means remains open to question.

- For a number of drivers it is not that they are incapable of driving safely, it is that they choose not to do so. Within The Highway Code there are the formal rules of the road and recommended guidelines for road user behaviour. Consideration should be given to the inclusion of a section within The Highway Code pointing out some of the problems for road users. If car drivers were made more aware of the accident statistics, the possible effects of passenger influence, the dangers of particular types of roads, the vulnerability of certain road users and the most dangerous times of day for driving, then it is likely that **some** drivers (who choose to) might adapt their driving behaviour accordingly.

- Self-reported violations were correlated with reported accident frequency so it is suggested that this might be a reasonable method to assess the effectiveness of any campaigns designed to alter car driver attitudes. This would have the advantage of being easily administered and provide relatively quick feedback as to effectiveness.

- However, the study found no correlation between reported level of drink-driving violations and reported accident frequency. This result is difficult to explain but may reflect a gradual shift in attitude amongst the younger drivers towards the unacceptability of drink-driving and a reluctance to admit levels of drink-driving as has been found in earlier studies.

- Previously published statistical risk curves have demonstrated differences between sexes. Results from this study do not show such large differences on reported accident frequency possibly due to the lack of data on accident type and accident severity.

In conclusion, it must be emphasised that this study found that a substantial **minority** of young drivers could be classified as unsafe drivers. The results therefore, do not lend support to "blanket" legislation or other remedial measures that would unjustifiably penalise all young drivers. Greater attention should be given to programmes for education and attitude change which incorporate the social aspects and influences on car driving behaviour. These are likely to prove to be effective in reducing car driver casualties amongst younger drivers.

Trials should be instituted to develop and evaluate this "social programme" approach.

passenger, and in particular, peer group presence has a significant correlation with reported accident frequency. This effect is strongest for the youngest drivers (17-20 years). This is almost certainly because such drivers get positive feedback in terms of peer approval and esteem for driving dangerously.

- The study clearly shows the need to influence attitudes and social norms and try to provide greater perceived social support for "safer" driving behaviour. It is likely that educational programmes involving sessions in small groups (for all pre-learner drivers in schools as well as later for convicted drivers) might prove more effective than campaigns that merely increase knowledge levels or involve "shock" advertising tactics. Evidence for the efficacy of this form of action comes from work in related health safety fields. Through this method many of the important social aspects and influences of car driving behaviour coming out of this study could be focused on; such factors are largely ignored within the current methods of driver training which concentrate on "driving skills."

- The effect of driving experience is different for different age groups. Keeping exposure levels constant, the youngest age group (17-20 years) has a very high initial accident frequency at low experience, which falls rapidly with increasing experience. The 21-25 year old group has a low initial accident frequency which rises modestly with increased experience but approaches only the lower levels of the youngest group. This modest increase may be due to over confidence as experience increases. For the oldest group (31-40 years) experience has little effect on accident frequency.

- This finding with regard to the effect of experience on the youngest age group (17-20 years) is particularly important. In the light of the data obtained, there are strong indicators that further attention needs to be paid to this area, which would incorporate detailed consideration of the social aspects identified, as well as specific skill assessment and accident analysis. Such attention should be based on precise information regarding specific age and experience assessed in terms of both number of years a licence has been held and number of miles driven. The need is to accelerate improvements in the young (17-20 years) whilst ensuring no deterioration in the middle age group (21-25 years).

- Certain technical measures could be introduced to influence those drivers, especially the young, who possess the necessary skills to drive "safely" but choose not to. An increase in the likelihood of detecting driver violations should influence behaviour. The finding that the driver violation action of crossing red lights was significantly correlated to reported accident frequency suggests that measures to reduce this type of behaviour such as the use of video cameras should be more widely implemented.

- Results from the study show that one-fifth of 17-20 year old driver journeys take place between the hours of 8pm and 4am. While there is no compulsory "night time" driving component prior to obtaining a full licence, there are also social influences on night time driving such as drunken passengers that should be addressed.

- The fact that speeding errors comprised 90% of all dangerous errors

1 What is this study about?

1.1 Introduction

Road accidents occur to all types of road user. More than two-thirds of road accidents that result in personal injury and which occur on the public highway are recorded by the police and subsequently published as annual statistics. Many studies have shown that young car drivers (under 25 years of age) are over-represented in these accident statistics. The need is to identify those aspects of behaviour which can help to explain the higher accident involvement rates of younger drivers whilst taking into account driving experience and exposure. An understanding of car driving behaviour of the young will assist in formulating effective countermeasures to those characteristics of young drivers which are identified as contributory factors to accident involvement; such measures could involve education and training rehabilitation and changes in the law.

The main objective in this study was to identify those aspects of driver performance, characteristics, habits and lifestyle that relate to accident involvement and motoring offences, using comparative groups of young (17-25 years of age) and mature drivers (31-40 years) with differing amounts of experience. The work was carried out by a team of researchers at the Transportation Research Group, University of Southampton under the direction of the grant holders from the Departments of Civil Engineering and Psychology. Further details of many aspects may be found in the Technical Annexes available from the AA Foundation for Road Safety Research, Fanum House, Basingstoke, Hampshire RG21 2EA.

A very large sample of subjects was used in the study with 439 drivers providing information for the separate elements of activity. This substantial database coupled with the benefits of a multi-disciplinary team has given the study a unique strength.

1.2 Aims

The major aim of the study was to identify those aspects of driver behaviour and performance which might account for the different accident involvement rates across age whilst taking into account driving experience and exposure.

Driver performance was related to individuals' attitudes towards aspects of driving. The influence of social aspects, in terms of driver characteristics, driving habits and lifestyle was also investigated.

The investigation of such issues helps to provide a more comprehensive understanding of the "real-world" of the social contexts of driving and accidents. It is possible to unravel some of the numerous strands which contribute to the variations observed between younger and older drivers and between sub-samples of each. The relative contributions of the various factors can be established and greater precision as to important areas for future research can be attained.

The results will assist in formulating effective countermeasures to those

characteristics of younger drivers which are identified as contributory factors to accident involvement.

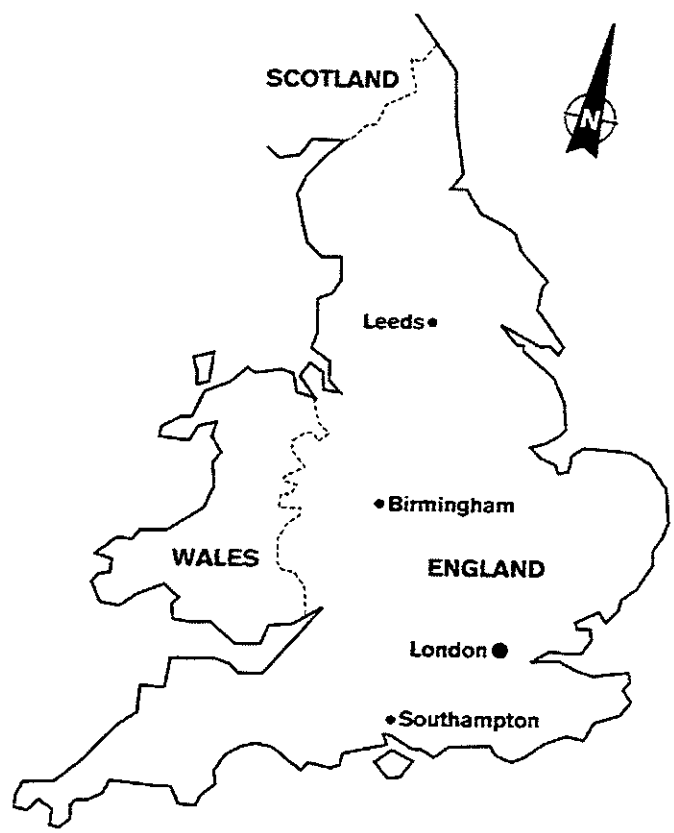
1.3 Relationship between this and earlier studies

Road accident statistics and other studies consistently show that young drivers (under 25 years of age) are over-represented in road accidents. Driver performance, attitudes and social factors appear to play some part in driver behaviour and subsequent accident risk.

1.4 Where did the study take place?

The study took place in Southampton, Hampshire (Figure 1.1). The route chosen for the driving evaluation part of the study incorporated rural areas in Hampshire and urban areas within Southampton. The majority of the subjects lived in Hampshire.

Figure 1.1 – Southampton in the national context



1.5 How was the study conducted?

The main stages in the study consisted of:

- a review of available background information
- construction of the subject database using categories of young and older drivers. This involved three main survey elements for each subject:
  - (i) an evaluation of the subject's driving on a selected route
  - (ii) a diary/logsheet of car journeys made by the subject
  - (iii) interview/questionnaire on the subject's attitudes to driving
- analysis and conclusions

2 Previous work on young drivers

2.1 The accident phenomenon

2.1.1 The extent of the problem

In 1989 in Great Britain, there were 260,759 reported personal injury accidents with 5,373 fatalities, 63,158 serious injuries and 273,061 slight injuries, making a total of 341,592 casualties. For ages 15-19 years, road accident deaths accounted for 38% of all male deaths and 30% of all female deaths and were the main cause of accidental death for people aged 15 to 24 years inclusive. The total economic cost of road accidents in Great Britain in 1989 was estimated to be £6,360 million (Department of Transport, 1990).

Death and injuries connected with road accidents form "a public health problem of the first magnitude" (Knapper and Cropley, 1981). Indeed as public health in general improves, road accidents account for increasing proportions of all injuries and deaths in the population. Various analyses of resident statistics have attempted to find patterns which might account for the prevalence.

2.1.2 Type of road

Broughton (1988) calculated the casualty and accident involvement rates for different types of road distinguishing between built-up and non built-up roads according to speed limit. Casualty rates show that male and female rates are very similar in built-up areas but male rates are higher in non built-up areas.

2.1.3 Type of accident

Broughton (1988) investigated the types of accident in which different groups of drivers were involved. Accidents were categorised by the characteristics of the other vehicles and road users involved.

Accident involvement and casualty rates per thousand drivers in 1985 varied with age, sex and accident type. One of the most common types of accident for young drivers is the single vehicle accident (SVA); more male drivers aged 17-20 were injured in this type of accident than any other. Yet this rate decreases quite substantially with an increase in age until it is the least common accident type for male drivers over 35. In addition, the male casualty rates for SVA's are over twice the female rate.

Broughton (1988) concluded that the "all casualties" rates for both sexes were similar for all ages and all accident types except single vehicle accidents with no pedestrian involvement, the difference being explained by the higher involvement of young male drivers in SVAs with no pedestrian.

It was also noted that the ratio of killed or seriously injured to overall accident involvement rates was generally higher for males than females for all types of accident.

Broughton (1988) showed that male drivers were more likely to be involved in an accident per mile driven than female drivers but that the

proportion of females injured in accidents was likely to be higher than the proportion of males. Broughton (1988) gave the proportion of accident involved drivers who were injured as 10% to 25% higher for females than for males for each type of accident.

2.1.4 Time of day

Broughton (1988) analysed casualty rates per thousand drivers by time of day, sex and age. As with earlier studies (Storie 1977) differences were observed between the sexes as to the time of day of the peak accident times. The peak time which was most striking was the one between 8pm and 4am involving young male drivers. The highest rate was between 10pm and midnight for males up to age 28; by contrast the highest rate for all age groups of female drivers occurred between 4pm and 6pm.

Differences between age and sex categories arise due to presumably varying social and travel patterns and the resulting exposure levels. Broughton (1988) found that for accidents involving a male driver in the 17-20 year age band, 44% occurred during darkness, compared to only 19% of accidents for the male driver category over 64 years. The corresponding figures for female drivers were 35% and 14%.

Results from Broughton and Stark (1986) suggest that the male accident involvement rate fell in the five years from 1980 more or less in line with the "all casualties" rate but that this fall was less for the midnight to 4am time span. Female rates did not show such a general decline and in some instances (early evening and early morning) showed an increase.

2.1.5 Day of week

Storie (1977) found that 79% of accident-involved female drivers had their accidents on weekdays compared to 70% of male drivers. Broughton (1988), with more up to date statistics (1985), analysed the casualty rate by day of the week and found that this difference was largely explained by the high weekend rate among young male drivers, particularly under 21 years of age. With age groups over 24 years for males and over 20 years for females the casualty rate was at its highest on a Friday.

2.1.6 Human factors

A considerable amount of research into road safety has involved the study of three broad factors (the vehicle, the road environment and the driver) which contribute to accidents.

Much of this research has shown that human factors play the major part in accident causation (Ross, 1940; Clayton and Mackay, 1972). Sabey and Taylor (1980) found human factors were present in 95% of accidents and in 65% of cases were the only contributory factor. The road environment was a sole factor in only 2.5% of accidents but a contributory factor to some degree in 28% of cases. A vehicle factor was also the sole factor in only 2.5% of cases and a contributory factor in only 9%. Only 1.25% of accidents showed a contributory role of all three factors.

This pattern of results was replicated by the same team in the same area in a later and smaller study (Sabey, 1983).

2.2 Influential variables: age, sex, experience and exposure

Analysis of the 1989 casualty rates (per 100,000 population) of car drivers by age, showed that young drivers in the 17-19 age group had a fatality rate almost twice as high as those drivers in any of the age groups over 30 years of age (Department of Transport, 1990).

Broughton (1988) analysed long term trends in casualty and accident involvement rates between 1979 and 1985. Male rates were reduced during this period, a favourable trend which cannot be accounted for entirely by the introduction of the 1981 Transport Act's legislative measures on drink driving and seat belts.

In the same period, there was an increase in the female fatal and serious casualty rate and accident involvement rates. Broughton (1988) questioned whether these rises were due to the greater numbers of inexperienced women drivers on the roads. He found that the female casualty rate had increased most in the younger age band. There had been an accompanying drop in the proportion of experienced drivers although there did not appear to be a consistent correlation between casualty changes and numbers of experienced and inexperienced drivers in a particular age band. Broughton (1988) concluded that, "the proportion of experienced drivers in a particular year can have only a limited influence on the casualty rate".

The effects of driving experience on driver behaviour are frequently confounded with other variables such as driver age and exposure (Brown 1982).

Lauer (1964), with a sample of 7,692 Iowa licensees, found that mean accidents per male driver over a two year period rose from only 0.07 at 16 years to 0.37 at 21 years of age. Pelz and Schuman (1971) in a series of studies also found a steady rise in likelihood of crashes and violations during the first three or four years.

Pelz and Schuman (1971) also examined the effect of driving exposure in terms of annual mileage. Mean mileage for men generally rose with age up to about 24 years of age when it levelled out, whilst for women it rose up to the age of 23 and then dropped somewhat. These figures did not provide support that young drivers have more accidents per year because they drive more miles; if anything the reverse appeared to be evident.

Pelz and Schuman (1971) next attempted to take into account not only driving exposure in terms of mileage but also a number of other conditions such as driving at night, driving on different types of road and so on. Results showed that "danger continued to be greatest for young males who were either 18 or 19 years old" (p.76).

The effect of driving experience was examined by Pelz and Schuman (1971) who concluded that "driving experience – measured in this case from the time when the young man (woman) said he (she) learned to drive – did not appear so important as age itself in accounting for infractions" (p.78). However, it has been questioned whether the measure of length of time since a person started to drive is an adequate measure of driving experience ignoring as it does amount or type of driving experience (Groeger and Brown, 1989).

Michels and Schneider (1984) examined the effect of experience measured in terms of length of time licence held, on levels of traffic offending. Inexperienced drivers (licence held less than two years) of various ages (from 18 years upwards) were found to commit a similar number of offences. Drivers differing in experience from less than 2 years to more than four years were found to differ in the types and number of offences. They concluded that experience was more important than age.

Levy (1990) examined the effect of driving age, driving experience and mandatory driver education on traffic fatalities of youth using data from 47 states in the U.S.A. The results showed that age of driver was an important determinant of fatalities and that "driving experience appears to have very minor if any influence" (p.334). However, Levy (1990) did state that the experience effect warranted further research due to measurement difficulties.

Many studies that provide evidence that youth *per se* is the problem with young drivers are based on observations of drivers performing specific behaviours where age has been estimated by appearance. Studies have shown that younger drivers speed more often (Harrington and McBride, 1970); adopt shorter headways (Evans and Wasielewski, 1983); have shorter gap acceptance (Bottom and Ashworth, 1978) and have higher approach speeds to signals (Konecni, Ebbesen and Konecni, 1976) than older drivers. Such studies can be criticised for not reporting the proportion of young drivers who did or did not engage in such activities not controlling for time of day or demographic differences of observed site usage and for not obtaining a measurement of age more accurately. However, even if all these things had been done the possible effects of age and experience would still have been confounded (Groeger and Brown, 1989).

2.3 Driving style and behaviour

Accident statistics are biased by the under-reporting, to different degrees, of different types of accidents. Accident conviction data are biased by the under-apprehending of violators. Neither of these measures is collected to illustrate driver behaviour, although they are often misused for this purpose. There are a number of methods which can be used to assess everyday driver behaviour.

There have been observational studies of driving behaviour in real life settings which suggest that young drivers are more likely to exhibit riskier behaviour, such as speeding or following too close than other groups of drivers (Harrington and McBride, 1970; Evans and Wasielewski, 1982).

Due to methodological difficulties there have been relatively few studies examining driving behaviour at first hand. This is surprising because it might be presumed that accidents (not necessarily reflected in the accident statistics) are often the end result of an inappropriate action or behaviour which is associated with a particular driving style.

There are two schools of thought on this issue. The first is that unsafe driving actions are indicative of accident conflicts at particular sites and

of individual drivers and the second is that accidents themselves are not good predictors of accidents at a particular site or for individual drivers. Despite these conflicting views, Quimby (1987), using an in-car observation methodology concluded; "it is clear from the results obtained that the technique employed in this feasibility study provided a suitable way of learning more about the role of faulty driving behaviour in road accidents" (p17).

2.4 Driving errors and violations

Most, if not all, drivers occasionally display some form of aberrant behaviour whilst driving. Such behaviours may lead to road accidents but are also likely to bring reward or advantage to the driver (for example by making the journey shorter or quicker) thus the aberrant behaviour becomes reinforced and is more likely to become part of the driver's everyday driving behaviour.

It is clear that the term "human error" cannot meaningfully be used to categorise all the ways in which people contribute to road traffic accidents. Reason *et al* (1990) suggested that a distinction could be made between errors and violations since they have different psychological origins and, more practically, should be made because they require different remedial approaches.

Group studies in which age and sex differences, rather than individuals, have been the focus of the study have indicated that the distinction between errors and violations does make a contribution to road accidents (Harrington and McBride, 1970; Storie, 1977).

Reason *et al* (1990) showed that for a low error/high violation group, male numbers greatly exceeded female numbers whilst the reverse was true for a high error/low violation group. Violations declined with age; errors did not. Men reported more violations than women who in turn reported more errors than men, although this was only significant in the case of harmless lapses.

Broughton (1986) analysed motoring offences committed in 1983 from Driver and Vehicle Licensing Centre (DVLC) driving licence records and found that 17-19 year old drivers had offence rates three times the average of all age and sex groups. Rates for male drivers were five times the rate for female drivers of a similar age. Broughton recognised that some of these differences might be explained by different annual mileage rates but that no information was available in the DVLC computer files on this subject.

2.5 Attitudes

Brown and Copeman (1975) analysed drivers' attitudes to the seriousness of various road traffic violations. A consistent pattern of attitude agreement was found across the age group/sex subgroups sampled with younger males (under 25 years) rating offences as less serious than the other groups. Subjects were also asked to judge offences in terms of personal responsibility, personal risk and the social consequences. Again, younger males gave significantly lower ratings when assessing their own "offensive" driving. These results led Brown and Copeman (1981) to suggest that there is an association between

these attitudes displayed by young men and the "ubiquitous over-representation of younger men in accident and violation studies" (p.23).

Colbourn, Brown and Copeman (1981) continued the work of analysing attitudes towards the perceived seriousness of "overt" and "covert" offences. Overt offences were defined as those which are immediately obvious to a casual observer such as jumping red traffic lights.

Covert offences were those which are not so easily observable, such as driving a defective vehicle. Results indicated that young male drivers did not distinguish between overt or covert offences and viewed both types of offences in a less serious light than the other age and sex groups of drivers.

Two recent surveys (AA Foundation, 1987a; AA Foundation, 1987b) provided evidence that there were considerable differences between older and younger drivers in their respective attitudes to driving cars and related behaviour such as drinking.

2.6 Social processes

In the last twenty years or so there has been a growing realisation that traffic behaviour does not take place in a social vacuum. It has become recognised that applied social psychology can make a practical contribution to explaining car driver behaviour. Some of the ways in which this has been done and which are relevant to this study are outlined below.

2.6.1 Passenger effects

The fatality rate of passengers by age (per 100,000 population) in Great Britain in 1989 showed a different pattern to car driver death rates. The passenger death rate for the 17-19 year age group was over six times higher than the age groups from 30-59 years of age (Department of Transport 1990, p.89). This may merely indicate that 17-19 year olds were six times more often passengers in cars than these other age groups. However, these figures may also suggest that passenger presence has some effect on car driver behaviour.

The idea that the presence or absence of spectators has an influence on a given task or behaviour has a long tradition in social psychology (Triplett, 1897; Travis, 1925; Zajonc, 1965). Despite this there have been relatively few studies concerned with the effect of passengers on car driver behaviour (Kruger, 1989; Baxter *et al*, 1989).

Kruger argued that "the driving performance level must be lower when passengers are in the car. As a result, the probability of causing an accident should increase" (Kruger, 1989, p.3). Kruger examined data on alcohol-related accidents and number of passengers present at the time of the accidents which showed that solo accidents were under-represented and accidents with two or more passengers were markedly over-represented.

Kruger accepted that passenger effect is affected by time stable variants like youth of the driver and driving experience and not only by transient influences such as alcohol. Kruger continued that, in future, it is

important to research actual driving difficulties, the amount and quality of social interaction within the car and driving performance.

Baxter *et al* (1989) provided further evidence of different effects on driver behaviour dependent on different passenger type. They found that signalling behaviour decreased by a significant amount only when younger males or older females were passengers in cars. Driver speed was found to vary by type of passenger in the car but it was not possible to conclude from this that passenger presence directly influenced driver speed since it is possible, *albeit* unlikely, that drivers who carry passengers are in some way different from those who do not.

2.6.2 Social norms

There are two kinds of rules which influence driver behaviour; the formal, involving legal rules, and the informal, involving generally accepted social norms. Car drivers develop patterns of social expectations (norms) in order to understand the driving situation. The most obvious example where these two norms differ is in the case of driving speed.

There is evidence which suggests that in order to drive safely one needs to follow the informal rules of the road adopted by other car users (Knapper and Cropley, 1981).

An explanation used to account for the passenger effects observed in the study by Baxter *et al* (1989, above) involves drivers perceiving passengers as representing particular social norms of what constitutes "good driving". It is suggested that drivers alter their driving to the perceived demands of these norms which vary with different driver/ passenger combinations.

2.6.3 Alcohol

Epidemiological research has shown a relationship between blood alcohol concentration (BAC) and the risk of collision involvement. This relationship is pronounced for young drivers, at all BAC's, compared to older groups. However, this relationship is not simple nor direct – alcohol is neither a necessary nor sufficient condition for accident collision. Even in those crashes that do involve the use of alcohol, other factors (social, psychological and behavioural) are likely to play a part between alcohol as "cause" and crash as "effect" (Bierness and Simpson, 1987).

An additional problem in drink-driving research is the general reluctance of car drivers to report actual levels of drink-driving (Sabey, Everest and Forsyth, 1988).

3 What were the basic data sources?

3.1 Sample characteristics

Over 430 subjects took part in the study in three age groups: 17-20 years, 21-25 years and 31-40 years. The youngest and oldest groups were chosen since they represent the extreme range of behavioural differences. The 17-20 year age group is known to have the highest accident involvement rates and those in the 31-40 year old group one of the lowest. It was expected that a number of drivers in the middle age range (21-25 years) whilst of similar age would have quite varying levels of driving experience thus enabling the possible effect of experience within age group to be studied. A structured sample, rather than a representative sample of the entire driving population, was required to facilitate comparisons across age and sex groups. Therefore, deliberate quotas were set for the different age and sex groups and certain subjects were excluded if they did not fit the required sample characteristics. Learner drivers were not included in the study.

A recruitment agency was engaged to help with the difficult task of obtaining sufficient subjects for the study. The general difficulty of obtaining subjects, particularly in the younger age groups, meant that a multi-method approach was used to obtain the final sample. This included selecting people randomly from the electoral register and inviting them to take part, advertising in local papers and displaying posters in local firms, schools and colleges. Direct contact was also made with company personnel officers for permission to use "in-house" magazines or direct memos for recruitment. The so-called "snowball" effect whereby volunteers persuaded friends and colleagues to participate also proved useful. As an inducement to take part and complete all parts of the study a payment was made to subjects.

All subjects were expected to complete the three components of the study; the route survey, the driving diary and the questionnaire. A total of 439 route surveys were conducted with 19 subjects failing to complete their diary and nine subjects who did not fill in a questionnaire (Table 3.1).

Table 3.1 – Sample and completed data

Completeness of sample	Male				Female			
	17-20	21-25	31-40	?	17-20	21-25	31-40	Total
Fully complete	78	72	75		57	48	81	**411**
Missing diaries	7	3	4		4	–	1	**19**
Missing background				9				**9**
OVERALL								**439**

The percentage of drivers in each socio-economic group (S.E.G.) was examined by age and sex (Table 3.2). S.E.G.'s were defined using the Registrar General's Classification (1-10) used for the General Household Survey.

Table 3.2 – Socio-economic grouping (%) by age and sex

Socio-economic grouping*	Male			Female			
	17-20	21-25	31-40	17-20	21-25	31-40	Overall
Non-manual (1-3)	12	41	65	30	46	56	**41**
Manual (4-6)	21	35	32	27	42	21	**29**
Students (7)	65	21	2	42	8		**24**
Housekeeping (8)					4	18	**4**
Unemployed (10)	2	3	1	1		5	**2**
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**

*The numbers in brackets are the Registrar General's classification from 1-10 used for the General Household Survey.
S.E.G. (9) = retired, of which there were none.

Of the 102 drivers categorised as students less than 15% of these were University students. The majority were from schools, sixth form and technical colleges in the surrounding area.

Care was taken not to get a preponderance of unemployed as a result of the financial inducements given to participate in the study.

SEG figures were compared with those of the 1987 General Household Survey (Table 3.3). The annual General Household Survey provided the SEG of adults but not broken down into age bands. Therefore the overall total percentages, using the same SEG definitions, were compared (from General Household Survey, 1987 (1989)).

The results would not be expected to be identical given the precise age criteria selections within our sample. The main differences between our sample and the national SEG figures was that there was a much higher percentage of students (people in full-time education) in our sample and a higher percentage of retired persons within the national SEG figures due to the selection of 66% of our sample from the 17-25 year old age groups. If only the manual and non-manual group totals are selected from both samples, it becomes evident that the comparative percentage figures are very similar (Table 3.3).

Table 3.3 – Manual and non-manual comparison (%) between General Household Survey (1987) and study sample

	Non-manual	Manual	Total
General Household Survey (%)	56	44	**100**
Study sample (%)	59	41	**100**

It would appear that a reasonable S.E.G. spread across all categories, but particularly the non-manual/manual distinction, was obtained. This was essential in order to eliminate any possible effects from an S.E.G. bias.

Two measures of driving experience were used: total career mileage (an estimate based on extrapolation from the last five years reported mileage) and number of years of driving since passing the test. Levels of experience had to overlap across age groups in order to investigate the effects of driving experience between as well as within age group. Quite wide variations of experience, both in terms of career mileage and

number of years since passing the test were obtained across all age and sex categories. Table 3.4 shows the minimum, maximum and average values for both types of experience measures across age and sex groups.

Table 3.4 – Driving experience measures by age and sex

Driving experience	Male 17-20	Male 21-25	Male 31-40	Female 17-20	Female 21-25	Female 31-40
Career miles (1000's)						
Minimum	0.3	3	22	0.2	0.7	3
Maximum	62	169	999	47	116	346
Average	15	49	233	11	37	97
Years of driving						
Minimum	0.1	0.3	5	0.1	0.3	2
Maximum	4	9	24	4	8	24
Average	2	5	15	2	4	13

3.2 The route surveys

3.2.1 Why are they relevant?

An assessment of drivers' performance on a specially selected route was necessary to identify specific driver skills, problems and errors related to age, experience and other characteristics.

3.2.2 Summary of task

All subjects drove their cars around a pre-determined 40 km route. Prior to the drive, subjects were given instructions to describe anything on the route which they felt might be dangerous to themselves or other road users. This subsidiary task was introduced to make the subject less aware that their driving was being assessed.

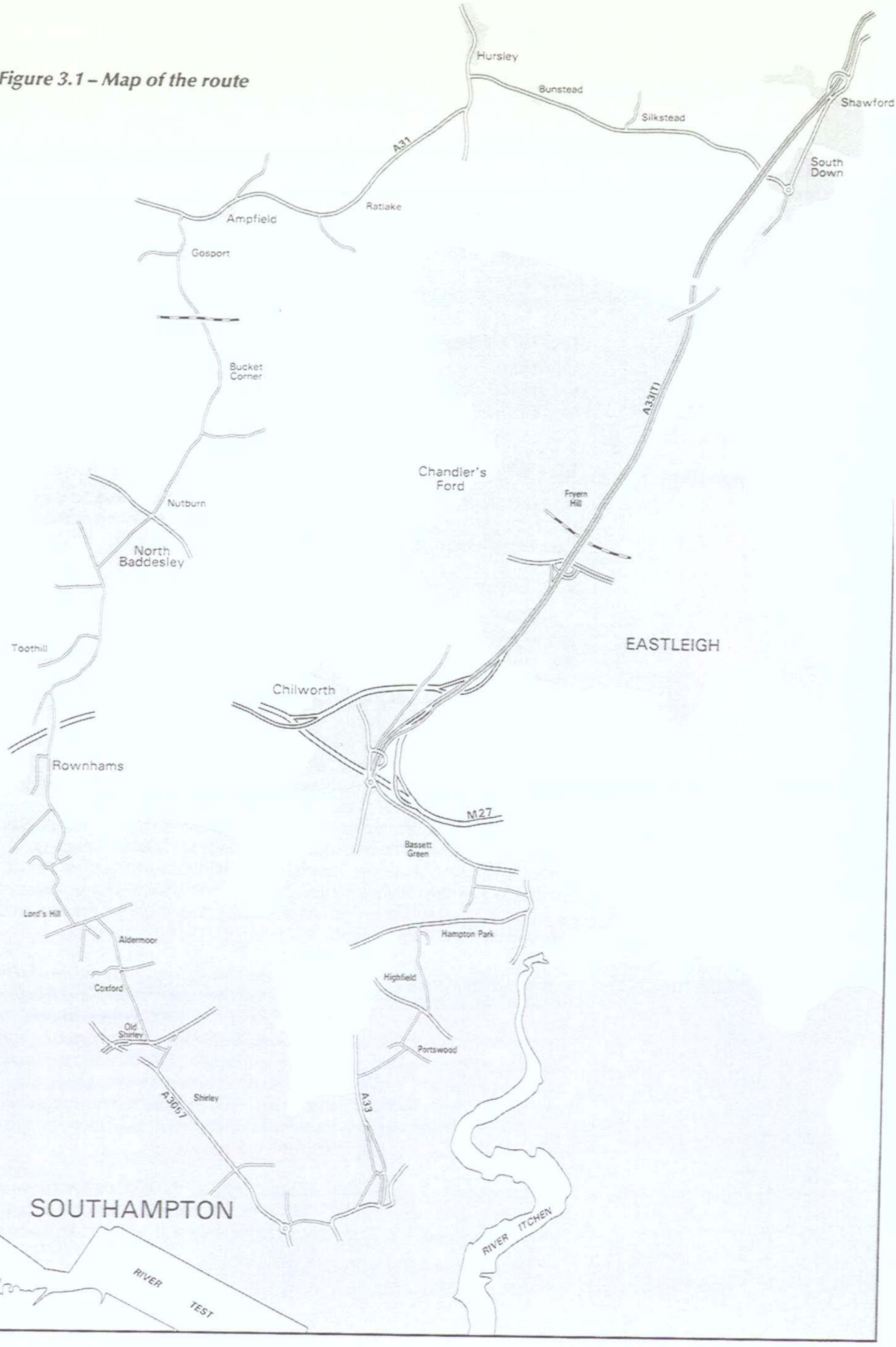
All drives were conducted between June 1989 and June 1990. The drives started and finished at the University and took place at a variety of different times between 8am and 9pm on weekdays or Saturdays.

During the drive, the subject was accompanied by a front seat passenger who gave route directions (the "route director") and a rear seat passenger (the "observer") who, it was stated, was there to record comments of the driver and conditions on the road, but who was actually assessing driver behaviour using the route assessment marking procedure (see Appendix 12.1).

Conversation from the route director was kept to a minimum unless initiated by the driver. The observer in the rear seat behind the front passenger made few comments during or after the drive in order to remain as inconspicuous as possible. Subjects were unaware that rear seat passengers were highly qualified driving instructors or examiners and the observers had no idea who the subjects were, other than identifying them by their forenames. This meant that nothing said or performed during the drive could have any repercussions for subjects or the observers. All of the observers were male.

A procedure to curtail the route survey was developed for those drivers who were so unsafe that the observer felt it was hazardous to continue with the entire drive. Only 2% of drives were shortened in this way.

Figure 3.1 – Map of the route



3.2.3 Choice of route

The route was chosen in collaboration with Hampshire Police Driving School guided by the need to include as many different road types, junction types and environments as possible in both rural and urban areas. A map of the route is shown in Figure 3.1. As many as 272 injury accidents were reported on the 40 km route in the previous three and a half years (1987 to mid-1990). An accident here was classified as one involving injury, recorded by Hampshire Police and where the vehicle or vehicles involved were travelling in the direction of the route. The numbers of different manoeuvres on the route are shown in Table 3.5. The total length of road measured for the speed limit sections was slightly less than 40 km because all turns and roundabout manoeuvres were not included in the measures.

Table 3.5 – Characteristics of route

Route characteristic (maximum speed limit)	**Length of road (kms)**
30 mph – in shopping area	3.6 km
30 mph – in residential area	7.6 km
40 mph	4.6 km
50 mph	9.3 km
60 mph	11.7 km
Road characteristic	**Number of manoeuvre sections**
Right turn – from minor to major road	6
Right turn – from major to minor	3
Left turn – from minor to major road	5
Left turn – from major to minor	4
Roundabout – right turn	3
Roundabout – left turn	2
Traffic lights – ahead	11
Traffic lights – left turn	5
Traffic lights – right turn	1
Pedestrian crossing	6

3.2.4 Choice of observers

The observers who assessed driver performance were highly experienced driving instructors or examiners. All the observers were given sufficient training time to familiarise themselves with the route and error marking procedure. A number of drives took place to improve and refine the measurement of driver performance. A series of test runs was undertaken in order to evaluate the consistency of the observers' marking.

3.2.5 The observer's task

Prior to the drive, observers filled in a record sheet containing basic details about the drive including date, time at start, make and model of car and weather conditions. Driver performance was assessed by the observers who marked driver errors by location on the route using the specially designed recording sheet. There were 12 error types to record

in addition to speeding errors which were itemised (see Appendix 12.2 for error definitions). If an error was considered dangerous it was circled on the route map. Observers also had to record road conditions on each identifiable section of the route in order to enable this to be taken into account with subsequent analyses.

At the completion of each drive observers made an overall assessment of driver performance and assessed whether or not each driver reached Department of Transport driving test standard in respect to the driving performance they displayed on the 40 km route.

3.2.6 Overall ratings by observers and drivers

Immediately after the drive, drivers were given a self-completion questionnaire and asked to assess their own driving performance on a number of different criteria. These included assessments of their own driving ability, safety, anticipation, concentration, observation and car control (see Appendix 12.3). This was administered and collected by the route director. At the same time, the observers made their own assessments on identical measures. This procedure ensured that direct comparisons could be made between self-assessed and observed scores for each driver's performance.

3.3 The driving diaries

3.3.1 Why are they relevant?

The use of driving diaries enabled a record of driving patterns to be drawn. These driving patterns were correlated to basic demographic and other information related to driving experience and exposure, involvements in accidents, general lifestyle characteristics, as well as the assessments of driver behaviour. Such data are also useful in enabling more precise estimates of relative exposure at different times of day and days of week.

3.3.2 What they involved

The diaries were designed to include every journey undertaken in the specified time period (at least one week). Each journey was entered and some standard information obtained including origin and destination, time, distance, purpose of journey, details of passengers and some scales reflecting the driver's perception of the journey (for example, enjoyable, tense, hurried) (see Appendix 12.4).

3.3.3 Were they completed properly?

Only 6% of subjects did not return their completed diary. These subjects did not appear to be significantly different in any of the measured characteristics from the rest of the sample. The reported number of journeys that were not recorded by the subjects in the specified one or two week period was extremely low although it was difficult to know whether such self reported estimates were accurate. It is likely that subjects underestimated the number of journeys that they actually forgot to fill in. However, there are no strong grounds for

suggesting that the "missing" journeys differed significantly from those reported, although it is perhaps more likely that the journeys not recorded were the shorter ones.

3.4 Questionnaires and interviews

3.4.1 Why are they relevant?

The interviews and questionnaires were essential to determine driver attitude. Findings were then related to driver performance and driving patterns determined from the diaries thus completing a picture of individual driver behaviour.

3.4.2 Summary of interview procedure

As many as 68 drivers were interviewed in order to determine their general characteristics and attitudes to driving. The interviews ranged in length from forty-five minutes to one and a half hours and included discussions about driving habits, experience, lifestyle, drink driving, car choice, possible effects of passengers, radio cassette use, accident history, motoring offences as well as attitudes to other drivers and provisional ("P") plates for novice drivers. All interviews were tape recorded for subsequent transcription and the majority took place at subjects' homes.

A semi-structured interview format was used as it is often effective in encouraging respondents to give accurate and honest answers. Time was spent training the interviewers to become skilled in the interview techniques with particular emphasis placed on trying to avoid getting "socially acceptable" responses.

3.4.3 Choice of key areas for questionnaire

Later, the interview component was replaced by a self-completion questionnaire which focused on the main findings from the interviews (see Appendix 12.5 for copy of questionnaire). The use of the questionnaire enabled larger amounts of data to be collected from a larger sample of drivers and for statistical analyses to be conducted on the data.

3.5 Accident statistics

Details of each reported injury accident occurring along the route in the previous three and a half years (1987 to mid-1990) involving a vehicle travelling in the same direction as the route survey, were obtained through Southampton City Council with Hampshire County Council. These accident data were classified by the route sections in which they occurred so that comparison could be made with the observed driving errors by section.

4 How did the drivers perform?

4.1 General

As noted above, weather, road and lighting conditions were recorded on each route survey in order to control for any effect these might have on driver behaviour.

Over 58% of the route surveys took place during fine, sunny weather in daylight hours on dry roads. A further 22% of the route surveys took place during daylight on dry roads when it was overcast. The remaining 20% (86) of the route surveys took place in conditions when at least one of the other measured conditions (rain, dusk, darkness or wet roads or any combination of these) was recorded.

Those route surveys that were conducted during unfavourable driving conditions were fairly evenly spread across all age and sex categories. The small numbers of subjects in each category undergoing the route survey in adverse weather meant that any conclusions drawn on the possible effects of weather on driver behaviour would be unreliable. It would seem unlikely that the weather conditions experienced on the drives played any significant part in driving performance on the route. In any case, the driving observers were instructed to take account of driving performance in relation to weather conditions.

Checks on the accuracy and consistency of the marking procedure across observers were examined. The distribution of observers' scores indicated that any weighting of scores was unnecessary.

4.2 Errors by age and sex

The average number of driver errors for each age and sex category showed that males aged 17-20 years made the most with 95 errors per driver. For the male groups, average number of errors fell sharply and consistently as age increased. No such pattern was evident from the female scores and average number of errors remained fairly high at over 80 errors per drive for all the female age groups. Steering errors comprised about a third of all driver errors whilst speeding errors comprised around a fifth to a quarter of all types of error.

The average number of errors per driver for each type of driver error and the percentage of the overall number of errors by age and sex category is shown in Table 4.1.

Table 4.1 – Errors by type by age and sex

Error type	Male 17-20 Ave	(%)	Male 21-25 Ave	(%)	Male 31-40 Ave	(%)	Female 17-20 Ave	(%)	Female 21-25 Ave	(%)	Female 31-40 Ave	(%)
1	3.5	(4)	2.7	(3)	2.4	(4)	3.8	(4)	4.2	(5)	5.1	(6)
2	32.1	(34)	25.9	(33)	16.6	(29)	29.0	(33)	26.5	(32)	27.4	(33)
3	4.8	(5)	2.9	(4)	3.0	(5)	4.6	(5)	4.7	(6)	4.7	(6)
4	13.9	(15)	10.5	(14)	8.3	(14)	11.5	(13)	8.1	(10)	9.5	(12)
5	1.9	(2)	2.7	(3)	2.6	(5)	1.9	(2)	3.4	(4)	3.3	(4)
6	9.0	(9)	9.1	(12)	7.2	(13)	9.1	(11)	10.8	(13)	10.3	(13)
7	3.2	(3)	3.5	(4)	2.2	(4)	4.8	(5)	3.8	(5)	3.5	(4)
8	0.6	(1)	0.3	(0)	0.6	(1)	0.5	(1)	0.3	(0)	0.5	(1)
9	–	–	–	–	–	–	–	–	–	–	–	–
10	0.8	(1)	0.7	(1)	1.0	(2)	1.0	(1)	1.5	(2)	1.3	(2)
11	1.6	(2)	0.7	(1)	1.0	(2)	0.8	(1)	0.7	(1)	0.9	(1)
12	1.2	(1)	0.6	(1)	0.7	(1)	0.9	(1)	1.4	(2)	1.1	(1)
13	–	–	–	–	–	–	0.2	–	–	–	–	–
14	22.0	(23)	18.2	(24)	11.4	(20)	19.9	(23)	16.0	(20)	13.7	(17)
Total	**95**	**(100)**	**78**	**(100)**	**57**	**(100)**	**88**	**(100)**	**81**	**(100)**	**81**	**(100)**

Numbers in total column may be rounded to nearest whole number.

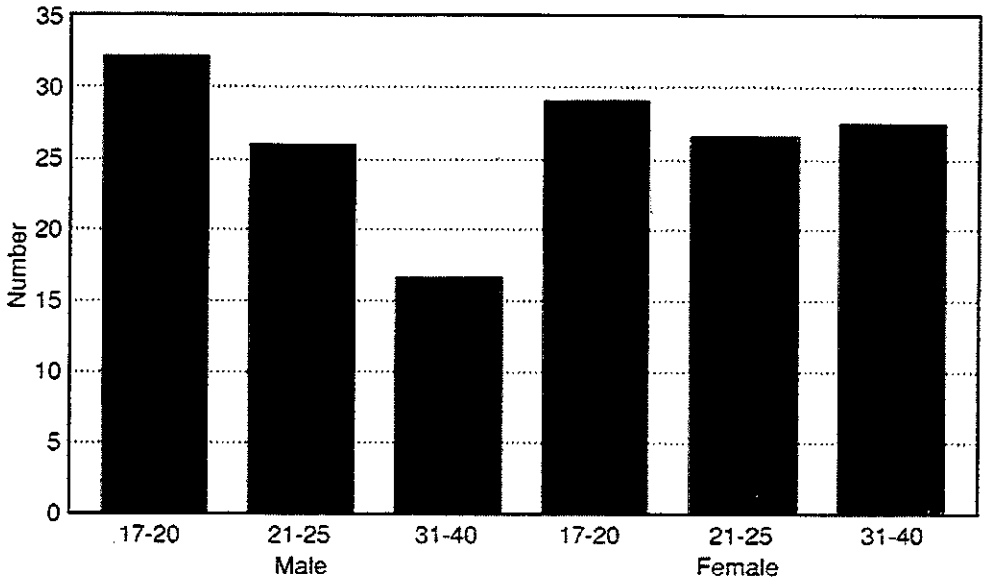
Key to error type:

1 = Brakes
2 = Steering
3 = Gears
4 = Mirrors
5 = Indicators
6 = Position on road
7 = Following traffic
8 = Joining traffic
9 = Leaving traffic
10 = Overtaking
11 = Erratic manoeuvres
12 = Consideration to other road users
13 = Slow speed
14 = Speed errors (too fast)

The average number of errors committed reflects to some extent the opportunity for committing such errors. For example, there were more occasions to commit steering errors on the route than joining traffic errors. Therefore the comparison between error types is not as valid as the comparison between age and sex within error type.

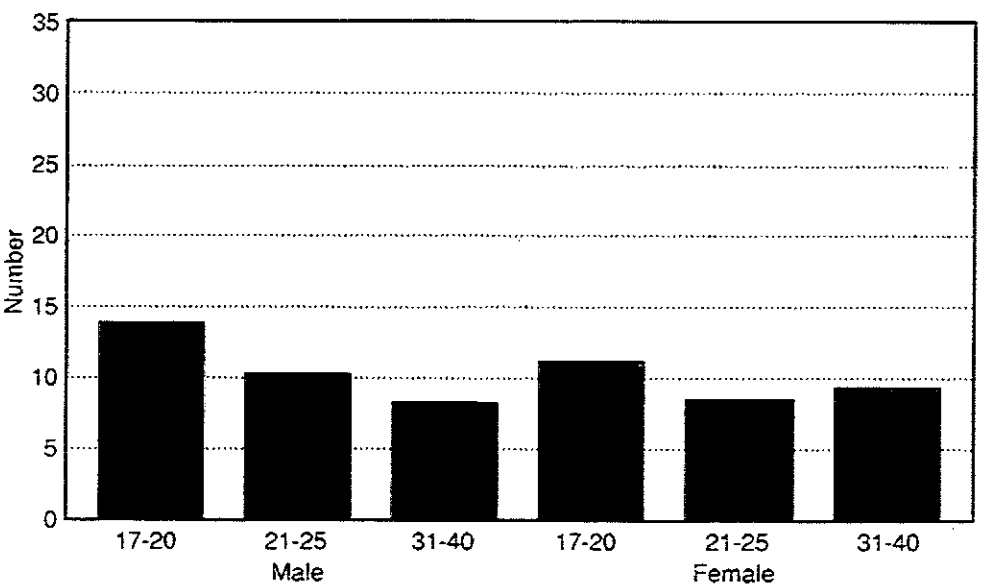
The types of errors with the highest average scores (steering, mirror, positioning on road and speeding) per driver by age and sex are shown in Figures 4.1 to 4.4.

Figure 4.1 – Steering errors (average) per driver



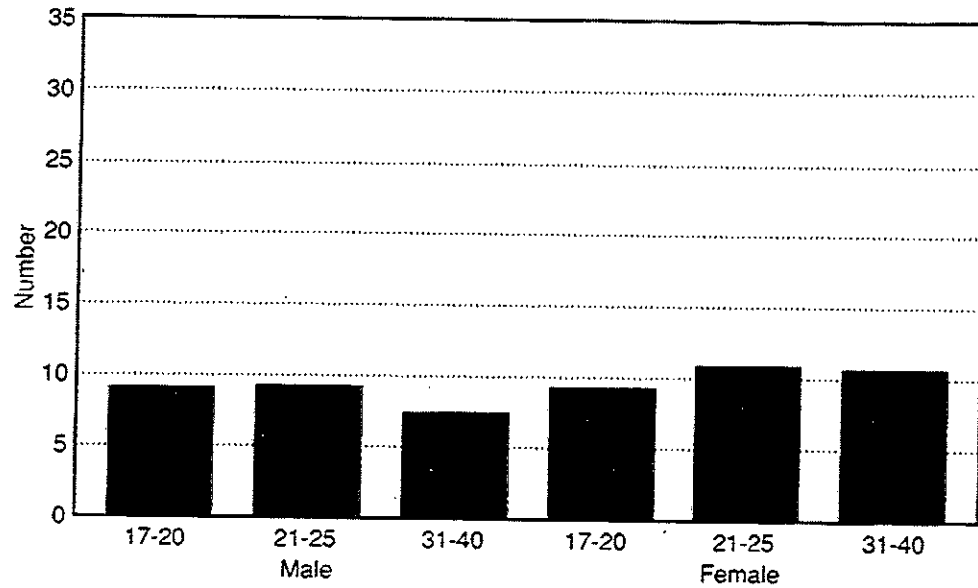
The number of steering errors for the male groups decreased as age increased whereas female steering errors remained at a consistent level.

Figure 4.2 – Mirror errors (average) per driver



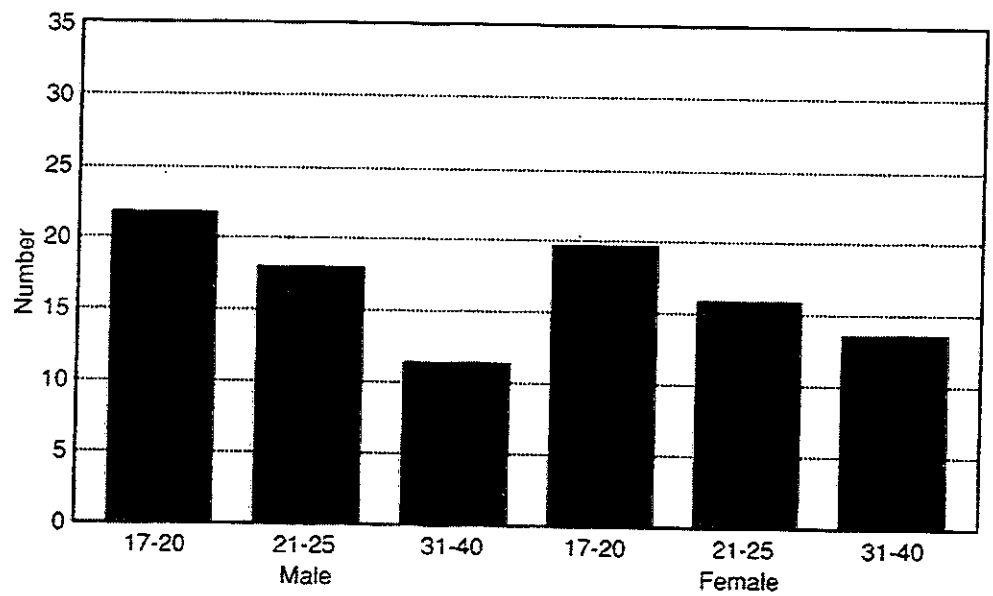
Mirror errors for the male drivers decreased as age increased. This pattern was not so marked with the female groups.

Figure 4.3 – Positioning errors (average) per driver



For the male groups, the number of positioning errors committed on the drive decreased slightly as age increased whereas for the female drivers the number of errors remained about the same across age.

Figure 4.4 – Speeding errors (average) per driver



For both sex groups, speeding errors decreased as age increased to a marked degree. This trend was particularly evident for the male groups.

4.3 Dangerous errors by age and sex

An error was classified as dangerous or not dependent on the driver action in relation to the road environment at the time of the error. The number of dangerous driver errors for each age and sex category again showed that males aged 17-20 years made the most such errors with an average of over 11 dangerous errors per driver. For the male groups, average number of dangerous errors was high both for the 17-20 year and 21-25 year age group but then fell to the lowest average of all age and sex groups recorded by the 31-40 year old male group. With the female scores the two youngest groups also made a higher average number of errors than the 31-40 year old group. Across all the age and sex categories speeding errors comprised around 90% of all the dangerous types of error (Table 4.2).

Table 4.2 – Dangerous errors by type by age and sex

Error type	Male			Female		
	17-20 Average	21-25 Average	31-40 Average	17-20 Average	21-25 Average	31-40 Average
Speeding	10.7	10.4	4.3	8.4	8.1	4.7
Others	0.9	0.6	0.3	1.1	0.8	0.5
Total	**11.6**	**11.0**	**4.6**	**9.5**	**8.9**	**5.2**

4.4 Where did the errors occur?

4.4.1 Errors

The route was divided into sections, which were either link sections or junction manoeuvre sections. There were five categories of link section, where the driver had continuous priority and eight categories of manoeuvre section where the driver may have had to give way or make a turning manoeuvre. The number of errors by each category of route are given (Table 4.3.(i)). The total number of errors for each link section was divided by the number of kilometres of that type and number of drivers in order to find out the average number of errors per kilometre per driver of link section. The total number of errors for each manoeuvre section was divided by the number of occasions that that manoeuvre occurred on the route (Table 4.3.(ii)).

Table 4.3 – Errors by route category

(i) Link sections (max speed limit)	Error total	Length of road kms	Errors per driver per km
30mph – shopping	2423	3.6	1.53
30mph – residential	7618	7.6	2.28
40mph	1648	4.6	0.82
50mph	3426	9.3	0.84
60mph	4638	11.7	0.90
(ii) Manoeuvre Sections	**Error Total**	**Number of manoeuvre sections**	**Errors per driver per manoeuvre section**
Right turn (RT)	3543	9	0.90
Left turn (LT)	3715	9	0.94
Roundabout (RT)	2070	3	1.58
Roundabout (LT)	767	2	0.87
Traffic Lights (Ahead)	2130	11	0.44
Traffic Lights (LT)	1820	5	0.83
Traffic Lights (RT)	476	1	1.08
Pedestrian Crossing	762	6	0.29

Results showed that the locations with the highest average number of errors for link sections were both of the 30mph sections, in particular, within residential areas.

With respect to manoeuvres, the highest average number of errors was recorded on right turns both at roundabouts and traffic lights.

Right and left turn errors were further examined by minor to major turnings and major to minor turnings. Major to minor turnings had more average errors per driver (average = 0.95) per turn than minor to major turnings (average = 0.90), but not to a significant level.

4.4.2 Dangerous errors

The same procedure (above) was used to determine the location of the highest average number of dangerous errors (Table 4.4).

Table 4.4 – Dangerous driving errors by route category

Link sections (max speed limit)	Dangerous error total	Length of road (kms)	Dangerous errors per driver per km
30mph – shopping	349	3.6	0.22
30mph – residential	1551	7.6	0.46
40mph	277	4.6	0.14
50mph	683	9.3	0.17
60mph	362	11.7	0.07
Manoeuvre sections	**Dangerous error total**	**Number of manoeuvre sections**	**Dangerous errors per driver per manoeuvre section**
Right turn (RT)	47	9	0.01
Left turn (LT)	99	9	0.03
Roundabout (RT)	58	3	0.04
Roundabout (LT)	10	2	0.01
Traffic Lights (Ahead)	125	11	0.03
Traffic Lights (LT)	28	5	0.01
Traffic Lights (RT)	0	1	–
Pedestrian Crossing	96	6	0.04

The route sections with the highest number of dangerous errors per driver were the 30 mph sections with the residential area again being the most dangerous. Errors on these types of road were often marked dangerous not just for the driver of the vehicle but more importantly for pedestrians and children near the road. The 50 mph section also recorded one of the highest number of dangerous errors per driver due possibly to road works on a particular road which resulted in added congestion and restricted speed limits.

The manoeuvre sections with the highest average number of dangerous errors were right turns at roundabouts and pedestrian crossings, although these numbers were small.

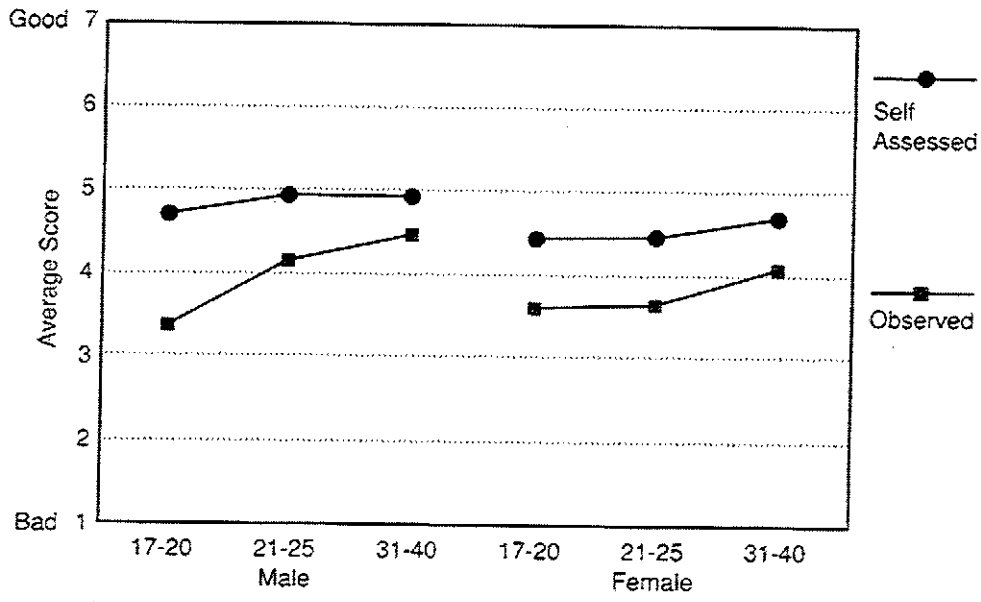
4.5 Overall assessments of driving ability by observers and drivers

Self-assessed and observed scores for driving performance on the route survey were recorded across six measures (ability, safety, anticipation, concentration, observation and car control). All assessments were based on a 7 point continuous scaling procedure (1-7). The lowest possible rating was 1= "very bad or unsafe" with the highest being 7= "very good or safe" with a mid-point mark of 4.

4.5.1 Assessments of ability

The observed and self-assessed scores for ability were compared across age and sex (Figure 4.5).

Figure 4.5 – Assessments of ability (observed and self-assessed)



Observed ability increased noticeably with age for the male groups, whereas it increased only slightly with age for the female groups. All of the age and sex groups assessed themselves to be better at driving ability than they were assessed by the observers; this difference was higher for the male 17-20 year old age group than for the other groups.

Thus, the youngest male group (17-20 years) believed themselves to be as able on the roads as the other age and sex groups and yet their performance indicated otherwise.

4.5.2 Assessments of safety

The observed and self-assessed scores for safety across age and sex were examined (Figure 4.6 opposite).

The safest group of drivers was observed to be the 31-40 year old male group and the least safe the 17-20 year old male group. The youngest male group (17-20 years) rated themselves almost as safe as other drivers, in contrast to their behaviour in terms of known accident rates and error scores on the drive.

4.5.3 Assessments of anticipation

The observed and self-assessed scores for anticipation across age and sex were examined (Figure 4.7 opposite). Only the male 31-40 year old group recorded an observed average score for anticipation above the mid-point mark of 4. A consistent pattern was again shown in that all groups of drivers rated themselves at least one to one and a half marks better at anticipation than they were observed, with the male 17-20 year old group rating themselves two marks better.

Figure 4.6 – Assessments of safety (observed and self-assessed)

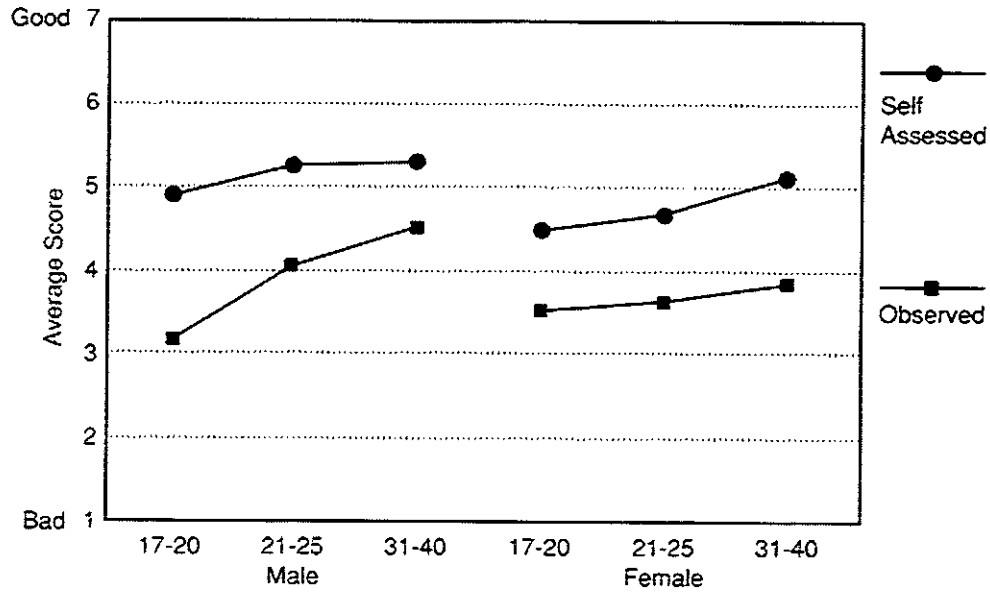
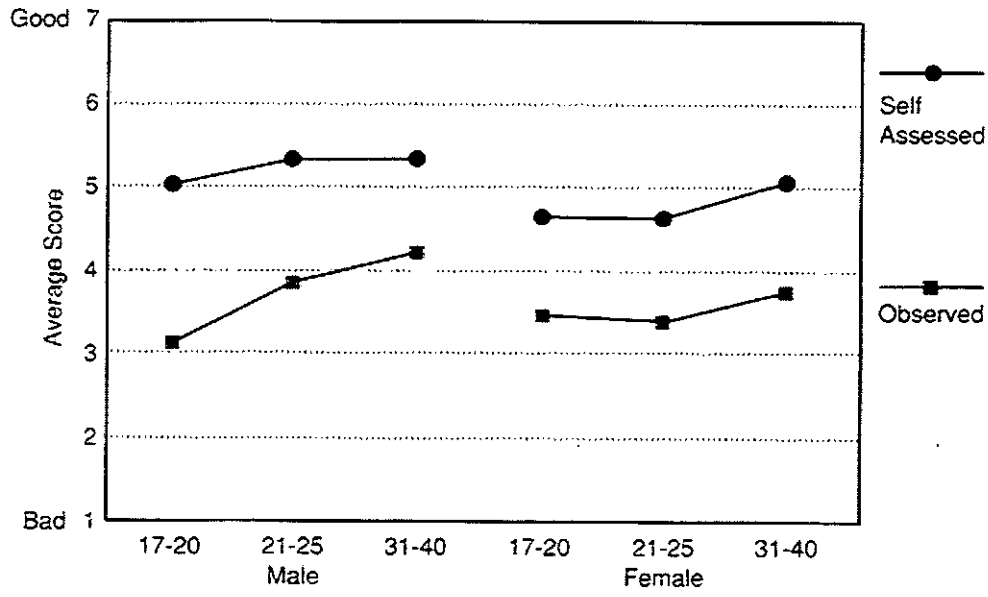


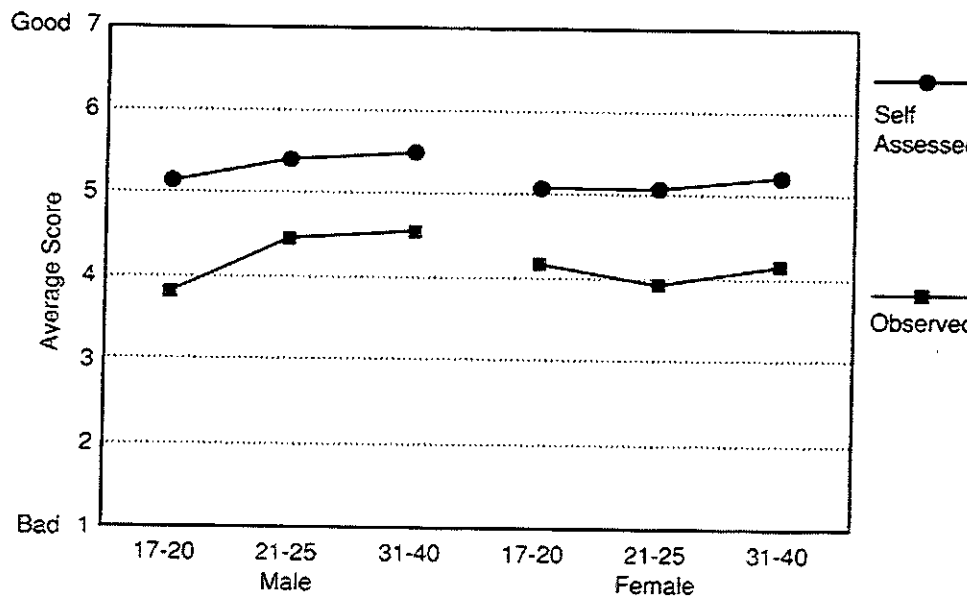
Figure 4.7 – Assessments of anticipation (observed and self-assessed)



4.5.4 Assessments of concentration

The observed and self-assessed scores for concentration across age and sex were examined (Figure 4.8 over page).

Figure 4.8 – Assessments of concentration (observed and self-assessed)

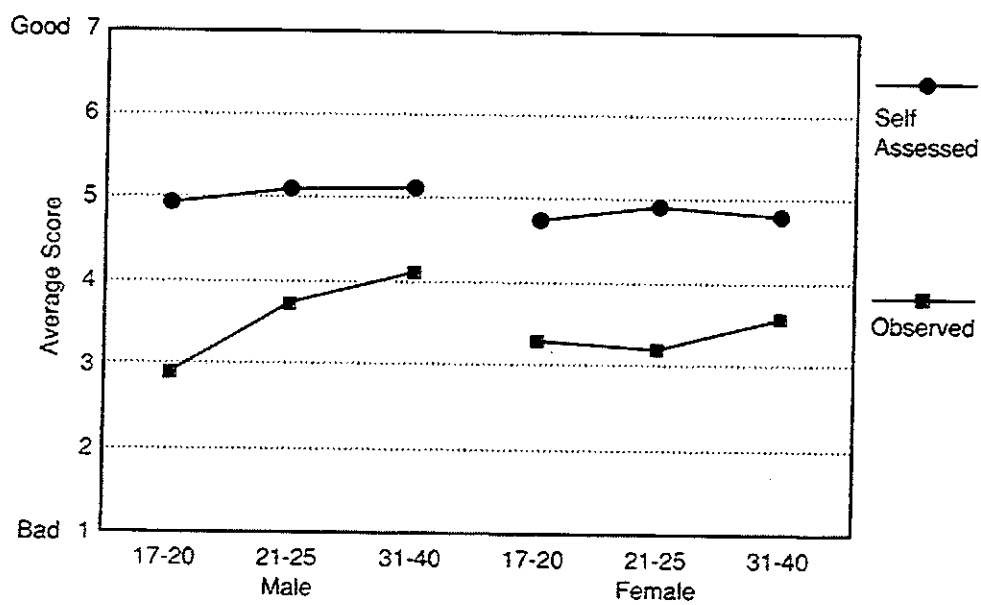


Given the nature of the driving task it might be expected that drivers would concentrate to a high degree and this was reflected in concentration scores being the highest of all the observed measures.

4.5.5 Assessments of observation

The observed and self-assessed scores for observation across age and sex were examined (Figure 4.9).

Figure 4.9 – Assessments of observation (observed and self-assessed)

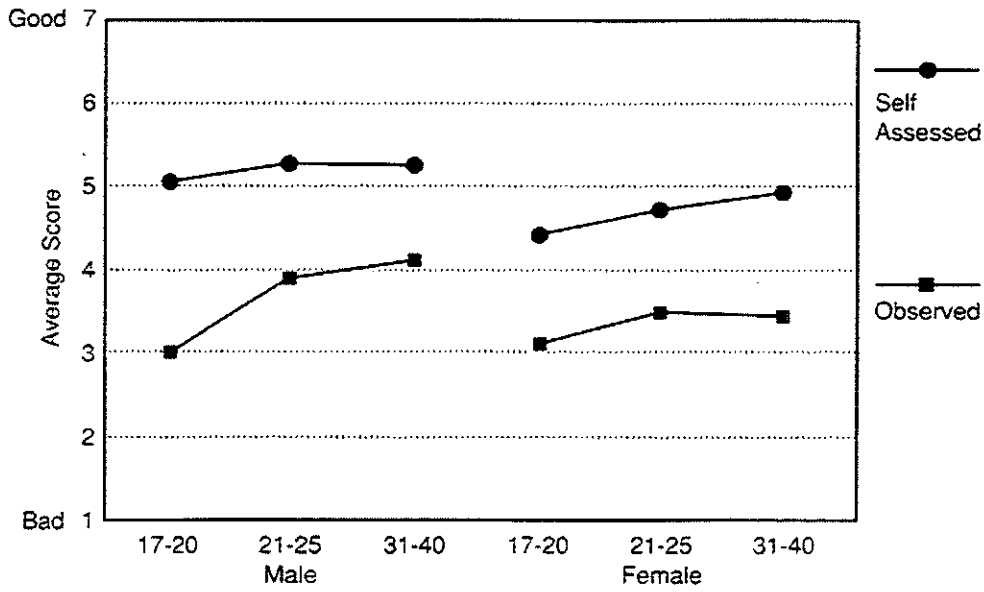


The young male group (17-20 years) again had the lowest average observed rating yet assessed themselves the same as the other groups.

4.5.6 Assessments of car control

The observed and self-assessed scores for car control across age and sex were examined (Figure 4.10).

Figure 4.10 – Assessments of car control (observed and self-assessed)



The youngest age group (17-20 years) for both sexes had the lowest observed rating averages for car control. Overall the females tended to score lower than the males.

SUMMARY

In general, the male, 17-20 year old group was the least accurate in their assessment of their driving behaviour across all the measures. Consistently rated the worst group on all the measures, the young male group (17-20 years) nevertheless rated themselves roughly on a par with the other age and sex groups.

4.5.7 Which drivers drove to Department of Transport test standard?

At the end of each drive, the observers made an overall subjective assessment of whether the driver drove up to Department of Transport (DTp) driving test standard on the route taking into account any driving errors made. It is recognised that the drivers were not aware that they were being assessed and that the driving task they were asked to perform was considerably different from the driving test. It is also acknowledged that the drivers might have been capable of maintaining a DTp test standard if they had been asked to do so. This was not the case as drivers were asked to drive in their "normal" way. Nevertheless, the percentage of drivers in each age and sex group that were adjudged to have actually driven to DTp test standard during the route survey is shown in Table 4.5 (over page).

Table 4.5 – Drivers (%) who drove to Department of Transport test standard

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
DTp standard or above (%)	5	11	34	10	6	17
Below DTp standard (%)	95	89	66	90	94	83
	100	**100**	**100**	**100**	**100**	**100**

As age increased the percentage of drivers who would have passed a driving test increased. This was an interesting result given the fact that it is likely that these older groups might be expected to have passed their test less recently than the other groups.

4.6 Are all drivers within an age and sex group the same?

One of the problems with using average scores is that certain high or low scores can have a disproportionate effect on the average. Therefore the distributions of the driver errors and driver ratings were examined.

4.6.1 Distributions of error scores

The distributions of error scores across age and sex were examined. The percentages of drivers in each age and sex group by number of errors are shown (Table 4.6).

Table 4.6 – Frequency distribution (%) of error scores

Number of errors	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
<20	1	18	24	7	2	6
20-59	32	29	41	38	42	28
60-99	25	20	18	23	28	32
100-139	23	13	9	15	16	27
140-179	14	16	8	10	8	6
180+	5	4	0	7	4	1
	100	**100**	**100**	**100**	**100**	**100**

19% of the 17-20 year old male group made 140 or more errors per drive along with 20% of the 21-25 year old male group. In addition only 1% of the 17-20 year old male group scored less than 20 errors per drive compared to as many as 24% in the 31-40 year old male group. Female scores did not vary so markedly across age, although a higher percentage of the 17-20 year old age group scored 140 or more errors in comparison to the other age groups.

4.6.2 Distributions of dangerous errors

The distributions of dangerous errors (definition given in Appendix 12.2.1) across age and sex were examined. The percentage of drivers in each age and sex group by number of dangerous errors is shown (Table 4.7 opposite). 9% of the young male (17-20 years) group made over 40 dangerous errors on the route compared with only 1% of drivers in both the male and female 31-40 year old groups.

Table 4.7 – Frequency distribution (%) of dangerous error scores

Number of dangerous errors	Male 17-20	Male 21-25	Male 31-40	Female 17-20	Female 21-25	Female 31-40
<10	66	73	88	75	69	82
10-19	18	9	7	10	19	13
20-29	6	7	3	3	8	4
30-39	1	4	1	5	0	0
40-49	6	1	0	3	2	1
50-59	0	4	0	2	0	0
60+	3	2	1	2	2	0
	100	**100**	**100**	**100**	**100**	**100**

A similar but less marked trend to the error frequency was found with dangerous error frequency in that fewer males in the 17-20 year age group scored less than 10 dangerous errors and a higher percentage scored over 40 dangerous errors than the other age and sex groups.

4.6.3 Distributions of driver ratings

The distributions of driver ratings across age and sex were examined (Table 4.8).

Table 4.8 – Distributions (%) of driver ratings

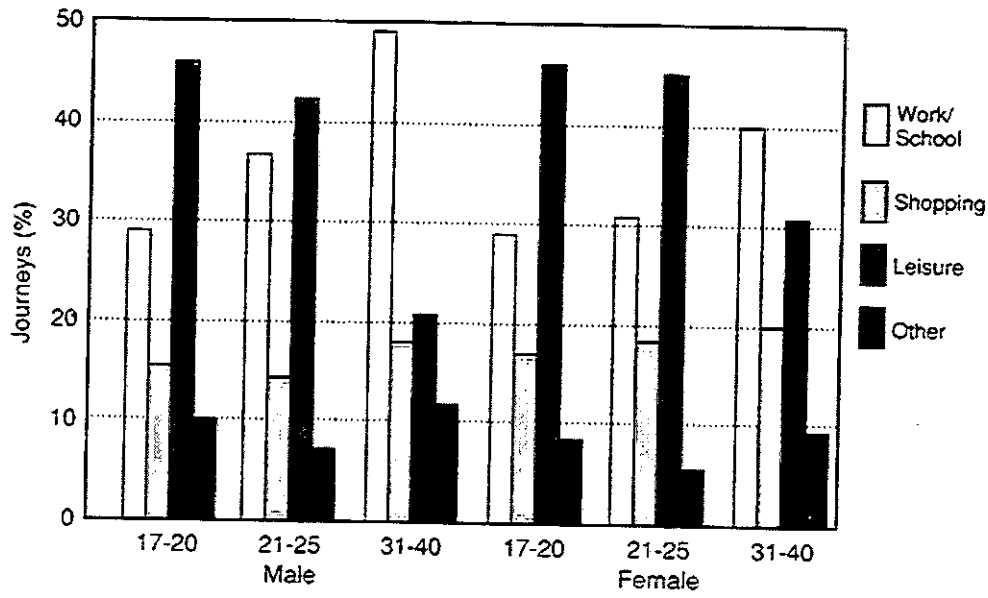
Safety rating	Male 17-20	Male 21-25	Male 31-40	Female 17-20	Female 21-25	Female 31-40
1 (Bad)	19	5	3	13	2	5
2	15	13	8	16	17	11
3	30	12	19	16	19	29
4	15	27	16	18	39	15
5	14	29	25	27	17	23
6	7	13	19	7	6	16
7 (Good)	0	1	10	3	0	1
	100	**100**	**100**	**100**	**100**	**100**

As many as 19% of the 17-20 male drivers scored the lowest possible observed safety rating. 13% of the 17-20 year old female groups were located at this lowest end of the distribution.

SUMMARY

The presentation of data in averaged group format can disguise the variations between members of particular categories and may lead to a false impression of homogeneity. In other words, not all, but a substantial minority of young male drivers were rated "unsafe" and not all, but a substantial minority of older drivers were rated "safe". Nevertheless, it must be noted that on a number of driving measures a higher percentage of younger drivers, males in particular, could be said to be "unsafe" compared to the other age and sex groups.

Figure 5.1 – Purpose of journeys



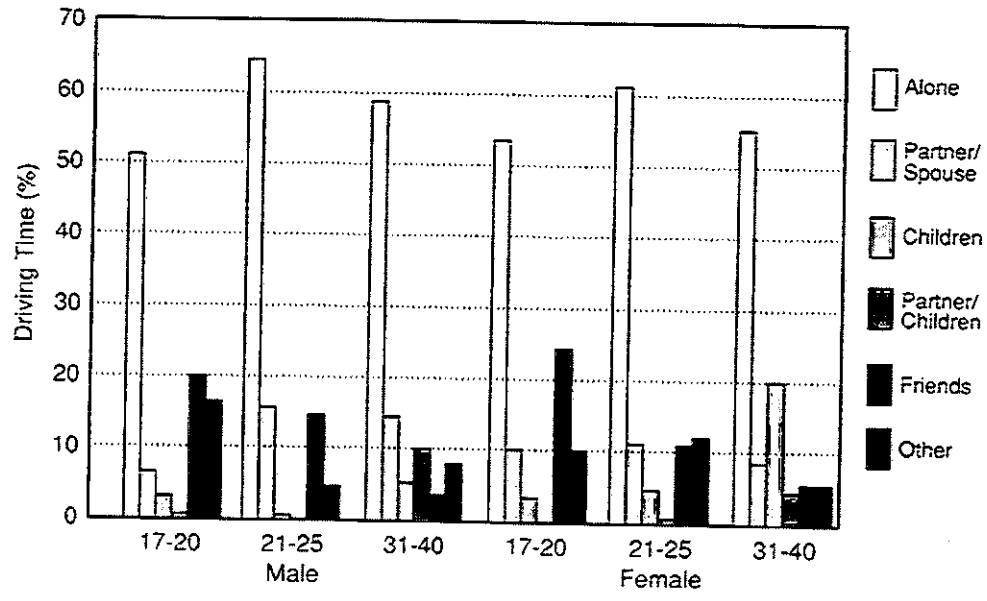
The major findings were that as age increased drivers spent a greater percentage of their driving time using the car for work/school purposes and less of their time for leisure purposes.

Results were similar to those found on the driving questionnaire on reported driving time by purpose of journey.

5.3 Passenger details

The percentage of their driving time that subjects spent with and without passengers was examined (Figure 5.2).

Figure 5.2 – Passenger occupancy



5 Why and when do the drivers drive?

5.1 General

Data collected from the driving diaries comprised the largest source of data. 94% of the diaries given to subjects who drove on the route survey were completed and returned. The reported number of journeys that were not recorded by the subjects in the specified one or two week period was extremely low.

5.1.1 Total number of journeys and distances

There were 11,665 journeys recorded in the diaries covering a total of 91,726 miles incorporating over 3,250 hours of driving time at an average speed of 28.2 mile/h.

The weekly average number of journeys and mileage are shown in Table 5.1. The average number of journeys per week and weekly mileage increased with age for the male groups in contrast with the female groups where the 21-25 year old drivers made the most number of journeys and had the highest weekly mileage. Overall females tended to make more journeys per week than males. Females journeys were generally also of a shorter distance than male journeys. The 31-40 year old female group made shorter journeys than all the other groups.

Table 5.1 – Weekly average number of journeys and distance driven

Weekly average per driver	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Number of journeys	20	24	27	23	29	28
Mileage driven	173	232	257	145	190	153

(To nearest whole number)

5.2 Purpose of journeys

The purposes for which subjects used their cars were investigated (Figure 5.1 over page). There were 17 categories of journey type which were combined into 4 types of journey (to/from work/school, shopping, leisure and other).

Results showed that the younger age group (17-20 years) of both sexes spent a much greater percentage of their driving time accompanied by friends than the older age groups. For males, the 31-40 year old group drove with friends for only 3% of the time compared with 20% and 14% for the 17-20 and 21-25 age groups; for females the corresponding percentages were 6%, 24% and 11%. The other most obvious difference was that older females spent a greater percentage of their driving time accompanied by children compared to all the other age and sex groups.

Again, results were similar to those found from the driving questionnaire on reported driving time with and without passengers.

5.4 Use of radio cassettes

The amount that drivers use their radio cassette whilst driving is shown (Table 5.2). Amount and type of use varied across age and sex. The male and female 31-40 year groups and the 21-25 year old female group drove for over 40% of their time not listening to the radio or cassette. The amount of time that music was played in the car decreased as age increased across both sexes.

Such results were of some significance in the light of the reported influence that the radio cassette can have on driving behaviour (Section 6.)

Table 5.2 – Journeys (%) with radio cassette in use

Radio cassette use	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Nothing	33	28	48	23	40	42
Music	57	60	34	64	50	37
Speech	1	5	11	2	2	6
Mixture	9	8	8	10	8	16
	100	**100**	**100**	**100**	**100**	**100**

5.5 Time of day of journeys

5.5.1 Time of day of all journeys

The percentage of journeys by time of day was examined (Table 5.3).

Table 5.3 – Journeys (%) by time of day

Time	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
4am-8am	6	8	7	5	5	4
8am-12 noon	21	20	26	21	23	31
12 noon-4pm	22	20	25	22	25	29
4pm-6pm	17	17	17	17	17	15
6pm-8pm	14	16	14	15	15	12
8pm-10pm	9	9	7	10	7	6
10pm-12 midnight	7	7	3	7	6	2
12 midnight-4am	4	3	1	3	2	1
Totals	**100**	**100**	**100**	**100**	**100**	**100**

Around a tenth of all journeys for the 17-20 and 21-25 year old groups took place between 10pm and 4am compared to less than half that amount for all journeys by both of the 31-40 year old groups.

5.5.2 Night time passenger occupancy

It is evident from results (above) that the 17-25 year old age groups drive for a higher percentage of their overall number of journeys between the hours of 10pm and 4am when compared to the 31-40 year old groups. These so-called "night time" journeys were examined to find out what type of passengers were present on these journeys (Table 5.4).

Of those drivers on the road between the hours of 10pm and 4am there are proportionately more younger drivers (17-25 years old) than older drivers (31-40 years old). These younger drivers are also accompanied by friends for higher percentages of their driving journeys than older groups.

Table 5.4 – Night-time journeys (%) by passenger presence

	Male											
	17-20				21-25				31-40			
Passenger type	**A**	**P**	**F**	**O**	**A**	**P**	**F**	**O**	**A**	**P**	**F**	**O**
Time												
10pm-12 midnight	12.4	2.6	5.4	1.7	10.3	4.4	5.4	1.6	6.3	3.0	1.4	2.4
12 midnight-4am	19.1	1.9	3.9	5.1	10.5	1.9	5.4	0.8	5.4	1.6	0.8	1.9

	Female											
	17-20				21-25				31-40			
Passenger type	**A**	**P**	**F**	**O**	**A**	**P**	**F**	**O**	**A**	**P**	**F**	**O**
Time												
10pm-12 midnight	10.3	2.3	1.2	4.9	7.2	1.2	3.3	2.3	5.6	2.1	1.9	0.9
12 midnight-4am	9.7	0.4	4.7	2.7	6.6	1.2	1.2	3.5	7.0	0.8	1.6	2.3

(percentage)

Key: **A** = Alone **F** = Friends
P = Partner **O** = Other passengers/combinations

5.6 Subjective ratings of driving

Self-assessed ratings of a number of variables on "risk", "enjoyment", "haste", "tenseness", "tiredness" and the "ability to concentrate" for each diary journey were examined. The rating scale went from 1 = not at all to 7 = extremely.

5.6.1 Overall ratings by age and sex

The overall ratings for each journey were examined. There were no large differences between sex and age group. This was not surprising as these ratings were not sensitive enough to take account of type of journey, passenger type, passenger number, time of journey and so forth. There is also the possibility that what was assessed as very risky behaviour by a 31-40 year old driver might have not been assessed at all risky by a 17-20 year old driver. Assessment ratings within age and sex group are likely to be less marked than between age and sex group. The two most different types of journey were compared (work journeys versus leisure journeys) to see if there were any differences between these two extremes.

5.6.2 Ratings for work and leisure journeys only

The average ratings for work journeys only and leisure journeys only were examined (Tables 5.5 and 5.6.) The ratings showed that work journeys were rated as more hurried, more tense, more tiring and less enjoyable than leisure journeys.

Table 5.5 – Average ratings for work journeys only

Ratings	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Risky	2.5	2.1	2.2	1.8	2.1	1.8
Enjoyable	3.7	3.6	3.9	3.5	3.5	3.3
Hurried	3.6	3.1	2.7	3.1	3.2	3.7
Tense	2.4	2.4	2.2	2.4	2.6	2.5
Tired	2.6	2.5	2.2	2.3	2.6	2.6
Concentration	5.2	5.2	5.5	4.8	5.0	5.7

Leisure journeys were rated as more enjoyable than work journeys. Concentration level and risk ratings across the two journey types did not show any clear patterns. It would seem that type of journey can affect driver state but not to a large extent.

Table 5.6 – Average ratings for leisure journeys only

Ratings	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Risky	2.2	2.2	2.1	1.9	1.9	1.9
Enjoyable	4.6	4.3	4.6	4.5	4.4	4.5
Hurried	2.7	2.8	2.1	2.1	2.3	2.3
Tense	2.0	2.3	1.9	1.9	2.1	2.0
Tired	2.3	2.4	2.1	1.9	2.4	2.3
Concentration	5.1	5.3	5.5	5.0	5.3	5.2

Only small differences were found with driver ratings between the two most different journey types. Effects between less contrasting journey types were of little significance.

5.6.3 Effects of passengers on ratings

The self-reported effects that passengers had on rating averages for all car journeys were examined. Effects by number of passengers and effects by type of passenger were investigated separately.

5.6.3.1 Effects of passenger numbers

The effects of the number of passengers on male and female car driver ratings were examined separately (Tables 5.7 and 5.8 over page).

Table 5.7 – Effects of passenger numbers on male car drivers

Number of passengers	17-20			21-25			31-40		
	0	1	≥2	0	1	≥2	0	1	≥2
Ratings									
Risky	2.2	2.2	2.3	2.2	2.1	2.4	2.2	2.1	2.3
Enjoyable	4.4	4.6	4.7	3.9	4.3	4.3	3.9	4.3	4.3
Hurried	2.8	2.5	2.4	2.8	2.7	2.7	2.5	2.2	2.1
Tense	2.1	2.0	2.0	2.3	2.2	2.2	2.1	2.0	2.1
Tired	2.6	2.3	2.5	2.6	2.8	3.1	2.5	2.3	2.4
Concentration	5.1	5.2	5.1	5.3	5.1	4.9	5.4	5.4	5.4

Table 5.8 – Effects of passenger numbers on female car drivers

Number of passengers	17-20			21-25			31-40		
	0	1	≥2	0	1	≥2	0	1	≥2
Ratings									
Risky	1.9	2.1	2.1	2.1	1.9	2.1	1.8	2.1	2.0
Enjoyable	3.8	4.4	4.5	3.8	4.2	4.6	3.8	4.1	4.1
Hurried	2.5	2.3	2.4	2.7	2.5	2.6	2.8	2.5	2.3
Tense	2.2	2.0	2.3	2.4	1.9	2.3	2.2	2.4	2.3
Tired	2.5	2.3	2.5	2.7	2.7	2.4	2.6	2.7	2.7
Concentration	4.9	4.9	4.7	5.1	5.0	4.6	5.4	5.0	4.8

All groups with the exception of the 17-20 female group rated journeys with one passenger slightly less risky than when alone.

Generally having one passenger in the car slightly added to the enjoyment of the journey which was slightly less hurried. All groups were slightly less tense with one passenger in the car than when alone except the 31-40 year old female group who were perhaps more likely to be carrying children as their passengers.

The effect of 2 or more passengers showed that risk levels very slightly increased from the "one passenger" or "alone" conditions. Enjoyment levels of the journeys with 2 or more passengers were higher than "alone" or with one passenger except for the male and female 31-40 year old groups. Concentration levels tended to fall slightly as passenger numbers increased for all groups except the 31-40 year old male group where they stayed about the same.

5.6.3.2 Effects of passenger types

Journeys where there was only one type of passenger (either P = partner/spouse, C = children or F = friend) were examined (Tables 5.9 and 5.10 opposite). These three passenger types were chosen because, from the interview data, it became clear that these passenger types have the most effect on driver behaviour.

Table 5.9 – Effects of passenger type on male car drivers

Types of passenger	17-20			21-25			31-40		
	P	C	F	P	C	F	P	C	F
Ratings									
Risky	2.0	–	2.3	2.1	–	2.8	2.2	2.0	1.9
Enjoyable	4.8	–	4.7	4.3	–	4.3	4.3	3.9	4.3
Hurried	2.3	–	2.7	2.7	–	2.6	2.0	2.2	2.6
Tense	1.7	–	2.1	2.2	–	2.1	1.9	2.1	2.0
Tired	2.0	–	2.5	2.9	–	2.8	2.2	2.6	2.3
Concentration	5.3	–	5.0	5.0	–	5.1	5.5	5.1	5.2

Key: **P** = Partner/spouse
C = Children
F = Friend

Table 5.10 – Effects of passenger type on female car drivers

Types of passenger	17-20			21-25			31-40		
	P	C	F	P	C	F	P	C	F
Ratings									
Risky	2.0	–	2.2	1.7	2.5	1.8	2.0	2.0	2.2
Enjoyable	4.7	–	4.5	3.9	4.8	4.4	4.2	4.1	3.8
Hurried	2.0	–	2.5	2.6	3.0	2.4	2.5	2.5	2.3
Tense	1.7	–	2.2	1.8	2.6	1.9	2.3	2.4	2.2
Tired	2.4	–	2.4	2.9	2.8	2.6	2.7	2.8	2.5
Concentration	5.3	–	4.7	4.6	3.9	5.3	5.0	4.9	4.5

Key: **P** = Partner/spouse
C = Children
F = Friend

All groups, except the 31-40 year old male group, assessed journeys with friend(s) slightly more risky than with their partner or spouse. The largest differences were in the 17-20 and 21-25 year old male groups. All groups found it more enjoyable driving accompanied by their partner or spouse than friends or children except the female 21-25 year old group. Those groups that had carried unaccompanied children as passengers assessed these journeys as the most tense.

6 What were driver attitudes and opinions?

A total of 350 drivers filled in the questionnaire. The other drivers who took part in the route survey were interviewed in Phase I of the study.

Some of the questions on the questionnaire had open ended answers whilst others required forced choices.

6.1 Learning to drive

6.1.1 Driving illegally on road before obtaining provisional licence

A number of drivers admitted having driven illegally on the road prior to obtaining a provisional licence. Almost a fifth of male drivers had driven illegally prior to obtaining their provisional licence compared to less than a tenth of female drivers.

Table 6.1 – Drivers (%) who drove illegally prior to obtaining provisional licence.

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Drove illegally prior to provisional licence (%)	19	16	25	12	16	1

(Total number who drove illegally prior to obtaining a provisional driving licence was 50)

6.1.2 Attitudes to the driving test

On average, males took fewer lessons (16 lessons) to pass their driving test than females (22 lessons).

Opinions on the adequacy of the driving test varied greatly. The male drivers on average tended to rate the test as less adequate than the female drivers. However, for all groups the average rating was around 4, the mid-point mark, meaning that the test was assessed overall as "adequate".

Table 6.2 – Rating of adequacy of test

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
How adequate is test?	3.9	3.7	3.8	4.3	4.2	4.2

(Average rating score with 1 = Not at all . . . 7 = Completely)

Nevertheless, a number of ways were proposed for improving the driving test. Over half of the drivers stated that some form of motorway tuition or testing should be incorporated into the test. 37% of drivers suggested parking skills should be tested and 22% stated that the test should be longer than the current format. Around 10% of the drivers mentioned that there is no night driving in the test and a similar number suggested that a written test and basic car maintenance could be taught and tested. 5% of drivers suggested some compulsory lesson component prior to the driving test which could encompass some of these other ideas.

6.1.3 How does driving change after passing the test?

Drivers were asked whether or not they still drove in the same way as on their driving test. 91% of drivers claimed to drive differently: 22% claimed to drive better overall, 54% to drive worse overall, 13% to drive in a different way but not necessarily better or worse with the other 2% not indicating in what ways their driving had altered.

Of those 54% of drivers who claimed to drive worse, the ways that they drove worse varied. 46% thought they drove faster than they did on their test, 31% were worse at steering, 13% were worse at using mirrors, 8% were worse at gear changing and another 8% thought that they were too relaxed when driving.

6.2 Car choice

6.2.1 Importance of car type

Males placed a higher importance on the type of car they drove than females (Table 6.3).

Table 6.3 – Rating of importance of car type

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
How important is car type?	4.7	4.8	5.2	3.9	4.5	4.0

(Average rating score with 1 = Not at all . . . 7 = Extremely)

6.2.2 Importance of car qualities

When split into the different attributes of cars, males tended to place more emphasis than women on the importance of speed, acceleration and engine size when buying a car. Acceleration and speed also appeared to be correlated to age. As age increased speed and acceleration tended to become less important factors and this was particularly marked for males (Table 6.4).

Table 6.4 – Rating of importance of car qualities

Car qualities	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Speed	4.6	4.2	4.0	4.0	4.2	3.3
Acceleration	5.2	4.7	4.6	4.2	4.5	3.8
Engine size	4.4	4.0	4.4	3.8	4.3	3.8
Comfort	5.3	5.2	5.7	5.2	5.4	5.5
Price	6.0	5.6	5.3	6.1	6.1	5.7
Reliability	6.2	6.3	6.4	6.4	6.7	6.9
Safety	5.4	5.6	6.2	6.4	6.3	6.7
Utility	4.6	4.7	5.6	5.3	5.1	5.3
Appearance	5.3	4.8	4.9	4.5	5.0	4.3

(Average rating score with 1 = Not at all . . . 7 = Extremely)

For all the age and sex groups, comfort, price and reliability were the most important factors, reliability being of overriding importance for women as age increased.

The importance of safety increased with age for males but remained at a comparatively higher level for women regardless of age. Car appearance was more important overall for males than females with the 17-20 year old males giving this as high a priority as safety, a finding not replicated with any of the other age and sex groups.

6.2.3 Aspects of current car choice

As expected, price was the most important factor for all groups particularly younger drivers (Table 6.5). After price, appearance of the car was the most important priority for males whereas reliability was more important for females. The importance of safety was only indicated by the older 31-40 year old groups. This is an interesting finding because when asked of the importance of car qualities in the abstract, all groups rated safety a fairly high priority but when it came to actually choosing their own car, safety factors had a negligible part in the choice.

Table 6.5 – Most important factors in current car choice

Car qualities	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Speed	–	–	3	–	–	–
Acceleration	–	–	–	–	–	2
Engine size	--	2	3	–	–	5
Comfort	–	4	6	–	14	5
Price	76	66	39	68	54	60
Reliability	2	11	10	14	14	14
Safety	–	–	13	–	–	7
Utility	–	4	13	9	9	5
Appearance	22	13	13	9	9	2
Total	**100**	**100**	**100**	**100**	**100**	**100**

6.2.4 Aspects of ideal car choice

With ideal car choice, appearance was the most important factor for all age and sex groups (Table 6.6). Speed and acceleration were important for all groups but particularly the 17-20 year old male group. Comfort, reliability and utility were also mentioned as was safety the importance of which increased with age across sex. Again, although safety is seen as

Table 6.6 – Factors in ideal car choice

Car qualities	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Speed	7	12	12	12	15	8
Acceleration	16	5	1	4	5	5
Engine size	6	–	9	4	1	5
Comfort	9	13	13	8	16	8
Price	7	11	3	9	8	6
Reliability	12	11	12	6	9	14
Safety	4	5	12	2	4	12
Utility	8	14	14	13	9	12
Appearance	31	29	24	42	33	30
Total	**100**	**100**	**100**	**100**	**100**	**100**

an important factor *per se*, it would appear to not have as high a priority when it comes to a criterion for one's ideal car, this is particularly true for the younger age groups.

6.3 Reported effects of passengers

6.3.1 Overall effects of passengers

Drivers were asked to rate on a seven point scale whether having passengers in the car affected their driving style. The continuous rating scale went from 1 = not at all to 7 = a lot (see Table 6.7). The 17-20 year old male group were a half point higher than the next highest group (31-40 year old females) in rating that passengers did affect their driving style.

Table 6.7 – Effects of passengers on car driving

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Passenger effect	4.2	3.2	3.6	3.3	3.5	3.7

(Average rating score with 1 = Not at all... 7 = A lot)

6.3.2 Effects of different passenger types

These findings were further examined to show what effect different types of passenger had on driving behaviour. The effects were combined initially into two broad categories. Firstly, passenger effects which made the driver drive worse than if driving on their own. In this group effects where the driver stated that they either drove worse, faster, less safely, with less concentration or with more nerves than usual were included. Secondly, passenger effects which made the driver drive better than when on their own. Included in this group were effects where the driver stated that they drove better, slower, safer or concentrated more.

There were three types of passengers (friends, children and partner/spouse or boyfriend/girlfriend) that appeared to adversely affect driving behaviour to any significant degree. These effects were different across age and sex.

There were also three types of passengers (parent, children and partner/spouse or boy/girlfriend) that appeared to improve driving behaviour to any significant degree. These effects were also different across age and sex.

6.3.2.1 Effects of friends

35% of 17-20 year old males indicated that their driving was adversely affected by the presence of friends in the car. This was over 10 percentage points more than the next most affected groups namely 21-25 year old males and 21-25 year old females (Table 6.8 opposite).

Table 6.8 – Drivers (%) affected by friends as passengers

Passenger type Friends	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Adversely affected	35	16	8	16	24	11
Positively affected	13	9	2	16	11	7

The presence of friends as passengers seems adversely to affect 17-20 year old males more than any of the other groups. However, it would appear that the presence of friends can also have a beneficial effect on driving behaviour. Again this effect was most marked for the younger age groups.

6.3.2.2 Effects of children

16% of 31-40 year old females and 6% of 31-40 year old males indicated that their driving was adversely affected by the presence of children in the car. The low rate amongst the younger age-groups probably reflects the lower proportion who drive regularly with children as passengers (Section 5.2.6).

Table 6.9 – Drivers (%) affected by children as passengers

Passenger type Children	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Adversely affected	–	1	6	2	2	16
Positively affected	11	7	10	10	2	33

All groups (except the 21-25 year old female group) indicated their driving was more likely to be improved by the presence of children in the car.

The presence of children can lead to either improved or worse driving behaviour. This is probably linked to whether the driver is able to concentrate fully on the driving situation. The interviews suggested that parents deliberately slow down when they have children in the car because they feel particularly responsible for their well-being and are also aware that children can sometimes be a distraction.

6.3.2.3 Effects of partner/spouse or boy/girlfriend

23% of 31-40 year old females and 12% of 21-25 year old females indicated that their driving was adversely affected by the presence of their partner/spouse or boy/girlfriend in the car.

Table 6.10 – Drivers (%) affected by partner/spouse or boy/girlfriend as passengers

Passenger type Partner/spouse	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Adversely affected	2	4	2	9	13	23
Positively affected	27	19	15	12	18	5

27% and 19% of drivers in the 17-20 year old and 21-25 year old male groups reported that their driving was improved by the presence of their

partner/spouse or girlfriend compared to just under 11% of female drivers when accompanied by their partner/spouse or boyfriend.

It would seem that for males their driving, if affected at all, is more likely to improve when accompanied by their partner/spouse or girlfriend, but that the reverse is true for females, particularly for older females (31-40 year olds).

6.3.2.4 Effects of parents

Over half of the drivers in the 17-20 year old male and female groups indicated their driving was improved by the presence of a parent in the car. 34% and 44% of the 21-25 year old male and female groups also stated that having a parent as a passenger led to improved driving (Table 6.11). The lower percentages evidenced in the older age groups may be due to this group having fewer parents still alive.

Table 6.11 – Drivers (%) affected by parents as passengers

Passenger type Parents	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Adversely affected	–	3	2	10	11	7
Positively affected	56	34	23	51	44	20

The reasons given for the changes in driving style when accompanied by parents varied across age. The younger groups' (17-20 and 21-25 years) most common reason for improved driving with their parents present was that they wanted their parents to think that they drove safely whereas the older 31-40 year old age groups most commonly stated that they drove more carefully with their parents in the car because they were old or in poor health. Around 10% of the 17-20 and 21-25 year old female groups were adversely affected by their parents in the car. No differentiation was made between sex of parent present, although given the finding that more females are adversely affected by their partner/spouse or boyfriend in the car, it is perhaps likely that fathers have a greater adverse effect than mothers on their daughters' driving behaviour.

6.4 Reported effects of radio cassette

All age and sex groups listen to the radio cassette for a large proportion of the time that they are driving (Section 5.4).

Drivers were asked to rate on a continuous seven point scale the degree to which listening to the radio cassette affected their driving behaviour in any way. The rating scale went from 1 = not at all to 7 = a lot. The average rating by age and sex is shown (Table 6.12 opposite).

Overall, each age and sex group rated the radio cassette as having some effect on car driving behaviour but this effect was not large and did not vary greatly across age and sex.

Table 6.12 – Effect of radio cassette on car driving

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Radio cassette effect	2.9	2.7	2.7	2.9	3.4	2.4

(Average rating score with 1 = Not at all . . . 7 = A lot)

The particular types of effect that the radio cassette had on car drivers were examined. The percentages within each age and sex group that stated that the radio cassette helped or hindered their driving is shown (Table 6.13). Effects that were categorised as positive benefits to driving were keeping the driver awake, relieving boredom, calming mood in traffic jam, relaxing mood to drive slower, helping concentration and informing on traffic conditions. Effects that were categorised as hindering driving included concentrating less, turning the tape over and driving to the tempo of the music.

Table 6.13 – Drivers (%) affected by radio cassette whilst driving

	Male			Female		
Radio cassette	17-20	21-25	31-40	17-20	21-25	31-40
Positive effect	14	23	27	24	29	20
Adverse effect	49	46	29	33	49	16

(percentage)

It is not possible to add up the two percentages for each age and sex group to determine the combined effect (whether positive or negative) of the radio cassette because these figures are not necessarily exclusive. In some circumstances the radio cassette can have a positive benefit on driving and in others it can be detrimental. However, it would appear that the radio cassette has an adverse effect on more younger drivers (< 25 years) of both sexes than it does a positive benefit whilst for older drivers (31-40 years) the adverse and positive effects even out. These age differences may be related to difference in type of listening.

6.5 Perceived danger of different road types and conditions

Drivers were asked to rate on a seven point continuous scale how dangerous they found a number of different road types. The average of these ratings across age and sex is shown (Table 6.14). The rating scale was from 1= not at all dangerous to 7= extremely dangerous.

Females rated motorways and rural roads as being slightly more dangerous than males did, which may relate to their lower level of use of such roads.

Table 6.14 – Average rating of dangerous road types

	Male			Female		
Road types	17-20	21-25	31-40	17-20	21-25	31-40
Motorways	3.6	3.5	3.8	4.2	4.4	4.5
Dual carriageways	3.6	3.5	4.1	3.7	3.9	4.2
Rural roads	4.1	4.1	3.9	4.7	4.6	4.1
Urban roads	3.9	4.0	4.0	3.8	3.9	3.6

(Average rating score with 1 = Not at all . . . 7 = Extremely)

Drivers were asked to rate on an identical scale to that above how dangerous they found a number of different road situations. The average of these ratings across age and sex is shown (Table 6.15).

Table 6.15 – Average rating of dangerous road situations

Road situations	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Roundabouts	3.5	3.5	3.5	3.6	4.1	3.7
Joining motorway	4.3	4.0	4.1	4.7	4.8	4.8
Right turns	3.4	3.4	4.0	3.2	3.8	3.8
Left turns	2.0	2.1	2.5	2.2	2.4	2.1
Traffic lights	2.3	2.5	3.0	2.1	2.4	2.6

(Average rating score with 1 = Not at all . . . 7 = Extremely)

6.6 Reported accidents and convictions

The total number of accidents and the total number of accidents reported to be the driver's own fault for each age and sex group were divided by the average number of years a full licence had been held. This enabled the average number of accidents and "own fault" accidents per driver per year to be ascertained (Table 6.16).

Table 6.16 – Number of accidents and "own fault" accidents (average) per driver per year

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Number of accidents per driver per year	0.35	0.28	0.12	0.30	0.21	0.08
"Own fault" accidents per driver per year	0.22	0.18	0.06	0.18	0.14	0.03

This result indicates that 22 in every 100 17-20 year old male drivers would have had an "own fault" accident per year compared to only 3 or 6 in every 100 drivers in the 31-40 year old female and male groups. It would appear that within the sample the male, 17-20 year old age group was around four times as likely to have an accident per year as the 31-40 year old age group.

The average number of convictions per driver per year is shown (Table 6.17). A similar pattern to the "own fault" accident average per year was produced with the exception being that the 17-20 year old females had a much lower average number of convictions.

Table 6.17 – Number of convictions (average) per driver per year

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Number of convictions	0.07	0.07	0.03	0.01	0.03	0.008

6.7 Reported errors and violations

Drivers were asked to rate how frequently they performed each of fourteen different driver actions (Appendix 12.5, Q.30). Seven of these driver actions were categorised as driver errors (ie unintentional). These driver errors were:

a = attempt to drive away from stationary in wrong gear;
c = forget that your lights are on full beam;
e = misjudge a gap in a car park and nearly (or actually) hit an adjacent vehicle;
g = switch on lights instead of windscreen wipers or vice versa;
i = forget which gear you are in and have to check with your hand;
k = misjudge speed of oncoming vehicle when overtaking;
n = miss your exit on a motorway and have to make a lengthy detour.

The other seven driver actions were categorised as driver violations (ie intentional). These driver violations were:

b = deliberately park on a double yellow line;
d = become impatient with a slow driver in the outer lane and overtake on the inside;
f = deliberately disregard speed limits late at night or early in the morning;
h = take a chance and cross on traffic lights that have just turned red;
j = "race" oncoming vehicles for a one-car gap on a narrow or obstructed road;
l = drive when you realise you may be over the blood alcohol limit;
m = get involved in unofficial "races" with other drivers.

The ratings went from 1 = Never to 7 = All the time. The averages of these ratings across age and sex for the seven error and seven violation actions (combined) are shown (Table 6.18).

Table 6.18 – Average error and violation scores

	Male			Female		
	17-20	21-25	31-40	17-20	21-25	31-40
Error scores	2.0	1.8	1.9	2.2	2.3	2.0
Violation scores	2.5	2.6	2.1	2.1	2.6	1.9

(Average rating score with 1 = Never . . . 7 = All the time)

Within sex groups, all the male groups admitted committing more violations than errors whereas two of the female groups (17-20 and 31-40 year olds) admitted more errors than violations. Both errors and violations were lowest for the 31-40 year olds of both sexes suggesting that they tended to decrease slightly with age. Between sex groups, male drivers admitted fewer errors but more violations than female drivers.

7 How do driver performance, attitude and behaviour relate?

7.1 Introduction

The principal aim of the study is to try and determine which of the many variables of driver behaviour and performance can be related to the accident involvement of the drivers and help to explain the different levels between the age/sex groups and different levels of experience. A multivariate modelling approach has been used to explore such differences.

The analyses presented in the previous sections have provided valuable insight to the differences in the behaviour, attitudes and driving performance of the six groups of drivers. However, some of the many variables investigated are likely to be highly inter-related and so it is useful to explore the correlations between the main variables, prior to multivariate analysis. The interaction of age is discussed in section 7.4.

7.2 Correlations between the variables

The degree of closeness to which two variables are related in a simple linear manner is measured by means of the correlation coefficient between the two variables. The many variables of driver performance, attitude and behaviour fall into groups of similar variables and by obtaining the correlation coefficient of pairs of variables within such types it was helpful to know how similar the variables were, since pairs of highly correlated variables cannot easily be used in multivariate analysis. Similarly correlations between some of the more important variables of different types were made, and of particular interest was the level of correlation with the following measures since these were the dependent variables for the multivariate analysis.

(i) annual accident frequency ie the number of accidents in the driver's history, divided by the number of years of driving (see section 6.6).
(ii) annual "at fault" accident frequency ie the number of accidents in the driver's history which were the fault of the driver, divided by the number of years of driving (see section 6.6).
(iii) total number of errors observed.
(iv) total number of dangerous errors observed.

7.2.1 Observed error scores

In general, the observed error scores for each type of error were correlated significantly between each other. In particular, the score for braking errors was correlated significantly with all the other error types except slow speed (13) errors (of which there were very few). The total of all errors was also very highly correlated with each of the types of error, except slow speeds, and so provided a good overall error assessment score. Apart from these, the highest correlations were between indicator errors and road position errors and also between road position errors and overtaking errors.

Dangerous errors were generally less correlated between the types of dangerous error, largely reflecting the much lower level of scores for

dangerous errors. However notable high correlations were found between: dangerous braking errors (1) and dangerous overtaking errors (10); dangerous indicator errors (5) and dangerous position errors (6); and dangerous following traffic errors (7) and dangerous errors with regard to consideration for other road users (12). Correlations with the total dangerous error score were generally low except with dangerous following traffic errors (7), dangerous consideration errors (12) and dangerous speeding errors (14). The latter correlation had a value of 0.99 reflecting the domination of dangerous speeding errors within the total of dangerous errors.

Examination of the correlation with the annual accident frequency and "at fault" accident frequency showed that only erratic manoeuvre errors (11) and dangerous overtaking errors (10) were correlated at a significant (5%) level. In particular, total errors and total dangerous errors fell far short of a significant correlation with the self-reported accident frequencies.

Factors representing the presence of each type of "continuous error" which was observed to occur continually throughout the drive were hardly correlated at all with each other. The only significant correlation with the accident frequencies was between "following too closely" and the "at fault" accident frequency. Total driving errors correlated significantly with continuous errors of braking, steering, gears, mirrors and speeding.

7.2.2 Assessment scores

The six overall driving assessment scores made by the observers concerning ability, safety, anticipation, concentration, observation, and car control were highly correlated between each other, so use of a total or average score would be well justified. A similar position was found with the driver's own assessment scores. Correlations between the observers' assessments and the drivers' assessments were mostly only marginally significant, which confirmed that the drivers' perceptions of their abilities were inconsistently different from those of the observers.

More importantly however, the observers' assessment scores were all significantly and negatively correlated with the accident frequency variables indicating lower accident frequencies to be associated with higher assessment scores. However, only one of the drivers' assessment scores (for anticipation) reached a significant level, the correlation again being negative. A similar pattern was shown in the correlation with total error and total dangerous error scores.

7.2.3 Car use by journey purpose

Information concerning the use of the car by journey purpose (categorised as work, shopping, leisure or other) was available from the questionnaire and also from the driving diary. The questionnaire data provided estimates of the percentage of driving time by purpose while the diary data provided estimates by purpose of the percentage of journeys, percentage of mileage and percentage of time.

Within the diary data the percentage of mileage and percentage of time estimates were very highly correlated (eg 0.96) with each other for the

corresponding journey purpose. Both of these measures were also highly correlated (0.75 – 0.83) with the percentage of journeys by purpose from the diaries.

Correlations of the percentage of times from the diary and from the questionnaire were not as high (0.38 – 0.55) but still very significant statistically.

However, correlations of these percentages with the two accident frequency variables showed that the only variable to have a statistically significant correlation was the percentage of car time for shopping purposes from the questionnaire data. This had a negative value indicating lower levels of accident frequency to be associated with higher levels of car use for shopping purposes. The shopping variables were also the only ones to reach a significant correlation with the total error score though for these the correlations were positive. None of the journey purpose variables correlated significantly with the total dangerous error score.

7.2.4 Passenger types and numbers of passengers

In the same way as for journey purpose data on the percentages of driving time spent with different types of passengers (alone, partner only, children only, partner and children, friends and others) were available from both the questionnaires and the driving diaries and the same patterns of correlations were found between the sets of percentage estimates.

For accident frequency, the only correlation marginally to reach significance (at 5% level) was that with the percentage of time spent with friends which had a positive value indicating higher levels of accident frequency to be associated with higher percentages of driving time accompanied by friends. This variable was based on the questionnaire data and while the corresponding variables from the diary data also had positive correlations with accident frequency they were not statistically significant. The same result was found for correlations with the "at fault" accident frequency.

The total error score also provided significant correlations with the percentage of journeys, mileage and time spent driving with friends based on the diary data. The total dangerous error score showed no significant correlations with these passenger type variables.

The percentages of journeys, mileage and driving time by number of passengers were obtained from the driving diaries. With accident frequency the only correlations which reached even marginal significance were for two or more passengers. No significant correlations were found for "at fault" accident frequency total errors or total dangerous errors.

7.2.5 Experience and driver characteristics

The number of years of driving experience since passing the driving test was obtained from the questionnaire data. An estimate of the total mileage driven since passing the test was also made using the reported mileages over the last five years. These two measures were highly

correlated (0.64). The correlation of total mileage with accident frequency (at −0.12) just reached the 5% level of significance, while total years was more highly correlated (−0.23). Both had negative values indicating that lower accident frequencies were associated with greater total mileage or total driving years. Similar correlations were found with total errors and total dangerous errors.

The age group of the driver (group 1: 17-20 years, group 2: 21-25 years, group 3: 31-40 years) also showed significant correlations with the accident frequencies, with lower frequencies associated with group 2 but especially group 3. Similar, but lower correlations were found for the error scores.

Driver sex did not give a significant correlation with accident frequencies or error scores.

The number of journeys per week, mileage per week and driving time per week were obtained from the driving diaries, but none of these variables correlated significantly with the accident frequencies or total error scores.

7.2.6 Importance of car choice

Drivers' ratings of the importance of certain qualities when buying a car seem to fall into fairly distinct groups. The overall importance of the type of car, its speed, acceleration and engine size are all quite highly correlated (0.35 to 0.76). Comfort is moderately correlated (0.23 to 0.34) with all qualities apart from price, which has only moderate correlation (0.22) with utility. Safety and reliability are quite highly correlated (0.35 to 0.50).

Correlations of the importance ratings with the accident frequencies show positive correlations with speed and acceleration and negative correlations with reliability and safety, each of which was just significant at 5% level. This implies higher accident frequency for those drivers who give higher importance to speed and acceleration and lower accident frequencies for those who rate safety and reliability as important.

For total errors and total dangerous errors, significant correlations were found only for the rating of safety, the value again being negative.

7.2.7 Perceptions of dangerous road situations

With the exception of the ratings of motorways and urban roads, all of the road types and road situation ratings were quite highly correlated. However, none of the ratings reached a significant level of correlation with the measures of accident frequency.

For total errors, the correlations of perceived level of danger on urban roads, with right turns and at traffic lights just reached the 5% significance level and were all negative, implying lower error scores for drivers who considered these situations were more dangerous.

7.2.8 Driver action ratings

The frequency ratings for each of the reported driving actions were

generally fairly well correlated. It is quite evident, however, that the seven actions which may be regarded as violations have much higher correlations with each other than with the actions which are just errors of driving. (Section 6.7 for definitions.) Similarly correlations between just the driving error actions were also high.

Nearly all of the action ratings correlated with accident frequency close to or above the 5% significance level. The exceptions were actions (a) (driving away in wrong gear), (g) (use wrong switches), (j) (race for a gap) and (l) (drive after drinking), which were far from significance. The highest correlations were for action (m) (racing with other drivers) and action (h) (crossing red traffic signal) both of which were positively correlated.

Correlations with total error scores showed a similar pattern but correlations with total dangerous errors were much lower.

7.2.9 Use of radio cassette

The percentage of journeys, miles or time while driving with the radio cassette on showed no correlation at all with accident frequency, but were all significantly and positively correlated with total errors and total dangerous errors.

7.3 Correlation of observed error scores with accidents along the route

The number of accidents occurring on each section of the route in the three and a half year period (1987 to mid-1990) was correlated with the total number of observed errors and total number of dangerous errors in each section. The correlation between accidents and total errors was 0.21 which exceeds the 5% level of significance (0.18), whereas that between accidents and total dangerous errors was 0.41, significant at a level greater than 1% (0.24). Such significant correlations therefore support the assertion that the observed assessments of driving performance do reflect the level of safety in varying conditions and provide an indicator of accident potential.

7.4 Multivariate analysis

7.4.1 Introduction

The previous section has provided some useful guidance as to how many of the variables relate to each other as isolated pairs. The objective of the analysis described in this section is to explore simultaneously the relative effects of all potentially useful variables, which may explain the different levels of self-reported accident frequency and observed errors among drivers.

The generalized linear modelling technique which is a form of multiple regression analysis, was used to derive the most suitable relationships between the accident frequencies or error totals and functions of the explanatory variables of driver performance, attitude and behaviour. Full details of the method are given in Appendix 12.6.

7.4.2 The form of the relationship

The relationship fitted for the accident frequency was of a multivariate form as follows:

$$A = k M^m \exp (\sum c_i V_i)$$

where:
A is the average number of accidents per year for a driver
M is the estimated average mileage (in thousands) per year for a driver. It was calculated as:

$$\frac{\text{(estimated total mileage since passing test)}}{\text{(number of years since passing test)}}$$

V_i are the various explanatory variables of driver experience, age group, sex, performance, attitude and behaviour
k, m, c_i, are parameters estimated by the regression procedure.

The variable M is included as the measure of exposure to accidents and is expressed as an annual average mileage in order to balance with the annual average accident frequency. The form of the model also ensures that zero accidents are predicted for zero mileage.

7.4.3 Fitting procedure

The model was fitted in a step-by-step procedure, starting with the "null" model which simply fits the mean accident frequency. As further variables were included, the number of drivers on which the model was based tended to reduce since there were missing values for different variables for some of the drivers and the model could be based only on those drivers for which data was available for all variables. The first variable to be included was the exposure variable, M, so that the effect of different levels of mileage per year could be taken into account. The age group factor (AGE), and sex factors (SEX) were then added. AGE was highly significant, while SEX did not reach the 5% level of significance; however SEX was retained in the model as it was of particular interest and importance. Interaction terms between AGE and M and SEX and M were tested to see whether the effect of exposure was different for the age/sex groups, but neither interaction was significant. The AGE.SEX interaction was not significant either, showing that the difference between the age groups was not significantly different for males and females.

Two measures of experience were then used. These were the number of years of driving, YRS, and the driver's estimated total mileage (in thousands) since passing the test, MLS. Various functions of each variable, V, of the form aV, V^2, and a/(V+b) (where a and b are constants) were tried, but when added to the model by themselves none of these was significant. However, when the interaction term with AGE was also included with the experience variable, a highly significant improvement of the model was obtained. This showed that the effect of experience was significantly different for the three age groups. Years of experience (YRS) was also a much better explanatory variable than total mileage (MLS) in explaining difference between the age groups, and the simplest form of the variable (ie. untransformed) was as good as any other. The interaction of experience with sex was also tested. In this case

the SEX.YRS interaction was not significant, but the SEX.MLS interaction was, indicating a difference in the effect of total mileage driven for males and females.

Further explanatory variables of the drivers' performance, attitude and behaviour were then tried together with interaction terms with AGE and SEX as appropriate. A full list of all the explanatory variables is given in Appendix 12.8. The most significant of these (at a level better than 0.1%) was the average frequency rating for driver violations (ACTV).

The observer's rating of the driver's safety (OASS2) was the next variable to be included (significant at the 0.1% level) while the last variable to be included was the observed total of "following too closely" errors (ERR7) (significant at the 5% level). Interactions with these variables were not significant and no further explanatory variables could be found which improved the model significantly. The resulting model provided a good fit to the data in that 77% of the potentially explainable variation was explained by the model.

7.4.4 The resulting model for accident frequency

The model of accident frequency, A, is as follows:–

$$A = 0.222\, M^{0.47}\, a\, b\, \exp(c\, YRS + d\, MLS + 0.294\, ACTV - 0.142\, OASS2 + 0.014\, ERR7)$$

where:
M = average mileage (in thousands) per year

a = 1.000 for age group 1 ie 17-20 years
= 0.178 for age group 2 ie 21-25 years
= 0.159 for age group 3 ie 31-40 years

b = 1.000 for males
= 1.327 for females

c = –0.337 for age group 1
= 0.121 for age group 2
= 0.030 for age group 3

YRS = the number of years (and part years) since passing the driving test

d = –0.00123 for males
= –0.00803 for females

MLS = the total mileage (in thousands) since passing the driving test

ACTV = average frequency rating (on scale 1 to 7) for driver violations

OASS2 = observer's assessment rating (on scale 1 to 7) for driver safety

ERR7 = the number of "following too closely" errors

The estimates of the parameter coefficients in the form obtained in the fitting process are given in Appendix 12.7, together with their standard errors and other statistics relevant to the fitting procedure.

7.4.5 Model predictions of accident frequency

The predicted effect on accident frequency of each of the variables in the model is described below. Since the model is multivariate, one way to examine the predicted effects of a variable is to set all the other variables at suitable constant values and determine the resulting effects on accident frequency of change in the variable of interest. This is the procedure used in this section. To start with, the following variables are set at values close to the mean values as follows: ACTV = 2, OASS2 = 4, ERR7 = 3, so that the model becomes:–

$A = 0.236\ M^{0.47}\ a\ b\ \exp(c\ YRS + d\ MLS)$

and the effect of exposure, age and experience can be examined.

7.4.5.1 Effect of exposure (miles per year)

The model shows that accident frequency increases with the exposure (miles per year), M, at a rate close to a square root relationship (the exponent of M being 0.47). However MLS = M.YRS, so the effect is partly reduced by the presence of MLS in the model.

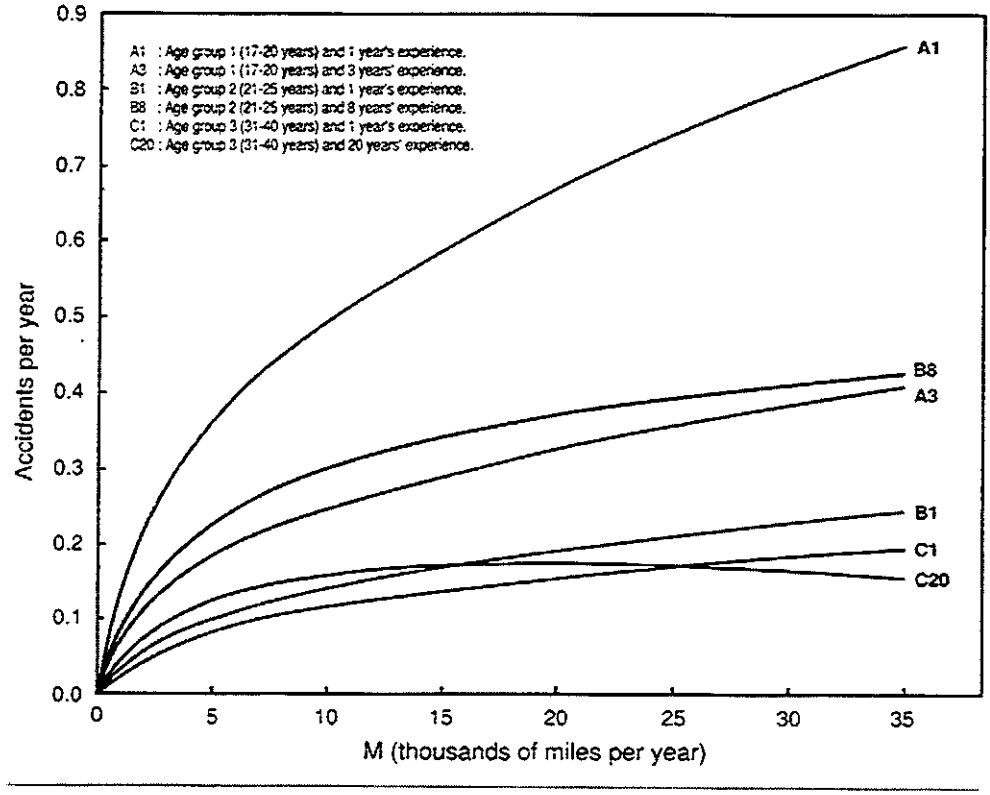
The value of accident frequency is also dependent on the age group, sex and experience, so for illustrative purposes only males are considered (so b = 1 and d = −0.00123), so that selected combinations of age group and years of experience can be examined. Figure 7.1 (opposite) shows the predicted effect of exposure on accident frequency for the following combinations:

A1: Age group 1 (17-20 years) and one year's experience.
A3: Age group 1 (17-20 years) and three years' experience.
B1: Age group 2 (21-25 years) and one year's experience.
B8: Age group 2 (21-25 years) and eight years' experience.
C1: Age group 3 (31-40 years) and one year's experience.
C20: Age group 3 (31-40 years) and 20 years' experience.

For all of the groups, accident frequency increases with increased exposure, but the rate of increase is much higher for the youngest age group with only one year's experience. The rate of increase for the group is some three and a half times that of the 21-25 year olds and four times that of the 31-40 year olds both with the same one year's experience. With three years experience the accident frequency for the 17-20 year olds is lower by over 50% compared with the same age group with one year's experience. However, for the older age groups of 21-25 year olds increased experience gives rise to higher accident frequencies, the increase being about 60% between those with one year's experience and those with 8 years' experience.

It may be that some drivers of this age have become over-confident but even so the level of accident frequency for these drivers is fairly close to that for the 17-20 year olds with three years experience. For the oldest group (31-40 years) greater experience gives rise to slightly higher accident frequencies for all except those who drive very high mileages (over 25,000 per year).

Figure 7.1 – The predicted effect of exposure on accident frequency



7.4.5.2 Age group, sex and experience

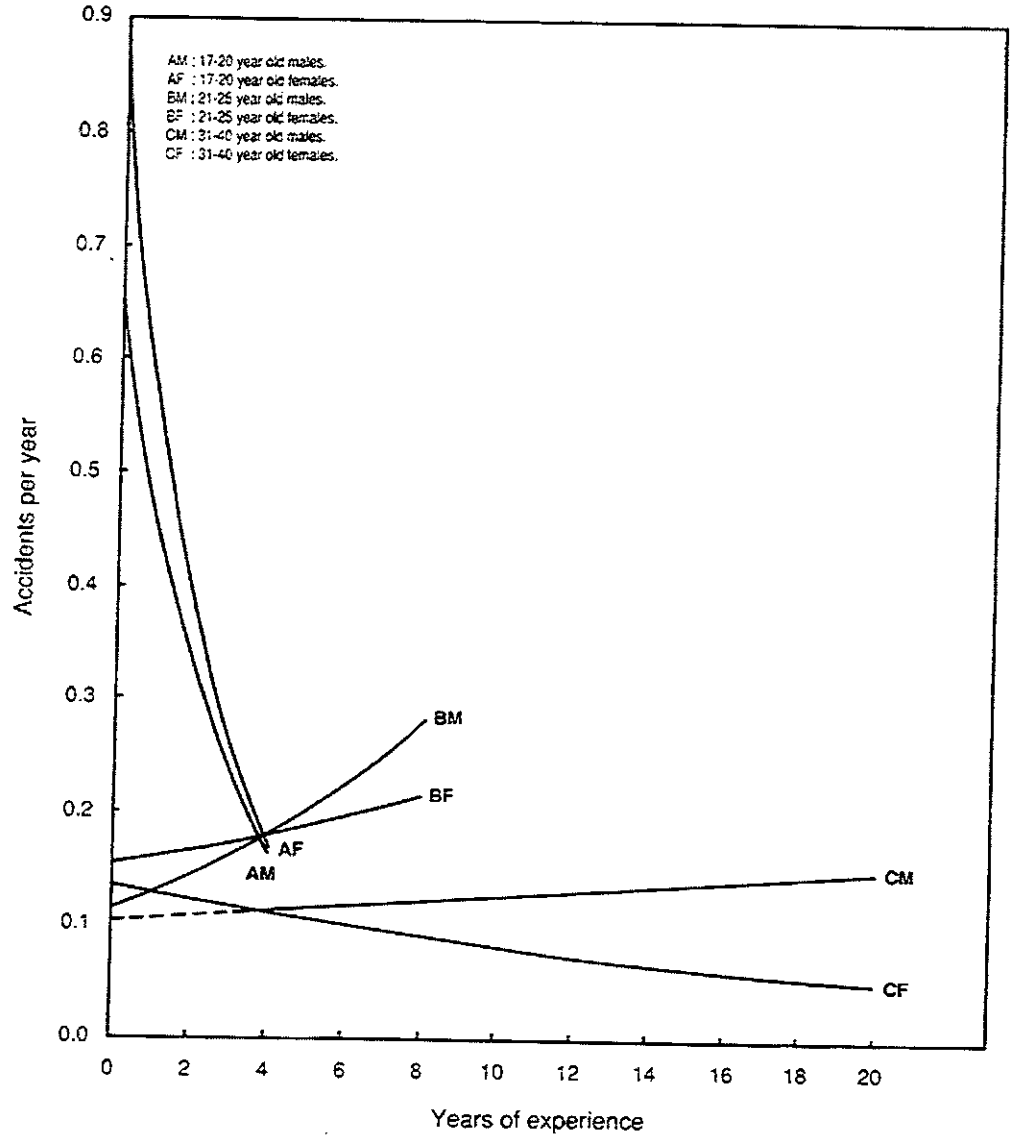
Figure 7.2 illustrates the predicted relationship between accident frequency and years of experience for each of the age and sex groups. In this illustration, an average exposure of 10,000 miles per year is used, this value being close to the overall mean value. It is recognised that male mean mileage values were slightly higher than this figure and female mean mileage rates were slightly lower, but use of one value is essential to provide directly comparable relationships.

The figure shows the very high accident frequency for the 17-20 year olds with little experience but also that the accident frequency falls rapidly with increasing experience for this group. The youngest female drivers have slightly higher initial accident frequencies than the youngest male drivers but are at the same level after four years of experience.

The 21-25 years olds have a relatively low initial accident frequency at low experience but this rises moderately as experience increases. Females in this age group have a slightly higher accident frequency at low experience but the rate of increase is not as great as that for males.

The 31-40 year olds have the lowest accident frequencies. For males, the accident frequency rises very slightly with increasing experience while for females in this age group there is a slight decrease.

Figure 7.2 – The predicted effect of experience on accident frequency



7.4.5.3. Effect of other variables

The average frequency rating for driver violations (ACTV) was a highly significant variable and indicated that accident frequency increased for those drivers with higher average reported ratings, the increase being greater than three times over the range from rating 1 to 5 (the minimum and maximum values within the data). This average rating over the seven driver violations was used in preference to choosing just one of the driver violation frequency ratings, since most of these measures were highly correlated with each other. Though ACTV is based on self-reported ratings, its strong effect is notable and indicates that those who perceive themselves as making more violations of traffic law are more liable to be involved in an accident.

Drivers with higher assessment scores for "safety" have lower accident frequencies as shown by the variable OASS2. Over the range from 1 to 7 the reduction in accident frequency is over 50%. Thus observed safer driving is associated with lower reported accident frequency.

Those drivers who were observed to have higher numbers of "following too closely" errors were associated with higher accident frequencies. Over the full range within the data of 1 to 58 errors of this type, the accident frequency is doubled. Thus potentially dangerous driving behaviour is associated with increased accident risk.

7.4.6 Fitting the model for "at fault" accident frequency

The form of the model for "at fault" accident frequency was the same as that used for accident frequency given in 7.4.2.

The fitting procedure also followed a similar pattern to that described in 7.4.3. Average mileage per year, M, was fitted first and was highly significant. AGE was significant but SEX and the AGE.SEX interaction were not significant. The two measures of experience, YRS and MLS, were then tried but by themselves neither was significant. However when the interaction term with AGE was also added a very significant improvement in fit of the model was achieved. The number of years of driving, YRS, also provided a better fitting model than total mileage, MLS, so YRS and YRS.AGE were added into the model. Unlike the previous model for total accident frequency, the MLS.SEX interaction was not significant for the "at fault" accident frequency model, so SEX was dropped from the model.

The average frequency for driver violations (ACTV) again proved to be the most significant of all the variables of driver performance, attitude and behaviour. The average of the observers' ratings of the drivers' performance (OASSA) was the next most significant variable. Five further variables were then found to be significant when added in turn to the model. These were as follows:–

STU,	a factor indicating whether the driver was a student or not (ie SEG 7)
CONF5,	a factor indicating whether the driver continually made indicator errors
CONF13,	a factor indicating whether the driver continually drove too fast
CARU1,	proportion of car use for work purposes
SHAR5,	proportion of driving time with friends as passengers

The best combination of these variables was to add both CONF13 and SHAR5 into the model. The resulting model was very well fitting and accounted for some 92% of the explainable variation and so was better than the model for total accidents.

7.4.7 The resulting model for "at fault" accident frequency

The model for "at fault" accident frequency, F, is given by:

$$F = 0.266\, M^{0.40}\, a\, e\, \exp(c\,YRS + 0.324\,ACTV - 0.241\,OASSA + 0.862\,SHAR5)$$

where M, YRS and ACTV are as defined before (Section 7.4.4) and

a = 1.000 for age group 1 (17-20 years)
= 0.073 for age group 2 (21-25 years)
= 0.056 for age group 3 (31-40 years)

c = −0.633 for age group 1
= 0.184 for age group 2
= 0.028 for age group 3

OASSA = the average of the observers' six assessment ratings (on scale 1 to 7) of general performance, safety, anticipation, concentration, observation and car control.

SHAR5 = the proportion of driving time with friends as passengers

e = 1.441 for drivers who were observed continually to be driving too fast (factor CONF13)
= 1.0 otherwise

Further details of the model and related statistics are given in Appendix 12.7.

7.4.8 Model predictions of "at fault" accident frequency

The above model is somewhat simpler in structure to that for the total accident frequency, but gives largely similar predicted effects. As before, to examine the effects of exposure (M), experience (YRS) and age group it is convenient to set the other variables in the model to suitable values close to the mean values as follows:–

ACTV = 2, OASSA = 4, SHAR5 = 0.16 and also set e = 1.0.

The model then becomes $F = 0.223\ M^{0.40}$ a exp (c YRS)

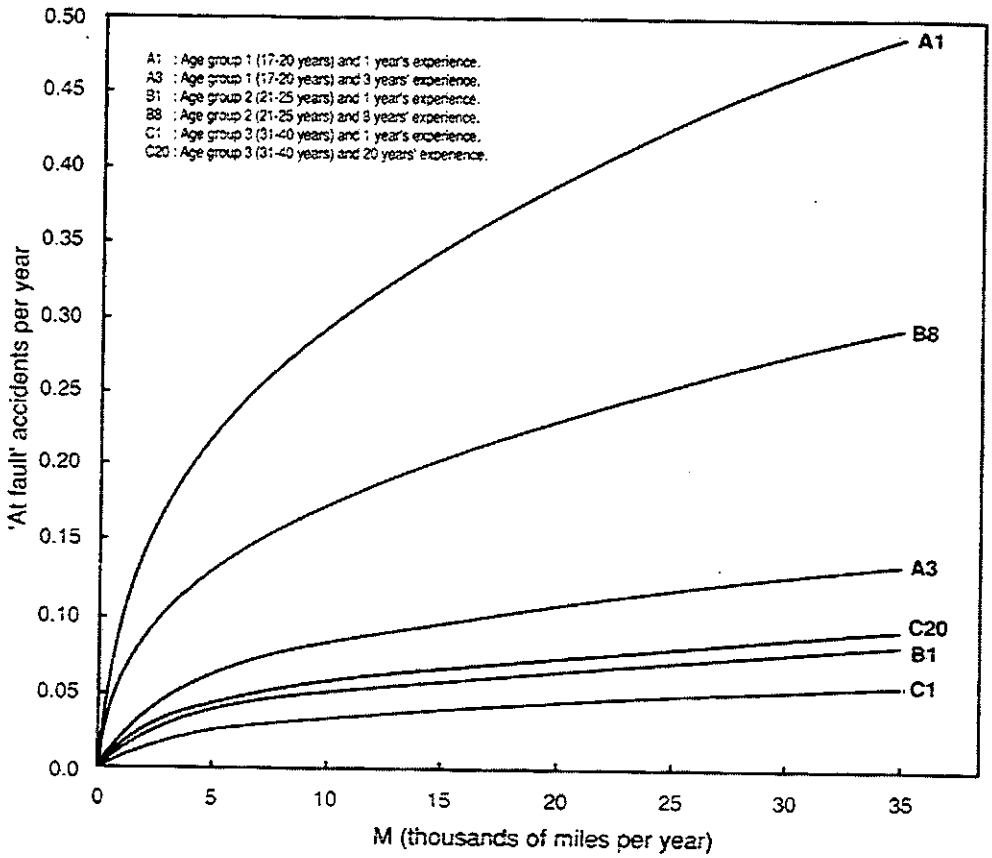
7.4.8.1 Effect of exposure (miles per year)

"At fault" accident frequency increases with exposure, M, at a rate slightly below a square root relationship, the exponent of M being 0.40. The accident frequency is also dependent on age group and years of experience, so the selected combinations of age group and experience given in section 7.4.6 are used again. Figure 7.3 (opposite) shows the predicted effect of exposure on "at fault" accident frequency for these combinations.

The figure shows the "at fault" accident frequency increasing with exposure and the youngest age group (17-20 years) with only one year's experience, to have clearly the greatest rate of increase. The rate of increase for this group is over five times that of the 21-25 year olds and over nine times that of the 31-40 year olds, both with the same one year's experience. With three years' experience, the "at fault" accident frequency for the 17-20 year olds is over 70% lower compared with the same age group with only one year's experience.

For the 21-25 year age group, increased experience gives rise to much greater levels of "at fault" accidents with the frequency for those with eight years' experience being some three and a half times that for those with just one year's experience. For the oldest group (31-40 years) accident frequencies are comparatively low, and increased experience is associated with only slightly higher rates of increase.

Figure 7.3 – The predicted effect of exposure on "at fault" accident frequency

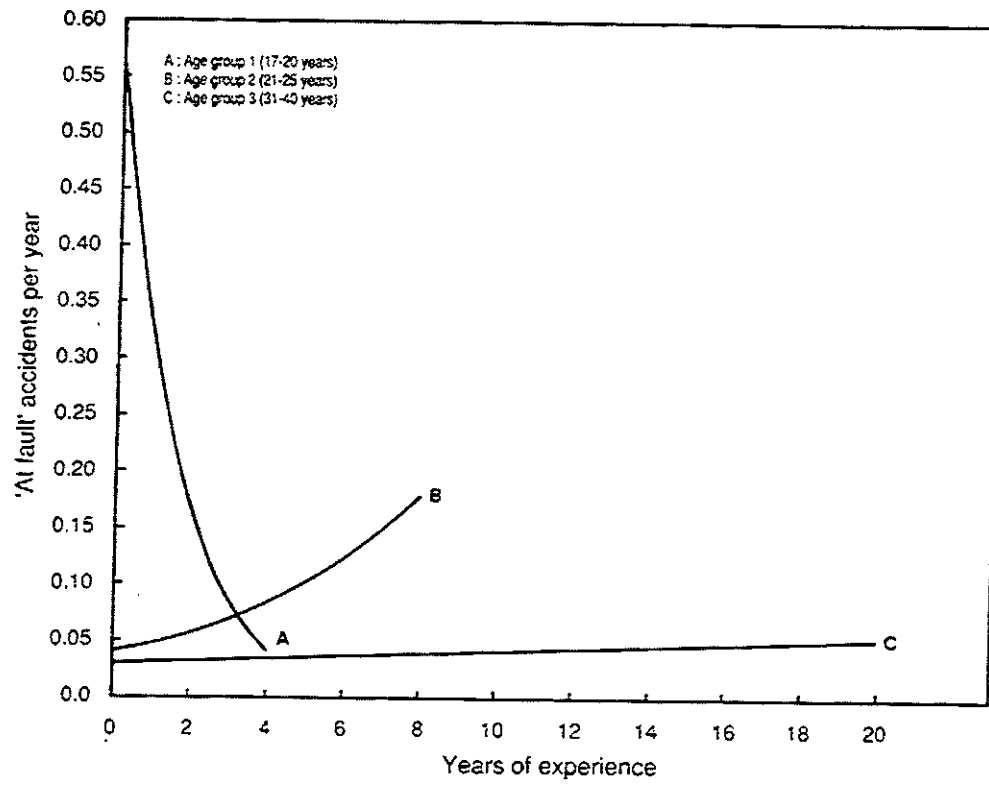


7.4.8.2 Effect of experience

For illustrative purposes only, an average exposure of 10,000 miles per year is again assumed, to provide directly comparable relationships of "at fault" accident frequency with years of experience for the three age groups. This is shown in Figure 7.4 (over page).

The relationships shown in Figure 7.4 for "at fault" accident frequency are quite similar to those of Figure 7.2 for total accident frequency. For the 17-20 year olds with little experience, "at fault" accident frequency is high but falls rapidly as experience is gained. The 21-25 year olds have a low initial accident frequency but this rises at a modest rate with experience. For the oldest group of drivers (31-40 years), "at fault" accident frequency is at a comparatively low level and the very slight rise with increasing experience is not statistically significant.

Figure 7.4 – The predicted effect of experience on "at fault" accident frequency



7.4.8.3 Effect of other variables

The variable ACTV (the average frequency rating for driver violations) showed higher "at fault" accident frequencies for those drivers with higher average reported ratings. The size of the effect is much the same as for total accident frequency, the increases in the effect being more than 3 times over the range from rating 1 to 5 within the data. As before this variable was an effective summary measure of the various driver violation frequency ratings.

The average of the observer's six assessment ratings (OASSA) also provided as good a variable as any of the individual ratings. Over the range from 1 to 6.6 within the data, the reduction in "at fault" accident frequency is over 60%. Thus drivers who were observed overall to drive better also reported lower "at fault" accident frequencies.

Drivers who are frequently accompanied by friends as passengers are associated with a higher "at fault" accident frequency. The range of the variable SHAR5 (the proportion of driving time accompanied by friends) is from 0.0 to 0.9. Over this range, the "at fault" accident frequency is predicted to more than double. The youngest age group (17-20 years) spent much more of their driving time accompanied by friends (see section 5.3) so are most affected by this influence.

The final variable in the model is the factor CONF13, which indicates that for those drivers who were observed continually to be driving too fast, the "at fault" accident frequency is higher by some 40%.

7.4.9 Driver error models

As noted in section 7.2, it was also of interest to try to build models of the total number of driving errors (refer to Appendix 12.2.1 for definition of "errors") observed and of the total number of dangerous errors observed, since these could be regarded as measures of potential accident risk.

7.4.10 Form of the driving error models

Both additive and multiplicative forms of model were tried but showed little difference in level of fit. In common with the accident frequency models, therefore, a multiplicative form was chosen. (This also ensures that negative predicted values could not be produced, as would be possible with an additive model.) Since there was no exposure variable, the model was simply:

$$E = k \exp (\sum c_i V_i)$$

where:

E is the total number of errors (or dangerous errors).

V_i are the various explanatory variables of driver experience, age group, sex, attitude and behaviour.

k, c_i are parameters estimated by the regression procedure.

7.4.11 Model of total driving errors

Initially, the AGE and SEX factors were tried. AGE was significant indicating lower total errors for increasing age group, but SEX was not significant. However, when the measures of driving experience were added into the model the effect of age group was no longer significant and was dropped. Various functions of the driving years, YRS, and total driving mileage were tried, but the simplest form was as good as any other. MLS was also a more useful variable than YRS. MLS was also the best single variable to relate to total errors. The next was ACTV, and the third was YRS.

ACTV, the average rating for driver violations, also contributed significantly with MLS, so was added into the model. NJP2, the proportion of journeys for shopping was the next best variable. The age group factor was tried again and was just significant, but showed only age group 2 to be significantly different from the other age groups.

No further variables or interactions could be found to significantly improve the model of total errors even though the resulting model was rather poorly fitting, accounting for only 13% of the explainable variation. The model of total errors, E, was as follows:–

$$E = 58.1\ a \exp (-0.00148\ MLS + 0.194\ ACTV + 0.527\ NJP2)$$

where:

MLS and ACTV are as before (section 7.4.4) and

a = 1.000 for age group 1 (17-20 years)
= 0.820 for age group 2 (21-25 years)
= 0.946 for age group 3 (31-40 years)

NJP2 = proportion of journeys for shopping purposes.

Further details of the model are given in Appendix 12.7

7.4.12 The predicted effects of total driving errors

Greater driving experience, in terms of total mileage (MLS), is associated with lower error totals. Over the range from 1 to 600 thousand miles within the data total errors is lower by over 50%.

As with the accident frequency models, higher levels of ACTV (the average rating for driver violations) is associated with higher total errors. Over the range from 1 to 5 the predicted error total is doubled, so those who report that they frequently make driving violations were observed to make higher numbers of driving errors.

Across all the drivers, the reported proportion of time spent on shopping trips ranges from 0.0 to 1.0. Over the range the predicted total error score increases by over 70%.

The age factor was also just significant in the model. It indicated that, in conjunction with the effects described above, the 21-25 year olds were associated with total error scores about 18% lower than the 17-20 year olds, where the total errors for the 31-40 year olds were only 5% lower. However, the effects of experience would particularly modify the overall predicted effect for the oldest age group.

7.4.13 Model of total dangerous driving errors

The best single variables in the model of total dangerous errors were years of driving experience, YRS, and age group, AGE. YRS was slightly stronger than AGE, and when both together in the model AGE no longer reached significance.

The next variables to enter the model were NRAD (the proportion of journeys with the radio on), IMP8 (the importance of safety in car choice) and IMP10 (the importance of appearance in car choice). Finally, TJP2 (the proportion of driving time for shopping purposes) and MPW (mileage per week) were added to the model.

The resulting model gave a better fit to the data than that for total errors, and accounted for 21% of the explainable variation. However, neither of the error models were as well fitting as the models for accident frequency or "at fault" accident frequency.

The resulting model for total dangerous errors, D, was:

$$D = 7.90 \exp(-0.062\,YRS + 0.955\,NRAD - 0.219\,IMP8 + 0.151\,IMP10 + 1.304\,TJP2 + 0.840\,MPW)$$

where:

YRS = number of years of driving
NRAD = proportion of journeys with the radio on
IMP8 = driver's rating of importance of safety in car choice (on scale 1 to 7)
IMP10 = driver's rating of importance of appearance in car choice (on scale 1 to 7)
TJP2 = proportion of driving time for shopping purposes
MPW = mileage (in thousands) per week (from driver diary)

7.4.14 The predicted effect of total dangerous driving errors

Increased years of driving experience (YRS) was associated with lower total dangerous errors. Over the range from 0 to 20 years, the total dangerous error score is reduced by some 70%.

Higher proportions of journeys made with the radio cassette on (NRAD) are associated with higher dangerous error scores. For those who make all journeys with the radio on, the associated effect is to more than double the total dangerous error score.

Drivers who rate safety as important in car choice (IMP8) are associated with lower total dangerous error scores. Over the range from two to seven within the data predicted, total dangerous errors are lower by over 60%.

Conversely, drivers who rate appearance as important in car choice (IMP10) are associated with higher dangerous error scores. Over the range from one to seven within the data, total dangerous errors are more than doubled.

The final variable is mileage per week, based on the driver diary data, and indicates higher mileages to be associated with greater dangerous error scores. The increase is one and a half times for the full range of data from 30 to 1,430 miles per week.

8 What are the main findings?

The study identified those aspects of behaviour and performance which might account for the different accident involvement rates across age and experience. This was undertaken by directly observing car driver performance on a 40 km route, interviewing drivers and obtaining questionnaire data on driver attitudes and collecting diary/logsheet information on driving patterns. The study involved 439 drivers of both sexes in three different age groups (17-20 years, 21-25 years and 31-40 years). Two measures of driving experience were used: career mileage and number of years since obtaining a full licence. Levels of driving experience overlapped across age groups in order to facilitate the investigation of the effect of driving experience **between** as well as **within** age group. As expected, due to the age criteria set for the selection of the sample, a higher proportion of students (people in full-time education) were present in the sample compared to national socio-economic group (SEG) figures. Nevertheless, an excellent spread from all the anticipated SEG categories, but particularly the non-manual/ manual distinction, was obtained.

8.1 Driver performance on the route surveys

(i) The average number of driver errors committed by males fell as age increased (17-20 year olds = 95 errors, 31-40 year olds = 57 errors). The number of female driver errors remained fairly high across age (female = >80 errors). Steering, speeding, mirror and positioning errors were the most frequently committed errors in the order given (Section 4.2).

(ii) The number of dangerous errors committed fell as age increased for both sexes. Speeding errors comprised 90% of all dangerous errors for all age and sex groups. On average, the 17-25 year old male groups made slightly more dangerous errors than the corresponding female groups whilst the 31-40 year old male group made slightly fewer errors on average than the 31-40 year old female group (Section 4.3).

(iii) The locations with the highest number of errors per driver per km (shown in parentheses) were the 30 mile/h sections in both shopping (1.53) and residential areas (2.28), right turns both at roundabouts (1.58) and traffic lights (1.08). The same pattern was repeated with dangerous error location with pedestrian crossings also recording a high number of dangerous errors (Section 4.4).

(iv) All of the age and sex groups rated themselves to be better at driving ability and safer at driving than they were assessed by the observers. However, the 17-20 year old male group was the least accurate in their assessments in that they rated themselves as highly as other age and sex groups but were assessed considerably lower (Section 4.5).

(v) The distribution of error scores and observed ratings showed quite wide variation within age and sex groups. Examining the observer ratings made at the end of the route surveys, it is evident that 34% of 17-20 year old males were rated "bad" on safety (scored two or less on the seven point scale) with only 7% of the 17-20 year old males rated "good" on safety (6 or above). By comparison, 11% of the 31-40 year old males

were rated "bad" on safety and 29% were rated "good" on safety. Thus not all 17-20 year old male drivers were "unsafe" and not all 31-40 year old male drivers were "safe". Nevertheless, a higher proportion of 17-20 year old males recorded high error scores and low driver ratings than the other age and sex groups (Section 4.6).

8.2 Why and when do drivers drive?

(i) Male drivers, on average, drove higher weekly mileages (221 miles) than their female counterparts (163 miles) who tended to make more journeys (male = 24 journeys, female = 27 journeys) (Section 5.1.1).

(ii) Both male and female younger drivers (17-25 year olds) used the car at least 10% more often for leisure purposes than work purposes in comparison to male and female 31-40 year old drivers who used the car at least 10% more often for work purposes than leisure (Section 5.2).

(iii) Although every group drove for over 50% of their time alone, the 17-20 year old male and female groups drove for over 20% of their time accompanied by friends compared to only about 5% of the time for 31-40 year old drivers. Older females (31-40 year olds) drove for 20% of their time accompanied by children (Section 5.3).

(iv) The male and female 31-40 year old groups and the 21-25 year old female group drove for over 40% of their time not listening to a radio or cassette. The amount that music was played whilst driving decreased as age increased for both sexes (Section 5.4).

(v) A higher percentage of journeys for the 17-25 year old groups of both sexes took place between 10pm and 4am compared to the 31-40 year old groups (Section 5.5.1). In addition more of these night time journeys were accompanied by friends for the 17-25 year old groups than the 31-40 year old groups (Section 5.5.2).

(vi) Type of journey appeared to affect driver state in that work journeys were rated as more tiring, hurried, tense and less enjoyable than leisure journeys. However, the extent of this effect is not large (Section 5.6.2).

(vii) Passenger numbers affected driver self assessed risk level in that all groups except the 31-40 year old female group rated journeys with two or more passengers as more risky than when alone or carrying one passenger (Section 5.6.3.1).

(viii) Type of passenger affected driver ratings. All groups except the 31-40 year old male group rated journeys with friends as slightly more risky than when accompanied by their partner or spouse. Those groups that had carried unaccompanied children as passengers assessed these journeys as the most tense (Section 5.6.3.2).

8.3 What were driver attitudes and opinions?

(i) Considerably higher proportions of males (15%) had driven illegally prior to obtaining their provisional driving licence than female drivers (7%) (Section 6.1.1).

(ii) Over half the drivers (54%) indicated that their driving had become worse since passing their test with only 22% stating that their driving had improved (Section 6.1.3).

(iii) Males placed a higher importance on type of car they drove than females (Section 6.2.1).

(iv) For all age and sex groups, comfort, price and reliability were the most important qualities to look for, in **general**, when buying a car. Reliability was of increasing importance for women as age increased. Males placed more importance on speed, acceleration and engine size than females. As age increased speed and acceleration tended to become less important factors. The importance of safety increased with age but was higher for females than males regardless of age. The 17-20 year old male group rated car appearance as important as safety (Section 6.2.2).

(v) Price was rated the most important factor by all groups when it came to **current** car choice. After price, appearance of the car was the most important priority for males whereas reliability was more important for females. The importance of safety was only indicated by the older 31-40 year old groups (Section 6.2.3).

(vi) The 17-20 year old male group reported the largest effect of passengers on their driving behaviour. (Section 6.3.1)

(vii) There were three types of passengers which adversely affected driving style. These were friends, children and partner/spouse or boyfriend/girlfriend. These effects varied across age and sex (Section 6.3.2).

(viii) All age and sex groups rated the radio cassette as having some small effect on car driving behaviour. For both the male and female 17-20 and 21-25 year old groups the overall effect was an adverse effect on their driving. For the male and female 31-40 year old drivers the adverse effects of the radio cassette were balanced out by positive effects. Such different age effects might be linked to differences in types of listening which have been shown to exist between the age groups (Section 6.4).

(ix) Female drivers rated motorways, dual carriageways and rural roads more dangerous than male drivers whilst male drivers rated urban roads more dangerous than female drivers did (Section 6.5).

(x) Joining motorways, roundabouts and right turns were rated most dangerous road situations by all drivers (Section 6.5).

(xi) Male drivers in the 17-20 year old age group were three to five times more likely to have an "own fault" accident per year than the 31-40 year old age groups. As age increased number of "own fault" accidents per year decreased for both sexes (Section 6.6).

(xii) The number of convictions per driver per year was higher for male drivers than female drivers of the same age. As age increased number of convictions per driver per year for male drivers fell. This pattern was not reproduced with the female drivers whose average number of

convictions per year was generally low in comparison to male groups. Female average number of convictions per year were at their highest for the 21-25 years old group before falling to the lowest leel for all age and sex groups for the 31-40 year old female group (Section 6.6).

(xiii) Within sex groups, all the male groups admitted committing more violations than errors whereas two of the female groups (17-20 and 31-40 year olds) admitted more errors than violations. Both errors and violations were lowest for the 31-40 year olds of both sexes suggesting that they tended to decrease slightly with age. Between sex groups, male drivers admitted fewer errors but more violations than female drivers (Section 6.7).

8.4 Inter-relations

8.4.1 Correlations between the variables

Correlations between variables within sets of a similar type were generally high and generally precluded more than one variable from a set entering the multivariate models. Correlations between variables of different types were also examined and notable findings were as follows:

(i) The total of all observed error scores was very highly correlated with all but one of the individual error scores and so provided a good overall error score.

(ii) Correlations of individual dangerous error scores with total dangerous errors were generally low except with dangerous following traffic errors, dangerous consideration errors and dangerous speeding errors.

(iii) Total errors and total dangerous errors fell far short of a significant correlation with the self-reported accident frequencies.

(iv) High correlations between the observers' general assessment ratings showed that an average value was a good representation. The observers' assessment ratings were all significantly correlated with accident frequency variables, while only one of the drivers' assessment scores reached significance.

(v) Of the journey purpose variables only those concerning shopping had significant correlation with accident frequency and total error score, but the nature of the effects were opposite in sense.

(vi) The percentage of driving time spent with friends correlated significantly with the accident frequency variables and total error score, indicating higher percentage to be associated with higher accident frequencies and error scores.

(vii) Greater experience measured in terms of years of driving or total driving mileage were negatively correlated with the accident frequencies and total error scores, years of driving giving more significant values.

(viii) Age group also showed that lower accident frequencies or error scores were correlated with the older age groups.

(ix) Sex of the driver did not correlate significantly with the accident frequencies or error scores.

(x) A driver's rating of the importance of the car's speed, acceleration and engine size were highly correlated together; safety correlated highly with reliability. The former group correlated positively with the accident frequencies, while significant negative correlations with accident frequency were found for safety and reliability.

(xi) Perceptions of dangerous road situations showed no significant correlation with accident frequency and little correlation with total error score.

(xii) The drivers' frequency ratings of actions which may be regarded as violations were very highly correlated together, indicating that an average value would be a good representation. Nearly all of the action ratings correlated with accident frequency particularly those for "racing for a gap" and "crossing red traffic signal" both of which were positively correlated.

(xiii) No correlation was found between reported level of drink-driving and reported accident frequency.

8.4.2 Correlations of error totals with accidents along the route

A significant correlation was found between the error total and accident frequency on each section of the route, while that between accidents and total dangerous errors was highly significant (at 1% level). This result supports the assertion that the observed assessments, but particularly the observed dangerous errors, do reflect the level of safety in varying conditions and provide an indicator of accident potential.

8.4.3 Multivariate analysis

The multivariate analyses provided a means of simultaneously exploring the effects of significant variables on the level of reported accident frequency, "at fault" accident frequency, total errors and total dangerous errors.

Excellent models were obtained for accident frequency and "at fault" accident frequency, which showed particularly:–

(i) The accident frequencies increased with exposure, measured in terms of average mileage per year, at a rate slightly lower than a square root relationship. The youngest drivers, with little experience gave rise to particularly high levels of accident frequency at high levels of exposure. The total accident frequency for the 17-20 year olds with one year's experience was three and a half times that of the 21-25 year olds and four times that of the 31-40 year olds with the same level of exposure; similarly the "at fault" accident frequency for the youngest group was five times that of the 21-25 year olds and nine times that of the oldest group, again for the same one year of experience.

(ii) For the same level of exposure, the youngest age group (17-20 years) has a very high initial accident frequency at low experience, but this falls

rapidly with increasing experience. The 21-25 year old group, however, has a low initial accident frequency which rises modestly with increased experience. It may be that drivers in this age group become over confident as experience increases. For the oldest group (31-40 years) experience has little effect on accident frequency.

(iii) There is only a small difference in the predicted effect of accident frequency for men and women. At the lowest level of experience accident frequencies for women are slightly higher than those for men, but after about four years' experience the opposite effect is found. No significant effect between the sexes could be found for "at fault" accident frequencies. It must be noted that type of accident or accident severity were not accounted for and there may be important sex differences in these respects.

(iv) The reported average frequency rating for driver violations was a highly significant variable indicating that total accident frequency and "at fault" accident frequency was higher for those drivers with higher average ratings. Thus, those who perceive themselves as making more violations of traffic law are more liable to be involved in an accident.

(v) The observers' overall assessment ratings of the driver's performance was also a good explanatory variable of accident frequency, with drivers assessed as being better having lower total accident frequencies and lower "at fault" accident frequencies.

(vi) Drivers who were observed frequently to "follow traffic too closely" had a higher total accident frequency. Also those who continually drove too fast were associated with a higher "at fault" accident frequency.

(vii) Drivers who were frequently accompanied by friends as passengers were associated with higher "at fault" accident frequencies; this most affects the youngest age group (17-20 years) who spent much more of their driving time with friends.

8.4.4 Driver error models

Models of total driver errors and total dangerous driver errors were developed, since such measures could be regarded as measures of potential accident risk. The main findings from these analyses are:-

(i) Though initial models showed a significant difference between the age groups, the inclusion of the measures of experience led to the age group factor to be dropped from the total dangerous error model, though it just remained significant in the total error model. This indicates the greater influence of experience, whether measured in terms of total mileage or total years of driving, as a stronger effect than age group on the total error and total dangerous error scores.

(ii) In a similar way to the accident frequency models, the average rating for driver violations was associated with higher total error scores.

(iii) The proportion of journeys for shopping purposes was also associated with higher total errors.

(iv) For the total dangerous error model, the following also gave rise to higher total dangerous error scores:
  (a) higher proportions of journeys with the radio on
  (b) higher driver's ratings of the importance of appearance in car choice
  (c) higher mileage per week

A higher rating of the driver's importance of safety in car choice, however, was associated with a lower total of dangerous errors.

8.5 Social contexts and the issue of choice

This project has identified a number of variables which influence accident probability, the primary factors being age and experience. To this extent, the findings mirror earlier work, albeit with a larger sample and using self-reported accident frequencies rather than published official accident statistics. Similarly, numbers of errors and dangerous errors recorded on the route survey are strongly related to experience and, to a lesser extent, age.

In previous research, "age" has been regarded as a "causal" factor, with little attempt to probe further. Such attempts as have been made have tended to emphasise "internal" aspects, such as lack of skill (possibly through lack of experience), misjudgement of situations, underestimation of risks, and so on.

However, data from the various components of this study point to alternative means of accounting for much of the variation between the drivers of different age and sex combinations. By contrast to the individual skill/ability level of explanation, attention needs to be paid to the social and interactional aspects of driving, and, in particular, the effects of social contexts. Further, given these contexts, attention is drawn to the crucial issue of **choice**. In other words, drivers (especially young males) may drive poorly **either** due to a lack of skill and ability **or** due to choosing to drive in particular ways in which social context plays a crucial role. There are two ways in which social contexts can be considered.

The first concerns the immediate social context of driving, and the clear indication that the presence or absence of passengers in the car affects the way people drive. It is demonstrated that higher accident frequency is associated with the proportion of time that young males drive with passengers. From the questionnaire and interview data, it is clear that passengers affect driving in different ways, according to the age and sex of the driver and of the passenger(s). Whereas for the older drivers having passengers in the car tended to lead to safer and more responsible driving than when they were alone, this was not necessarily the case with the young male drivers. The presence of parents led to safer driving, whereas the presence of peer group members led, in many cases, to more dangerous and risky styles of driving.

Furthermore, those drivers who reported strong negative effects due to peer group passengers in the interviews, were found to score worse on the overall safety and other ratings at the conclusion of their route surveys.

The second way in which social context appears to have an effect relates to wider considerations than the immediate social context of driving.

The distributions of error and dangerous error scores between the various age groups demonstrate clearly that not all young male drivers can be regarded as "unsafe" or "poor" drivers. Rather, there is a substantial minority who are "unsafe" and whose scores have the effect of lowering the overall averages for the group as a whole.

Particular attention needs to be paid to this group, and, on the basis of the interview data some preliminary conclusions can be drawn. These relate to the concepts of "reputation", "identity", and "social worlds" concepts which are central to modern social psychological thinking. It is argued that all individuals acquire and maintain their identities or sense of self-worth and uniqueness, through the gaining of social reputations. These may be acquired through educational achievement, sporting prowess, occupational advancement, physical strength, and/or a range of other fields. Different groups within society at large place different emphasis on particular ways of acquiring reputations; groups with common criteria for evaluating social worthiness are referred to as "social worlds". Hence, basic demographic information about individuals is, of course, relevant up to a point, but does not provide much useful information regarding these more specific "social worlds" which the individuals inhabit.

To an extent, being a "young person" is characterised by some common attributes; these include, for example, questioning, to a greater or lesser extent, the official sources of information and advice from their elders, a general tendency to underestimate risk in many domains, and so on. Within this general category of "young people", however, there is a wide range of "social worlds", each with characteristic criteria for the gaining of reputations. This point is well-illustrated by the constantly changing patterns relating to preferences for popular music, fashion, leisure pursuits, and so on.

The interview material obtained in this study provided clear evidence of the importance of driving style for reputations and identities. Amongst the young male drivers in particular, frequent reference was made to the ways in which "rewards" were obtained from peer group members by driving in a risky manner, and thereby demonstrating prowess and "skill". It is of interest that the criteria of what constitutes "skill" vary between the different relevant "social worlds". Whereas for many older drivers it was regarded in terms of safety and comfort (especially when passengers were present), for many of the younger drivers it was regarded more in terms of being able to "handle" a car at relatively high speed, not to "chicken out" (and risk losing face or reputation) of risky situations and so on. An important point to note in this type of analysis is that other people do not actually need to be present for these considerations to be important. Thus, styles of driving, even when alone, reflect individual identities which are, to a large extent, shaped by social presences.

The interviews with the older drivers reflected the changing patterns of social worlds. As individuals moved from peer group influences to traditional family contexts, so the criteria of "good" driving altered. Quite frequent acknowledgements were made by the older drivers of the changes they had experienced in their driving, towards a more "safe" and responsible style.

So, in sum, it is argued that some of the apparent variation in driver behaviour **between** the different age groups can be accounted by the variation **within** the age groups. This is particularly pronounced in the younger male group, where there is evidence of a substantial minority whose driving can be described as relatively unsafe, not only as a result of age or lack of confidence, but also as a result of the social contexts in which their reputations are acquired and maintained.

Data from other parts of this study lend support to this general argument. As mentioned earlier, those drivers who have been involved in a higher number of accidents spend a greater proportion of time driving with passengers. Those drivers who report greater pressures from peer group passengers to drive in less safe ways scored worse on the observers' assessments at the end of the route surveys. There was a greater tendency for the young male drivers to select "speed" and "acceleration" as important attributes affecting car choice, rather than "safety" and "reliability", which were selected more frequently by the older drivers. The results from the questionnaires regarding errors and violations revealed a greater number of the latter amongst the younger drivers. Since, by definition, violations arise from choice, this pattern of results lends strong support to the argument that it is in this area – rather than in purely skill-based assessments – that greater attention needs to be focussed.

Two general lines follow from this analysis. Firstly, more needs to be known about the particular distinguishing features of the sub-groups within the young male group; deeper exploration of the features of the "social worlds" is warranted. Secondly, there are implications concerning training and rectification. A clear lack of skills implies greater skill training is needed. However, given the importance of elements of choice and the social considerations, greater attention needs to be paid to these aspects of driving, and how attempts can be made to counteract the clearly negative impact they can have on some drivers. These considerations are discussed in the next chapter.

9 What are the implications?

This study set out to explore the reasons why young drivers are particularly over-represented in current accident statistics. The large database and multi-disciplinary approach has developed valuable insights into behaviour and performance of young drivers. These insights, and the research findings discussed previously lead to implications for action, and also give guidance for future studies.

In 1987, the Department of Transport outlined an objective to reduce road casualties by one-third by the year 2000 (using the average for the years 1981-1985 as a base figure) (Department of Transport, 1987). In order to assist this objective and extend it beyond the year 2000, new initiatives particularly related to road user behaviour have to be introduced which are based on, and developed from, empirical research. This study is, therefore, particularly important because it has as its main focus younger car drivers.

- There are many factors which contribute to the over-representation of younger drivers in the accident statistics. The complex nature of this problem suggests that the multi-method approach that has been adopted is essential in order to gain an insight into young car driver behaviour. Use of a single methodology might find important differences between less safe, younger drivers and safer, older drivers but it would be impossible to work out how much weight such differences could contribute to the overall picture. The significant interaction between the data in the study collected through different research methods adds weight to the current findings.

- The data obtained from the route survey component of the study suggest that ***a substantial minority of younger drivers, particularly 17-20 year old males (but not*** all ***17-20 year old males), does not possess the skills or, more likely, does not use them in as responsible a way as generally displayed in the other age and sex groups.*** Evidence for this is shown by the high number of speeding errors and violation errors which are committed.

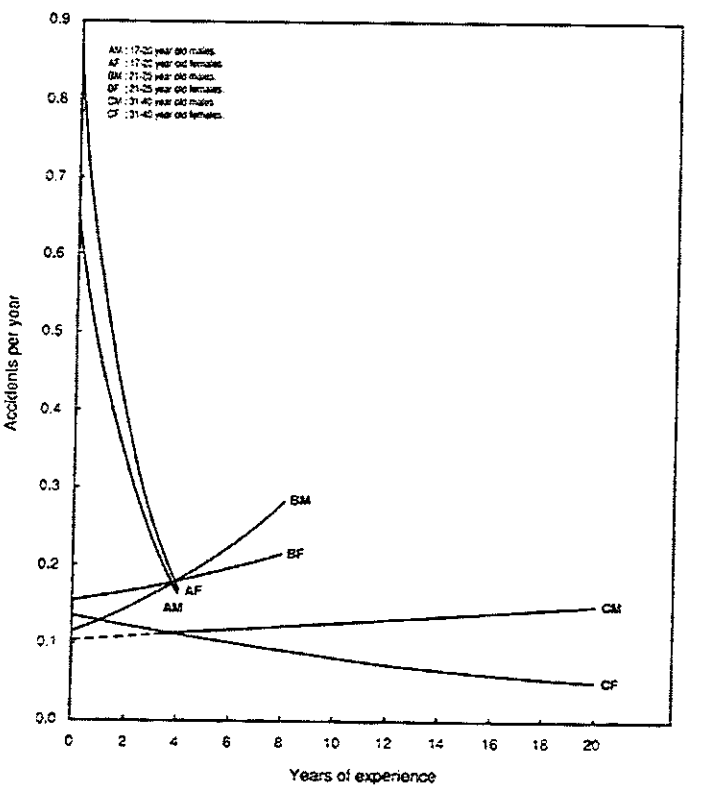
- Attention on high risk drivers could focus on the possibility of targeted measures emphasising social factors. Passenger presence has been shown to affect driver behaviour, especially violations and this reinforces the view that attention should be given to some of the influential social aspects of car driving. It has been shown that passenger, and in particular, peer group presence has a significant correlation with reported accident frequency. This effect is strongest for the youngest drivers (17-20 years). ***This is almost certainly because such drivers get positive feedback in terms of peer approval and esteem for driving dangerously.***

- The study clearly shows the need to influence attitudes and social norms and try to provide greater perceived social support for "safer" driving behaviour. ***It is likely that educational programmes involving sessions in small groups (for all pre-learner drivers in schools as well as later for convicted drivers) might prove more effective than***

campaigns that merely increase knowledge levels or involve "shock" advertising tactics. Evidence for the efficacy of this form of action comes from work in related health safety fields. Through this method many of the important social aspects and influences of car driving behaviour coming out of this study could be focused on; such factors are largely ignored within the current methods of driver training which concentrate on "driving skills."

- The effect of driving experience is different for different age groups. ***Keeping exposure levels constant, the youngest age group (17-20 years) has a very high initial accident frequency at low experience, which falls rapidly with increasing experience.*** The 21-25 year old group has a low initial accident frequency which rises modestly with increased experience but approaches only the lower levels of the youngest group. This modest increase may be due to over confidence as experience increases. For the oldest group (31-40 years) experience has little effect on accident frequency.

Figure 7.2 – The predicted effect of experience on accident frequency



These relationships represent the average values within age bands.

- ***This finding with regard to the effect of experience on the youngest age group (17-20 years) is particularly important.*** In the light of the data obtained, there are strong indicators that further attention needs to be paid to this area, which would incorporate detailed consideration of the social aspects identified, as well as specific skill assessment and accident analysis. Such attention should be based on precise information regarding specific age and experience assessed in terms of both number of years a licence has been held and number of miles

driven. The need is to accelerate improvements in the young (17-20 years) whilst ensuring no deterioration in the middle age group (21-25 years).

- ***Certain technical measures could be introduced to influence those drivers, especially the young, who possess the necessary skills to drive "safely" but choose not to.*** An increase in the likelihood of detecting driver violations should influence behaviour. The finding that the driver violation action of crossing red lights was significantly correlated to reported accident frequency suggests that measures to reduce this type of behaviour such as the use of video cameras should be more widely implemented.

- ***Results from the study show that one-fifth of 17-20 year old driver journeys take place between the hours of 8pm and 4am.*** While there is no compulsory "night time" driving component prior to obtaining a full licence, there are also social influences on night time driving such as drunken passengers that should be addressed.

- The fact that speeding errors comprised 90% of all dangerous errors for all age groups and that dangerous errors were found to be correlated to reported accident frequency suggests that ***the problem of drivers' speeding, particularly on urban, residential roads, should be given attention.*** Whether this could best be done by further enforced legislative measures, by greater traffic calming programmes or by educative means remains open to question.

- ***For a number of drivers it is not that they are incapable of driving safely it is that they choose not to do so.*** Within The Highway Code there are the formal rules of the road and recommended guidelines for road user behaviour. ***Consideration should be given to the inclusion of a section within The Highway Code pointing out some of the problems for road users.*** If car drivers were made more aware of the accident statistics, the possible effects of passenger influence, the dangers of particular types of roads, the vulnerability of certain road users and the most dangerous times of day for driving, then it is likely that **some** drivers (who choose to) might adapt their driving behaviour accordingly.

- ***Self-reported violations were correlated with reported accident frequency so it is suggested that this might be a reasonable method to assess the effectiveness of any campaigns designed to alter car driver attitudes.*** This would have the advantage of being easily administered and provide relatively quick feedback as to effectiveness.

- However, the study found no correlation between reported level of drink-driving violations and reported accident frequency. This result is difficult to explain but may reflect a gradual shift in attitude among the younger drivers towards the unacceptability of drink-driving and a reluctance to admit levels of drink-driving as has been found in earlier studies.

- Previously published statistical risk curves have demonstrated differences between sexes. Results from this study do not show such large differences on reported accident frequency possibly due to the lack of data on accident type and accident severity.

In conclusion, it must be emphasised that this study found that a substantial* minority *of young drivers could be classified as unsafe drivers. The results therefore, do not lend support to "blanket" legislation or other remedial measures that would unjustifiably penalise all young drivers. Greater attention should be given to programmes for education and attitude change which incorporate the social aspects and influences on car driving behaviour. These are likely to prove to be effective in reducing car driver casualties amongst younger drivers.

Trials should be instituted to develop and evaluate this "social programme" approach.

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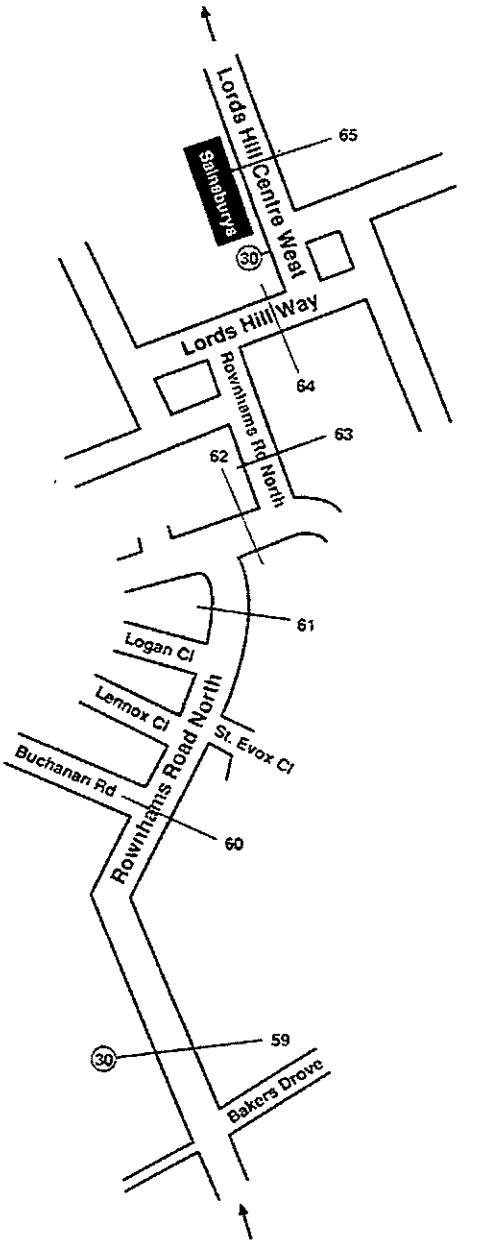
12 Appendices

Appendix 12.1 Route assessment marking procedure

Sections 59-64 from route survey assessment sheets (118 sections in total) to illustrate route assessment marking procedure. Observers were instructed to mark errors by the driver as they occurred on the route using the error category key. All errors classified as dangerous (see Appendix 12.2) were circled.

Any errors that could not be described using the error marking procedure were written in full on the map. Traffic conditions were noted on the route.



Traffic Conditions

1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Light Heavy

B - Brakes
S - Steering
G - Gears
M - Mirrors
I - Indicating
P - Position on road
35 - Speed (Itemise)
F - Following too closely
J - Joining traffic
L - Leaving traffic
O - Overtaking
E - Erratic manoeuvres
C - Consideration to other road users

↑ - Direction of travel
59-60 etc. - Route Sections

12.2 Glossary of terms

12.2.1. Definitions of errors

Definition of a driver error:
"any action or lack of action on the part of the driver that increased their risk or potential risk of an accident".

Definition of a dangerous driver error:
"a driver error (see above) involving particular liability or exposure to harm".

B-Braking
Incorrect use of brakes which increased accident risk eg. late braking.

S-Steering
Incorrect steering or positioning of hands on wheel such that the subject would be less able to react to any given traffic situation.

G-Gears
Incorrect choice or use of gears that could result in an unsafe situation occurring.

M-Mirrors
Involved failure to use rear observation when it was necessary to take account or be aware of following road users. For example, changing lanes into the path of an overtaking vehicle that had to slow or swerve. Also the result of looking over the shoulder for an excessive length of time and not adequately taking account of the traffic situation ahead at the time.

I-Indicating
Misleading or failing to warn other road users of actions at appropriate time.

P-Position on road
When the correct position on the road was not adopted. Examples would include straddling lanes, driving too near the kerb or centre of the road.

35-Speed (itemised)
Driving at a speed that was inappropriately high for the road, traffic or environmental conditions at the time regardless of posted speed limits.

F-Following too closely
With reference to factors such as traffic conditions, road surface and type of vehicle being followed.

J-Joining traffic
Involved pulling out of the minor road when there was not a safe gap in the major road traffic. This type of Unsafe Driver Action (UDA) could occur after the subject had stopped at the Give Way or Stop line, or if they emerged without stopping.

L-Leaving traffic
Involved exiting from a road when it was unsafe to do so. This type of UDA mainly applied to right turn manoeuvres when the subject had to cross on-coming traffic.

O-Overtaking
Involved overtaking other vehicles or passing parked vehicles in an unsafe manner. Examples would include passing cars in the face of oncoming traffic, forcing on past parked cars causing approaching cars, with right of way, to brake or swerve, overtaking in an illegal situation or too close to be safe.

E-Erratic manoeuvres
When for no apparent reason the driver carried out a manoeuvre, such as changing lanes, much too quickly for it to be safe.

C-Consideration to other road users
Involved not taking account of the needs or abilities of other road users including cyclists, pedestrians (particularly children), horse riders and so on.

If any driver action (as above) was considered to be particularly dangerous the letter or itemised speed was placed in a circle.

12.2.2. Definitions of driver ratings

Ability
The overall ability of the driver to deal with any task or hazard which presents itself.

Safety
The margins of safety that the driver displays to enable the vehicle to be positioned on the road with the minimum risk to themselves and other road users.

Anticipation
The continual assessment by the driver to correctly anticipate other road users' actions to allow uninterrupted flow and time to deal with situations.

Concentration
The application of mind and body to a particular endeavour (driving) to the complete exclusion of everything not relevant to that endeavour.

Observation
The ability of the driver to look into the correct areas thus enabling themselves to complete an unflourished drive.

Technical skills of car control
The skills displayed by the driver relating to the smoothness and correct use of all the vehicle controls.

12.3 Post route questionnaire

1 How do you think you drove on the route survey?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Badly **Very Well**

2 How safely do you think you drove on the route?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Unsafely **Very Safely**

3 What do you think your level of anticipation was like on the route?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Bad **Very Good**

4 What do you think your level of concentration was like on the route?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Bad **Very Good**

5 What do you think your level of observation skills was like on the route?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Bad **Very Good**

6 What do you think your technical skills of car control were like on the route?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Bad **Very Good**

7 What speed did you drive at on the route compared to "normal"?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very much slower **Very much faster**

8 How did you find the route?

1 - - - - - - - 2 - - - - - - - 3 - - - - - - - 4 - - - - - - - 5 - - - - - - - 6 - - - - - - - 7
Very Difficult **Very Easy**

9 Which sections of the route had you previously driven?

- -

- -

10 Do you think the drive gave a fair indication of your "normal" driving?

11 Did the observer's presence affect your driving? In what way(s)?

12 Did the task you were given affect your driving? In what way(s)?

13 Have you any other comments about the route or the drive etc?

12.4 Page from driver diary

DRIVER DIARY

Instructions: Fill in a new column for each journey that you make. Try to write as clearly as possible in the boxes provided.

1	Journey					
2	Car Number					
3	Date					
4	Start of journey					
5	Weather Conditions					
6	Lighting Conditions					
7	From?					
8	To?					
9	Time to complete journey					
10	Distance of journey					
11	Purpose of journey					
12	Passenger details (Give ages, sex and relationship to you)					
13	What were you doing prior to the journey?					
14	Had anything significant happened prior to the journey? eg an argument, good news etc.					
15	Had you driven the route before? If yes, how frequently?					
16	Was the radio/cassette on?					
17	What were you listening to? eg music/conversation etc					

For Questions 18 and 19, please decide your level of feeling from the 7 point scale and enter the number of your choice in the box provided in the appropriate column. (see notes on page 4 of the instructions)

1------2------3------4------5------6------7

Not at all **Extremely**

18	The journey was:	a. Risky due to road conditions					
		b. Enjoyable					
19	On the journey I felt I was:	a. Hurried					
		b. Tense					
		c. Tired					
		d. Able to concentrate					
20	Additional notes on each journey (if applicable)						

12.5 Questionnaire

DRIVING STYLES QUESTIONNAIRE

Instructions

This questionnaire is concerned with car driver behaviour.

Please read the questions carefully and answer them as truthfully as you can. Since the replies will be completely confidential, we would like you to answer the questions (especially those in Section E) according to how you **do** drive, rather than how you think you **should** drive (these may or may not be the same thing)!

In some cases you are required to put a tick in the appropriate box and in some cases to enter a number in a box. For the questions which involve a seven-point scale, please circle the number which best describes how you wish to answer the question.

For example:

1----2----3----4----5----6----7
Never **All the time**

With some questions you are asked to add comments – please use these fully and continue overleaf on a separate sheet if necessary.

Very many thanks for your help.

DRIVING STYLES QUESTIONNAIRE

Answer the following questions as truthfully as possible.

Part A: Background information

1 Age: 17-20 ☐ 21-25 ☐ 26-30 ☐ 31-40 ☐ 41-50 ☐ 51-60 ☐ 60+ ☐

2 Sex: Male ☐ Female ☐

3 Marital Status: Single ☐ Married/ Co-habiting ☐ Widowed/Separated/Divorced ☐

4 Occupation? ----------

5 How many children do you have (if any)? ----------
If so, how old are they? ----------

		Month	Year
6	When did you start driving (approximately)?	☐	☐
7	When did you pass your test (approximately)?	☐	☐

8a Estimate the number of miles you have driven in each of the following years?

	Miles
1985	☐
1986	☐
1987	☐
1988	☐
1989	☐

8b Estimate the total number of miles driven in your driving career? (If over 50,000 miles, just tick the box.) ☐

9 Who owns the car that you usually drive? (Please tick one)

Yourself	☐	Employer	☐
Parents	☐	Friend	☐
Other relative	☐	Boy/girlfriend	☐
Husband/wife/partner	☐	Other	☐

10 Details of the car that you usually drive:

Make and model ☐
Engine size (cc) ☐
Year of manufacture ☐

11 Please indicate the general purposes of your journeys over an average week in terms of percentage of time spent driving your car – these should add up to 100%; (eg, to and from work – 50%; leisure – 35%; shopping – 15%)

to and from work	☐ %	
as part of job	☐ %	
shopping	☐ %	
leisure: eg visiting friends, pubs, cinema, sport etc.	☐ %	
other	☐ %	Please specify ----------

12 Please indicate the proportions of your driving time when you are alone and when you have passengers with you. These should add up to 100%. (eg, driving alone for 70% of time, accompanied by partner/spouse for 15% and with friends for 15% of time).

alone	☐ %	
partner/spouse	☐ %	
children only	☐ %	
partner/spouse **and** children	☐ %	
friends	☐ %	
other	☐ %	Please specify ----------

Part B: Learning to drive

13 Did you ever drive illegally on the road before obtaining your provisional licence?

Yes ☐
No ☐

14a Did you have professional driving lessons?

Yes ☐
No ☐

14b If Yes, how many lessons did you have before passing your test?

Number ☐

15 How many tests did you take to pass?

Number ☐

16 Do you think the driving test is an adequate test for drivers? (Please circle appropriate number)

1----2----3----4----5----6----7
Not at all adequate **Completely adequate**

17 Are there any ways that you think the test might be improved?

---

18 What was the **main** motivation for you to learn to drive?

19a Do you still drive in the same way as on your test?

Yes ☐
No ☐

19b If No, how does it differ?

Part C: Car choice

20a How important to you is the type of car that you drive?

1----2----3----4----5----6----7
Not at all important — **Extremely important**

20b If appropriate, in what way(s) is it important?

---

21 How important are the following qualities to you when buying a car?

a	Speed	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
b	Acceleration	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
c	Engine size	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
d	Comfort	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
e	Price	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
f	Reliability	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
g	Safety	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
h	Utility/Functional	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
i	Appearance	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**
j	Other (Specify) ----------	**Not at all important**	1----2----3----4----5----6----7	**Extremely important**

22 Which was the main factor when buying your current car? (if applicable)

---

23 Which car would you like to own?

Car: ---

Why?

Part D: Passenger/Radio presence

24a Does having passengers in the car affect you driving style?

1----2----3----4----5----6----7
Not at all **A lot**

24b If appropriate, which type of passengers affect your driving and in what ways?

	Type of Passenger	**Effect?**
For example . . .	Parent	Drive slower
	----------	----------
	----------	----------
	----------	----------
	----------	----------
	----------	----------
	----------	----------

24c Have you any other comments concerning possible effects of passenger presence on driving?

---

25 How often do you listen to a radio/cassette whilst driving?

1----2----3----4----5----6----7
Never **All the time**

26 What do you most often listen to?

Pop music ☐
Classical ☐
Pop radio ☐
Conversational radio ☐

27a Does listening to the car radio/cassette affect your driving in any way?

1----2----3----4----5----6----7
Not at all **A lot**

27b If appropriate, in what way(s)?

Part E: Perceptions of driving situations

28 In general, how dangerous do you find the following types of roads?

a	Motorways	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
b	Dual carriageways	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
c	Rural roads (60mph)	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
d	Urban roads (30mph)	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**

29 In general, how dangerous do you find the following road situations?

a	Roundabouts	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
b	Joining a motorway	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
c	Right turns	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
d	Left turns	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**
e	Traffic lights	**Not at all dangerous**	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7	**Extremely dangerous**

30 How frequently do you perform the following driving actions?

a	Attempt to drive away from stationary in wrong gear.	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 **Never**	**All the time**
b	Deliberately park on a double yellow line.	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 **Never**	**All the time**
c	Forget that your lights are on full beam.	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 **Never**	**All the time**
d	Become impatient with a slow driver in the outer lane and overtake on the inside.	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 **Never**	**All the time**
e	Misjudge a gap in a car park and nearly (or actually) hit an adjacent vehicle.	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 **Never**	**All the time**
f	Deliberately disregard speed limits late at night or early in the morning.	1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7 **Never**	**All the time**

g Intend to switch on the windscreen wipers, but switch on the lights instead or vice versa.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

h Take a chance and cross on traffic lights that have just turned red.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

i Forget which gear you are in and have to check with your hand?
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

j "Race" oncoming vehicles for a one-car gap on a narrow or obstructed road.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

k Misjudge speed of oncoming vehicle when overtaking.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

l Drive when you realise you may be over the blood alcohol limit.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

How frequently do you perform the following driver actions?

m Get involved in unofficial "races" with other drivers.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

n Miss your exit on a motorway and have to make a lengthy detour.
1 - - - - 2 - - - - 3 - - - - 4 - - - - 5 - - - - 6 - - - - 7
Never **All the time**

31a How many car accidents had you have whilst driving? ☐

b How many of these accidents were, to any extent, your fault? ☐

32a Have you any convictions for motoring offences?
(*delete as appropriate) *Yes/No

b What were the details? ----------

Thank you again for your time and co-operation.

12.6 Statistical modelling methods

The objective of the statistical modelling described in Section 7.4 was to relate the reported accident frequencies and error totals to the range of explanatory variables so as to try to explain the differences in accident frequencies and error totals between the drivers. The statistical method used was a form of multiple regression modelling. The method is described initially with accident frequency as the dependent variable, while variations in the procedure for modelling total errors are given later. The explanatory variables were those of age, sex, mileage, observed behaviour, reported attitudes etc. Since numbers of accidents follow a Poisson error distribution and not a Normal distribution, standard least squares regression could not be used. Thus the generalised linear modelling technique, available in the statistical computer packages GENSTAT (Alvey *et al*, 1977) and GLIM (Numerical Algorithms Group, 1986) has been used, since it allows the dependent variable to be drawn from a family of exponential distributions (such as Poisson) and enables non-linear models to be fitted by means of suitable transformations. The technique has been applied previously to a number of similar accident data sets (Maycock and Hall, 1984; Pickering, Hall and Grimmer, 1986; Hall, 1986; Quimby *et al*, 1986; Taylor and Lockwood, 1990).

12.6.1 The form of the model

The model of accident frequency fitted was of a general multiplicative form (as successfully used in the previous works) as follows:-

$$A = k\, M^m \exp\left(\sum c_i V_i\right) \quad \ldots\ldots (1)$$

where:

A is the accident frequency (per year)

M is the estimated average mileage (in thousands) per year in the person's driving career

V_i are the explanatory variables of driver experience, age group, sex, attitude, performance and behaviour, and may be continuous variables or discrete level "factors".

k, m, c_i, are parameters estimated by the regression.

The form of the model permits a non-linear relationship between the accident frequency and average mileage (or exposure), while ensuring that zero accidents are predicted for a zero mileage.

However, in order that the dependent variable may be regarded as following a Poisson error distribution, the above model is multiplied by the number of driving years, Y, as appropriate for each driver, to give:

$$AY = k\, Y\, M^m \exp\left(\sum c_i V_i\right) \quad \ldots\ldots (2)$$

so that (AY) is now the number of accidents in the driver's history. Before fitting, the model is transformed to the linear form using the logarithmic (base e) transformation to give:

$$\ln(AY) = \ln(k) + \ln(Y) + m \ln(M) + \sum c_i V_i \quad \ldots\ldots (3)$$

The term ln(Y) is known as the "offset variable", its coefficient being constrained to the value 1.

For the models of total errors, the basic form of the model was:-

$$E = k\,P \exp(\sum c_i V_i) \quad \ldots\ldots (4)$$

where
E is the total number of errors (or dangerous errors) and
P is the proportion of the route completed. (The multiplier, P, needed to be included since a few of the drivers only completed part of the route.)

Since E is a count variable (ie taking only positive integer values) a Poisson error distribution was again assumed, though, since the mean value is large, the Normal error assumption gave very similar results.

In the linear form the model becomes:-

$$\ln(E) = \ln(k) + \ln(P) + \sum c_i V_i \quad \ldots\ldots (5)$$

with ln(P) as the "offset variable."

12.6.2 Significance testing

Each model was fitted in a step-by-step procedure starting with the "null" model, which simply fits the mean accident frequency. Variables were tried one at a time in the model, and the variable which gave the best fit was selected. At each step, the statistic calculated, which forms the basis for significance testing, was the "scaled deviance", which is a maximum likelihood ratio statistic (analogous to the residual sum of squares for Normal errors). With Poisson errors, the scaled deviance is asymptotically distributed as a chi-squared variable with (n-p-l) degrees of freedom (where n is the number of data points and p the number of independent variables fitted). Provided the predicted mean value of the dependent variable (accidents in the driver's history) is greater than about 0.5 (Maycock and Hall, 1984), the scaled deviance may be used as a chi-squared variable to test the overall goodness-of-fit of the model.

At each step in the model building process the significance of adding one or more terms to the model also needs to be assessed. Generally, the difference in scaled deviance between two nested models with degrees of freedom df_1 and df_2 will be distributed like chi-squared with $(df_1 - df_2)$ degrees of freedom and so may be used to assess the significance of adding terms to the model. Thus for the addition of one term, a value of at least 3.9 is required for significance at the 5% level.

For the models of total errors and total dangerous errors, however, the residual scaled deviance is greatly in excess of the degrees of freedom, probably due to over dispersion or between-driver variability, so for these models the significance tests have used the Mean Deviance Ratio (MDR) defined as:-

$$MDR = \frac{\text{Scaled deviance difference}/(df_1 - df_2)}{\text{Residual scaled deviance}/df}$$

where the residual scaled deviance is the scaled deviance of the best fitting model with df degrees of freedom. The Mean Deviance Ratio is approximately distributed as an F statistic, so in testing the significance of adding one term to the model a value of at least 3.9 is required for significance at the 5% level.

12.7 Full model details

Full details of the models described in section 7.4 are given in Tables 12.1 to 12.4 of this appendix. The models are given in logarithmic linear form in which they were actually fitted (ie the form of equations 3 or 5 in section 12.6.1 above). The fitted parameter estimates are given together with their standard errors, which are based on Poisson errors but adjusted by multiplying by the square root of the residual mean deviance (ie scaled deviance of full model/degrees of freedom of full model) to allow for over-dispersion in the fitted models. This multiplier is quite small (1.10 and 1.03) for the accident frequency models which fit the data very well, but quite large (5.8 and 3.9) for the error models which are poorly fitted.

For each model, the percentage reduction in explainable scaled deviance is also given as a measure of the overall goodness of fit. Since for a well fitting model the expected value of the residual scaled deviance is equal to the number of degrees of freedom of the model, the percentage reduction in explainable scaled deviance is calculated as:

100. (SDn – DFf) / (SDn –SDf)

where:
SDn is scaled deviance of null model
SDf is scaled deviance of fitted model
DFf is degrees of freedom of fitted model

Table 12.1 – The full model for accident frequency

Model terms [1]			Estimate	s.e.[2]
Constant		Lk	−1.503	0.460
Mileage per year		LM	0.473	0.130
Age group differences	(for group 2)	AGE(2)	−1.727	0.426
	(for group 3)	AGE(3)	−1.836	0.406
Females difference		SEX(2)	0.283	0.184
Years of driving	(age group 1)	YRS	−0.337	0.128
	(difference for age group 2)	YRS. AGE(2)	0.458	0.138
	(difference for age group 3)	YRS. AGE(3)	0.367	0.129
Total mileage	(for males)	MLS	−0.00123	0.00093
	(difference for females)	MLS.SEX(2)	−0.00680	0.00188
Average violation rating		ACTV	0.294	0.067
Observed safety rating		OASS2	−0.142	0.042
Number of "close following" errors		ERR7	0.0136	0.007

	scaled deviance	degrees of freedom
Null model	620.7	338
Fitted "full" model	393.2	326

Percentage reduction of potentially explainable scaled deviance = 77%

Notes:

[1] The prefix L stands for $\log_e$ eg Lk = $\log_e$ (k)
The factor terms and interaction terms give the difference in the constant and variables respectively for that level of the factor.

[2] The standard errors are based on Poisson errors but adjusted by $\sqrt{\text{residual mean deviance}}$ to allow for over-dispersion in fitted model.

Table 12.2 – The full model for "at fault" accident frequency

Model terms [1]		Estimate	s.e.[2]
Constant	Lk	−1.326	0.486
Mileage per year	LM	0.397	0.111
Age group (for group 2)	AGE(2)	−2.614	0.503
differences (for group 3)	AGE(3)	−2.885	0.553
Years (age group 1)	YRS	−0.633	0.157
of (difference for age group 2)	YRS. AGE(2)	0.817	0.170
driving (difference for age group 3)	YRS. AGE(3)	0.661	0.159
Average violation rating	ACTV	0.324	0.082
Average observer's rating	OASSA	−0.241	0.068
Proportion with friends	SHAR5	0.862	0.390
Continually too fast	CONF13(2)	0.365	0.156

	scaled deviance	degrees of freedom
Null model	536.6	331
Fitted "full" model	337.2	321

Percentage reduction of potentially explainable scaled deviance = 92%

Table 12.3 – The full model for total errors

Model terms [1]		Estimate	s.e.[2]
Constant	Lk	4.062	0.117
Age group (for group 2)	AGE(2)	−0.198	0.085
differences (for group 3)	AGE(3)	−0.055	0.107
Total mileage	MLS	−0.00148	0.00052
Average violation rating	ACTV	0.194	0.040
Proportion of journeys for shopping	NJP2	0.572	0.228

	scaled deviance	degrees of freedom
Null model	12467	333
Fitted "full" model	10900	328

Percentage reduction of potentially explainable scaled deviance = 13%

Table 12.4 – The full model for total dangerous errors

Model terms [1]		Estimate	s.e.[2]
Constant	Lk	2.132	0.414
Years of driving	YRS	−0.062	0.015
Proportion of journeys with radio on	NRAD	0.988	0.258
Driver's importance rating of safety	IMP8	−0.222	0.050
Driver's importance rating of appearance	IMP10	0.138	0.052
Proportion of time for shopping	TJP2	1.350	0.424
Mileage per week (thousands)	MPW	0.825	0.306

	scaled deviance	degrees of freedom
Null model	6329	333
Fitted "full" model	5061	327

Percentage reduction of potentially explainable scaled deviance = 21%

12.8 List of variables

This appendix lists those dependent and explanatory variables used in the course of the multivariate analysis. For each continuous variable, the minimum, mean and maximum values are given and for all variables and factors the number of non-missing values is also shown.

Table 12.5 – "Continuous" variables

Label	Description	Minimum	Mean	Maximum
	Accidents			
NACC	Number of accidents (343)	0	1.14	15
NACY	Number of accidents per year (342)	0	0.29	5
NFAC	Number of "at fault" accidents (342)	0	0.62	10
NFAY	Number of "at fault" accidents per year (342)	0	0.18	5
	Observed number of errors of the following type: (439)			
ERR1	Braking	0	3.6	24
ERR2	Steering	0	26.1	160
ERR3	Gears	0	4.0	74
ERR4	Mirrors	0	10.5	74
ERR5	Indicating	0	2.6	20
ERR6	Position on road	0	9.1	49
ERR7	Following too closely	0	3.4	58
ERR8	Joining traffic	0	0.5	6
ERR9	Leaving traffic	0	0.1	2
ERR10	Overtaking	0	1.0	9
ERR11	Erratic manoeuvres	0	1.0	14
ERR12	Consideration to other road users	0	1.0	13
ERR13	Slow speed or progress	0	0.0	7
ERR14	Speed too fast	0	16.9	111
ERR15	Total of all errors 1 to 14	2	79.8	266

Table 12.5 (cont)

Label	Description	Minimum	Mean	Maximum
	Observed number of dangerous errors of the following type: (439)			
DERR1	Braking	0	0.07	7
DERR2	Steering	0	0.11	7
DERR3	Gears	0	0.01	1
DERR4	Mirrors	0	0.03	3
DERR5	Indicating	0	0.02	2
DERR6	Position on road	0	0.10	6
DERR7	Following too closely	0	0.15	20
DERR8	Joining traffic	0	0.04	2
DERR9	Leaving traffic	0	0.00	0
DERR10	Overtaking	0	0.05	2
DERR11	Erratic manoeuvres	0	0.06	3
DERR12	Consideration to other road users	0	0.04	3
DERR13	Slow speed or progress	0	0.02	5
DERR14	Speed too fast	0	7.71	110
DERR15	Total of all errors 1 to 14	2	8.39	118
M	Average mileage per year (thousands) (421)	0.3	9.4	50.0
MLS	Total mileage per driver (thousands) (422)	0.2	79.0	600.0
YRS	Years of driving (428)	0.1	7.2	23.6
NCH	Number of children (430)	0	0.42	4.0
	Proportion of time spent on journeys for the following purposes: (429)			
CARU1	To and from work	0	0.40	0.95
CARU2	As part of job	0	0.09	0.95
CARU3	Shopping	0	0.10	0.60
CARU4	Leisure	0	0.38	1.00
CARU5	Other	0	0.05	0.80
	Proportion of driving time with following passengers: (430)			
SHAR1	Alone	0.0	0.62	1.00
SHAR2	Partner/spouse only	0.0	0.10	0.85
SHAR3	Children only	0.0	0.05	0.90
SHAR4	Partner/spouse and children	0.0	0.03	0.90
SHAR5	Friends	0.0	0.16	0.90
SHAR6	Others	0.0	0.04	0.80
NLES	Number of driving lessons (343)	0	19.0	100
NTES	Number of driving tests (343)	1	1.7	5
NCON	Number of driving convictions (344)	0	0.2	4

Table 12.5 (cont)

Label	Description	Minimum	Mean	Maximum
	Importance of following qualities when buying a car (scale 1 to 7) (342)			
IMP1	Speed	1	4.5	7
IMP2	Acceleration	1	4.0	7
IMP3	Engine size	1	4.5	7
IMP4	Comfort	1	4.1	7
IMP5	Price	1	5.4	7
IMP6	Reliability	1	5.8	7
IMP7	Safety	2	6.4	7
IMP8	Utility	2	6.0	7
IMP9	Appearance	1	5.0	7
IMP10	Other	1	4.8	7
	Perceived level of danger (scale 1 to 7) for the following: (343)			
DANR1	Motorway	1	4.0	7
DANR2	Dual carriageway	1	3.8	7
DANR3	Rural roads	1	4.2	7
DANR4	Urban roads	1	3.9	7
DANR5	Roundabouts	1	3.6	7
DANR6	Joining a motorway	1	4.4	7
DANR7	Right turns	1	3.6	7
DANR8	Left turns	1	2.2	7
DANR9	Traffic lights	1	2.5	7
	Frequency of the following actions: (scale 1 to 7) (343)			
ACT1 a	Wrong gear used	1	2.0	6
ACT2 b	Park on double yellow lines	1	2.1	7
ACT3 c	Lights on full beam	1	2.1	6
ACT4 d	Overtake on inside	1	2.6	7
ACT5 e	Misjudge gap in a car park	1	1.7	6
ACT6 f	Speed late at night	1	4.0	7
ACT7 g	Use wrong switches	1	1.9	7
ACT8 h	Cross red traffic lights	1	2.3	7
ACT9 i	Need to check gear	1	2.6	7
ACT10 j	Race "oncoming" vehicles for gap	1	2.1	7
ACT11 k	Misjudge speed when overtaking	1	2.1	6
ACT12 l	Drive when over blood alcohol limit	1	1.4	7
ACT13 m	Race with other drivers	1	1.8	7
ACT14 n	Miss motorway exit	1	2.0	6
ACTE	Average of errors a,c,e,g,i,k,n	1	2.1	4.6
ACTV	Average of violations b,d,f,h,j,l,m	1	2.3	5.3
	Observers' assessment ratings of: (scale 1 to 7) (439)			
OASS1	General performance	1	3.9	7
OASS2	Safety	1	3.8	7
OASS3	Anticipation	1	3.7	7
OASS4	Concentration	1	4.2	7
OASS5	Observation	1	3.5	7
OASS6	Car control	1	3.5	7

Table 12.5 (cont)

Label	Description	Minimum	Mean	Maximum
	Drivers' assessment ratings of: (scale 1 to 7) (439)			
DASS1	General performance	2	4.7	7
DASS2	Safety	2	5.0	7
DASS3	Anticipation	1	5.1	7
DASS4	Concentration	2	5.3	7
DASS5	Observation	2	5.0	7
DASS6	Car control	2	5.0	7
NJW	Number of journeys per week (439)	2	24.8	191
MPW	Mileage per week (439)	3	193	1439
TPW	Time per week spent driving (mins) (439)	20	412	1923
	Proportion of diary journeys for following purposes: (411)			
NJP1	Work/school	0.0	0.31	1.0
NJP2	Shopping	0.0	0.17	1.0
NJP3	Leisure	0.0	0.32	1.0
NJP4	Other	0.0	0.19	0.88
	Proportion of diary mileage for following purposes: (411)			
MJP1	Work/school	0.0	0.31	1.0
MJP2	Shopping	0.0	0.13	1.0
MJP3	Leisure	0.0	0.36	1.0
MJP4	Other	0.0	0.19	0.88
	Proportion of diary driving time for following purposes: (411)			
TJP1	Work/school	0.0	0.33	1.0
TJP2	Shopping	0.0	0.14	1.0
TJP3	Leisure	0.0	0.34	1.0
TJP4	Other	0.0	0.19	0.78
NRAD	**Proportion of journeys with radio/cassette on (411)**	0.0	0.64	1.0
MRAD	**Proportion of mileage with radio/cassette on (411)**	0.0	0.68	1.0
TRAD	**Proportion of driving time with radio/cassette on (411)**	0.0	0.67	1.0
	Proportion of journeys with the following number of passengers			
NJPS1	None	0.0	0.61	1.0
NJPS2	One	0.0	0.26	1.0
NJPS3	Two or more	0.0	0.13	1.0

Table 12.5 (cont)

Label	Description	Minimum	Mean	Maximum
	Proportion of mileage with following numbers of passengers (411)			
MJPS1	None	0.0	0.57	1.0
MJPS2	One	0.0	0.28	1.0
MJPS3	Two or more	0.0	0.16	1.0
	Proportion of driving time with following numbers of passengers (411)			
TJPS1	None	0.0	0.58	1.0
TJPS2	One	0.0	0.27	1.0
TJPS3	Two or more	0.0	0.15	1.0
	Proportion of journeys with the following types of passengers (411)			
NPT1	Alone	0.0	0.61	1.0
NPT2	Partner only	0.0	0.10	1.0
NPT3	Children only	0.0	0.05	1.0
NPT4	Partner and children	0.0	0.02	0.68
NPT5	Friends only	0.0	0.12	0.81
NPT6	Other	0.0	0.10	0.78
	Proportion of mileage with the following types of passengers (411)			
MPT1	Alone	0.0	0.57	1.0
MPT2	Partner only	0.0	0.11	1.0
MPT3	Children only	0.0	0.05	1.0
MPT4	Partner and children	0.0	0.03	0.95
MPT5	Friends only	0.0	0.13	0.93
MPT6	Other	0.0	0.11	0.93
	Proportion of driving time with the following types of passengers (411)			
TPT1	Alone	0.0	0.58	1.0
TPT2	Partner only	0.0	0.10	1.0
TPT3	Children only	0.0	0.05	1.0
TPT4	Partner and children	0.0	0.03	1.0
TPT5	Friends only	0.0	0.13	0.89
TPT6	Other	0.0	0.11	0.90

Table 12.6 – Factor variables

Label	Description
AGE	Age group (439) 1 = 17-20 years 2 = 21-25 years 3 = 31-40 years
SEX	Sex (439) 1 = male 2 = female
STA	Marital status (430) 1 = single 2 = married/co-habiting 3 = widowed/divorced/separated
SEGG	Socio-economic group (427) 1 = Non-manual (SEG 1-3) 2 = Manual (SEG 4-6) 3 = Students (SEG 7) 4 = Housekeeper (SEG 8) 5 = Unemployed (SEG 10)
STU	Student or not (427) 1 = Not student 2 = Student
DRBE	Drove before obtaining provisional licence (343) 1 = No 2 = Yes
	"Continual" faults of the following types (439) where: 1 = no such continual fault 2 = continual fault
CONF1	Braking
CONF2	Steering
CONF3	Gears
CONF4	Mirrors
CONF5	Indicating
CONF6	Position on road
CONF7	Following too closely
CONF8	Joining traffic
CONF9	Leaving traffic
CONF10	Overtaking
CONF11	Erratic manoeuvres
CONF12	Consideration to other road users
CONF13	Speed too fast

Table 12.6 (cont)

Label	Description
	Passengers of the following types which have "good" effects (ie better, slower, safer, concentrate more) (430) where:
	1 = no such effect
	2 = "good" effect
PASG1	partner
PASG2	parent
PASG3	brother
PASG4	sister
PASG5	boyfriend
PASG6	girlfriend
PASG7	friends
PASG8	relatives
PASG9	colleague
PASG10	children
PASG11	animals
PASG12	other
PASG13	brother or sister
PASG14	girlfriend or boyfriend
	Passengers of the following types which have "bad" effects (ie worse, faster, less safely, concentrate less, more nervous) (430) where:
	1 = no such effect
	2 = "good" effect
PASB1	partner
PASB2	parent
PASB3	brother
PASB4	sister
PASB5	boyfriend
PASB6	girlfriend
PASB7	friends
PASB8	relatives
PASB9	colleague
PASB10	children
PASB11	animals
PASB12	other
PASB13	brother or sister
PASB14	girlfriend or boyfriend

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