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AN INVESTIGATION OF CHARACTERISTICS ASSOCIATED WITH DRIVING SPEED

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Abstract

Previous research has shown that speed has a clear role in accident causation and injury severity. A model of speed choice, derived from the literature, is presented and explored using data collected from road-side surveys. A relationship was found between drivers' attitudes towards speeding, such as feeling comfortable at high speeds and perceived risk of detection, and their observed speed. Drivers' tolerance of illegal behaviours was also related to speed choice, where those who were tolerant of illegal behaviours drove faster than other drivers.

The characteristics associated with speeding, as defined in this report, can be used to model characters in public education campaigns, such as the Transport Accident Commission advertisements, or to target specific groups of the population as the recipients of education and enforcement campaigns. This report closely follows the methodology used by Fildes, Rumbold & Leening (1991).

Key Words
Speed, Attitudes, Driver behaviour,

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EXECUTIVE SUMMARY

This project is concerned with investigating the factors related to speed choice. Substantial research has linked speed to crash causality and injury severity (Fildes & Lee, 1993; Zaal, 1994; Garber & Gadiraju, 1989), thus it is important to understand which factors influence speed choice in order to reduce the number and severity of crashes. This project aimed to:

- collect data relevant to a model of speeding behaviour derived from the literature and to determine its potential validity;
- to collect data concerning the general relationship between a number of variables and speed choice; and
- to investigate the changes in speed behaviour since a similar project was conducted almost ten years ago (Fildes, Rumbold & Leening, 1991).

The data collection method was similar to that used by Fildes et al. (1991) with the view that comparisons could be made between the two studies. Three of the four sites used in the earlier study were used in this project. These were the Calder Highway, Woodend, Beach Road, Parkdale and Belmore Road, Balwyn. A total of 496 drivers were sampled and surveyed at the road side after covert measurement of their speed.

The key results of the study were:

- A factor analysis was performed and observed speed loaded most strongly on the factor which included loadings from most of the speed-attitude related measures. Faster drivers felt more comfortable driving at relatively high speeds, had a history of speeding and believed other drivers were travelling relatively fast. These drivers were also less likely to rate travelling fast as dangerous, were more tolerant towards the range of illegal behaviours included in the survey and they believed themselves to be safer than other drivers.
- Observed speed loaded less strongly on two other factors, one relating to age and the other to work-related use of the vehicle at the time of interview. Older drivers tended to drive more slowly, and faster speeds were associated with work-related trips, driving larger cars which were not their own, and relatively high driving exposure.
- There was a positive correlation between tolerance of illegal behaviours and observed speed, suggesting that it would be beneficial to conduct further research into the role of moral development or social deviance in speeding behaviour.
- Faster drivers considered themselves to be safer than other drivers and reported feeling comfortable at speeds above the speed limit.
- No conclusions regarding the effect of increased automated speed enforcement or the Transport Accident Commission public education program could be made with regards to the differences found between the Fildes et al. (1991) study and the current study. A number of potential influences could not be controlled for, including changing economic and demographic factors and changing road conditions, which may have changed the nature of the sample interviewed in the sample.

It was recommended that:

- The results could be used to guide character selection in advertising material and/or to define target groups towards which advertising should be directed. Key variables include self-calibration, enforcement attitudes, moral attitudes, speed estimates, personal characteristics and car use.
- The potential value of targeting corporate bodies should be investigated as a road safety measure.

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INTRODUCTION

The issues associated with excessive speed and the consequences of speeding behaviour are of interest to researchers, law makers, law enforcers, and the community at large. The causal links between speed and accidents, and between excessive speeds and accident severity are well accepted (Fildes & Lee, 1993; Zaal, 1994; Garber & Gadiraju, 1989).

Both internal (psychological) and external (environmental and social) factors have been identified as contributors to driving speed, and a range of countermeasures targeting these factors have been applied. These have included physical traffic-management devices (such as speed humps or chicanes), publicity, punishment, and the threat of detection and punishment. A recent report by Corbett, Simon & O'Connell, (1998) states that while these measures are effective, they are "on their own unlikely ever to eradicate speeding…Drivers' and society's attitudes to speeding and to speed must therefore be changed." (pp. 47-48). This study aimed (in part) to investigate the relationship between internal factors, such as attitudes, and speed-related decisions and behaviours.

While the use of speed limits is a recognised countermeasure, it is clear that exceeding the speed limit is a common practice (Fildes & Lee, 1993). In an investigation of factors relating to speeding in Victoria prior to the introduction of high-intensity use of automated speed enforcement, Fildes, Rumbold & Leening (1991) found that only 9% of their sample were travelling below the speed limit and that the average speed was 12 km/h above the speed limit. Similar findings have also been reported in other jurisdictions (Beilinson, Glad, Larsen & Åberg, 1994; Kimura, 1993; Nilsson, 1992).

Several studies have shown that speed choice for individual drivers tends to be consistent over time (Kanellaidis, Golias & Zarifopoulos, 1995; Rothengatter, 1988; Wasielewski, 1984), suggesting that drivers may have habitual speed-related behaviours. This finding, in conjunction with the apparent normalcy of exceeding the speed limit, suggests that consistent speed-choice behaviours in individuals may be an issue of concern. It is likely that this consistency is the result of the action of internal or psychological factors. It would be expected, for example, that speed behaviour might be determined in part by cognitive, personality, attitudinal, motivational, perceptual, and emotional factors. The complexity of the factors influencing driver behaviour in the speed domain needs to be recognised in the development of successful speed programs.

The focus of speed-related programs in Victoria over the last decade has been the implementation of publicity and enforcement campaigns by the Transport Accident Commission and the Victoria Police respectively. There is evidence that these countermeasures have together been associated with reductions in road-crash casualties (Cameron, Haworth, Oxley, Newstead & Le, 1993; Newstead, Cameron, Gantzer, & Vulcan, 1995).

A key component of the Victorian effort has been the intensive use of automated speed enforcement. Research indicates that the introduction of speed cameras in Victoria has had a beneficial road safety effect (Cameron, Cavallo, & Gilbert, 1992; Rogerson, Newstead, & Cameron, 1994). Bourne and Cooke (1993) suggested that the introduction of speed cameras in Victoria helped reduce traffic collisions by more than 25%, injuries by 40% and fatalities by more than 45% (since 1989).

While research has supported the effectiveness of the use of speed cameras, there is clear evidence that speed camera effects in particular (and enforcement effects in general) may be specific to the location and time of enforcement (eg. Hauer, Ahlin & Bowser, 1982; Zaal, 1994). Further, few

studies have identified shifts in attitude towards speeding resulting from the effect of enforcement or other countermeasures. It seems that while these strategies (including the current speed camera program) have indeed been effective at reducing speeding behaviour, there is no evidence of associated long-term changes in drivers' attitudes to this behaviour (eg. DeWaard & Rooijers, 1994).

It has been suggested that there is a need to understand the underlying motivations of speeding drivers in order to alter their relevant belief and value structures so that long term driving behaviour changes can be established (Rothengatter, 1988). This may be of particular importance given the finding of the Roper survey (Anon., 1991) which found that drivers believe speeding is a relatively acceptable practice (in contrast to drink-driving behaviour, which was seen to be "intolerable").

This idea has been supported by recent calls to reach a better understanding of the attitudes and motivations that underlie speeding behaviour and unsafe speed choice (Blockey & Hartley, 1995; Elander, West, & French, 1993; Parker, Manstead, Stradling, Reason, & Baxter, 1992). A better understanding of the attitudes and motivations of speeding drivers could help in the development of better targeted programs for excessive speeding behaviour. A similar argument was made in the context of road safety practice and research in general by Harrison (1989), and in the context of drink-driving by Harrison (in press). A few studies have attempted to address this issue as it relates to speeding.

Kimura (1993) found a close relationship between drivers' attitudes towards speed and their self-reported behaviours in hypothetical situations. This study identified a particular type of speeding driver based on their attitudes. Fildes et al. (1991) examined the attitudes and behaviours of speeding drivers. They found that a large number of drivers believed that it was not dangerous to exceed the speed limit by 30 km/h. Further, many of these motorists believed that the likelihood of them being stopped by the police while exceeding the speed limit by 20 km/h was less than 50%, although the practical implication of this finding is uncertain.

This report reviews some literature relating to factors contributing to speed choice and consequently discusses a model of speed-related behaviours or speed-choice consistent with the literature. The report then details the method and results of a survey of drivers conducted to investigate the relationship between speed choice and a number of factors in the model.

FACTORS CONTRIBUTING TO SPEED CHOICE

This section of the report presents a review of the literature relating to the factors that have been shown to have an effect on the speed-related behaviours of drivers.

ENVIRONMENTAL CHARACTERISTICS

The environment can have a significant effect on speed choice and recent research has examined the impact that strategic manipulations of the driving environment have on drivers' behaviour.

Speed Limits

New speed limits were introduced or lowered in many countries in the early 1970's as a result of the international oil crisis as a means of energy conservation. One of the additional consequences of this measure was a reduction in road trauma (Fildes & Lee, 1993; Zaal, 1994).

Speed limits are generally set using the 85th percentile method, which sees the speed limit set to the speed at or below the speed at which 85% of drivers choose to travel (Zaal, 1994), although Fildes & Lee (1993) have suggested that the 85th percentile method may be inappropriate and may not be a true reflection of the speed that the majority of drivers believe to be acceptable. Regardless of the perceived credibility of the speed limits, however, there will most likely continue to be a group of road users who drive at speeds in excess of the speed limit (Zaal, 1994; Beilinson et al., 1994).

Some drivers explain their speeding behaviour as a result of inappropriate speed limits, and the mean speed has been found to increase when speed limits are lowered. Corbett et al. (1998) suggest that drivers may feel the speed limit is so unrealistic, once lowered, that they drive at a speed they consider safe in the circumstances.

In general, however, it might be argued that the speed limit at any one location acts to encourage drivers either to slow down (if their speed at that location exceeds the limit) or to speed up. The strength of this effect is unknown, however, and is likely to vary between drivers, and between different contexts for individual drivers.

Road Factors

Jennings and Demetsky (1983, cited in Fildes and Lee, 1993), identified a number of environmental variables they believed could influence drivers speed choice. These included:

- The general land use or population density of the area around the road – Metropolitan and rural areas generally have different speed limits and traffic volumes, and therefore different engineering and community expectations about speed choices.

- Roadside development – This refers to any aspect of the environment that is close enough to the roadway to influence driving. People generally perceive they are travelling at a greater speed when the roadside environment is built up or heavily treed, resulting in lower driving speeds.

- Road category and lane width – These were found to influence travel speed. Drivers are more likely to underestimate their speed on roads that are wide and with a higher design standard, resulting in higher driving speeds.

- Horizontal and vertical curvature – Curvature also may affect drivers speed choice. Single vehicle crashes (often speed related) are associated with horizontal curvature, though the frequency of curves does not seem to have an effect on the crash rate. There have been inconclusive studies concerning vertical curvature and speed choice, though some researchers have reported that sight distance influences driving performance (Michaels & Van der Haijden, 1978; Kadiyalia, Viswanathen, Jain & Gupta,1981 cited in Fildes & :Lee, 1993).

- Traffic density – Higher traffic density leads to a reduction in travel speed.

- Night and day – Time of day can effect speed choice. Although the ability to see the road ahead at night-time is greatly reduced, there is a marked increase in speed at this time.

- Trip purpose and distance - A number of studies have found that trip purpose and the distance travelled significantly affected speed and that drivers' control of speed diminishes over time.

SELF-CALIBRATION

Self-calibration refers to the assessment of one's own driving ability. Research indicates that drivers tend to overestimate their own driving abilities, particularly when comparing themselves to other drivers.

Overestimation

In their review of the literature Kanellaidis et al. (1995) suggested that drivers display a self-serving bias, whereby they perceive themselves and their abilities in a favourable light. Drivers tend to overestimate their ability and perceive themselves to be safer and more skilful than others (Svensson, 1981; Rumar, 1988). Guppy (1993) found that drivers perceive the likelihood of either accident or detection to be smaller for themselves compared to the average driver and that offending drivers (those who reported drink-driving and speeding behaviour) perceived a lower probability of being involved in an accident when compared to the non-offending drivers. Holland (1993) also identified the presence of this self-serving bias in drivers aged in their 70's, though it was somewhat less than that in younger drivers.

Research has shown that poor self-calibration is especially prevalent in younger drivers. Finn & Bragg (1986) found that young male drivers perceive their chance of being involved in an accident to be less than that of their same age peers and older males. Further, Matthews & Moran (1986) found that younger drivers (on average) perceive their abilities to be the same as those of older drivers, and superior to their own age peers. This is concerning when many studies have identified that younger drivers have higher accident and violation rates, and that younger drivers speed more, are involved in more rear-end collisions, adopt shorter headways, have a higher approach speed to traffic signals and underestimate stopping distances (Evans & Wasielewsky, 1983; Matthews & Moran, 1986). DeJoy (1992) found that calibration errors are more pronounced for young male drivers than young female drivers.

In terms of speed choice, it is likely that an over-estimation of driving skill will be associated with higher driving speeds, and that more-accurate or lower estimations of skill will discourage fast driving.

Perceived Control

Several researchers have suggested that perceived behavioural control may contribute to this over-estimation bias (Guppy, 1993; Holland, 1993; Parker et. al., 1992). Rumar (1988) has suggested that drivers' overestimation of their driving abilities could be supported by the feeling of being in control. Supporting this, Corbett & Simon (1992) found that drivers who were defined as high speeders explained their behaviour by saying that they felt in control. In later research these authors conclude that perception of control is critical, and that this is where effort to change attitudes should be concentrated (Corbett et al, 1998). Matthews & Moran (1986) found that when drivers felt themselves to be in control, they perceived their risk of being involved in an accident as being low. Further, Rumar (1988) states that drivers think that accidents are not random events but rather result from a lack of skill.

The notion that perceived control is a factor in crashes is consistent with Harrison's (1997) view that the shift from a deterministic internal model of the driving environment (where perceived control is high) to a probabilistic internal model (where perceived control is likely to be lower) is a critical factor in the increasing safety that accompanies the accrual of driving experience.

TRIP PURPOSE AND MOTIVATION

Trip purpose and motivation for driving have been found to influence drivers' speed choice. People generally perceive being on time as more important than any perceived (under-estimated) risks associated with speeding, so they tend to drive faster if they are time-pressured (Adams-Guppy & Guppy, 1995; Beilinson et al., 1994). Competitiveness, thrill-seeking and time urgency are important motivations which may also outweigh the perceived risk of speeding. Gregersen & Bjurulf (1996) support this, noting that these motives may influence a driver to choose a faster travelling speed. Speeding behaviour is more likely to be rewarded than punished as detection and crashes are relatively rare events and fast driving is reinforced in many ways.

Fildes et al. (1991) found that business travellers were more likely to drive relatively fast and those travelling for domestic purposes were more likely to be relatively slow.

VALUES RELATING TO LEGAL BEHAVIOUR

Some research has identified a group of drivers who travel within the speed limit as they believe that to do otherwise would be wrong. For example, Corbett and Simon (1992) identified a group of "low offending drivers who had decided never intentionally to break any (or most) traffic laws and referred to their moral commitment to the law". These subjects indicated that they actively sought not to commit traffic offences since the laws were designed so that average drivers would be in control of their actions if behaving within the law. Rothengatter (1988) proposed that a motivation for speed choice of drivers could be "the belief that one is seriously violating traffic law when driving above the limit". He suggested that there may be a group of drivers who are committed to traffic law and prefer

to abide with these rules. These values would be expected to correlate with other, more general moral values.

INTRINSIC ROAD SAFETY MOTIVATION

Drivers' general attitudes towards road safety may be an important factor in speed choice, although there has not been much research into this concept. Consistent with Protection Motivation Theory (PMT), developed by Rogers (1983, cited in Sturges & Rogers, 1996), it could be argued that driving speed might depend, in part, on the motivation of drivers to protect themselves from potential harm.

There is a developmental aspect within PMT. Younger people are known to be involved in greater risk taking (Gardner 1993) and it is also known that different attitudes towards health risks are present at different points in the life span.

Thus, it is possible that drivers are influenced in their speed-related behaviours and other safety-related behaviours by their more-general safety-oriented motivations.

SOCIAL FACTORS

The effects of social influences on behaviour are well documented in the social psychology literature (Zajonc, 1965; Cottrell, 1972; Henchy & Glass, 1968, cited in Guerin, 1993). The term 'social facilitation', originally coined by Allport (1924), describes the facilitation or inhibition of behaviour by the presence of other people, and generally refers to the strengthening of a dominant response in the presence of others. While the presence of other people seems to have an effect on behaviour, the actual mechanisms involved are complex and still unclear. Corbett et al. (1998) suggest that sociocultural context and societal attitudes may be important as an influence in speed choice.

Passengers

A number of studies have investigated the effect passengers have on driving behaviour. Drivers with passengers are less likely than solo drivers to commit traffic violations, including speeding (Baxter, Manstead, Stradling, Campbell, Reason & Parker, 1990; Wasielewski, 1984). Baxter et al. (1990) investigated the 'social facilitation' effect and found that drivers accompanied by older female passengers tend to drive more slowly, whereas the number of violations younger male drivers commit tends to increase when accompanied by other younger males.

One variety of social facilitation theory is the theory of social conformity, where the presence of another person can make salient the social value of certain behaviours and thus influence a person to conform to group norms. It may be that young males regard "good" driving as the ability to drive fast and control the car under difficult conditions and that this is the norm for young men though it is not in accordance with wider, societal norms. Under this theory, the reduction in violations in the presence of older women may relate to normative pressures from this group which would be expected to differ from those of younger males.

Parker et al. (1992) found both the time of day and the presence of passengers to have an effect on speed choice. Committing traffic violations (drink-driving, close following, dangerous overtaking) in

the presence of a passenger during the day was viewed more negatively, whereas at night this was viewed less negatively.

Age

Younger drivers tend to drive faster than older drivers (Baxter et al, 1990), and are more likely to believe that speeding on local roads or highways is acceptable (Anon., 1991). Young males as a group tend to violate traffic laws more often than any other group. Corbett & Simon (1992) suggested that young men feel a wider range of social and psychological pressures, such as the need to express individuality, rebelliousness, identification with a peer group, masculinity, one-up-manship, equality with other road users, to demonstrate skill or courage, to impress or please passengers, to live dangerously, to express freedom or independence, and to relieve frustration and impatience. It may also be the case that the maturational development of impulse-control skills leads younger drivers to be less capable of self-control in a driving environment. Krug & Cattell (1980) found that impulsiveness correlated negatively with age and that self-control correlated positively with age, indicating that younger people are generally more impulsive and show less self-control than older people.

PERCEIVED SPEED OF OTHER DRIVERS

There is a substantial body of research concerning the impact others have on behaviour (Allport, 1924; Milgram, 1965; Zajonc, 1965, as cited in Guerin, 1993). Such influences can be seen to have a direct or indirect effect, and Zaidel (1992) has suggested that it is the indirect influences and forces that may be of particular importance when considering the effects on drivers. Zaidel (1992) identified the following ways that speed choice might be influenced by other drivers' behaviour:

- Where other drivers' behaviour is used as a source of information about the current speed limit or appropriate speed for the driving context ;
- Where there is some level of communication between drivers, such as might be the case between heavy vehicle drivers using two-way radio or where flashing headlights is used as a signal of enforcement activity;
- Where drivers who are motivated to behave consistently with the normative behaviour of others use other drivers as their reference group; and
- Where drivers imitate those in their immediate environment.

There is considerable evidence that driver behaviour (including speed choice) is influenced by the behaviour of other drivers (Connolly & Åberg, 1993; Zaidel, 1992; Shinar & McKnight, 1985**;** Yinon & Levian, 1995). Kimura (1993), for example, found that the perceived speed of others was a predictor of speeding behaviour.

Connolly & Åberg (1993) and Van Houghton et al. (1985) found that cars travelling close to one another tend to drive at similar speeds and that this tendency is particularly strong for slower and faster drivers. Connolly & Åberg (1993) have suggested that this tendency could be specific to a particular road, situation or even weather condition. Nishiyama (1988, cited in Kimura, 1993), reported that car drivers' speed seemed to be dependent (in part) on the speed of other cars around them.

The importance of conforming with the perceived social norm and not standing out has received considerable attention in social psychological research (Cottrell 1972; Henchy & Glass, 1968).

Rothengatter (1988) noted that "Motivation for speed choice concerns the belief that…one deviates from the average speed when driving above the limit" (p. 604).

Beillinson et al. (1994) found that drivers' observed speeds are positively related to the perceived normal speed along a road segment and Zaidel (1992) has suggested that drivers adhere to the "social norm". Further, this author has suggested that this norm can be viewed as a "summary representation" of the opinion of others and as a consequence is subjective, which could in part explain the wide variety of behaviours exhibited by drivers.

This "social norm" could have an effect on both the slowing down and speeding up of traffic. Beillinson et al. (1994) has suggested that some drivers feel a pressure to drive at a faster speed in order to keep up with the traffic. This could contribute to the general speeding up of the traffic, since this author also found that many drivers wrongly perceive other drivers to be travelling faster than they really are. Parker et al. (1992) reported that drivers said they perceived more normative pressure to speed during the night and that the intention to avoid this behaviour at night was also weaker. Rothengatter et al., (1985, cited in Rothengatter, 1988), identified that drivers believe their speed would deviate from the average traffic speed if they travelled below the speed limit (travelling on undivided roads with an 80 km/h limit).

ENFORCEMENT AND DETERRENCE

Several researchers have found that speed behaviour and speed choice are affected by police speed enforcement (Hauer et al, 1982; DeWaard & Rooijers, 1994; Rothengatter, 1990). An illustration of this is the finding in Finland when, during a period when the police were on strike, the proportion of vehicles exceeding the speed limit by 10 km/h or more was found to increase by more than 50% (Summala, Näätänen & Roine, 1980). Further, Andersson (1991, cited in Cameron, 1992), found that when police speed enforcement increased (by a factor of 7 in the amount of enforcement time and by a factor of between 7 and 11 in the number of vehicles), the proportion of vehicles exceeding 50 km/h limits fell by 17 - 46%.

Many researchers have attempted to understand the relationship between speed enforcement and behaviour change through variations of rational choice theories of decision making. These theories suggest that drivers assess the costs and benefits of travelling at a particular speed (which may be in excess of the speed limit) before choosing their travel speed (Fildes & Lee, 1993; Zaal, 1994). This assumes that such decisions involve the weighing of the expected utilities (eg. time saving and thrills of risk taking) and costs (eg. consequences of breaking the law and getting caught and the increased likelihood of being involved in a crash) of speeding (Fildes & Lee, 1993). There are a number of problems associated with this account of the effects of speed enforcement on driving speed. These problems, and an alternative account, are discussed after the empirical relationship between enforcement and speed choice is discussed.

In the context of rational-choice models of the effect of police enforcement, it has been suggested that the pertinent factors considered by drivers when choosing whether or not to speed (Corbett & Simon, 1992, cited in Zaal, 1994) are the perceived risk of being caught, the fear of being caught, and the fear of likely punishment. Shinar & McKnight (1985) have suggested that the perceived risk of being caught is the crucial determinant as to whether or not a driver chooses to travel at an excessive speed. Thus it is held under this model that the primary aim of police traffic enforcement is to increase the risk of detection and thereby deter drivers from speeding behaviour (Zaal, 1994).

Principles of Enforcement

Under the rational-choice based deterrence model originally applied to drink-driving enforcement, police enforcement is believed to increase the perceived expected costs of speeding, through the detection and deterrence of speeding drivers (Fildes & Lee, 1993). There are a number of principles applied to speed enforcement under this model.

Deterrence - Specific and General

There are two types of deterrence believed to be important in the context of police enforcement of speeding. These are termed specific deterrence and general deterrence.

Specific deterrence relates to changing the behaviour of drivers by detecting and punishing them for an offence. By detecting and punishing individual drivers for exceeding the speed limit, it is believed that these drivers will be deterred from repeating this behaviour in the future (Zaal, 1994). The impact of this type of deterrence has been believed to be quite limited (Fildes & Lee, 1993), although in the context of high levels of automated speed enforcement it may be the case that specific deterrence is more important than it is in other driving and enforcement contexts. Some psychologists have questioned the effects that such constant negative reinforcement may actually have (Fildes & Lee, 1993), and there is still considerable uncertainty about the mechanisms underlying the effect of detection on subsequent behaviour.

General deterrence is the effect on speeding behaviour of the perceived threat or risk of detection and punishment for speeding. General deterrence also depends on the detection and punishment of drivers exceeding the speed limit, and influences the behaviour of potential speeding drivers through avenues such as education, knowledge of others who have been caught and punished, and the general fear of being caught (Fildes & Lee, 1993; Zaidel, 1992).

The two forms of deterrence are not mutually exclusive. High levels of specific deterrence would be expected to impact on general deterrence by means such as word of mouth (Fildes & Lee, 1993). To further illustrate this point, in the context of seatbelt usage, Watson (1986) found that an increased threat of legal punishment was an effective general deterrent. Mechanisms by which the threat of detection influences behaviour are also poorly understood, although in the case of drink driving, Harrison (1998) has developed a model of enforcement effects based on a naturalistic decision-making model which suggests separate underlying mechanisms for general and specific deterrence.

Perceived Risk of Detection

It has been suggested that the perceived risk of detection is more important than the actual risk of detection and punishment (Fildes & Lee, 1993; Zaal, 1994). In their review, Ostvik & Elvik (1990) concluded that drivers underestimate real increases in the actual risk of detection. For example, increases in levels of enforcement of three times the previous level had practically no effect on either the perceived risk of detection or on drivers' behaviour. These authors commented that increasing the perceived risk of detection is one of the most important objectives of all speed enforcement strategies. Rothengatter (1988) has suggested, however, that the subjective risk of detection increases only when the objective level increases. It seems that significant increases in the actual risk of detection are required to increase the perceived risk of detection. Fildes & Lee (1993) have suggested that the most effective method for manipulating this perceptual risk may be through the use of publicity.

A recent MUARC study examined the change in perceived risk of detection after increased enforcement activity in certain Police districts in Victoria. There was only a very small correlation between exposure to enforcement and the perceived risk of being caught for speeding. This suggests that the link between recent enforcement activity and perceived risk of detection may not be as strong as previously thought (Harrison & Pronk, 1998).

Effects on Different Types of Drivers

Evidence suggests that different types of drivers are affected by traffic enforcement in different ways. For example, Parker et al. (1992) found that males (and particularly young males) believe the negative outcomes of speeding (such as being fined) to be less likely than do other drivers. Hauer et al (1982) indicated that both fast and slow drivers tend to change their speed more in response to enforcement than do those near the speed limit. Corbett and Simon (1992) found that frequent traffic offenders perceived lower costs and more benefits in committing traffic offences including speeding than did other drivers.

DeWaard & Rooijers (1994) noted that speed enforcement can have differentially preventative effects. In particular, they found that non-offenders are particularly deterred from speeding in response to enforcement. These authors have suggested that the perceived probability of being detected prevents approximately 40% of all drivers from speeding. This, however, leaves 60% of drivers who may be speeders and who are not deterred from speeding by enforcement.

This raises the suggestion for the need to target the different groups with different enforcement and publicity approaches. For example, it may be important to target those speeders who have to date, been unaffected by the publicity and enforcement campaigns.

Deterrence and Publicity

Publicity and advertising campaigns can be used as an adjunct to police enforcement to reduce the speeding behaviour of drivers. Evidence suggests that changes in enforcement campaigns are best supported by complementary publicity campaigns (Zaal, 1994).

Rothengatter (1988) has suggested that the combination of publicity and enforcement campaigns is much more effective in the long-term. In Victoria intensive, emotive advertising campaigns have accompanied the speed enforcement program and research has suggested that early applications of this approach were effective in reducing speeding and the negative consequences associated with this behaviour (Bourne & Cooke, 1993; Cameron et al, 1993).

Publicity and advertising can contribute to the reduction of speeding through the action of general deterrence. Such campaigns can heighten the perceived costs of exceeding the speed limit, and can do this using informative or emotive approaches. Thus, publicity campaigns in conjunction with observations of police enforcement activities can increase the perceived risk of detection (Zaal, 1994). Further to this, publicity can have an impact on community awareness of road safety issues (Elliott, 1993).

Problems with a Deterrence Model of the Effects of Enforcement

There are a number of reasons to be concerned about the application of the deterrence model (eg. Homel, 1988) to the effect of speed enforcement activity and publicity on speed behaviours. While it

is clear that both enforcement and publicity do impact on speed choice, it is also clear that recent developments in the area of behavioural decision making reduce the likelihood that the original deterrence model is an appropriate way of accounting for these effects.

In some respects the deterrence model has been treated as true by road-safety practitioners and researchers without significant efforts to understand the mechanism underlying the effects of enforcement activity on behaviour, and without attempts to test the model in the usual ways. Indeed, Homel's (1988) application of deterrence to drink-driving starts from the basis that the deterrence model is appropriate in the driver-behaviour domain.

The deterrence model is based loosely on rational or normative models of decision making which in turn are based on the notion that decisions about behaviour involve a process which includes information about the likely outcomes of the various behavioural options and the relative utility of each possible outcome. Deterrence theory draws on a subset of decision-making theories that include a rational component, and in particular draws on subjective expected utility (SEU) theory which has its genesis in attempts to understand how people make uncertain economic decisions (Lehto, 1997). The decision-making process is viewed as rational in the sense that behavioural options which are perceived to have relatively positive outcomes are more likely to be chosen than those with less positive or negative perceived outcomes.

Homel's (1988) application of the deterrence model to drink driving and subsequent applications of the same model to other road-use behaviours such as speeding (eg. Harrison, 1987) and red-light running (eg. South, Harrison, Portans, & King 1988) relied on the same concepts – that unsafe road use behaviours represent the outcome of a decision process which incorporates a rational cognitive process to determine the relative utility of various potential behaviours in a particular road-use situation or context.

The main thrust of recent research in the decision-making area has been an increasing understanding of the ways in which day-to-day decisions are made in relation to day-to-day behaviours. While it might be the case that a rational approach to planned decision-making is sensible in terms of maximising the long-term success of behavioural decisions, there is little evidence that this type of process is the basis for day-to-day behavioural choice in humans where decisions are made at points in time near to the behaviour of concern rather than in advance of the behaviour in a planned fashion. The deterrence model assumes a behavioural-choice process which may not occur naturally, especially in the context of a behaviour such as speeding.

Since the original application of SEU theory and the deterrence model to drink-driving and enforcement by Homel (1988) there have been a number of developments in the decision-making area which have not been considered in relation to road safety research. In particular, Klein, Orasanu, Calderwood, & Zsambok (1993) (amongst others) have considered a number of naturalistic decision-making models which attempt to account for behavioural choices in natural environments without recourse to the concept of the human as a rational decision maker or to a mechanism which weighs alternatives or compares outcomes in terms of expected utility as required under classical decision making theory.

Lehto's (1997) review recognises that current developments in two areas represent a revolution in thinking about behavioural decisions. The recognition-primed decision-making model originally developed by Klein (1989) emphasises the role of the recognition of situational cues and the application of previously learned behaviours associated with the recognised cues. The levels of task performance model (Rasmussen, 1983; Lehto, 1991) takes into account the multiple levels of cognitive control of behaviour emphasised more recently in relation to driver behaviour by Harrison et al. (1997, Harrison, 1997), noting that knowledge-based or judgement-based processes are rarely utilised as the cognitive system is designed to generate behaviours in a way that minimises cognitive workload.

Both the recognition-primed model and the levels of performance model exclude rational processes in their consideration of the ways in which behaviours are generated. In relation to road-safety and drink-driving in particular, recent research by McKnight, Langston, McKnight, & Lange (1995) supports the emphasis of these models on naturalistic decision-making processes and on the importance of lower (relatively automatic) levels of processing in the generation of drink-drive behaviours.

It is suggested here, therefore, that the rational decision-making basis of the deterrence model is less than adequate as an assumed process in behavioural choice. The potential for alternative decision-making models to be applied to the link between enforcement and behaviour in the same way as the rational deterrence model, and then to be used as the basis for further policy development needs to be explored. This is one aim of the present report, and in a sense this work is consistent with current theoretical developments in the drink-driving area (Harrison, in press, & 1998).

THE MODEL

This section outlines a model of speed choice which was used as the structural basis for the review of the literature presented above. The use of a model such as the one proposed here was considered appropriate in this context, where the large literature concerning the many factors influencing driving speed was potentially unmanageable without applying some form of structure.

The presentation of the model serves another purpose, however. It was hoped that developing a model of speed choice based on cognitive processes might result in the identification of additional research possibilities and the development of additional ideas for speed countermeasures. At the very least, Harrison's (1989, in press, 1998) arguments about the need to develop an improved understanding of the psychological, cognitive, or behavioural factors underlying unsafe driving behaviour encouraged the development of a new model of speed choice.

A COGNITIVE BASIS FOR SPEED CHOICE

It has been argued elsewhere that driving behaviours are, at least in part, the result of a number of interacting cognitive mechanisms. Harrison et al. (1997), for example, noted that automated processes have an increasing impact on driving as drivers accrue experience. In a recent conference paper, Harrison (1997) applied theoretical developments in the cognitive domain (eg. Cowan, 1995) to the development of safe driving skills and concluded (amongst other things), that driving experience influences driving behaviour through the development of complex internal models or representations of the driving environment. As driving experience accrues, these internal representations are thought to activate automatic behavioural responses to cues in the changing driving environment.

It is argued here that speed choice needs to be viewed as a fluid process rather than as the result of a single choice at a point in time. The necessity of a fluid view of speed choice is underscored by the substantial evidence that driving speed varies depending on a range of characteristics of the driving environment (Jennings & Demetsky, 1983; Westerman, 1990; Brindle, 1980). As aspects of the dynamic driving environment can influence speed-related behaviour, it is clear that driving speed (ie. speed choice) will vary moment by moment.

Further support for the notion that speed choice behaviours reflect underlying continuous processes arises from recent developments in decision-making theory in psychology (eg. Klein, 1993; Lipshitz, 1993), where the focus has moved from rational, utility-based, normative models of decision making to the processes underlying behavioural decisions in naturalistic, complex environments such as that in which driving occurs. In the context of developments such as these, speed choice or decisions may be seen as ongoing processes which modify driving speed based on the presence or absence of cues in the environment (or within the driver) which are associated with increases or reductions in driving speed.

Developments in cognitive psychology (eg. Cowan, 1995; Reason, 1990) suggest that behaviours are likely to result from two general cognitive processes. One involves the processing of environmental and internally-derived information under the control of attention. This process might be regarded as conscious information processing. It is slow, subject to interference from other events competing for attention, and is workload-intensive within the constraints imposed by a limited-capacity attentional system.

The other general cognitive process is unconscious and automatic in nature, relying on pattern-matching processes rather than attentional processing of information. Under this general process, aspects of the environment are matched automatically to similar situations or more general schemata stored in memory and behaviours are generated based on the behaviours associated with the remembered situation. This process is thought to be largely automated and is likely to be the basis for many skilled behaviours (such as driving) which develop with experience. As experience accrues, the range of stored situations and linked behavioural responses increases, leading to automatic behavioural responses which are more appropriate to specific situations. This process is likely to be the basis of the naturalistic decision-making processes discussed by Klein (1993) and is argued to be one basis of drink-driving behaviour by Harrison (1998).

The second (automated) cognitive process provides a mechanism by which the efficiency of cognitive processing and the selection of behaviours is improved. In situations that are not novel or in some way salient or threatening, the driver (in the case of road-use behaviours) does not need to allocate limited conscious processing power. Instead, automatic mechanisms match the context to stored representations and generate an appropriate behaviour. It is clear that many driving errors could potentially result from this type of mechanism, especially in inexperienced drivers. Never-the-less, Reason (1990) argues strongly that this pattern-matching process is the preferred cognitive process. Thus, the human information processing system is biased towards less workload-intensive mechanisms to generate behaviours.

This automated, pattern-matching process may provide the basis for understanding the way in which environmental, social, and intrapersonal factors impact on speed behaviour.

APPLYING COGNITIVE PROCESSES TO SPEED BEHAVIOURS

The successful application of developments in cognitive psychology and decision-making theory to speed behaviours relies on the conceptualisation of speed choice as a fluid process. It also relies on a reconceptualisation of the nature of the behaviours critical to speed choice.

An underlying assumption in much of the speed-related literature appears to be that driving at a particular speed is the behaviour of interest. Under this assumption, a decision-making process sets a speed appropriate for the particular driver and the particular circumstances. The driver's behaviour is conceptualised as "driving at a particular speed".

It is proposed here that this view of speed behaviour does not reflect the nature of the processes likely to be involved in speed behaviours and that driving speed relies on processes which result in "speed up" or "slow down" responses. It is proposed that these "change speed" behavioural responses are more appropriately viewed as the behaviours of interest in studies of the effects of various factors on driving speed.

Under the model proposed in this section, particular aspects of the driving environment or the person are, moment-by-moment, matched automatically to stored characteristics of the driving context. Where matches occur, "speed up" or "slow down" behaviours are generated based on behaviours previously associated with the stored characteristics. Speed behaviour reflects the net effect of these "speed-up" and "slow-down" responses generated at each point in time via the pattern-matching process.

The activation of some internally-stored characteristics of the driving context are likely to result in "slow-down" behaviours. These might include wet or slippery road conditions, symbols of

enforcement activity, corners in the road, child pedestrians, and so on. Some are likely to result in "speed-up" behaviours. These might include factors relating to the trip purpose and motivation to reach the destination and the social context of driving. Internal characteristics of the driver are also likely to bias the behaviour-generation process towards "speed-up" or "slow-down" behaviours. At any one point in time it is proposed that driver behaviour (speed up or slow down) reflects the net effect of many such influences. Thus, at a particular point in time, the driver's behaviour will reflect the combined effect of "slow-down" responses activated by some aspects of the driving context and "speed-up" responses activated by others

It is proposed that the strength of speed-change responses associated with internal representations of driving contexts will vary in strength as well as direction, and that they will also vary in strength and direction between drivers and within drivers at different times depending on the particular experiences and characteristics of the driver.

THE MODEL

This model is presented in Figure 1, which shows some of the contextual factors that are proposed to influence driving speed via the pattern matching and speed-change processes outlined above. The model in Figure 1 includes some additional factors which are likely to place upwards or downwards pressure on driving speed and which are not part of the external driving context. These include the general perceived risk of detection, values relating to legal behaviour, and intrinsic road safety motivation. It is suggested here that these factors act directly on speed responses in the same way as activated internal representations of the driving context.

Driving speed, therefore, is argued here to be the outcome of a balancing act between speed-change responses activated by the matching of different aspects of the driving environment with internal representations, and speed-change responses or pressures associated with a number of relevant intrapersonal characteristics. The net effect of the range of "speed-up" and "slow-down" responses is a momentary increase or decrease in driving speed which then becomes one input into the next momentary speed-change decision.

While the data in this project were not intended to test the model in a formal sense, a part of the discussion section focuses on the consistency of the data and the model. There is substantial potential for this model to impact on the development and targeting of countermeasures. It's focus, for example, on the automaticity of some speed-related behaviours under naturalistic decision-making models suggest that some features of public education campaigns may be more successful than others. This issue is discussed later.

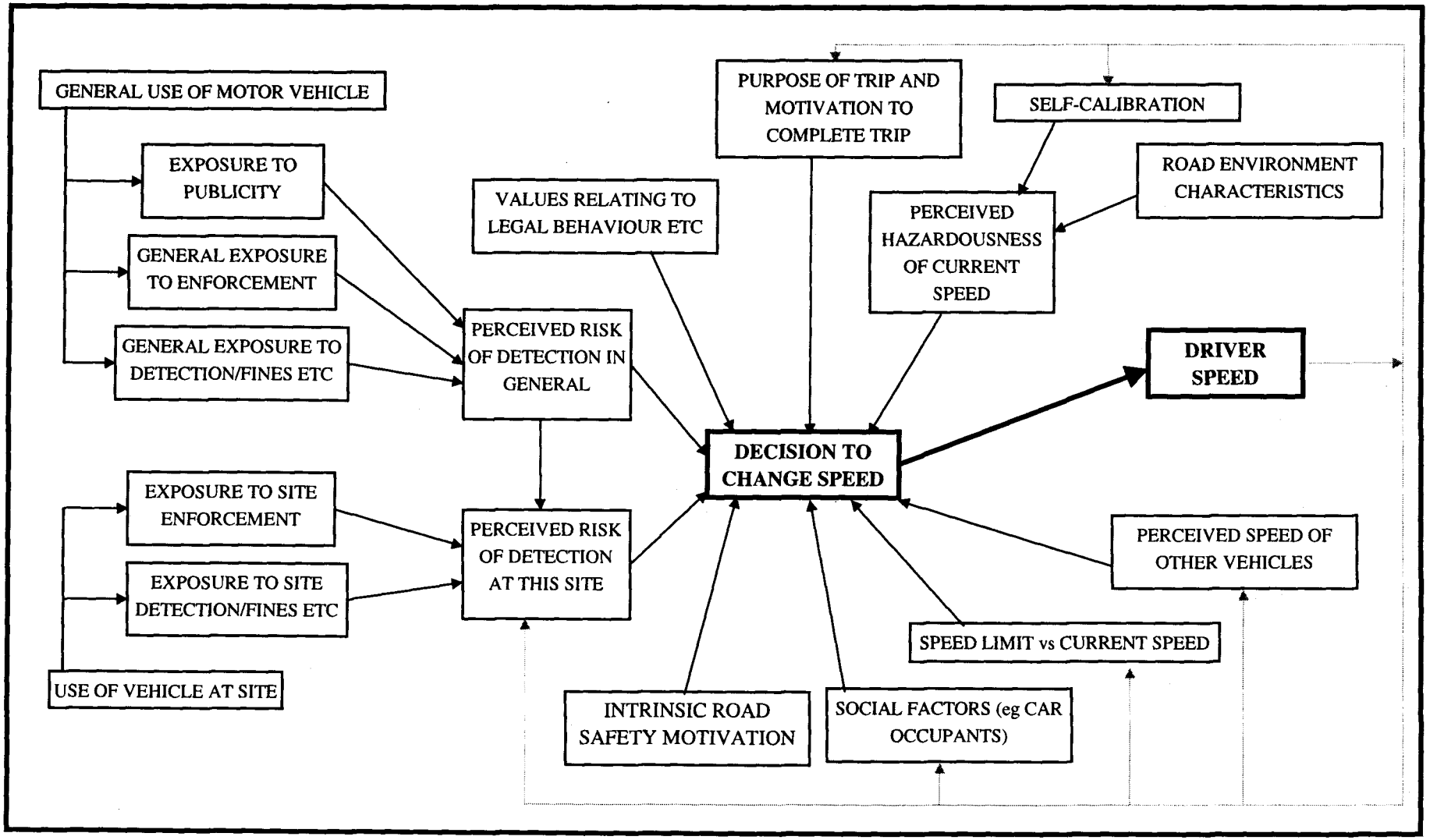

Figure 1: Speed Choice Model

OUTLINE OF THIS PROJECT

The current project was designed:

- to collect data relevant to the structure of the model in Figure 1, to determine at an exploratory level the potential validity of the model, although it was not possible here to assess the strength of the change-speed behaviours in the model;
- to collect data concerning the general relationship between a number of variables and speed choice; and
- to collect speed-related data to investigate the change in speed behaviours in the period since a similar project was conducted in 1991 (Fildes, Rumbold, & Leening, 1991).

The method used was largely a repeat of the method used in Fildes et al. (1991), and three of the original four sites were used to allow comparisons between Fildes et al.'s results and those obtained here.

METHOD

PARTICIPANTS

Participants were 496 drivers who agreed to be interviewed at three sites in Victoria. Data were collected at one rural site and two urban sites. Vehicles' speeds were measured using a laser speed detection gun borrowed from the Victoria Police, and drivers were asked to take part in the survey. Participants were unaware that their speed had been measured, and at each site the speed measurements were conducted in such a way as to ensure that the laser gun was used as near to front-on to the direction of traffic motion as possible.

Data collection occurred over 5-6 days at each of the three sites. For 3-4 days data were collected between the hours of 12pm and 6pm and on two days they were collected between the hours of 12pm and 8pm, thus including data for drivers on the road network in the early evening. Safety issues precluded the collection of data at night. Data collection took place between November, 1997 and April, 1998, as shown in Table 1. Data were collected on weekdays only.

Table 1: Data Collection at Each Site

SITE	DATA COLLECTION PERIOD	NUMBER OF SPEEDS MEASURED	NUMBER OF INTERVIEWS
Calder Hwy, Woodend	17/11/97 - 21/11/97	694	125
Beach Rd, Parkdale	17/2/98 - 24/2/98	1024	169
Belmore Rd, Balwyn	16/3/98 – 23/3/98	692	202

SITE SELECTION

The sites were chosen to match sites used in an earlier study by Fildes et al. (1991). The rural site was the Calder Hwy, Woodend, and the urban sites were Beach Road, Parkdale and Belmore Road, Balwyn. The previous study collected data at an additional rural site near Euroa, however this site could not be used in the present study as traffic volumes had decreased substantially as a result of the construction of a bypass. Fildes et al. (1991) selected each site on the basis that:

1) it was an appropriate environment (a flat straight or curved section of road with an adequate sight distance);
2) there was a normal distribution of free speeds;
3) that there was a suitable location for both speed measurement and interviewing; and
4) that where possible, it was a known accident black spot.

The safety of each site was considered, both from the point of view of the participants and the research staff involved in the study. Safety considerations resulted in some minor changes to the placement of speed measurement staff and interview staff from those locations used in the original

Fildes et al. study. These were not considered substantial enough to impact on the results of the present study.

Residents (and shop-owners at the rural interview site) were informed of the study and the presence of the research team, as were appropriate VicRoads, local government, and Victoria Police representatives.

Urban sites

Beach Road, Parkdale is a four lane arterial road between the Nepean Highway and Warrigal Road, with a speed limit of 60 km/h. It is a residential area with the beach and foreshore on one side of the road and few access routes. It has a high volume of traffic, particularly medium to heavy vehicles, and is a high-accident location. Speeds were measured from a car in a car park 700 metres south of the Parkers Road pedestrian lights, for north-bound traffic. The road at the measurement location is straight. The pedestrian lights were used to stop traffic and drivers (if they agreed) were directed to the Parkdale Yacht Club car park, approximately 400 metres further north for interviews.

Belmore Road, Balwyn is also a four lane arterial road, between Union and Balwyn Roads, with a 60 km/h speed limit. Speeds were measured from Bruce Street on a curved section of road (with approximately a 500 metre radius) for vehicles travelling westwards. Belmore Road is also in a residential area, with a higher proportion of residential vehicles. Vehicles were stopped at the pedestrian operated traffic signals near Alandale Ave, and the car parking area near the traffic signals was used for interviews.

Rural site

The Calder Highway at Woodend is a two lane highway with a fairly high volume of traffic (Woodend is situated on the main route between Melbourne and the rural city of Bendigo). Speed measurements were conducted at a site about 3 km west of Woodend for eastbound traffic. Vehicles had just come out of a bend with a 500 metres radius when their speed was measured. The section of road is called the "Avenue of Honour" and there are many large trees by the side of the road. This section of road is known to be a high-accident risk location. The speed limit is 100 km/h. Interviews were conducted in the Woodend township, using the pedestrian operated traffic signals between Tylden-Woodend Road and Anslow Street to stop vehicles.

PRELIMINARY SPEED MEASUREMENT

Prior to data collection, free speeds[1] were measured at each site to investigate the distribution of vehicle speeds at the selected sections of road; the range of speeds that could be expected; and to establish speed categories. The data collected on these days was used to determine the speed categories for collecting data during the interview-component of the project. No further analysis was conducted using these data.

[1] Free speed is determined by the speed that a driver chooses to travel, and not one that is influenced by other vehicles on the road. Vehicles were not measured if they were in a group of cars or following another car, however the first car in a group could be measured as it was assumed that its speed was the free speed chosen by the driver. All speed measurements in this study were measurements of free speed.

The free speeds were measured in the same way that speed was measured during data collection, in an inconspicuous vehicle using a police laser gun. This new technology allowed discreet measurement of speed that could not be detected by radar detectors. The preliminary speed data were collected over approximately four hours during one weekday prior to the data collection week at each site.

The mean speed recorded at the Calder Highway, Woodend was 85.5 km/h (SD=9.1). Five speed bins were established which reflected the free speed distribution. These were 79 km/h or less, 80-88 km/h, 89-95 km/h, 96-100 km/h and 101 km/h or greater.

The mean speed recorded at Beach Road, Parkdale was 66.4 km/h (SD=9.1). Six speed bins were established for this site. They were 55 km/h or less, 56-60 km/h, 61-65 km/h, 66-70 km/h, 71-75 km/h and 76 km/h or greater.

The mean speed recorded at Belmore Road, Balwyn was 64.8 km/h (SD=6.9), and five speed bins were established. These were 55 km/h or less, 56-60 km/h, 61-65 km/h, 66-70 km/h and 71 km/h or greater.

Appendix A gives a detailed description of the distributions of free speeds recorded for each of the sites and a comparison with the preliminary free speed data collected by Fildes et al (1991).

DATA COLLECTION

An inconspicuous car was positioned in an appropriate location to measure the speeds of oncoming vehicles. Appendix C includes site maps for each of the three sites used in this study. Two research assistants measured and recorded the free speeds of oncoming cars with a police laser gun. It was necessary to measure speeds without being observed to ensure that responses to the interview questions were unbiased by drivers' awareness of having had their speeds measured.

Vehicles' speeds were measured only if they were passenger cars, four wheel drive vehicles, or small passenger vans. Commercial and heavy vehicles and motorcycles were not included in the study. Free speeds were measured by the speed measurement team for subsequent analysis. Quota sampling to fill the speed bins discussed above was then applied to select vehicles for interview-data collection, and the speed, registration and description of potential sample vehicles were relayed to the interview team using a two-way radio. Interviewers were not informed of the sample vehicles' observed speeds. The interviewer approached the targeted vehicle and invited the driver to be involved in the survey. Drivers were offered a small reward for participating – either a pocket diary at the Woodend site or $5 at the other sites.

If the driver agreed to be involved in the study they were directed to a car park where the interviews took place. If the driver refused they were thanked, and information was recorded about them and the car to determine the degree of selection bias. The first page of the questionnaire was used to record information about those who declined to participate.

Three to four research assistants conducted the interviews. An information sheet was offered to drivers explaining the project (but not disclosing that their speeds had been measured) and stating that information provided for the study was confidential and for research purposes only. The interview took between five and ten minutes.

The speed-measurement component of the study was noticed by very few participants, and some media coverage of the study identified only the interview sites and not the accompanying speed-measurement (at Woodend and Beach Road).

ATTITUDE ASSESSMENT

The questionnaire used by Fildes et al. (1991) was designed to investigate drivers' attitudes concerning speeding, and some other related issues. The questionnaire used in this study was modified from the Fildes et al. questionnaire and is included in Appendix B. The questionnaire was designed to collect information about each participant's driving exposure; trip details; assessment of their own travel speed and attitudes towards speeding; attitudes towards some moral issues; offence history and their accident history over the last five years.

Attitudes towards speeding were assessed by showing participants a colour photograph of the section of road where their speed had been unobtrusively measured and asking questions about their speed and other speed related perceptions they had on that section of road. Their perceptions of their own speed could then be compared with their actual speed, as measured by the laser gun. Some general information was also collected.

DATA ANALYSIS

Data analysis was conducted using SPSS for Windows. Descriptive analyses and an analysis of the relationship between observed speed and some other items were conducted for each site, followed by a more complex analysis of the data to examine in more detail the relationship between observed speed and a range of driver and vehicle characteristics.

The data analysis was planned to conform largely to the analysis method in the original Fildes et al. (1991) study, although some variations were necessary to ensure the use of appropriate techniques. The multiple regression analyses in the Fildes et al. study were not repeated here as it was considered that the data did not meet the assumptions required for this statistical technique. The factor analyses were repeated, but using a technique appropriate for the inclusion of dichotomous data in the analysis.

DESCRIPTIVE RESULTS

The environmental and situational characteristics of each of the three sites used in this study differed substantially, presumably influencing driver behaviour in different ways. For this reason each site was examined separately. This section presents descriptive analysis of the free speeds recorded during the study period, sample characteristics and driver and vehicle characteristics in relation to observed speed. Driver attitudes and their relationship with observed speed were explored, and the data were analysed using factor analysis.

SURVEY SPEED DISTRIBUTIONS

Free speed data were collected for many vehicles during the study period as described in the method section. The following section describes the speed distributions for all vehicle speeds measured during the study period. The vehicles selected for participation in the survey (using the quota sampling discussed above) were a subset of the vehicles included in the speed distributions discussed here. The distributions presented below therefore represent vehicle free speeds at the sites over the survey periods prior to any sampling process.

Calder Highway, Woodend

The speeds of 694 vehicles travelling on a straight stretch of road 3 km prior to the township of Woodend were measured. The mean speed was 92.7 km/h with a standard deviation of 8.8 km/h. The 85^{th} percentile speed was 101 km/h, and the 15^{th} percentile speed was 84 km/h. The speeds measured ranged from 62 km/h to 125 km/h. The speed limit along this section of road is 100 km/h, and of the 694 vehicles whose speeds were measured, 18% were measured travelling above this limit. Figure 2 illustrates the distribution of speeds measured over the four study days. The speeds observed in the current study at Woodend were similar to the speeds observed by Fildes et al. (1991), where the mean speed was found to be 92.4 km/h (SD=9.9) and the 85^{th} percentile value was 103 km/h.

Beach Road, Parkdale

The speed of 1024 vehicles travelling on a straight section of road in an urban environment was measured. The mean speed was 66.9 km/h with a standard deviation of 8.5 km/h. The 85^{th} percentile speed was 75 km/h and the 15^{th} percentile speed was 59 km/h. The speeds measured ranged from 36 km/h to 105 km/h. Of the 1024 vehicles whose speeds were observed, only 22% were observed travelling at or below the speed limit of 60 km/h. Figure 3 shows the distribution of speeds observed over the six study days.

Fildes et al. (1991) found the mean travel speed on this section of road at a similar time of year to be higher at 72.3 km/h (SD=10.2), and only 9% of drivers were observed travelling at or below the speed limit.

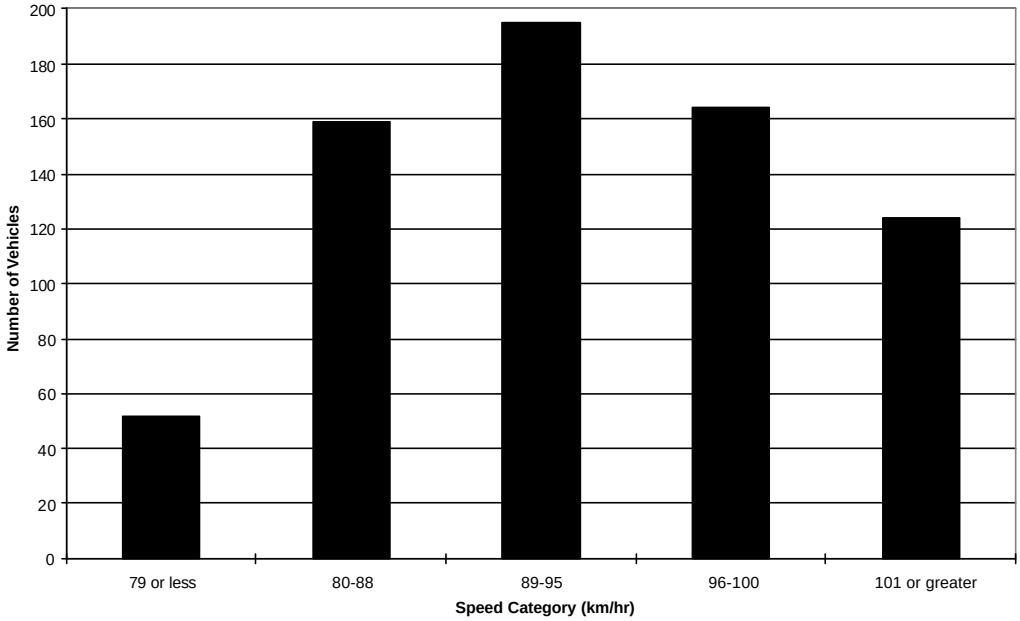

Figure 1: Free Speed Distribution of Vehicles on the Calder Highway, Woodend

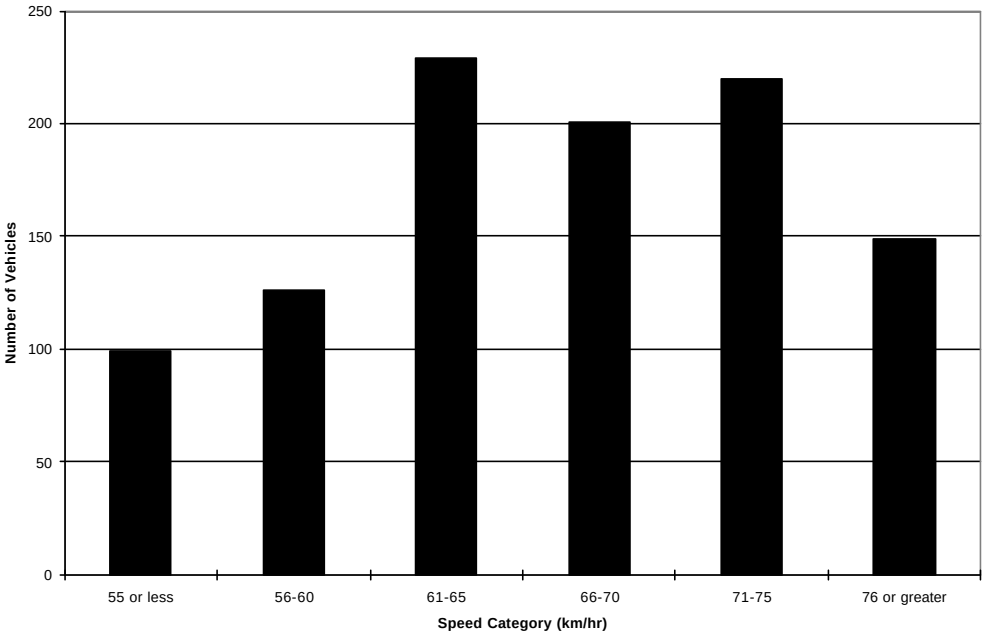

Figure 2: Free Speed Distribution of Vehicles at Beach Road, Parkdale

The lane in which vehicles were travelling was recorded for 94% of all vehicles observed at the Beach Road site. The mean speed of vehicles travelling in the curb-side lane was 64.9 km/h and 69.1 km/h for vehicles travelling in the centre lane. Figure 4 shows the speed distribution according to the lane in which the vehicle was travelling. Fildes et al. (1991) found greater variation in

observed speed between the two lanes in 1990 (70.2 km/h in the curb-side lane and 80.5 km/h in the centre lane).

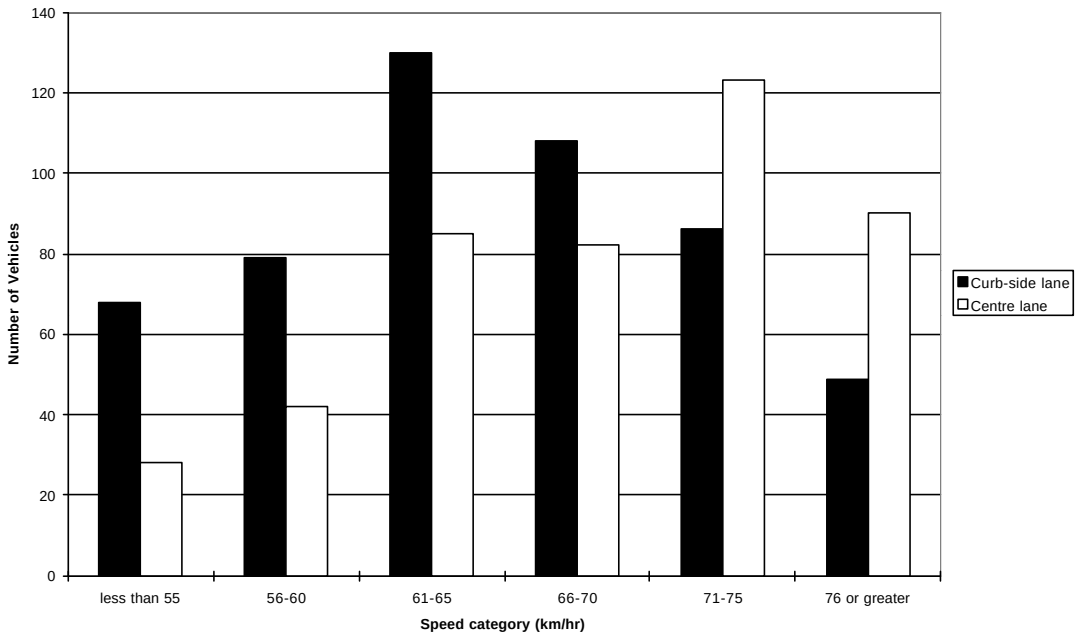

Figure 3: Vehicle Speed by Lane at Beach Road, Parkdale

Belmore Road, Balwyn

The speed of 692 vehicles was measured as they came out of a curve at Belmore Road, Balwyn. Vehicles observed during the study days had a mean speed of 61.4 km/h and a standard deviation of 6.6 km/h. The 85th percentile speed was 68 km/h and the 15th percentile speed was 55 km/h. The lowest speed measured was 32 km/h and the highest speed measured was 86 km/h. Of the 692 drivers whose vehicle speeds were recorded, 45% were observed travelling at or below the speed limit of 60 km/h. Figure 5 shows the distribution of observed speeds at this site.

The speeds observed by Fildes et al. (1991) at Belmore Road were similar to those observed in the current study. The earlier study found the mean speed to be 62.3 km/h (SD=6.8) and that 40% of drivers were travelling at or below the speed limit.

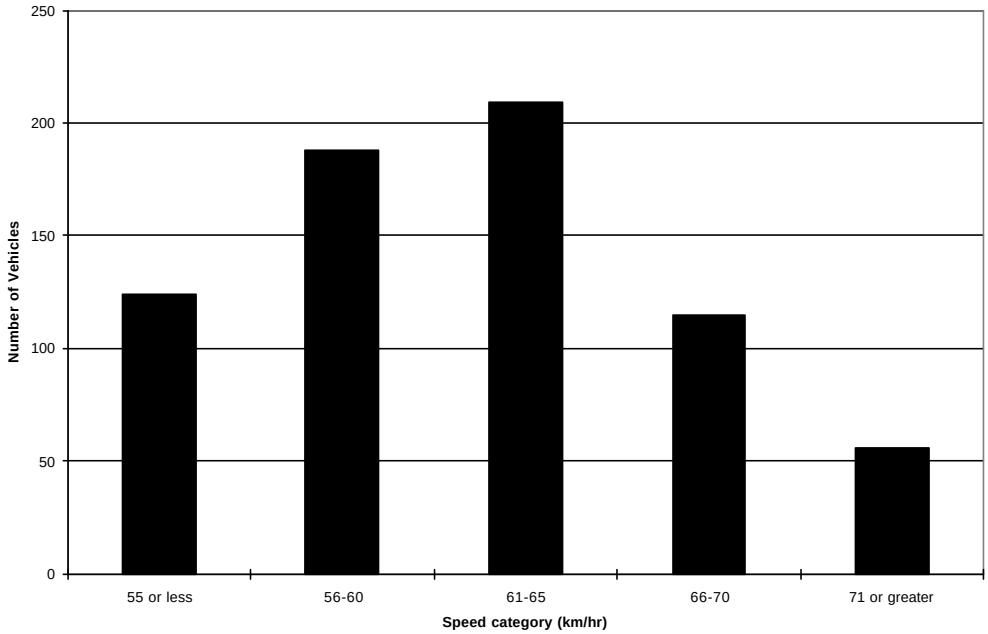

Figure 4: Free Speed Distribution of Vehicles at Belmore Road, Balwyn

The lane in which vehicles were travelling was recorded for 94% of all the vehicle speeds observed. The mean speed for vehicles travelling in the curb-side lane was 59.8 km/h and 62.8 km/h for vehicles travelling in the centre lane. Figure 6 shows the observed speeds of vehicles according to the lane in which they were travelling.

These speeds are very similar to those found by Fildes et al. (1991), where the mean speed observed in the curb-side lane was 61.7 km/h and vehicles travelling in the centre lane had a mean speed of 62.8 km/h.

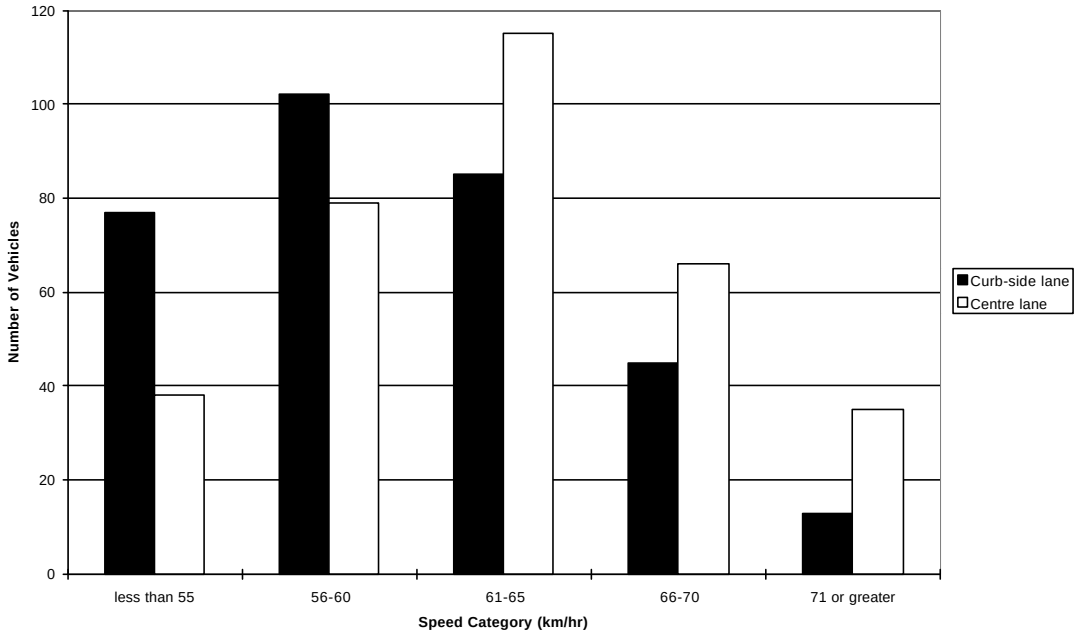

Figure 5: Vehicle speed by Lane at Belmore Rd, Balwyn

Summary of results

Table 2 gives a brief overview of the results found in the current study compared with those found by Fildes et al. (1991). The greatest difference between studies was found for Beach Road, Parkdale, where the mean speed has reduced by 5.4 km/h and the percentage of drivers travelling over the speed limit has reduced by 13%.

Table 2. Summary of Speed Distribution Results

	Variables	Current study	Fildes et al. (1991)
Calder Highway, Woodend	Mean speed	92.7 km/h	92.4 km/h
	Standard deviation	8.8 km/h	9.9 km/h
	% vehicles travelling above the limit	18	not reported
Beach Road, Parkdale	Mean speed	66.9 km/h	72.3 km/h
	Standard deviation	8.5 km/h	10.2 km/h
	% vehicles travelling above the limit	78	91
	Mean speed centre lane	69.1 km/h	80.5 km/h
	Mean speed curb-side lane	64.9 km/h	70.2 km/h
Belmore Road, Balwyn	Mean speed	61.4 km/h	62.3 km/h
	Standard deviation	6.6 km/h	6.8 km/h
	% vehicles travelling above the limit	55	60
	Mean speed centre lane	62.8 km/h	62.8 km/h
	Mean speed curb-side lane	59.8 km/h	61.7 km/h

SAMPLE BIAS

A subset of drivers whose speeds were measured were selected by the survey team for participation in the study based on the quota sampling discussed above. These drivers were stopped and asked to participate. There was some concern that those who were stopped and asked to participate might differ from those who refused so data concerning some driver and vehicle characteristics were collected for both those drivers who agreed to participate in the study and those who refused. These were examined to determine whether the sample of drivers interviewed was biased in any of the variables common to the two groups.

Calder Highway, Woodend

One hundred and twenty five (40%) of the 314 drivers stopped at the pedestrian lights in Woodend and asked take part in the survey agreed to do so. The refusal rate was independent of the day of the interview (χ^2=5.5, p>.05) and the time of day[2] that drivers were asked to participate (χ^2=3.3, p>.05). The refusal rate was also independent of driving speed (χ^2=.16, p>.05). There was, however, a significant relationship between refusal rate and the sex of the driver (χ^2=4.6, p<.05), where males

[2] The day was divided into four time periods; morning (10:00-12:00), early afternoon (12:01-15:00), late afternoon (15:01-1800) and evening (18:01-20:00).

were more likely to refuse to take part in the survey. The refusal rate for males was 64% compared to females where it was 52%.

It was difficult to investigate the relationship between refusal rate and driver age as the scale used to record driver age differed for refusers and participants. There were three broad age categories for those who did not wish to participate, compared to seven categories for those who did. This difference was a result of the need to reduce the difficulty of the age-estimation task for those drivers who refused to participate.

Of those who did not wish to participate, 31 (21%) were estimated to be between 18 and 29 years of age, 121 (68%) between 30 and 59 years of age and 20 (11%) were estimated to be over 60 years of age. Of those who agreed to participate, 4 (3%) were between 18 and 20, 7 (6%) were between 21 and 24, 18 (14%) were between 25 and 34, 34 (27%) were between 35 and 44, 32 (26%) were between 45 and 54, 23 (18%) were between 55 and 69 and 7 (6%) were over 70. Figures 7 and 8 show the age distributions for the group who refused to complete the survey and the group who did complete the survey respectively. There was no reason to believe that the age distributions varied markedly between refusers and participants.

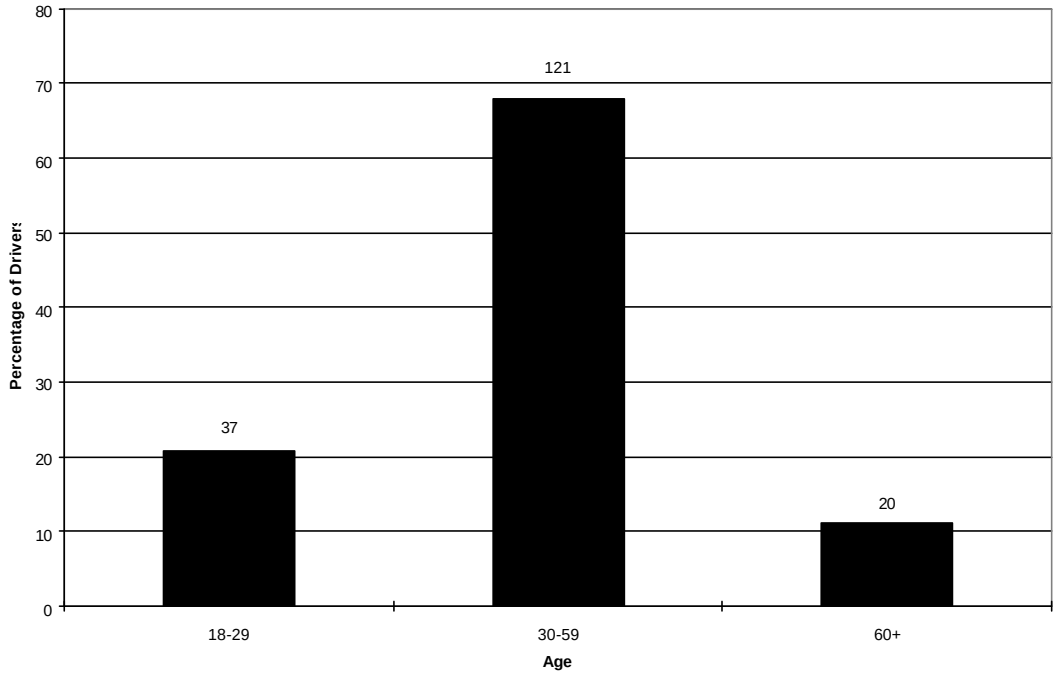

Figure 6: Distribution (including Number of Drivers) of Estimated Age of Refusers, Calder Highway, Woodend

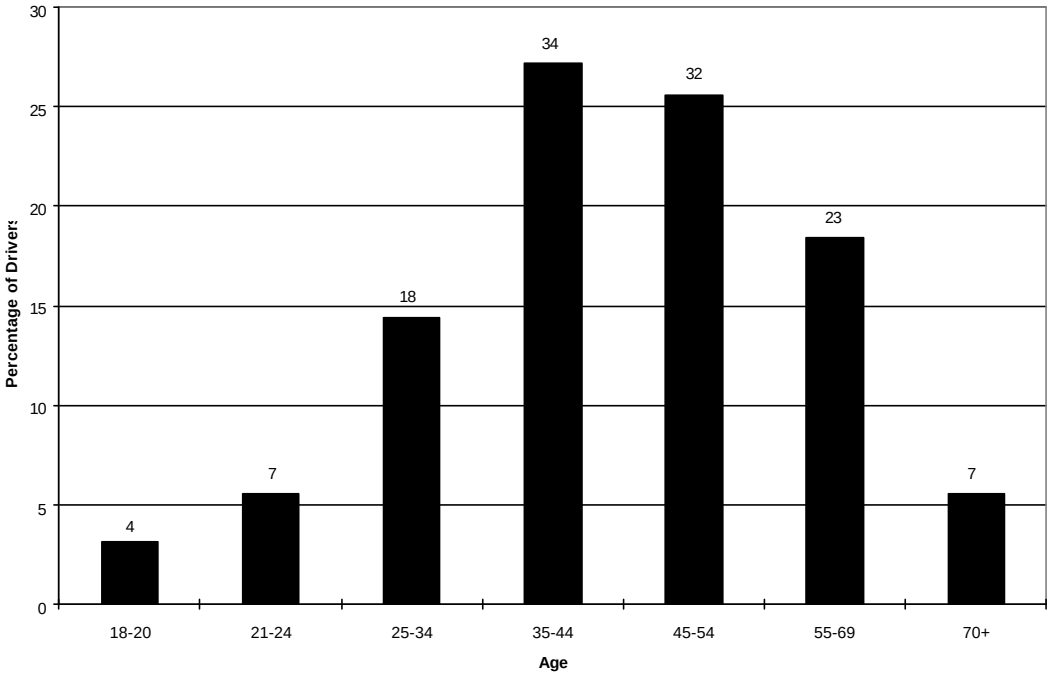

Figure 7: Distribution (including Number of Drivers) of Self-Reported Age of Drivers who Completed the Survey, Calder Highway, Woodend

The type of vehicle was classified into one of five discrete groups, based on classifications determined by NRMA, RACV, RTA and VicRoads (1996). *Small cars* consisted of hatch and small bodied cars (eg. Toyota Corolla), *medium cars* included Toyota Camry and Nissan Bluebird, large *cars* consisted of 'family' cars with a large body (eg. Holden Commodore, Ford Falcon), *four-wheel-drives* (eg. Toyota Landcruiser, Nissan Pajero) and *commercial vehicles* which were utilities and vans (including passenger vans). There was no relationship between the refusal rate and the type of vehicle driven (χ^2 =.26, p>.05) nor the estimated year of manufacture of the car (χ^2=2.8, p>.05).

No vehicles towing a trailer were stopped and asked to take part in the study at Woodend. The display of P-plates did not significantly effect in the refusal rate (χ^2=0.9, p>.05), nor did the number of occupants in the vehicle (χ^2=1.5, p>.05).

Only 14 (11%) of those who completed the survey said they were behind schedule, however the most common reasons given by those who did not wish to participate related to being time pressured. The reasons given for declining to participate were coded. Thirty-four percent of drivers said they were late or in a hurry, 15% had an appointment to get to or were working, 27% were either on their way somewhere or doing something else, 10% said no without giving a reason and 15% of drivers gave other reasons for not participating in the survey.

Thus, the group who refused to participate only differed from the group who agreed on one quantified factor, the sex of the driver. Males were more likely to refuse than females. It is possible, however, that refusers were more likely to be time pressured than were participants. The data presented above suggest that the sample of drivers who agreed to participate in the study did not differ substantially from those who refused.

Fildes et al. (1991) found a slightly higher acceptance rate of 45%. They found that younger drivers were more likely to agree to be interviewed. Neither study found a relationship between speed group and interview rate, nor did Fildes et al. (1991) find a relationship between interview rate and sex of

the driver. Fildes et al. (1991) found the interview rate increased with the age of the vehicle. This finding was not confirmed in the current study, though neither study found that class of vehicle driven had a relationship with interview rate. Fildes et al. (1991) also concluded that the differences in response rate were not substantial enough to bias further analysis.

Beach Road, Parkdale

One hundred and sixty nine (28%) of the 614 drivers stopped at the pedestrian lights and asked if they would like to take part accepted, giving a 72% refusal rate. Fildes et al. (1991) found the refusal rate at urban sites was considerably higher than at the rural sites, and for this reason a higher refusal rate was expected for the urban sites in the present study. A significant relationship was found between the refusal rate and day of the study (χ^2=15.6, p<.05). The number of refusals on Friday was less than on the other days of the week, particularly earlier weekdays. Figure 9 shows the refusal rate by day of interview. The refusal rate was independent of the time of day that drivers were asked to participate (χ^2=4.2, p>.05), the sex of the driver (χ^2=1.2, p>.05), driving speed, (χ^2=11.0, p>.05), and the lane that the driver was travelling in when their speed was measured (χ^2= .0, p>.05).

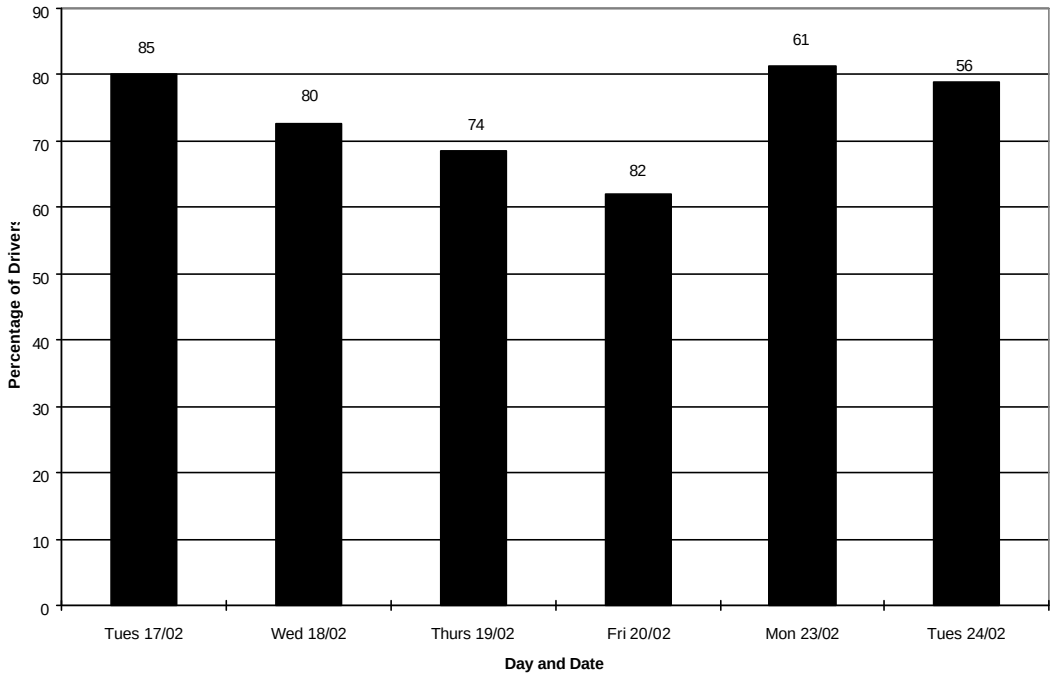

Figure 8: Refusal Rate (including Number of Drivers) by Day of Week at Beach Road, Parkdale.

As discussed previously, it was not possible to examine the relationship between refusal rate and age, however of those who refused, 94 (22%) were between 18 and 29, 279 (65%) were between 30 and 59 and 57 (13%) were over 60. Of those who accepted, 9 (5%) were between 18 and 20, 16 (9.5%) were between 21 and 24, 42 (25%) were between 25 and 34, 30 (18%) were between 35 and 44, 39 (23%) were between 45 and 54, 22 (13%) were between 55 and 69 and 11 (6.5%) were over 70. Figures 10 and 11 show the age distribution for the group who refused to completed the survey and the group who did complete the survey respectively. Again the age distribution was assumed to be approximately equivalent for refusers and participants.

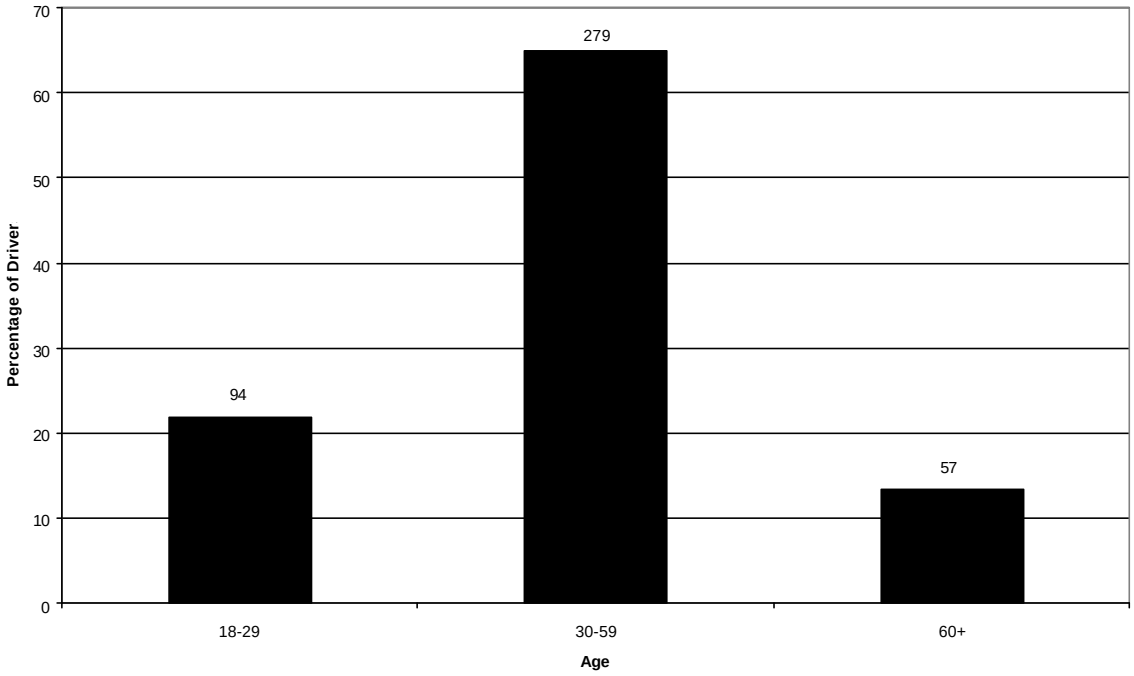

Figure 9: Distribution (including Number of Drivers) of Estimated Age of Refusers, Beach Road, Parkdale

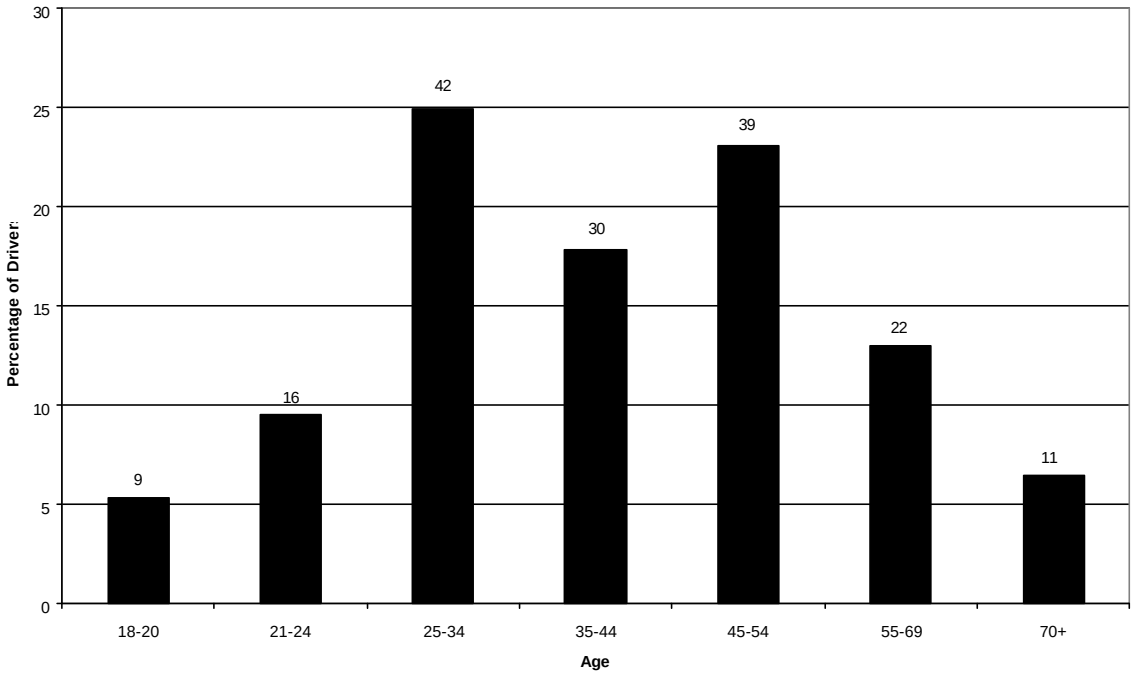

Figure 10: Distribution (including Number of Drivers) of Self-Reported Age for Drivers Who Completed the Survey, Beach Road, Parkdale

There was no significant relationship between refusal rate and the type of car driven (χ^2=8.4, p>.05), however refusal rate was dependent on the year of manufacture (χ^2=8.4, p<.05) with those driving newer cars being more likely to refuse to participate. Figure 12 shows this relationship.

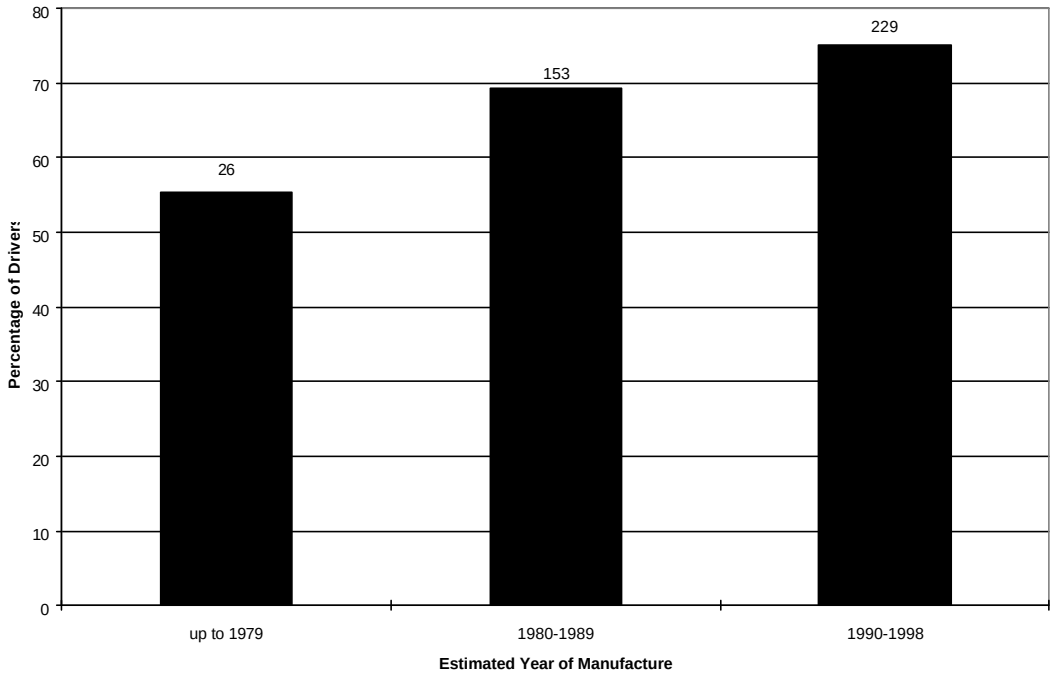

Figure 11: Refusal Rate (including Number of Drivers) by Estimated Year of Manufacture of Cars at Beach Road, Parkdale

Very few cars were towing a trailer and there was no significant relationship between refusal rate and whether or not a trailer was towed (χ^2=1.7, p>.05), nor was there a relationship between refusal and displaying P-plates (χ^2=3.8, p>.05). The number of occupants was also independent of refusal to participate (χ^2=2.2, p>.05).

Only 21 (12%) drivers who completed the survey said they were running behind schedule but this was the predominant reason given for refusing to participate in the study. Of the reasons given for refusing to participate, 41% said they were either late or in a hurry, 9% were going to an appointment or were working, 20% of drivers were either on their way somewhere or doing something else, 16% said no without giving a reason and 14% gave other reasons for not completing the survey. These results suggest that drivers who were not time-pressured were more likely to participate.

In conclusion, more drivers agreed to complete the survey at the end of the week and a greater number of drivers of newer vehicles refused to participate. It was considered that these characteristics did not substantially bias the sample, although it was apparent here, as was the case at Woodend, that the sample may have been biased towards drivers who were not under pressure to complete their trip.

Fildes et al. (1991) reported a higher acceptance rate (35%), with 206 drivers agreeing to be interviewed. They found that days in the middle of the week had a higher acceptance rate, whereas the current study found that drivers were more likely to agree to participate towards the end of the week. There was no relationship between speed group or sex of the driver and interview rate for either study. A distribution of ages similar to that in Fildes et al. (1991) was found in the current

study, however Fildes et al. (1991) found a slight over-representation of older and younger drivers in their urban sample. No relationship was found between class of vehicle and interview rate in either study, however the current study found that drivers of older cars were more likely to agree to participate.

Belmore Road, Balwyn

Two hundred and two (39%) of the 692 drivers stopped at the pedestrian lights and asked to participate in the survey agreed, which was similar to the acceptance rate in Woodend and higher than that found at Beach Road. There was a significant relationship between refusal and day of the survey (χ^2=25.2, p<.05). The rate of refusal on the first Monday and Tuesday of the study was high and there was a relatively low refusal rate on Thursday. Figure 13 shows the refusal rate by day of the study.

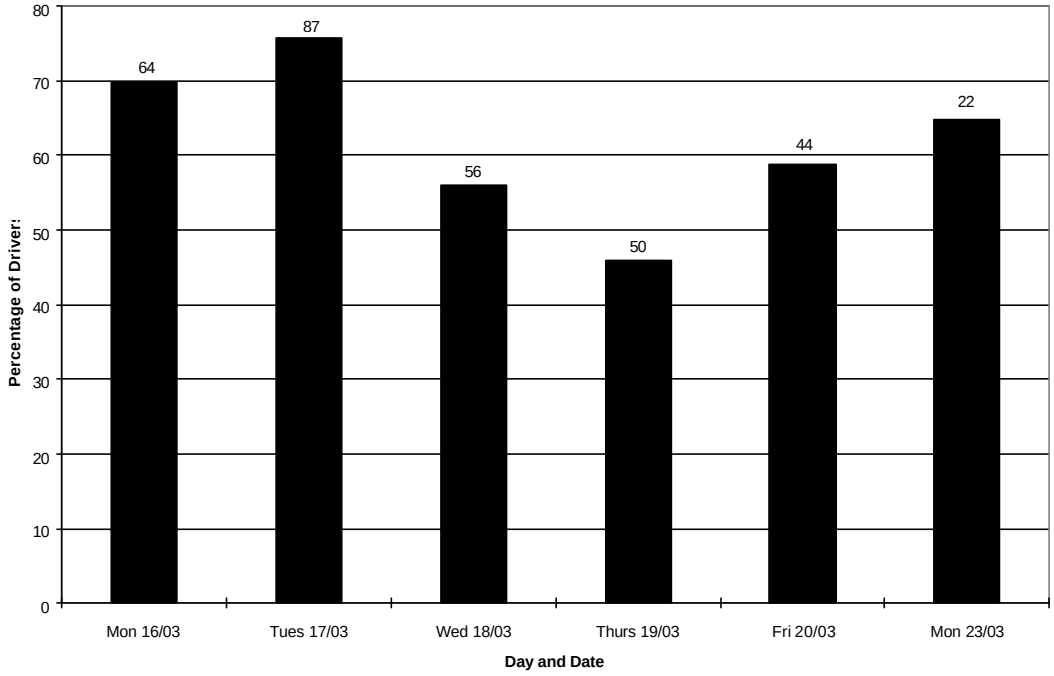

Figure 12: Refusal Rate (including Number of Drivers) by Day of Week at Belmore Road, Balwyn

Refusal rate was independent of the time the driver was asked to participate in the study (χ^2=7.7, p>.05), their observed speed (χ^2=3.5, p>.05), and the lane the driver was travelling in when their speed was measured (χ^2=.0, p>.05). The sex of the driver and the refusal rate were also independent (χ^2=1.8, p>.05).

Of the drivers who refused to take part in the survey, 70 (22%) were between 18 and 29 years old, 196 (62%) were between 30 and 59 years old and 52 (16%) were over 60 years old. Of those who agreed to take part, 9 (5%) were between 18 and 20, 17 (8%) were between 21 and 24, 28 (14%) were between 25 and 34, 52 (26%) were between 35 and 44, 35 (17%) were between 45 and 54, 39 (19%) were between 55 and 69 and 22 (11%) were 70 or over. Figures 14 and 15 show the age distribution for the group who refused to completed the survey and the group who did complete the survey. The distributions do not seem to differ substantially from each other.

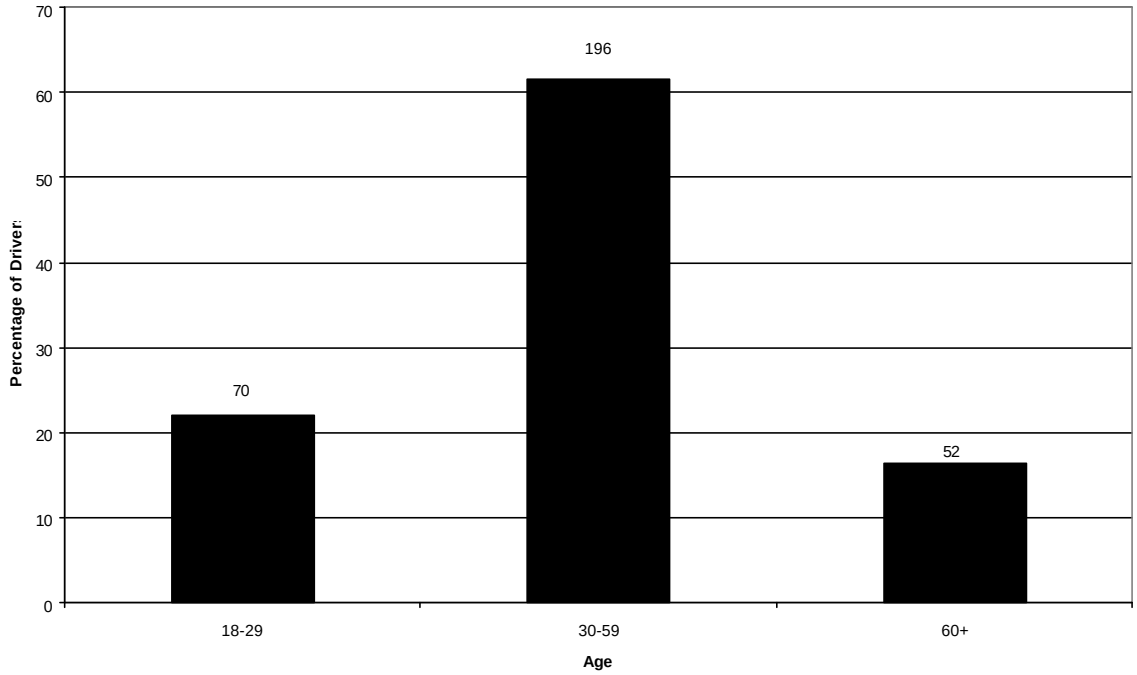

Figure 13: Distribution (including Number of Drivers) of Estimated Age of Refusers, Belmore Road, Balwyn

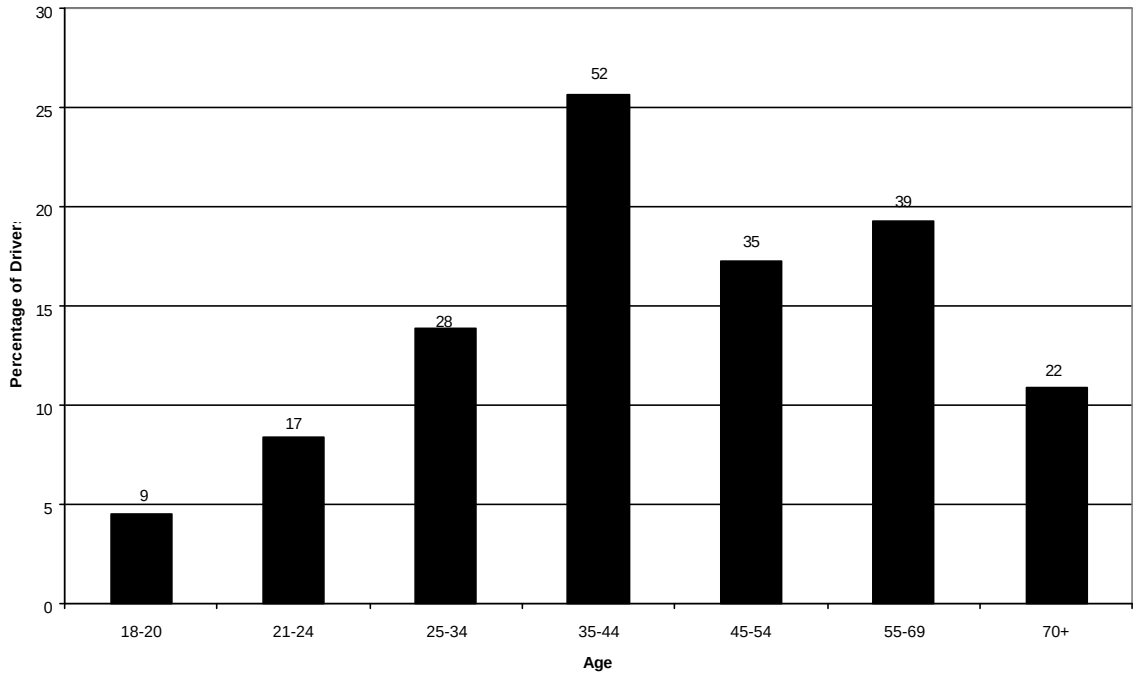

Figure 14: Distribution (including Number of Drivers) Of Self-Reported Age for Drivers Who Completed the Survey, Belmore Road, Balwyn

There was no significant relationship between refusal rate and the type of car driven (χ^2=2.5, p>.05) or the estimated year of manufacture (χ^2=4.8, p>.05). There was only one car towing a trailer at Belmore Road. There was no relationship between refusal rate and the display of P-plates (χ^2=.9, p>.05) or the number of occupants in the vehicle (χ^2=.6, p>.05).

Ten percent of the drivers interviewed said they were behind schedule. Again the most common reason given for refusing to participate in the study was being time pressured. Of those who refused to do the survey, 37% said they were late or in a hurry, 16% were on their way to an appointment or working, 27% were on their way somewhere or they were doing something else, 7% said no without giving a reason and 14% gave other reasons for not participating.

One hundred and seventy-six (26%) drivers agreed to be interviewed at this site in the previous study. This is lower than the rate achieved in the current study. Again there were fewer refusals at the end of the week in the current study, whereas Fildes et al. (1991) found a higher acceptance rate mid-week. Fildes et al. (1991) also found that drivers aged between 35 and 44 years were least likely to participate. These authors concluded, as in the current study, that there were no factors that could significantly influence the results due to sample bias. In conclusion, the only factor which differentiated between the group who agreed to participate and the group who refused was the day the interview took place. The refusal rate was higher at the start of the week. It was apparent again, however, that the sample may have been biased towards drivers who were not under time-pressure.

For all sites, critical variables, such as observed speed and the sex of the driver were unrelated to refusal to participate. On the basis of this analysis of the data collected for both refusers and participants, it was considered that the samples collected at each site were not substantially biased towards particular types of drivers.

Summary of results

Table 3 shows a summary of the variables indicating a potential sample bias. It was concluded by both Fildes et al. (1991) and the current authors that those who agreed to participate in the study, and those who refused were essentially similar on the characteristics measured.

Table 3 Summary of Sample Bias Results

	Variables	Current study	Fildes et al. (1991)[1]
Calder Highway, Woodend	Acceptance rate	40%	45%
	Sex	Males more likely to refuse	
	Day of study	Independent	Acceptance higher in middle of week
	Age	Independent	At Woodend young drivers more likely to agree to be interviewed
	Year of manufacture	Independent	Acceptance higher for older vehicles
	Observed speed	Independent	Independent
	Time Pressure	Refusers likely to be time pressured	Refusers likely to be time pressured
Beach Road, Parkdale	Acceptance rate	28%	35%
	Day of study	Acceptance higher at end of week	Acceptance higher in middle of week
	Age	Independent	Drivers aged under 34 and over 70 were more likely to participate
	Year of manufacture	Acceptance higher for older vehicles	
	Observed speed	Independent	Independent
	Time Pressure	Refusers likely to be time pressured	Refusers likely to be time pressured
Belmore Road, Balwyn	Acceptance rate	39%	26%
	Day of week	Acceptance higher in middle of week	Acceptance higher in middle of week
	Age	Independent	Drivers aged under 34 and over 70 were more likely to participate
	Observed speed	Independent	Independent
	Refusers	Refusers likely to be time pressured	Refusers likely to be time pressured

[1]Combined Woodend and Euroa data

SAMPLE VARIABLES

This section describes the characteristics of the sample of drivers interviewed at each site.

Calder Highway, Woodend

Of the 125 participants at Woodend, 4 (3%) were between 18 and 20, 7 (6%) were between 21 and 24, 18 (14%) were between 25 and 34, 34 (27%) were between 35 and 44, 32 (26%) were between 45 and 54, 23 (18%) were between 55 and 69 and 7 (6%) were over 70. Forty eight percent of the sample interviewed was female. A very high proportion of drivers were wearing seat belts (97.6%).

Seventy-six (61%) vehicles were occupied solely by the driver, 37 (30%) had two occupants, 7 (6%) had three and 4 (4%) had four or more occupants. Three percent of drivers interviewed were displaying P-plates. Sixty-eight participants (54%) were driving a large car, 25 (20%) were driving a small car, 16 (13%) were driving a medium car, 10 (8%) were driving four-wheel drives and 6 (5%) were driving commercial vehicles. The year of manufacture was coded into broad categories: 1990 or later; 1980-1989; and 1979 or earlier. Sixteen vehicles (13%) were manufactured in 1979 or earlier, 41 (33%) were manufactured in the 1980's and 66 (53%) were manufactured in the 1990's. The most common makes of car were Ford, Holden, Mitsubishi and Toyota, and the most popular models were Falcon, Commodore and Magna.

Eighty-four (67%) drivers interviewed were driving their own vehicle. Fifty-nine (47%) drivers were on a business trip, 39 (31%) were driving for recreation or holiday, 19 (15%) of the drivers were completing domestic duties and 8 (6%) of drivers gave other as the purpose of their trip. As would be expected in a rural area, most drivers interviewed drove a substantial number of kilometres each week. Only 9 (7%) drivers drove less than 100km per week, 24 (19%) drove 101-200km per week, 31 (25%) drove 201-400km per week, 25 (20%) drove 401-600km per week and 36 (29%) drove more than 600km per week.

Thirty-two participants (26%) travelled on the Calder Highway in and near Woodend daily, 35 (28%) used it weekly, 24 (19%) used it monthly, 17 (14%) used it more than once each year, 12 (10%) used it yearly and 5 (4%) drivers were travelling along that section of road for the first time.

Most drivers were on schedule. Eighty-three (66%) were on time, 9 (7%) ahead of schedule, and 14 (11%) were behind schedule. For 65 (52%) respondents, the current trip they were on was their first trip that day. Of those who were not making their first trip for the day, 36 (60%) had made one other trip, 10 (17%) had made two and 14 (23%) had made three or more other trips. Sixty-nine (56%) drivers had been travelling for an hour or less and 14 (11%) of drivers claimed to have started their trip 7.5-11 hours earlier. Eight-eight (70%) drivers predicted an hour or less of travelling time until they reached their destination. Travelling time to Melbourne from Woodend is about one hour, which may explain why the majority of drivers estimated reaching their destination within an hour.

Thirty-seven (30%) drivers reported that they were not at all tired and one hundred and six (85%) drivers rated 5 or less on an 11 point scale of tiredness (where 0 means not at all tired and 10 means extremely tired). Sixty-two (52%) drivers had not taken a break during their current trip and 63 (46%) had taken a break in the last hour of driving.

Drivers were asked how safe they were compared to other drivers their age if they were to travel 20km/h over the speed limit. Nine drivers (8%) rated themselves as much safer, 67 (63%) thought they were safer than other drivers, 27 (25%) thought they were less safe than other drivers and 4 (4%) drivers rated themselves as much less safe than other drivers their age.

Drivers were asked questions about their driving history. Twenty-six (21%) drivers interviewed had been involved in an accident in the last five years, and of these 19 (73%) had been involved in one accident, 5 (19%) in two and 2 (8%) in three. Five drivers reported that in their accident someone involved had needed medical assistance. The majority of drivers had been caught for speeding (71%) and the mean amount of time that had passed since they had been caught was 62.3 months (SD=85.1). Seventy-nine (93%) of those who had been caught speeding were fined for the offence. Twenty-three (18.5%) drivers had been caught by the Police for other traffic offences (not including parking offences). The mean number of months that had passed since the driver had been caught for another traffic offence was 99.2 and 17 (85%) drivers had been fined at the time. The mean amount of time that had passed since someone the driver knew had been caught for speeding was 9.4 months (SD=18.0)

As a crude measure of drivers' likely exposure to Transport Accident Commission television advertising, drivers were asked how much television they watched on an average weeknight. Seventy one percent of drivers watched two hours or less of television on an average weeknight.

Beach Road, Parkdale

Of the 171 drivers who agreed to complete the survey, 9 (5%) were between 18 and 20, 16 (9.5%) were between 21 and 24, 42 (25%) were between 25 and 34, 30 (18%) were between 35 and 44, 39 (23%) were between 45 and 54, 22 (13%) were between 55 and 69 and 11 (6.5%) were over 70. Fifty percent of respondents were male. One hundred and fifteen (68%) vehicles were occupied by the driver only, 39 (23%) had two occupants, 12 (7%) had three occupants and 4 (2%) had four or more occupants.

Seven percent of the drivers interviewed were displaying P-plates. The distribution of the type of car driven on Beach Road was less varied than in Woodend. Fifty-three (31%) participants were driving a small car, 41 (24%) were driving a medium car, 59 (35%) a large car, 11 (6%) a four-wheel drive and 7 (4%) were driving commercial vehicles. Twenty-one (13%) vehicles were estimated to be manufactured in 1979 or earlier, 68 (40%) were manufactured in the 1980's and 76 (44%) were estimated to have been manufactured in the 1990s . Again the most common car models stopped were Ford, Holden, Toyota and Mitsubishi. The most popular models were Commodore, Falcon, Magna and Corolla. Ninety four percent of drivers were observed to be wearing a seat belt.

One hundred and thirty four (79%) drivers interviewed were driving their own vehicle. Sixty-nine (41%) were on a business trip, 59 (35%) were travelling for recreation or holidays, 34 (20%) were completing domestic duties and 7 (4%) gave other as the purpose of their trip. In comparison to the rural sample, the drivers stopped on Beach Road drove fewer kilometres per week. Twenty-seven (16%) participants drove less than 100km per week, 36 (22%) drove 101-200km per week, 50 (30%) drove 201-400km per week, 30 (18%) drove 401-600km per week and 26 (15%) drove more than 600km per week. Seventy-three (44%) drivers reported driving along Beach Road daily, 64 (38%) used it weekly, 15 (9%) used it monthly, 6 (4%) used it more than once each year, 4 (2%) used it yearly and 6 (4%) were driving there for their first time.

Seventy-three (43%) drivers were on time, 22 (13%) drivers claimed that they were ahead of schedule, 21 (12%) were behind schedule and 53 (31%) did not have a schedule. Seventy-one (43%) respondents were on their first trip when stopped and approached by the research team. Of those who were not on their first trip, 42 (45%) of drivers had made one other trip, 18 (19%) of drivers had made two, 15 (16%) of drivers had made three and the remainder had made four or more other trips that day. One hundred and ten (66%) drivers had started their trip up to an hour before being stopped at the pedestrian lights and 136 (81%) planned to complete their trip within the next hour. Again most drivers did not report feeling tired, with 147 (87%) rating 5 or less on the 11 point

scale. Ninety-one (55%) drivers had not taken a break during the trip that they were on and 82 (43%) drivers had stopped for a break in the last hour.

When asked to rate how safe they were when driving 20km/h over the speed limit compared with other drivers their age, 22 (13%) said they were much safer than other drivers, 115 (69%) said they were safer, 26 (16%) said they were less safe and 3 drivers (2%) said they were much less safe.

Fifty-four (32%) drivers had been involved in an accident in the last five years, and of these, 39 (72%) had had one accident, 7 (13%) had had two accidents and 8 (15%) had had three or more accidents. Of the drivers who reported being involved in an accident, nine reported that someone who had been involved required medical assistance.

One hundred and eighteen (70%) drivers interviewed reported that they had been caught for speeding and 106 (92%) had been fined for the offence. The mean number of months that had passed since drivers had been caught was 44.3 (SD=53.4). Thirty-two drivers had been caught by the Police for other traffic offences and 25 (93%) had been fined. The mean number of months that had passed since driver's were last caught was 51.2 (SD=52.6). The number of months that had passed since someone the driver knew had been caught by the Police for speeding was 14.6 (SD=25.7).

Drivers interviewed on Beach Road reported a median of 2 hours of television on an average weeknight. Sixty eight percent of the drivers interviewed watched this much television or less.

Belmore Road, Balwyn

Of the drivers who agreed to take part in the study, 9 (5%) were between 18 and 20, 17 (8%) were between 21 and 24, 28 (14%) were between 25 and 34, 52 (26%) were between 35 and 44, 35 (17%) were between 45 and 54, 39 (19%) were between 55 and 69 and 22 (11%) were 70 or over. Fifty one percent of drivers were female. One hundred and forty five (72%) vehicles had one occupant, 41 (20%) had two and 15 (8%) had three or more occupants. Six percent of the drivers were displaying P-plates. Eighty-four (42%) participants were driving a large car while 56 (28%) were driving a small car, 42 (21%) were driving a medium car, 9 (4.5%) were driving a four-wheel drive and 11 (5.5%) were driving a commercial vehicle. One hundred and eight (55%) vehicles were estimated to be manufactured in the 1990's, 71 (36%) in the 1980's and 19 (10%) in 1979 or earlier. The most popular makes were Ford, Toyota, Holden and Mitsubishi, and the most popular models were Commodore, Falcon, Camry and Magna. Ninety six percent of drivers were observed wearing a seat belt.

One hundred and sixty (79%) drivers were driving their own vehicle and 72 (36%) were on a business trip, 42 (21%) were driving for recreation or holiday, 66 (33%) were performing domestic duties and 20 (10%) gave other as the purpose of their trip. Twenty-seven (13%) drivers drove less than 100km per week, 65 (32%) drove 101-200km per week, 73 (36%) drove 201-400km per week, 21 (10%) drove 401-600km per week and 16 (8%) drove more than 600km per week. Ninety-three (46%) drivers travelled along Belmore Road daily, 72 (36%) used it weekly, 25 (12%) used it monthly, 4 (2%) used it less than yearly, 3 (1.5%) used it more than once each year and it was the first time for 5 (2.5%) of the drivers interviewed.
One hundred and nine (54%) drivers were on schedule with 19 (9%) ahead of schedule, 21 (10%) behind schedule, and 53 (26%) drivers had no schedule. Fifty-eight (29%) drivers interviewed were on their first trip for the day. Of those who were not on their first trip of the day, 64 (45%) had taken one other trip, 36 (27%) had taken two, 16 (11%) had taken three and 27 (17%) had taken four or more trips. At this site drivers were more likely to report having completed more trips, with 4% taking between 8 and 22 trips prior to the one they were on that day. One hundred and eight

(58%) drivers had started the trip up to thirty minutes prior to being interviewed and over half said they would end their trip in up to ten minutes (56%), confirming the expectation that urban drivers were more likely to take more frequent short trips than rural drivers. Again most drivers did not feel tired with 174 (86%) of drivers reporting 5 or less on the tiredness scale. One hundred and nine (54%) drivers had not taken a break on the trip they were on.

When asked to rate their safety as a driver compared with other drivers their age when travelling 20km/h over the speed limit, 21 (10%) drivers said they were much safer, 143 (71%) said they were safer, 31 (15%) drivers said they were less safe and 6 (3%) drivers said they were much less safe than other drivers their age.

Seventy (35%) drivers had been involved in an accident in the last five years, and of these, 55 (80%) had been involved in one, 11 (16%) had been involved in two, 2 (3%) had been involved in three and 1 (1%) had been involved in four accidents. Four drivers reported that someone who had been involved in their accident needed medical assistance.

One hundred and thirty six (67%) drivers reported having been caught for speeding and of these 129 (95%) were fined for the offence. The mean number of months that had passed since the driver had been caught for speeding was 56.8 (SD=65.35). Fifty-four (27%) drivers had been caught for other traffic offences and 44 (85%) were fined for the offence. The average number of months that had passed since the offence was 75.4 (SD=89.9). The mean number of months that had passed since someone the driver knew had been caught for speeding was 14.6 (SD=25.8).

The median amount of time for watching television was 1.5 hours and 54% of drivers interviewed watched this much television or less on an average weeknight.

Comparisons

The three samples were similar in many respects, however there were some differences which are discussed in the following section. The results are also compared with the Fildes et al. (1991) findings.

Rural versus Urban

The sample of drivers at the rural site tended to drive larger cars and fewer drove small cars. As would be expected, more drivers reported travelling greater distances than was the case at the urban sites. Fewer rural drivers reported domestic duties as the purpose of their trip and fewer drivers reported driving along that section of the Calder Highway on a frequent basis (either daily or weekly) than the urban drivers, who tended to use the section of road they were travelling on more frequently. Rural drivers reported being involved in fewer accidents than city drivers did in the last five years.

A greater number of urban drivers were driving their own vehicle. Fewer drivers were behind schedule on Belmore Road, and more drivers had taken more than one trip at this site.

Comparison with the Fildes et al. study

There was a similar age distribution in Fildes et al. (1991) for the sample interviewed at Woodend. The Fildes et al. (1991) comparison data discussed in this section are comprised of the two rural sites combined. A higher proportion of females was interviewed in the current study (48% cf. 38%) and

more vehicles had only one occupant (61% cf. 46%). A similar proportion of drivers were displaying P-plates and wearing a seat belt. Fewer vehicles towing a trailer were observed, and the distribution of car types was similar, with a high representation of newer cars. A similar number of drivers interviewed in each of the studies owned the vehicle they were driving. There was little difference in the purpose of trip or distance travelled in a week, over the studies. A higher proportion of the sample claimed to be travelling on time than Fildes et al. (1991) found (66% cf. 49%), however the same proportion claimed to be running late (11%). Drivers tended to have been travelling for longer distances in 1990 compared to the current study (19% cf. 44%), however Fildes et al. (1991) used kilometres rather than amount of time prior to being stopped. It was assumed that one hour of travel is roughly equivalent to 100km. There was little difference in accident involvement in the last five years between the two studies, with 25% having had at least one accident in the previous study compared with 21% in the current study. There was a similar distribution for the number of accidents drivers had been involved in.

Fildes et al. (1991) combined the data from the two urban sites. The comparisons presented here are of the combined urban data of the previous study with the Beach Road (Bh) and Belmore Road (Bl) data separately in the current study. A higher percentage of drivers under 25 years were interviewed in the current study (14.5% Bh, 13% Bl cf. 8%) and fewer males were interviewed (50%Bh, 49%Bl cf. 64%). There was no difference in the distribution of the number of occupants in the vehicle, or whether they owned the vehicle they were driving over the two studies. There were more P-plate drivers interviewed in the current study (7%Bh, 6%Bl cf. 1.3%). Similar vehicle types and sizes were observed for both studies, and recently manufactured vehicles were well represented. Fewer business travellers were interviewed in the current study (41%Bh, 36%Bl cf. 49%), and more drivers were travelling for recreation (35%Bh, 21%Bl cf. 21%). Similar weekly travel distances were reported over both studies, however drivers at Belmore Road tended to drive fewer kilometres. A slightly higher percentage of drivers use the section of road weekly or more frequently than was found in 1990 (82%Bh, 82%Bl cf. 75%). Fewer drivers were on time and a similar number were ahead of schedule in Fildes et al. (1991) (43% Bh 54%Bl cf. 37% and 13%Bh, 9%Bl cf. 13% respectively). Drivers tended to have been travelling for longer distances at Beach Road in the current study, than at Belmore Road, before being stopped by the research team. There was a similar rate of accident involvement (32%Be, 35%Bl cf. 34%), and the distribution of number of accidents in the last five years is similar across studies.

Table 4 shows gives a summary of the sample characteristics, and compares them with those found by Fildes et al. (1991).

Table 4: Summary of Sample Variables (continued on next pages)

Location	Variable	Current Study	Fildes et al. (1991)
	Sex (% Female)		
Woodend		48%	38%
Beach Road		50%	36%**
Belmore Road		51%	
	Age		
Woodend	18-24	9%	8%*
	25-54	67%	64%*
	55+	24%	28%*
Beach Road	18-24	14.5%	8%**
	25-54	66%	70%**
	55+	19.5%	22%**
Belmore Road	18-24	13%	
	25-54	57%	
	55+	30%	
	Purpose of trip		
Woodend	Business	47%	42%*
	Recreation/holiday	31%	36%*
	Domestic	15%	22%*
	Other	6%	
Beach Road	Business	41%	49%**
	Recreation/holiday	35%	21%**
	Domestic	20%	30%**
	Other	4%	
Belmore Road	Business	36%	
	Recreation/holiday	21%	
	Domestic	33%	
	Other	10%	
	No. of occupants		
Woodend	1	46%	61%
	2	36%	30%
	3+	18%	9%
Beach Road	1	68%	69%**
	2	3%	24%**
	3+	9%	7%**
Belmore Road	1	72%	
	2	20%	
	3+	8%	

* indicates that the figure is the combined Woodend and Euroa data, representative of the rural population sampled by Fildes et al. (1991)

** indicates that the figure is the combined the Beach Road and Belmore Road data, representative of the urban population sampled by Fildes et al. (1991)

Table 4 continued

Location	Variable	Current Study	Fildes et al. (1991)
	Displayed P-plates		
Woodend		3%	1.5%**
Beach Road		7%	1.3%*
Belmore Road		6%	
	Wearing seatbelts		
Woodend		97.6%	97.6%**
Beach Road		94%	99.4%*
Belmore Road		96%	
	Did not own vehicle		
Woodend		23%	29%**
Beach Road		21%	21%*
Belmore Road		21%	
	Weekly travel distance		
Woodend	Less than or equal to 400 km/h	51%	58%**
	Greater than 400 km/h	49%	42%**
Beach Road	Less than or equal to 400 km/h	68%	64%*
	Greater than 400 km/h	32%	36%*
Belmore Road	Less than or equal to 400 km/h	81%	
	Greater than 400 km/h	19%	
	Use of the survey road		
Woodend	Weekly	54%	49%
	Monthly	19%	31%
	Yearly or less	24%	20%
	First time	4%	
Beach Road	Weekly	82%	75%**
	Monthly	9%	16%**
	Yearly or less	6%	9%**
	First time	4%	
Belmore Road	Weekly	82%	
	Monthly	12%	
	Yearly or less	3.5%	
	First time	2.5%	

* indicates that the figure is the combined Woodend and Euroa data, representative of the rural population sampled by Fildes et al. (1991)

** indicates that the figure is the combined the Beach Road and Belmore Road data, representative of the urban population sampled by Fildes et al.

(1991)

Table 4 continued

Location	Variable	Current Study	Fildes et al. (1991)
	Schedule		
Woodend	Ahead of schedule	7%	9%*
	On time	66%	49%*
	Behind schedule	11%	11%*
	No schedule	16%	31%*
Beach Road	Ahead of schedule	13%	9%**
	On time	43%	37%**
	Behind schedule	12%	11%**
	No schedule	31%	43%**
Belmore Road	Ahead of schedule	9%	
	On time	54%	
	Behind schedule	10%	
	No schedule	26%	
	Rated as not tired		
Woodend		85%	90%*
Beach Road		87%	90%**
Belmore Road		86%	
	Vehicle less than 5 years old		
Woodend		53%	32%
Beach Road		44%	~50%**
Belmore Road		55%	
	Involved in a crash in last 5 yrs		
Woodend		21%	25%*
Beach Road		32%	34%**
Belmore Road		35%	
	Number of crashes in last 5 yrs		
Woodend	1	73%	75%*
	2	19%	20%*
	3+	8%	5%*
Beach Road	1	72%	72%**
	2	13%	23%**
	3+	15%	5%**
Belmore Road	1	80%	
	2	16%	
	3+	4%	

* indicates that the figure is the combined Woodend and Euroa data, representative of the rural population sampled by Fildes et al.

** indicates that the figure is the combined the Beach Road and Belmore Road data, representative of the urban population sampled by Fildes et al. (1991)

RELATIONSHIPS WITH OBSERVED SPEED

The next phase of the analysis involved an investigation of the relationship between certain driver and vehicle characteristics and the observed speed of vehicles at each site. The aim was to determine whether drivers travelling at particular speeds displayed certain characteristics, which could ultimately be employed to assist in targeting enforcement and public education programs for the speeding driver. For ease of analysis and interpretation, drivers were grouped into three categories depending on their observed speed. These were defined as drivers with speeds up to the fifteenth percentile, labelled the excessively slow group, speeds over the eighty-fifth percentile, labelled the excessively fast group and a third group, which includes the remainder of the drivers, whose speeds more-closely approximated the mean. All data were analysed site by site due to the varying road and environmental conditions at each site.

Calder Highway Woodend

The 15^{th} percentile was 84 km/h and the 85^{th} percentile was 101 km/h. There was no significant relationship between age and observed speed (χ^2=16.4, p>.05) for drivers interviewed at Woodend, however the sex of the driver was related to the observed travel speed (χ^2=11.4, p<.05). Figure 16 shows that males were over-represented in the excessively fast group and that females were more likely to be in the excessively slow group.

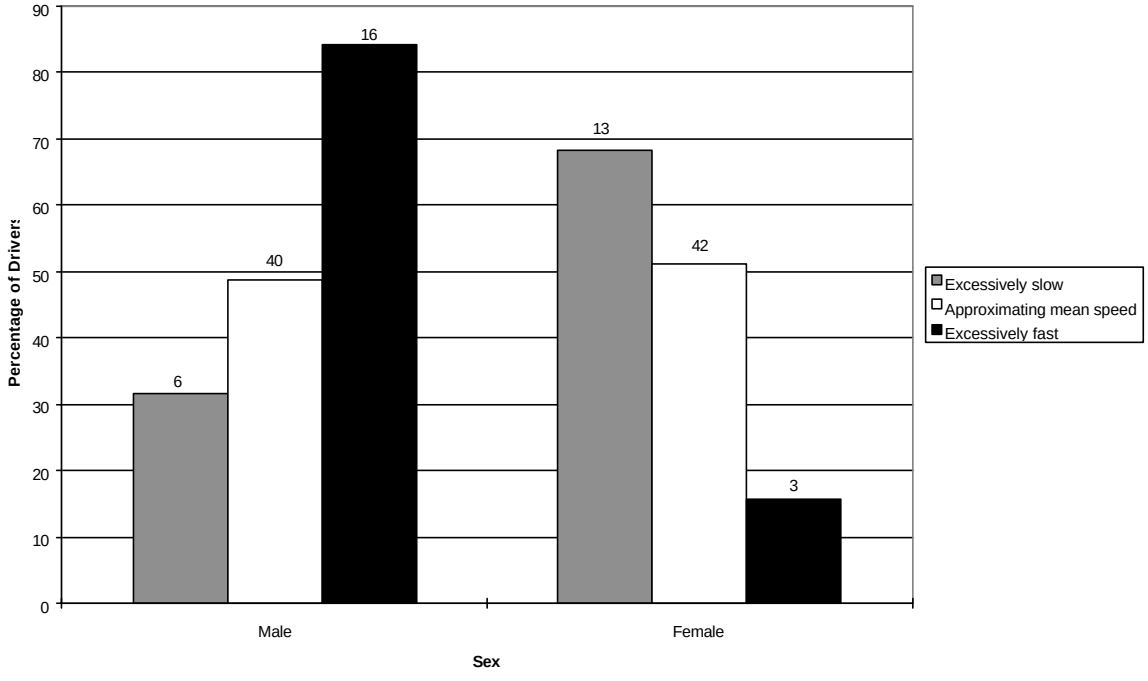

Figure 15: Percentage (and Number) of Drivers in Each Speed Category who were Male and Female, Calder Highway, Woodend

The number of occupants in the vehicle was related to speed choice (χ^2=12.2, p<.05) as shown in Figure 17. Vehicles travelling excessively fast were more likely to have three or more occupants compared to vehicles travelling either excessively slow or near the mean.

Driving exposure (determined by the number of kilometres driven each week) was not related to observed speed (χ^2=13.5, p>.05), nor was the frequency of driving on the specified section of the Calder Highway (χ^2=1.3, p>.05). The type of car was not related to speed (χ^2= 4.0, p>.05), nor was the estimated year of manufacture of the car (χ^2=4.8, p>.05).

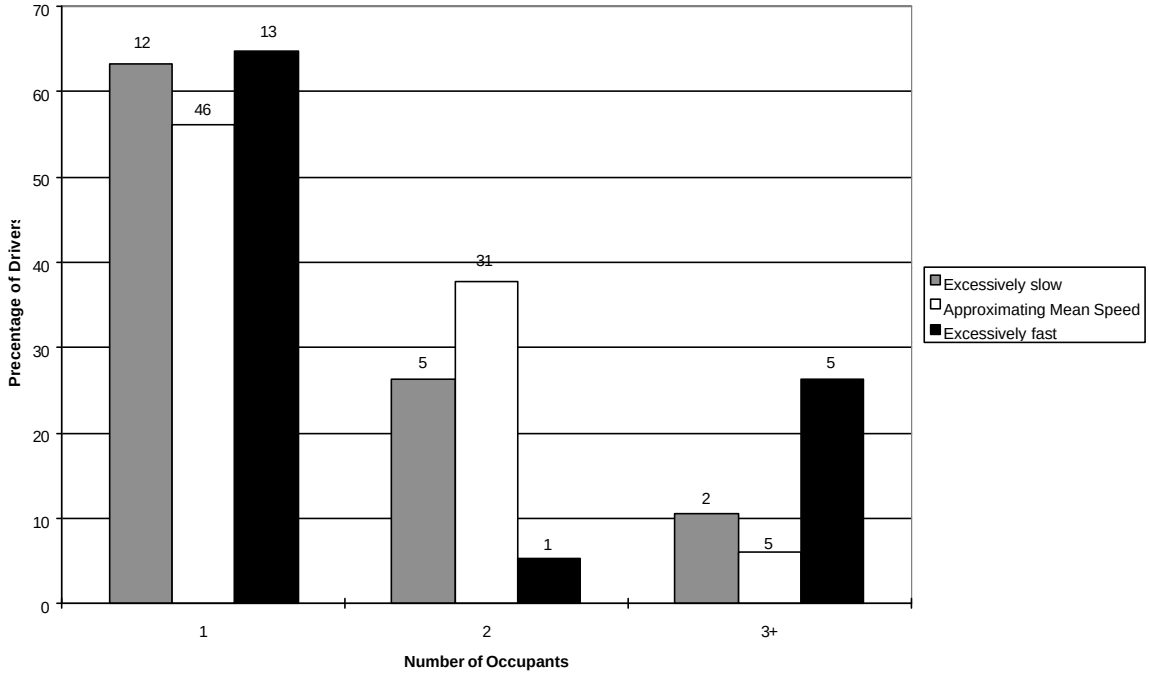

Figure 16: Percentage (and Number) of Drivers in Each Speed Category with 1, 2, or 3 or more Occupants in the Vehicle, Calder Highway, Woodend

The purpose of the trip and observed speed were also unrelated (χ^2=5.7, p>.05) however there was a significant association between whether the driver owned the vehicle or not and observed speed (χ^2=7.5, p<.05). Excessively slow drivers were more likely to be driving their own vehicle and those not driving their own vehicle were more likely to travel excessively fast (Figure 18).

The driver's schedule was unrelated to speed choice (χ^2=6.2, p>.05), therefore those who were behind schedule were no more likely to be speeding than other drivers. Tiredness was measured on an eleven-point scale. A histogram of reported tiredness is presented in Figure 19. The majority of drivers reported feeling not at all tired (0 on the scale). The scale was then aggregated into two categories for analysis, where 0-5 represented not feeling tired and 6-10 represented feeling tired. Tiredness and observed speed were not significantly related (χ^2=.5, p>.05).

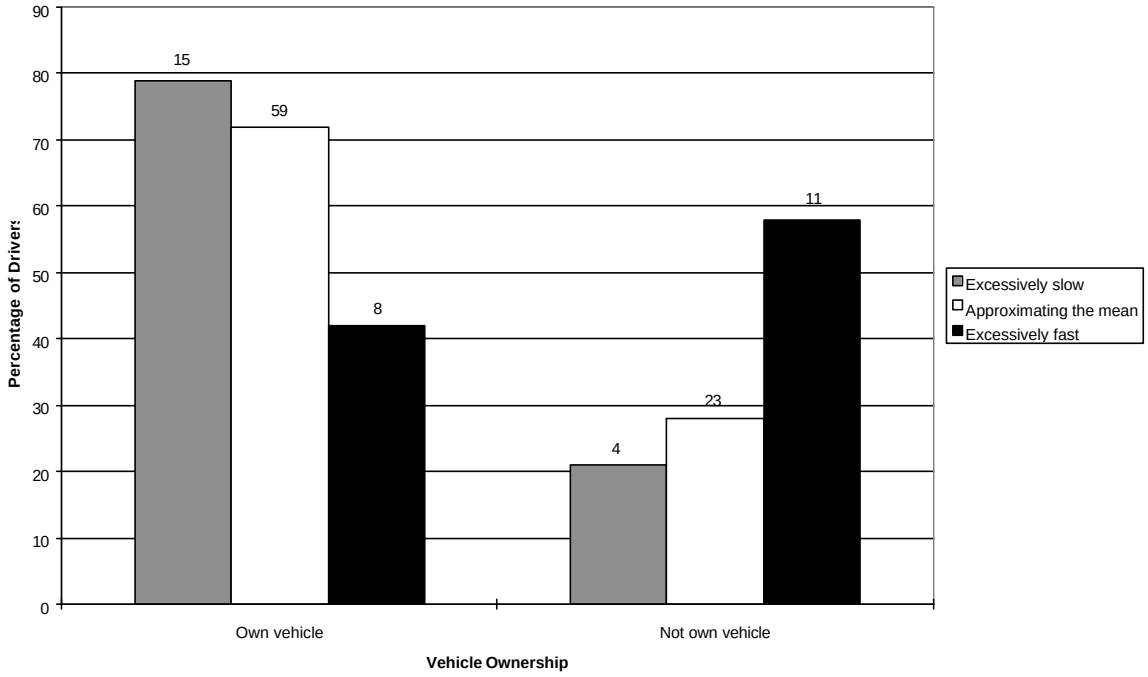

Figure 17: Percentage (and Number) of Drivers in Each Speed Category Who Owned or Did Not Own the Vehicle, Calder Highway, Woodend

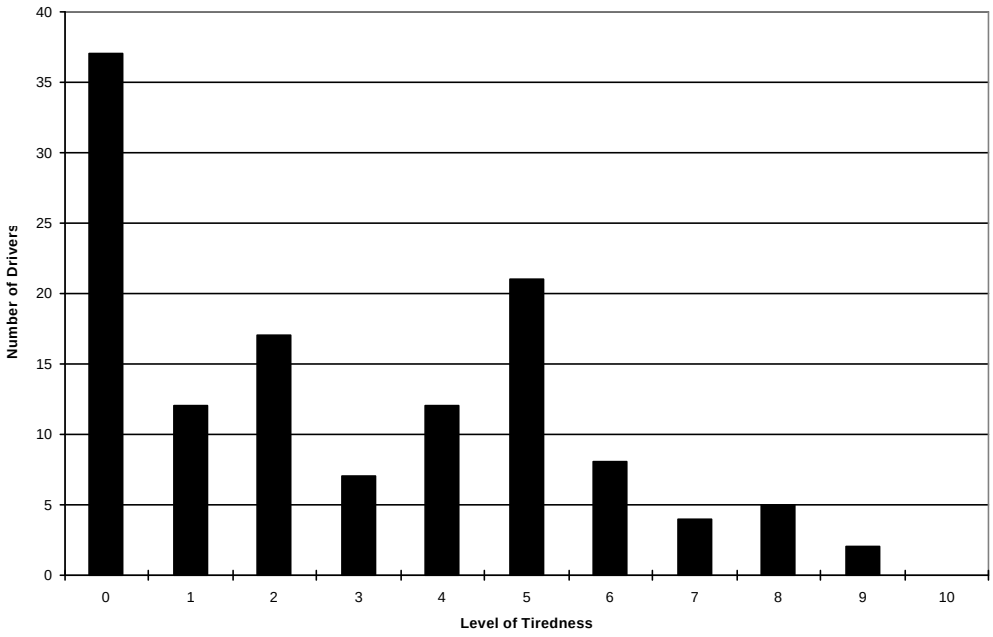

Figure 18: Histogram of the driver's reported level of tiredness, Calder Highway, Woodend

Self-calibration, rating one's safety as a driver as compared with a similar group, was independent of speed choice (χ^2=11.7, p>.05). Accident involvement was related to speed choice (χ^2=6.5, p<.05). As shown in Figure 20, prior crash involvement (involvement in one or more crashes in the preceding

five years) was associated with higher driving speeds, although the number of accidents each driver experienced in the last five years was not significantly related to speed choice (χ^2=6.68, p>.05). Detection for speeding was also unrelated to speed choice (χ^2=2.8, p>.05).

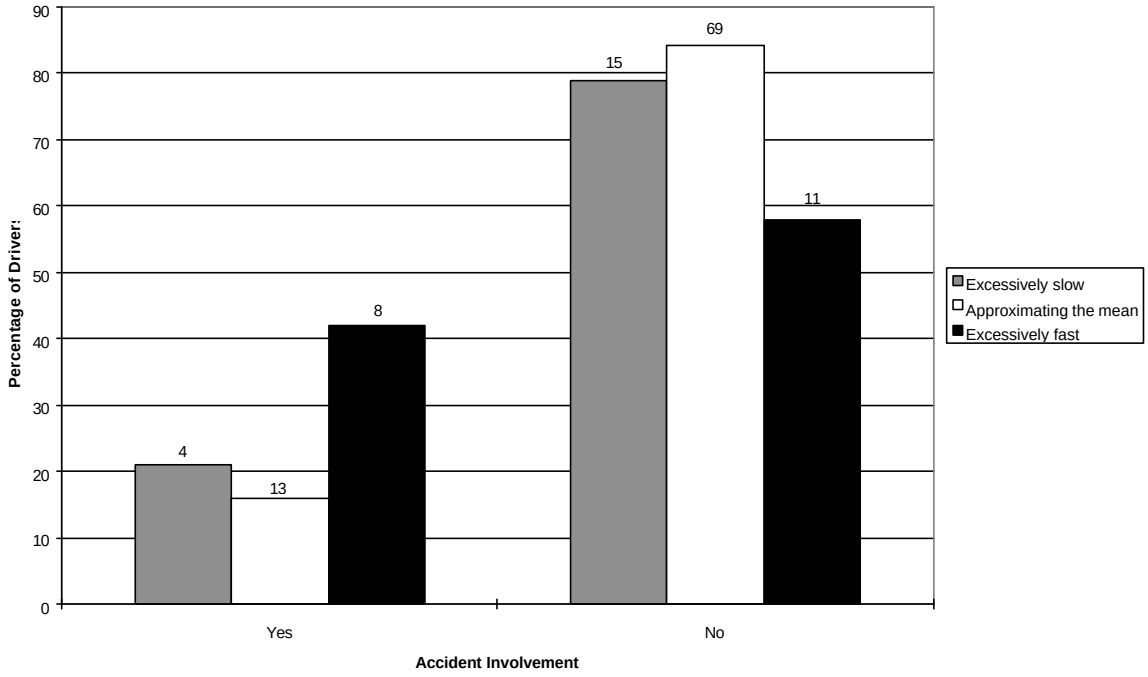

Figure 19: Percentage (and Number) of Drivers in Each Speed Category With and Without Crash Involvement in the Last Five Years, Calder Highway, Woodend

Beach Road, Parkdale

The speed at the 15th percentile was 59 km/h and 75 km/h at the 85th percentile. Age was significantly related to observed speed at Beach Road, Parkdale (χ^2=27.7, p<.001) as shown in Figure 21. There were no excessively fast drivers in the 55 and over group, and those aged 18-24 were more likely to drive excessively fast.

Speed and the sex of the driver were independent (χ^2=.9, p>.05). The number of occupants (χ^2=2.0, p>.05), the distance travelled by drivers in an average week (χ^2=14.5, p>.05), the type of car (χ^2=4.3, p>.05), the estimated year of manufacture (χ^2=2.7, p>.05), the purpose of the trip (χ^2=9.2, p>.05), ownership of the vehicle (χ^2=4.3, p>.05), the driver's schedule (χ^2=4.4, p>.05), and how tired the driver reported feeling at the time of the interview (χ^2=.04, p>.05) were unrelated to the drivers' observed speed.

A histogram of the driver's reported level of tiredness is presented in Figure 22. The majority of drivers reported not feeling at all tired, and only a few drivers rated themselves 6 or above on the tiredness scale.

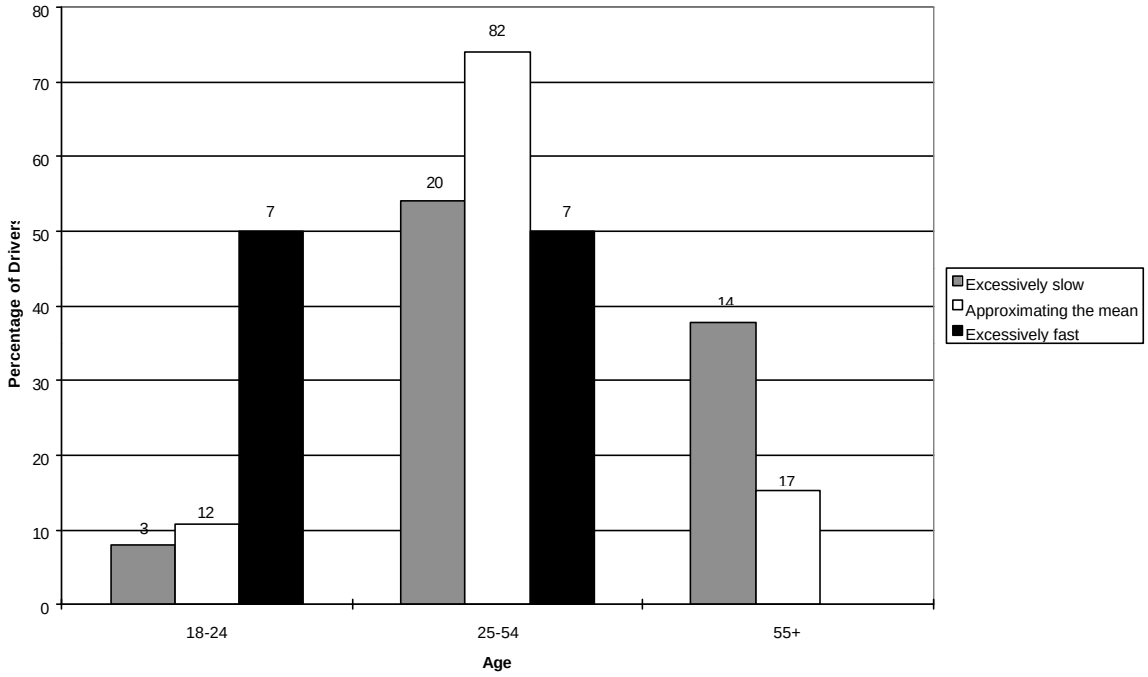

Figure 20: Percentage (and Number) of Drivers in Each Speed Category in the 18-24 Years, 25-54 Years, and 55+ Years Age Groups, Beach Road, Parkdale

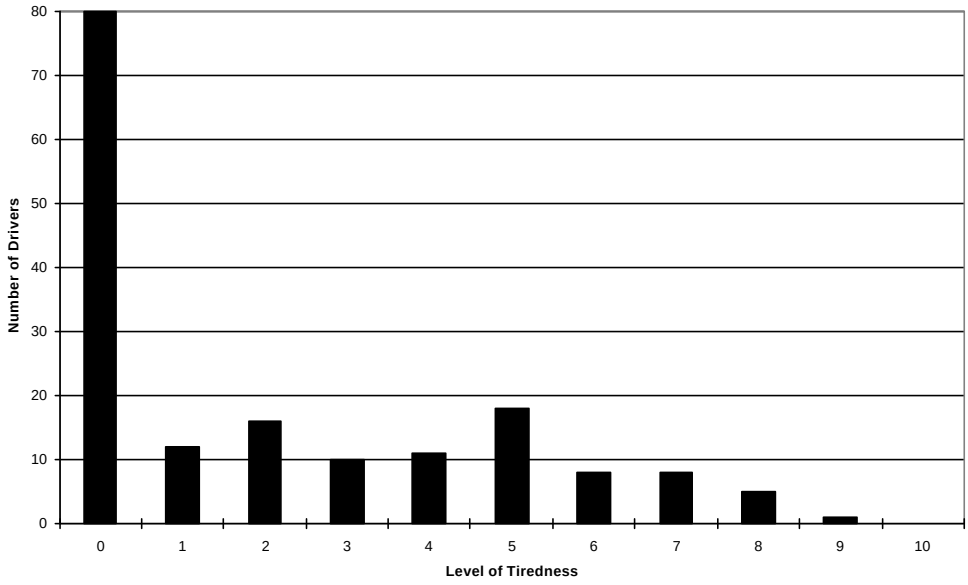

Figure 21: Histogram of the driver's reported level of tiredness, Beach Road, Parkdale

Accident involvement (χ^2=8.5, p<.05) and the number of accidents drivers had been involved in during the last five years were significantly related to drivers' observed speed (χ^2=11.2, p<.05). Figures 23 and 24 show that those who had not been involved in an accident in the last five years were more likely to drive excessively slowly or approximate the mean speed. Those in the

excessively fast group were more likely to have been involved in an accident. Of those who did report being involved in an accident, those travelling excessively slowly or travelling at approximately the mean speed were likely to have experienced only one accident and no more than two.

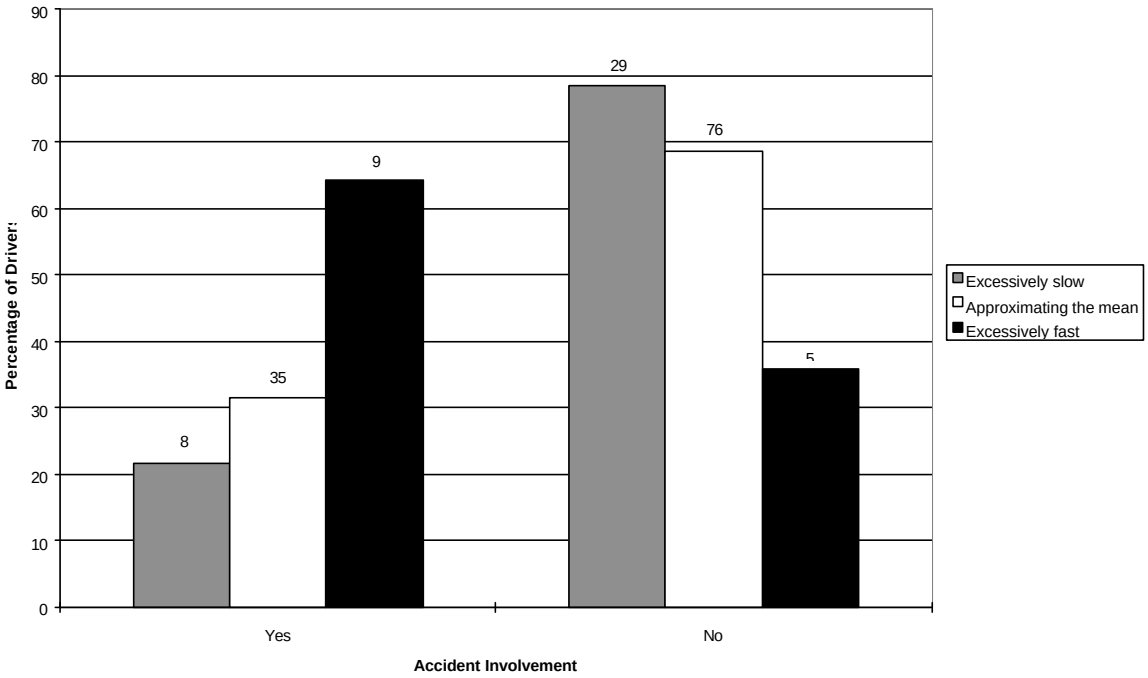

Figure 22: Percentage (and Number) of Drivers in Each Speed Category With and Without Crash Involvement in the Last Five Years, Beach Road, Parkdale

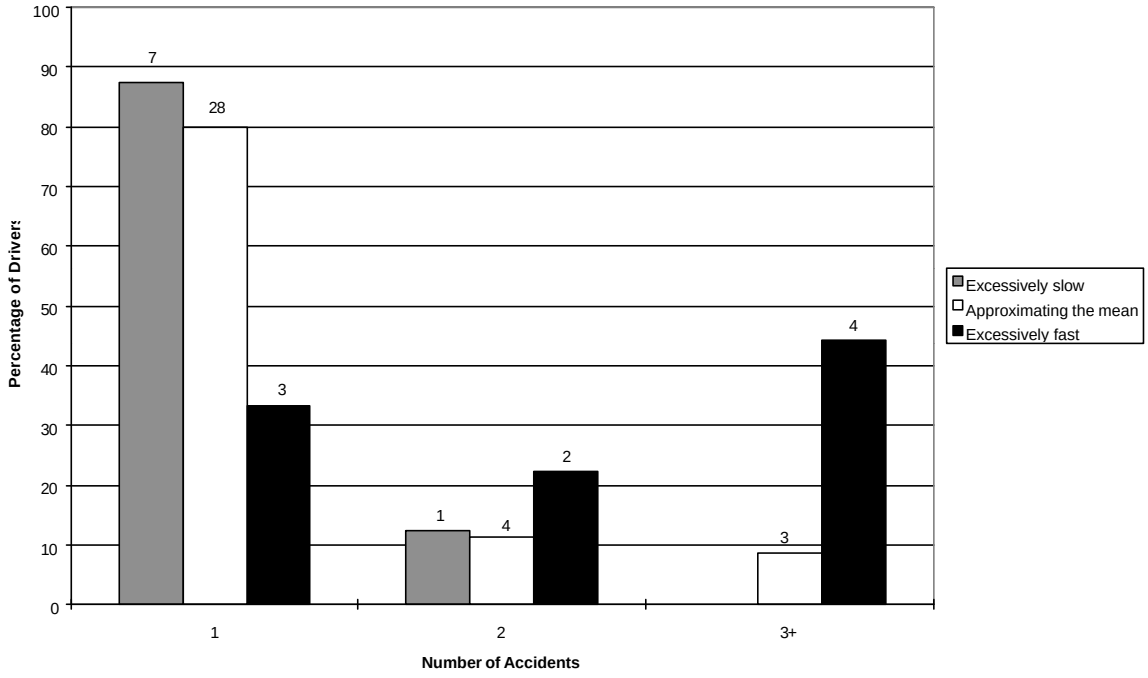

Figure 23: Percentage (and Number) of Drivers in Each Speed Category With 1, 2, or 3 or More Crashes in the last Five Years, Beach Road, Parkdale

There was a significant relationship between self-calibration and observed speed (χ^2=12.7, p<.05), as seen in Figure 25. There was also a significant relationship between observed speed and having been detected speeding (χ^2=2.7, p<.05). Most of the drivers in the excessively fast group had been caught by the Police for speeding as illustrated in Figure 26. Those whose travelling speed approximated the mean were also more likely to have been caught for speeding than were drivers in the excessively slow group.

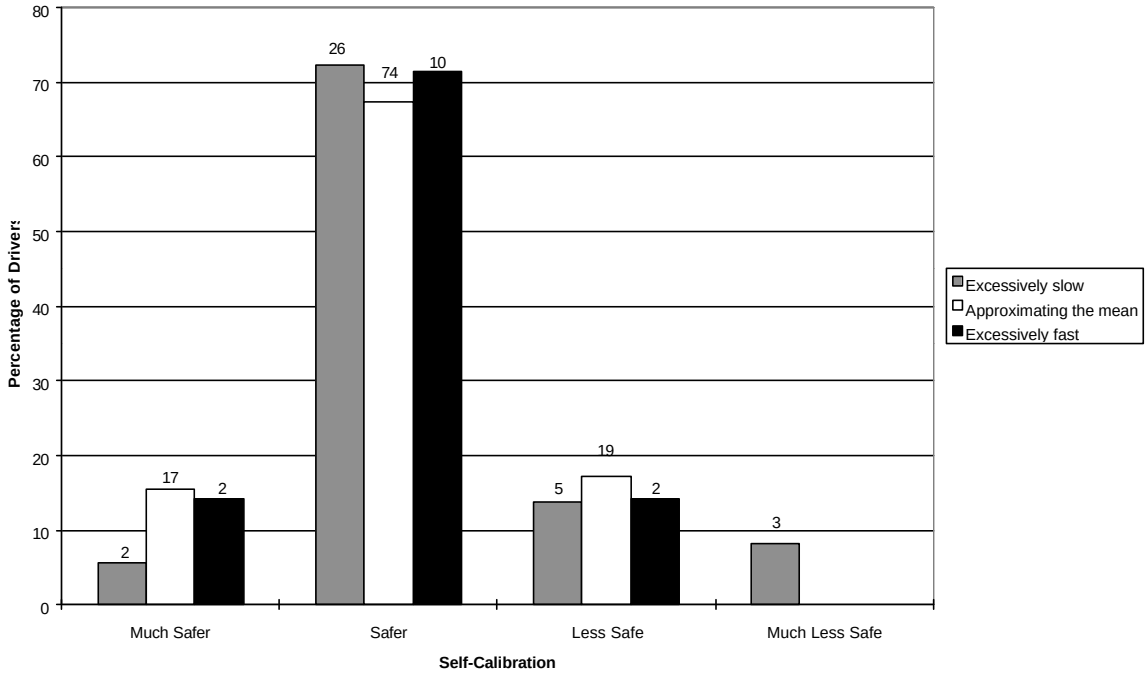

Figure 24: Percentage (and Number) of Drivers in Each Speed Category by Self-Calibration, Beach Road, Parkdale

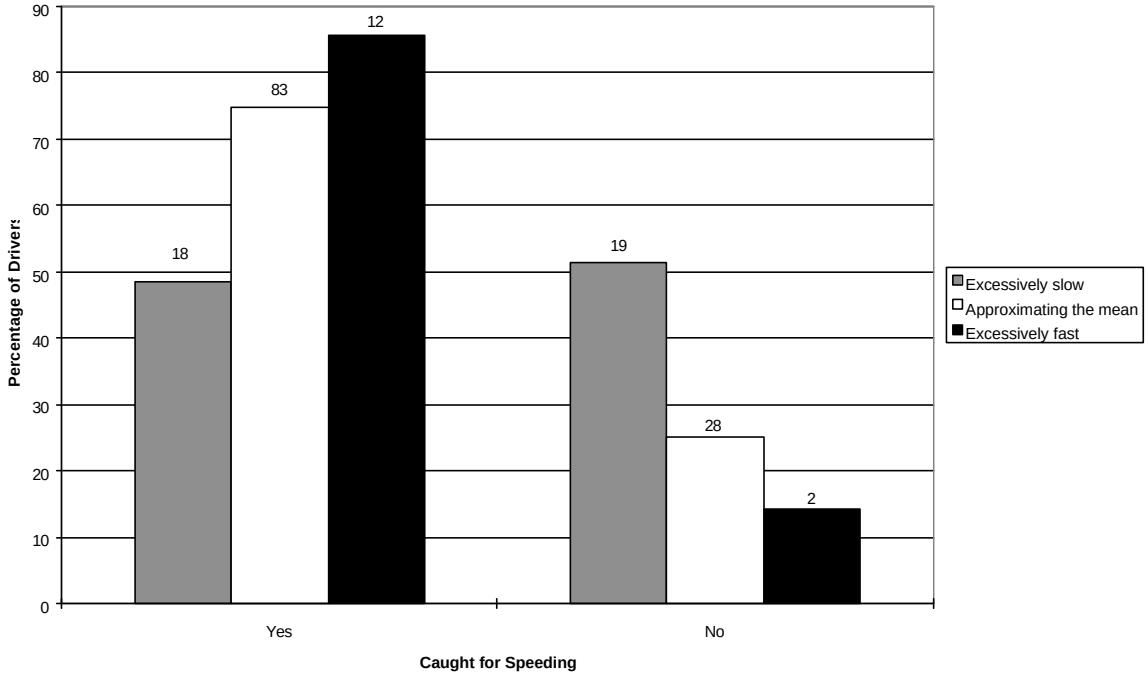

Figure 25: Percentage (and Number) of Drivers in Each Speed Category Who Had and Had Not Been Detected by the Police for Speeding, Beach Road, Parkdale

Belmore Road, Balwyn

The speed at the 15th percentile was 55km/h and 68km/h at the 85th percentile. Age was found to be related to speed choice at Belmore Road, Balwyn (χ^2=11.5, p<.05) as shown in Figure 27. Younger drivers tended to drive faster than older drivers.

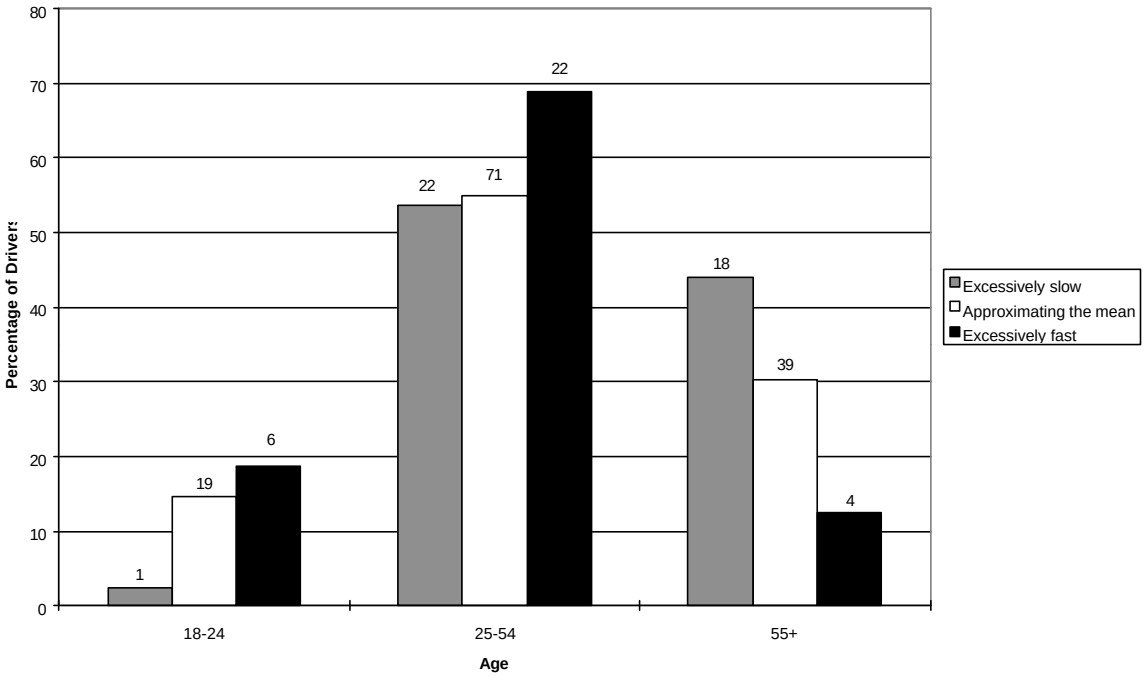

Figure 26: Percentage (and Number) of Drivers in Each Speed Category in the 18-24 Years, 25-54 Years, and 55+ Years Age Groups, Belmore Road, Balwyn

The sex of the driver was unrelated to observed speed (χ^2=.6, p>.05). Speed choice was independent from all the other driver and vehicle characteristics measured here. The results of the statistical tests are presented in Table 5.

Table 5: Non-Significant Chi-Square Statistics for fhe Association of Driver and Vehicle Characteristics with Observed Speed at Belmore Road, Balwyn

Variable	Chi-Square (c^2)	Probability
Number of occupants	2.2	.705
Kilometres driven per week	8.3	.407
Type of car	3.0	.933
Estimated year of manufacture	6.0	.203
Purpose of trip	6.1	.408
Vehicle ownership	4.7	.095
Schedule	7.8	.252
Reported level of tiredness	5.8	.056
Accident involvement	1.0	.597
Number of accidents	4.1	.394
Self-calibration	8.9	.348
Apprehended for speeding	5.8	.055

A histogram of reported level of tiredness is represented in Figure 28. The majority of drivers reported feeling not at all tired and 174 (86%) drivers rated themselves at 5 or less on the scale of tiredness.

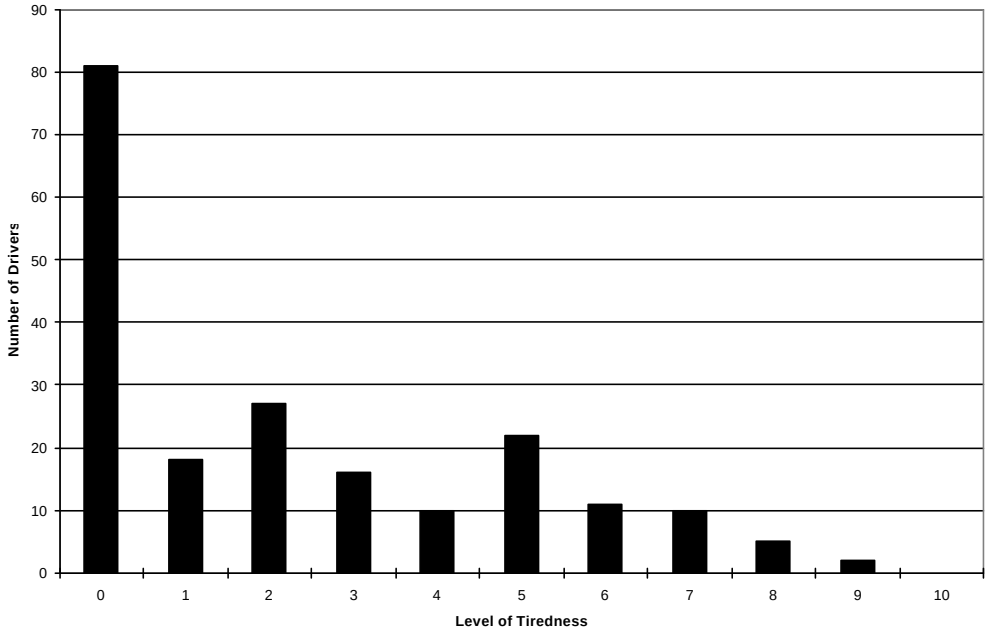

Figure 27: Histogram of the Driver's Reported Level of Tiredness, Belmore Road, Balwyn

Comparisons

Rural versus Urban

Age was found to be significantly related to choice of driving speed for the urban sample but not the rural sample and there was a significant relationship between sex of the driver and observed speed for the rural sample only. Many variables were found to be unrelated to speed in the urban sample, with only accident involvement, the number of accidents and apprehension for speeding having a significant relationship with speed choice at Beach Road, and only age having a significant relationship at Belmore Road. At Woodend, only vehicle ownership and accident involvement had a significant effect on speed choice.

Comparison with the Fildes et al study

Differences in the effect of some variables on observed speed were found between the current study and the Fildes et al. (1991) study. Fildes et al. combined the rural data, which are compared here with the current Woodend data. These relationships are presented in Table 6. A significant relationship was found between driver's age and observed speed for drivers interviewed by Fildes et al. in rural areas, where excessive speeders were more likely to be younger (under 34 years) and those driving excessively slowly were more likely to be over 45 years. This relationship was not found in the current study. Fildes et al. did not find a significant relationship between sex of the driver and observed speed however there was a significant relationship in the current study, with

males over-represented in the excessively fast group. In both studies the number of occupants in the vehicle was significantly related to speed choice, however the distributions differed. Figure 3.4 in Fildes et al. shows a greater number of excessive speeders for vehicles occupied solely by the driver whereas this distribution was more even in the current study, with excessive speeders over-represented in vehicles with three or more occupants.

Fildes et al. (1991) found significant relationships between observed speed and type of vehicle driven, the year of manufacture and the purpose of the trip where none were found in the current study. Speeding drivers were more likely to be driving an intermediate size vehicle, a newer vehicle, and to be on a business trip. Fildes et al. did not find a relationship between vehicle ownership and observed speed however a relationship was found in the current study, where those not driving their own vehicle were more likely to have been travelling excessively fast.

Neither study found a relationship between drivers' schedule or self-rated level of tiredness and speed. A significant relationship was found in both studies between accident involvement and observed speed with a higher proportion of excessive speeders having been involved in an accident in the last five years.

Fildes et al. (1991) also combined the urban data results. These data will be compared with the Beach Road and Belmore Road data separately.

Age was related to observed speed in both studies at the urban sites, with excessive speeders over-represented in the younger age group. The sex of the driver was not related to speed in either study. Fildes et al. found significant relationships between observed speed and the number of occupants, number of kilometres driven each week, year of manufacture, purpose of the trip, and schedule, however these variables were not found to be significantly related to speed at either of the urban sites in the current study. Vehicles with one occupant, drivers of newer cars and business travellers were more likely to be travelling excessively fast. Drivers who travel fewer kilometres per week were more likely to travel excessively slowly. Drivers behind schedule were more likely to be excessive speeders, and those with no schedule were more likely to travel excessively slowly. As seen in Figures 5.9 and 5.10, there was very little difference between the histograms of tiredness for the two studies.

Fildes et al. found a significant relationship between accident involvement and observed speed when the two sites were combined. This result was only found for the sample at Beach Road, Parkdale in the current study, where those in the excessively fast speed group were more likely to have been involved in an accident in the last five years. Similar also to Fildes et al. was the finding that those who had been involved in three or more accidents were more likely to be excessive speeders, although again this result was found at the Beach Road site only in the current study.

Table 6: Summary of Relationships with Observed Speed - Table Entries Indicate Groups Most Likely to Have Higher Observed Speeds (continued on next page)

Location	Variable	Current Study	Fildes et al. (1991)[1]
	Age		
Woodend		-	<34yrs
Beach Road		18-24	<34yrs
Belmore Road		younger	
	Sex		
Woodend		males	-
Beach Road		-	-
Belmore Road		-	
	Number of occupants		
Woodend		3+	1
Beach Road		-	1
Belmore Road		-	
	Weekly travel distance		
Woodend		-	-
Beach Road		-	More driving
Belmore Road		-	
	Use of the road		
Woodend		-	
Beach Road		-	
Belmore Road		-	
	Car type		
Woodend		-	vans/l.cars slower
Beach Road		-	-
Belmore Road		-	
	Estimated age of Vehicle		
Woodend		-	<5yrs
Beach Road		-	<5yrs
Belmore Road		-	
	Purpose of trip		
Woodend		-	business
Beach Road		-	business
Belmore Road		-	
	Vehicle ownership		
Woodend		does not own vehicle	-
Beach Road		-	-
Belmore Road		-	
	Schedule		
Woodend		-	-
Beach Road		-	behind schedule
Belmore Road		-	
	Tiredness		
Woodend		-	-
Beach Road		-	-
Belmore Road		-	

- Variable was independent of observed speed

[1] All significant relationships are from analysis of combined rural sites or combined urban sites

Table 6 continued

Location	Variable	Current Study	Fildes et al. (1991)[1]
	Self-calibration		
Woodend		-	
Beach Road		rated self as safer	
Belmore Road		-	
	Accident involvement		
Woodend		prior involvement	prior involvement
Beach Road		prior involvement	prior involvement
Belmore Road			
	Number of accidents		
Woodend		-	2+
Beach Road		2+	2+
Belmore Road		-	
	Detection for speeding		
Woodend		-	
Beach Road		caught before	
Belmore Road		-	

- Variable was independent of observed speed

[1] All significant relationships are from analysis of combined rural sites or combined urban sites

ATTITUDES TO SPEEDING AND OBSERVED SPEEDS

The following section investigates the relationship between driver attitudes and observed speed. Nonparametric Spearman correlation coefficients were computed for this analysis rather than Pearson correlation coefficients because both continuous (interval and ratio scale) and ordinal variables were included in the data. Table 7 shows the correlations between observed speed and variables which represent certain attitudes toward speeding and legal behaviours found by the current study and by Fildes et al. (1991). (Fildes et al. (1991) reported Pearson correlations). Some of the questions varied slightly between studies. The Fildes et al. study asked participants to nominate a safe speed for travelling on that section of road, whereas the current study asked participants to nominate the highest speed at which they would feel comfortable travelling at along that section of road. The questions relating to danger in the Fildes et al. questionnaire nominate a higher speed (85km/h for the urban sites, and 130km/h for the rural site). Fildes et al. did not include questions relating to drivers tolerance of illegal behaviours. Each variable is examined by site.

In the remainder of this section, each of the correlations with speed are discussed in more detail and are compared with the results reported by Fildes et al. (1991). See Appendix D for complete correlation tables for both the current study and for correlations reported by Fildes et al. (1991).

Table 7: Spearman Correlation Coefficients (and Significance Levels) Between Attitude Measures and Observed Speed for the Current Study and for Fildes et al. (1991)

		Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger	Intolerance towards Illegal Behaviour
Current Study								
Calder Highway, Woodend	Observed speed	.365 (.000)	.291 (.001)	.045 (.632)	.203 (.029)	-.020 (.828)	-.124 (.176)	-.257 (.005)
Beach Road, Parkdale	Observed speed	.583 (.000)	.370 (.000)	.232 (.003)	.255 (.001)	-.199 (.134)	-.237 (.002)	-.352 (.000)
Belmore Road, Balwyn	Observed speed	.503 (.000)	.176 (.012)	.041 (.567)	.046 (.519)	.022 (.757)	-.053 (.454)	-.186 (.009)
Fildes et al. (1991)								
Calder Highway, Woodend	Observed speed	.457 (.000)	.283 (.000)	.119 (.071)	.047 (.284)	.144 (.038)	-.055 (.251)	
Beach Road, Parkdale	Observed speed	.520 (.000)	.348 (.000)	.300 (.000)	.119 (.061)	.118 (.064)	-.346 (.000)	
Belmore Road, Balwyn	Observed speed	.121 (.045)	.338 (.000)	.138 (.034)	.077 (.155)	-.071 (.757)	-.083 (.137)	

SPEED LIMIT

Drivers were shown a photograph of the section of road where their speed had been measured and were asked to estimate the speed limit at that location.

Calder Highway, Woodend

Figure 29 shows the percentage of drivers who correctly nominated the 100 km/h speed limit at Woodend by observed speed. Driver estimates of the speed limit ranged from 60-100 km/h, with 58.7% of drivers correctly nominating 100 km/h and 31.4% of drivers nominating 80 km/h as the speed limit. Those in the faster speed group nominated the correct speed limit more often. There was a significant relationship between observed speed and estimate of the speed limit ($r=.203$, $p<.05$). There were also significant correlations between estimated speed limit and the driver's estimate of their own speed ($r=.712$, $p<.01$), and between estimated speed limit and the driver's estimate of the speed of other drivers ($r=.422$, $p<.05$).

Fildes et al. (1991) found that 60% of drivers correctly nominated the 100 km/h speed limit, and 31% nominated the speed limit to be between 75 and 90 km/h. Fildes et al. found no correlation between estimate of the speed limit and observed speed ($r=.047$, $p>.05$). Fildes et al. did report correlations between drivers' estimate of their own speed and their estimate of the speed limit ($r=.618$, $p<.05$). There was a significant positive correlation between the estimated speed of other drivers and the estimated speed limit ($r=.421$, $p<.05$)

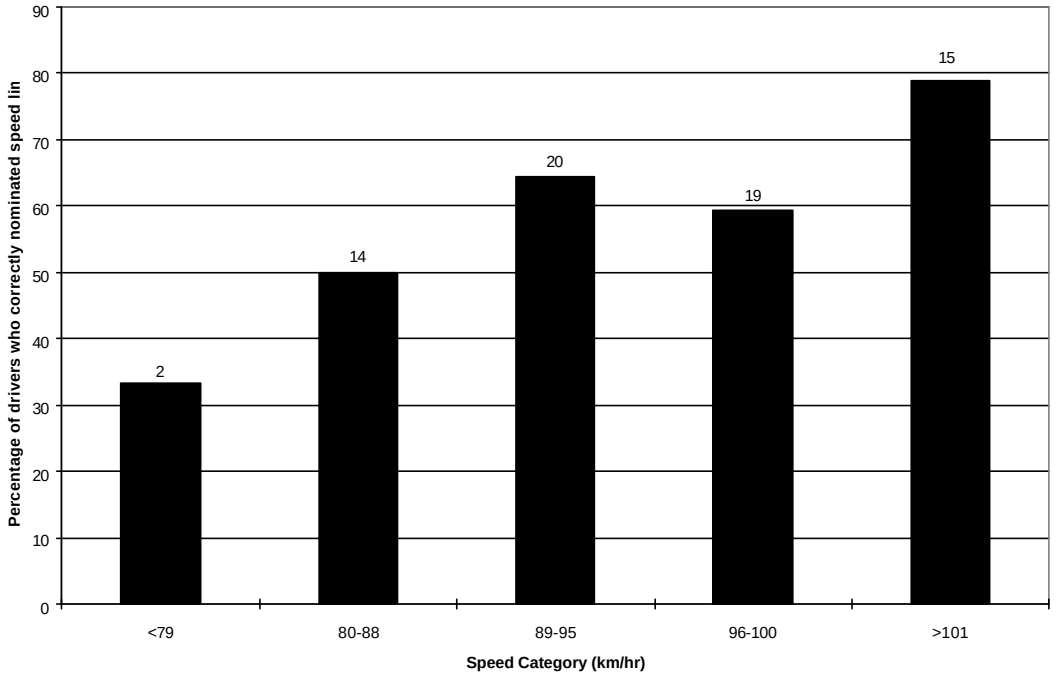

Figure 28: Percentage (and Number) of Drivers in Each Speed Category Who Correctly Nominated the 100 km/h Speed Limit, Calder Highway, Woodend

Beach Road, Parkdale

Ninety six percent of drivers nominated the correct speed limit along Beach Road, Parkdale. No driver thought the speed limit was below 60 km/h and the highest estimated speed limit was 75 km/h. There was a significant correlation (r=.255, p<.01) between the estimated speed limit and observed speed. Figure 30 shows that the faster drivers were less likely to nominate the correct speed limit.

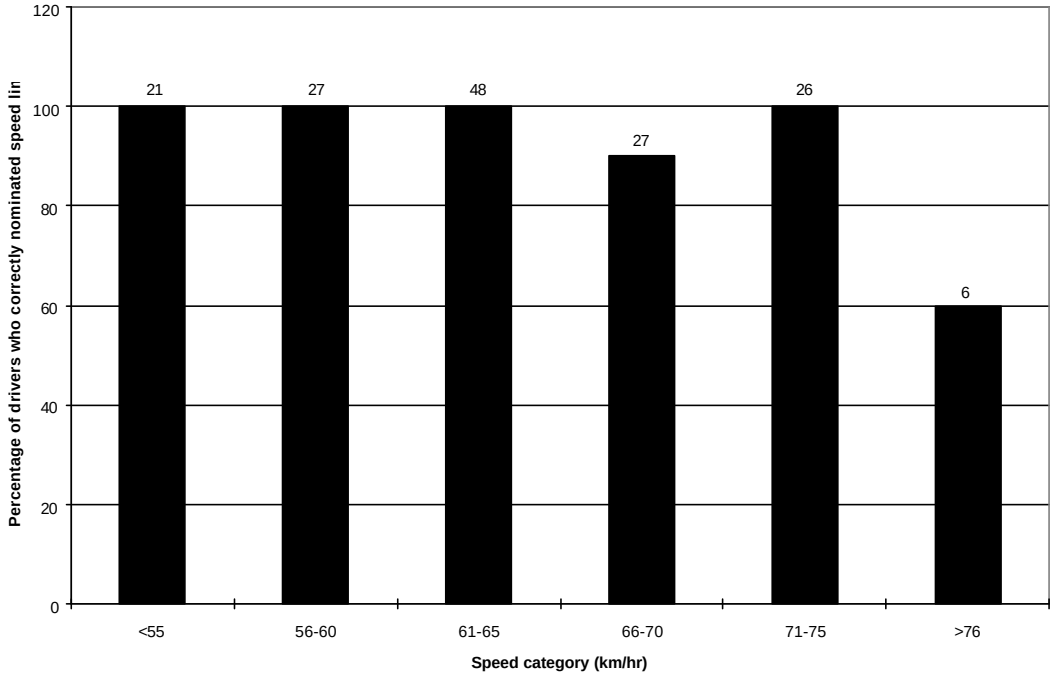

Figure 29: Percentage (and Number) of Drivers in Each Speed Category Who Correctly Nominated the 60 km/h Speed Limit, Beach Road, Parkdale

Fildes et al. (1991) found that almost all drivers correctly nominated the 60 km/h speed limit, and that no driver thought the speed limit was over 80 km/h. Fides et al., however, did not find a significant correlation between estimated speed limit and observed speed (r=.119, p>.05).

Belmore Road, Balwyn

Ninety seven percent of drivers correctly nominated the speed limit along the specified section of Belmore Road. The range of the estimated speed limit was from 40 km/h to 75 km/h. There was no significant relationship between estimated speed limit and observed travel speed (r=.046, p.>.05), however there were significant correlations between estimated speed limit and estimate of drivers own or others speed (r=.224, p<.05 and r=.148, p<.05).

Fildes et al. found that 94% of drivers correctly estimated the 60 km/h speed limit. Fildes et al. did not find a significant correlation between estimate of the speed limit and observed travel speed. Fildes et al. did not find significant correlations between estimate of drivers own or others speed.

ESTIMATE OF OWN AND OTHERS' TRAVEL SPEED

Drivers were shown the photograph of the section of road where their speed had been measured and asked to estimate the travel speed of other drivers and to estimate their own driving speed along that section.

Calder Highway, Woodend

A significant correlation was found between observed speed and drivers' estimate of their own speed ($r=.365$, $p<.01$). Figure 31 illustrates that drivers were reasonably accurate at estimating their own speed. The faster drivers tended to underestimate their own speed (or they did not truthfully report their estimate) and those in the slowest speed category tended to overestimate their own speed. Drivers' estimates of their own speed were also correlated with their estimate of the speed of other drivers on the road ($r=.485$, $p<.01$), however there was no correlation between observed speed and drivers' estimates of the travel speed of the other traffic on the road ($r=.045$, $p>.05$).

Fildes et al. (1991) reported significant correlations between driver estimates of their own and others speeds, and concluded that these two variables were measuring the same judgement. This strategy was not employed in the current study. Fildes et al. found that estimated own speed was positively correlated with observed speed ($r=.457$, $p<.01$), however driver's estimate of the speed of other drivers was not correlated with their observed speed ($r=.119$, $p>.05$). Fildes et al. commented that slower drivers at this site tended to nominate much higher speeds for other drivers than for themselves, which were generally closer to the speed limit. They explain this as a function of the particular characteristics of drivers at this site.

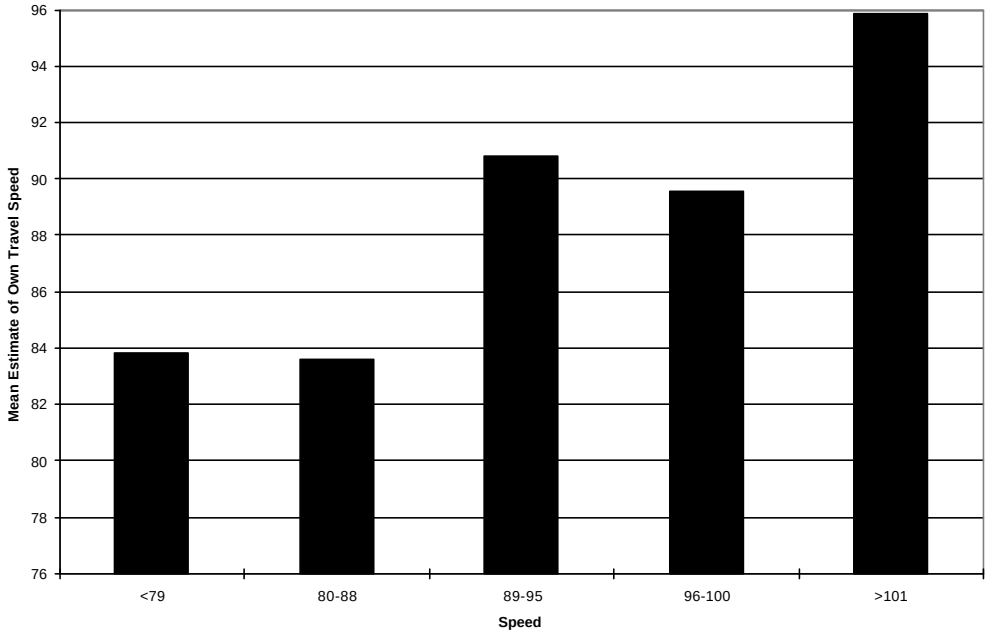

Figure 30: Relationship Between Observed Travel Speed and Drivers' Estimate of Their Own Speed, Calder Highway, Woodend

Beach Road, Parkdale

There was a significant relationship between observed speed and drivers' estimates of their own speed at Beach Road, Parkdale (r=.583, p<.01). Figure 32 shows that most drivers were reasonably accurate in estimating their own speed, however those in the faster group either underestimated their own speed or may not have been truthful when reporting their estimate.

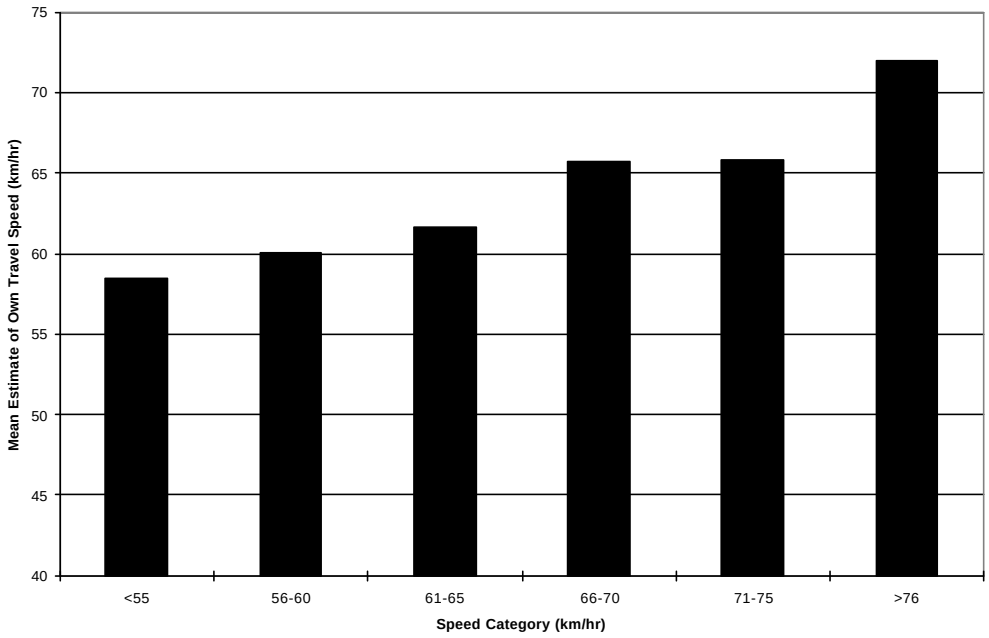

Figure 31: Relationship Between Observed Speed and Drivers' Estimate of Own Speed, Beach Road, Parkdale

There was also a significant correlation between observed speed and the estimated speed of other drivers (r=.232, p<.01). Figure 33 shows drivers' estimates of others' speed with observed travel speed. Generally the faster drivers were travelling, the higher their estimate of the speed of others, however those in the highest speed category estimated the speed of other traffic on the road to be travelling slower than they were. There was a significant correlation between drivers' estimates of their own speed and drivers' estimates of other drivers' speed (r=.313, p<.01).

Fildes et al. (1991) found observed speed to be correlated with drivers' estimates of their own speed (r=.520, p<.01) and with drivers' estimates of others' speed (r=.300, p<.05). Again, Fildes et al. found estimate of own speed and estimate of others' speed to be highly correlated and concluded therefore that they were measuring the same judgement.

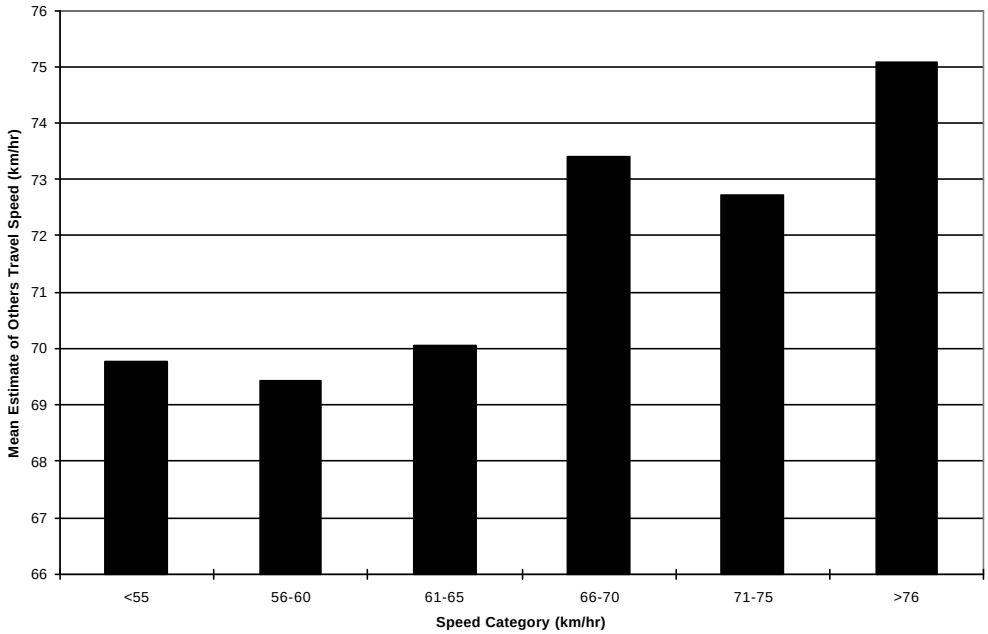

Figure 32: Relationship Between Observed Speed and Drivers' Estimate of Others Speed, Beach Road, Parkdale

Belmore Road, Balwyn

There was again a strong significant correlation between observed speed and the drivers' estimates of their own speed (r=.503, p<.01) . Figure 34 illustrates this relationship.

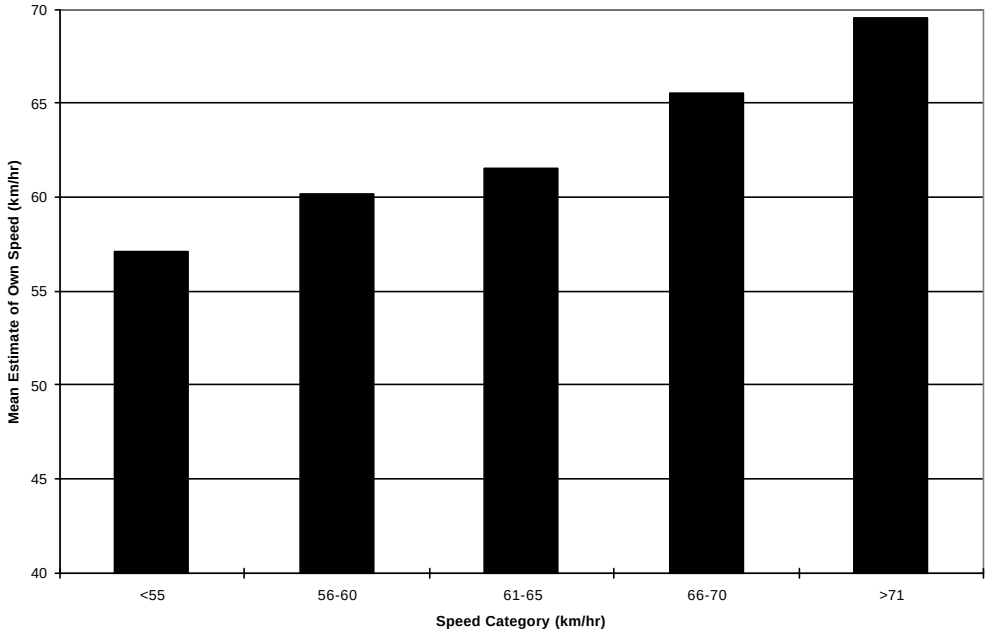

Figure 33: Relationship Between Observed Speed and Drivers' Estimate of Their Own Speed, Belmore Road, Balwyn

Drivers travelling slower than 60 km/h estimated that others were travelling faster than they were. A significant correlation was not found between the estimate of the speed of most of the traffic and observed speed ($r=.041$, $p>.05$), however the estimate of the speed of most of the traffic was correlated with drivers' estimate of their own speed ($r=.258$, $p<.01$).

Fildes et al. (1991) also found a significant correlation between observed speed and drivers estimates of their own travel speed ($r=.121$, $p<.05$). Though significant, this correlation is substantially weaker than the correlation found in the current study. Fildes et al. did not merge the estimate of drivers' own speed and of others' speed variables at this site because these items were not correlated as they were for the previous sites ($r=-.007$, $p>.05$). Fildes et al. did find a positive correlation between observed speed and estimate of the speed of other drivers ($r=.138$, $p<.05$).

DRIVER ESTIMATES OF COMFORTABLE MAXIMUM SPEED

Drivers were asked to provide an estimate of the highest speed at which they would feel comfortable driving at the measurement location, regardless of the speed limit.

Fildes et al. (1991) included a similar question in their survey, where drivers were asked to nominate a safe speed on that section of road. Comparisons were not made between the nominated safe speed of the Fildes et al. study and the highest comfortable speed in the current study. Although these two questions are similar, they may be measuring different constructs. The results found by Fildes et al. regarding a safe speed are reported for interest.

Calder Highway, Woodend

There was a significant correlation between observed speed and drivers' highest comfortable driving speed ($r=.291$, $p<.01$). The correlation was even stronger between highest comfortable driving speed and drivers' estimate of their own speed ($r=.732$, $p<.05$). Figure 35 shows that slower drivers felt comfortable at slower speeds and faster drivers at faster speeds.

Fildes et al. found a positive correlation between observed speed and nominated safe speed ($r=.283$, $p<.05$), and a strong correlation between drivers' estimate of their own speed and their nominated safe speed ($r=.758$, $p<.01$).

Beach Road, Parkdale

Observed speed and the highest speed at which drivers felt comfortable were significantly correlated ($r=.370$, $p<.01$). This again was correlated with drivers' estimate of their own speed ($r=.334$, $p<.05$). Figure 36 shows that slower drivers nominated slower speeds and faster drivers nominated faster speeds. Slower drivers also nominated a higher speed than their observed travelling speed and drivers travelling fast were more likely to be travelling at the speed they nominate as the highest speed at which they would feel comfortable.

One driver nominated 200 km/h as the highest comfortable speed along Beach Road. This response was 110km higher than the next highest response and was not included in this section of the analysis.

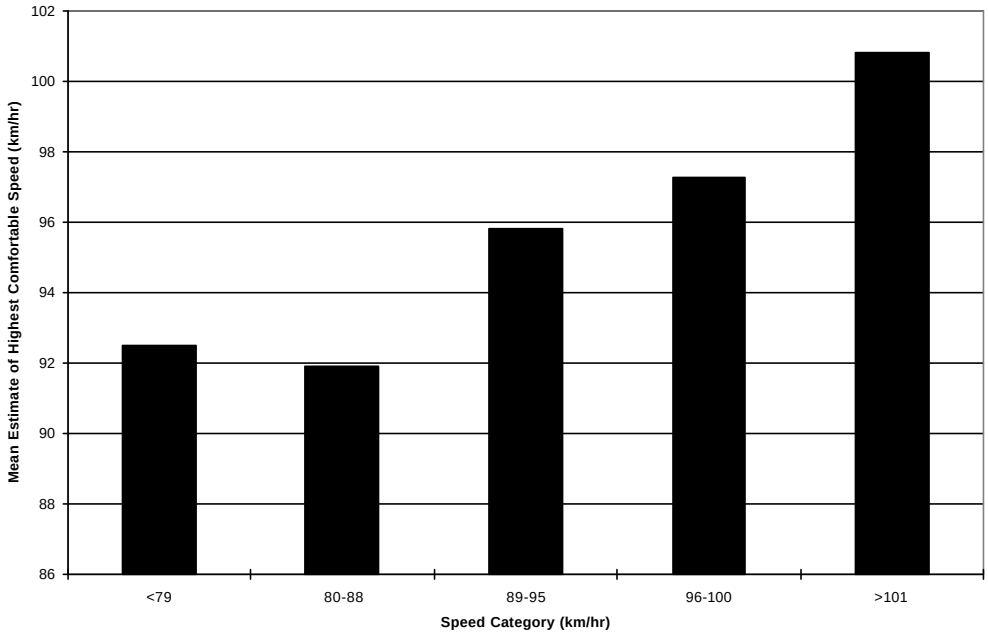

Figure 34: Relationship Between Observed Speed and Drivers' Highest Comfortable Speed, Calder Highway, Woodend

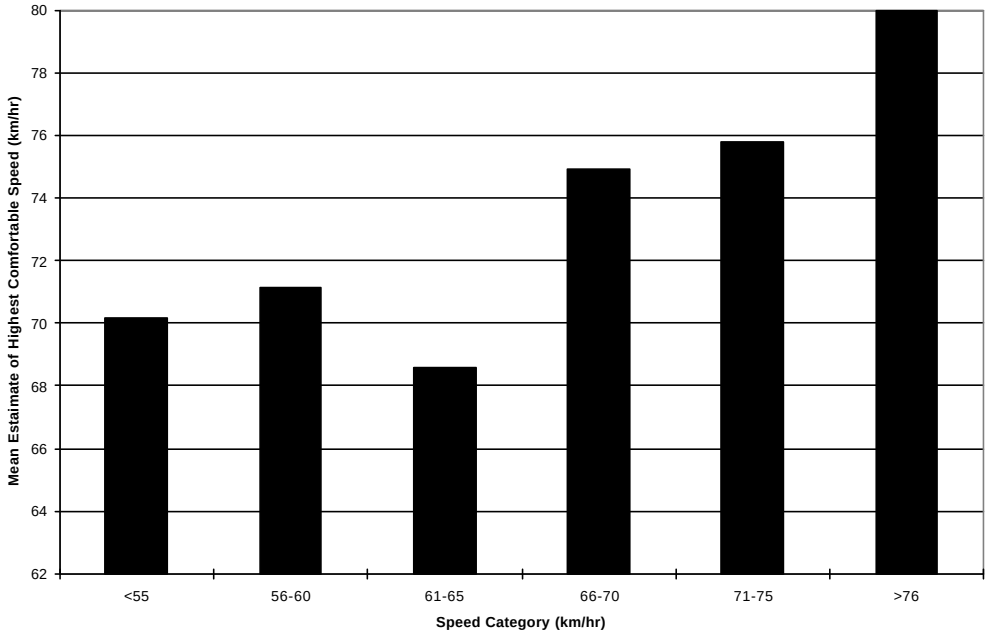

Figure 35: Relationship Between Observed Speed and Drivers' Highest Comfortable Speed, Beach Road, Parkdale

Fildes et al. found a positive correlation between observed speed and drivers' estimates of their own speed and nominated safe speed ($r=.348$, $p<.05$ and $r=.731$, $p<.05$ respectively).

Belmore Road, Balwyn

There was a significant (though not strong) correlation between observed speed and the highest comfortable speed (r=.176, p<.05). This is shown in Figure 37. There was a stronger relationship between nominated maximum comfortable speed and estimate of own driving speed (r=.388, p<.05).

Fildes et al. found a positive correlation between observed speed and nominated safe speed (r=.338, p<.05), however in comparison to the other sites, there was no correlation between estimated own speed and nominated safe speed.

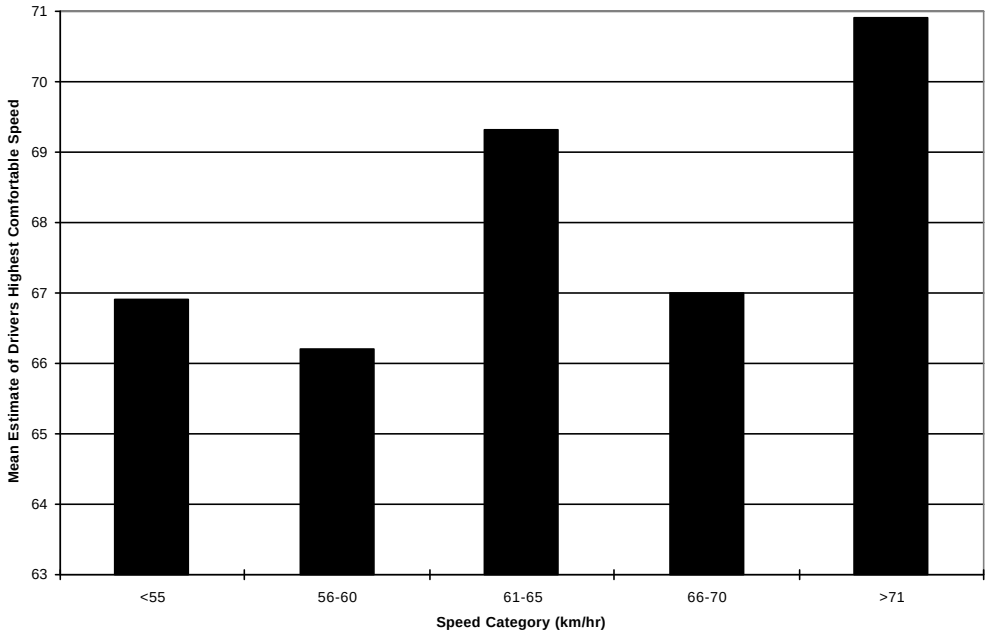

Figure 36: Relationship Between Observed Speed and Drivers' Highest Comfortable Speed, Belmore Road, Balwyn

PERCEIVED RISK OF DETECTION FOR SPEEDING

There was no correlation between certainty of being stopped by the police when travelling 20 km/h over the speed limit and observed speed at any of the sites where drivers were interviewed. It is interesting to note, however, the correlations between this variable and the other variables.

Calder Highway, Woodend

As for all sites, drivers' rating of the certainty of being stopped by the Police when travelling 20 km/h over the speed limit correlated significantly with their rating of dangerousness when travelling at the same speed (r=.375, p<.01). A significant correlation was also found between the certainty of detection and intolerance of illegal behaviours (r=.245, p<.01). Risk of detection was not correlated with any of the other variables.

Fildes et al. (1991) found a positive correlation between risk of detection and observed speed (r=.144, p<.05), however risk of detection and rating of speeding danger was not correlated. There were no correlations between risk of detection and the other variables.

Beach Road, Parkdale

The rating of the likelihood of being caught by the Police when speeding correlated negatively with drivers' estimate of their own speed (r=-.229, p<.01). This indicates that the faster the drivers estimate of their own speed, the lower their perception of the risk of detection for speeding. Figure 38 shows this relationship. This variable also correlated with intolerance of illegal behaviours (r=.280, p<.01) and the perceived danger when travelling 20 km/h over the speed limit (r=.153, p<.05).

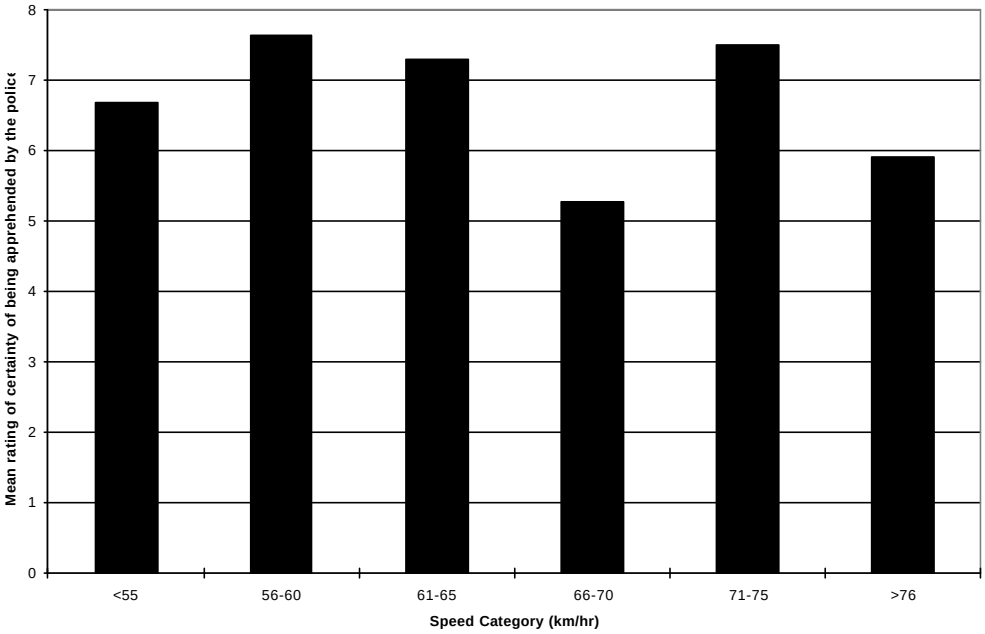

Figure 37: Mean Rating of Certainty of Being Stopped by the Police When Travelling 20 km/h Over the Speed Limit by Observed Speed, Beach Road, Parkdale

Fildes et al. (1991) found that drivers' perceived risk of detection when travelling above the speed limit did not correlate with any of the other variables.

Belmore Road, Balwyn

Drivers' perceived risk of detection when speeding correlated only with their perceived danger when travelling at the same speed (r=.256, p<.01). Fildes et al. (1991) found that drivers' perceived risk of detection did not correlate with any of the other variables.

PERCEIVED DANGER WHEN TRAVELLING 20 KM/H OVER THE SPEED LIMIT

There was not a significant correlation between the perceived danger of driving 20 km/h over the speed limit and observed speed at Woodend or Belmore Road, Balwyn. There was however a significant negative correlation between these two variables for drivers at Beach Road, Parkdale ($r=-.237$, $p<.01$), indicating that the slower drivers travelled, the higher their perceived danger when travelling 20 km/h over the speed limit. This is shown in Figure 39. Perceived danger correlated significantly with some of the other variables at the different sites.

Calder Highway, Woodend

For the rural drivers, perceived danger when speeding correlated negatively with the nominated highest comfortable speed ($r=-.342$, $p<.05$), indicating that the faster the nominated speed, the lower the perceived danger of travelling 20 km/h over the speed limit. Perceived danger was not correlated with observed speed ($r=-.124$, $p>.05$), own estimated speed ($r=-.061$, $p>.05$), estimated speed of other drivers ($r=-.055$, $p>.05$) or the estimated speed limit ($r=-.061$, $p>.05$).

Fildes et al. (1991) did not find perceived danger and observed speed to be correlated, however there were significant negative correlations with estimated own speed ($r=-.336$, $p<.05$), estimated speed of other drivers ($r=-.227$, $p<.05$) and a positive correlation with the estimated speed limit ($r=.229$, $p<.05$).

Beach Road, Parkdale

At Beach Road perceived danger correlated negatively with the estimate of own speed ($r=-.237$, $p<.01$), highest comfortable speed ($r=-.510$, $p<.01$) and estimate of others speed ($r=-.198$, $p<.05$), which together suggest that the faster drivers travel, the lower their perception of danger when speeding. It also correlated with intolerance of illegal behaviours ($r=.322$, $p<.01$). Perceived danger when speeding and the estimated speed limit were not correlated.

Fildes et al. (1991) found that perceived danger was negatively correlated with observed speed ($r=.346$, $p<.01$), own speed estimate ($r=.477$, $p<.01$), estimated speed limit ($r=-.198$ $p<.05$) and estimate of the speed of other road users ($-.290$, $p<.01$).

Belmore Road, Balwyn

Perceived danger when speeding correlated negatively with the nominated highest comfortable speed ($r=-.319$, $p<.01$) and positively with intolerance of illegal behaviours ($r=.341$, $p<.01$). Perceived danger did not correlate with any other variables, except perceived risk of detection, which was discussed in the above section.

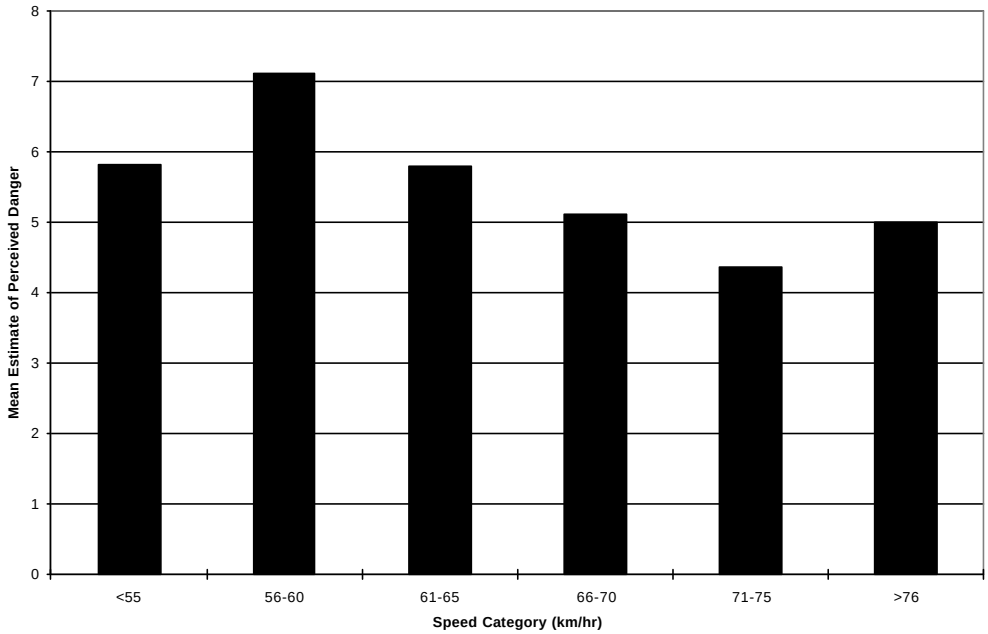

Figure 38: Relationship Between Observed Speed and Perceived Danger When Travelling 20 km/h Over the Speed Limit, Beach Road, Parkdale

The estimated speed of other drivers was found to correlate negatively with perceived danger by Fildes et al. ($r=-.317$, $p<.05$), as did the nominated safe speed ($r=-.437$, $p<.01$). Perceived danger did not correlate with any other variables.

INTOLERANCE OF ILLEGAL BEHAVIOURS

Eight questions were presented to drivers asking how bad or wrong certain illegal actions or scenarios were on an eleven-point scale. The ratings for each of the eight questions were summed to give a single score. These questions were not included in the Fildes et al. (1991) study. This variable reflects the general strength of negative attitudes towards illegal behaviours in both the road safety context and in more general contexts, and might be taken as a measure either of moral development or social deviance. The items were preceded by a request to provide ratings without considering the potential injury or financial consequences of engaging in each behaviour. This was included to limit responses to a rating that reflected the illegality of the behaviours *per se* rather than the potential consequences of the behaviours.

Calder Highway, Woodend

There was a significant negative correlation between intolerance of illegal behaviours and observed speed ($r=-.257$, $p<.01$). Figure 40 shows that those who were driving faster scored lower on the this scale, signifying they did not in general rate the presented behaviours as bad or as wrong as the slower drivers.

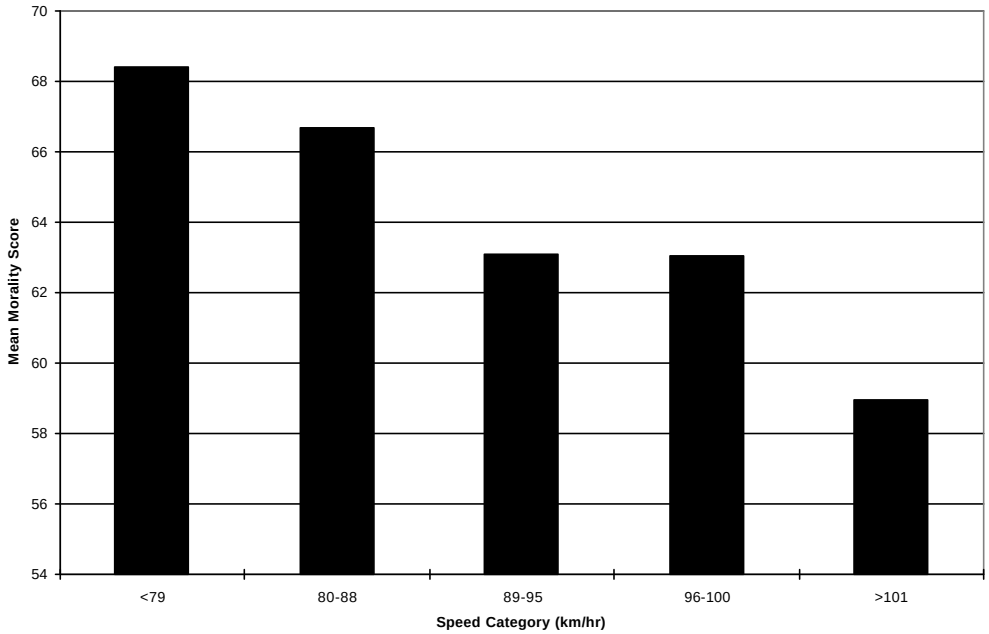

Figure 39: Relationship Between Observed Speed and Intolerance of Illegal Behaviour, Calder Highway, Woodend

Beach Road, Parkdale

Figure 41 shows the relationship between intolerance of illegal behaviours and observed speed. Again, drivers tend to score lower on the attitude scale the faster they were driving. There was a significant negative correlation between these two variables (r=-.352, p<.01).

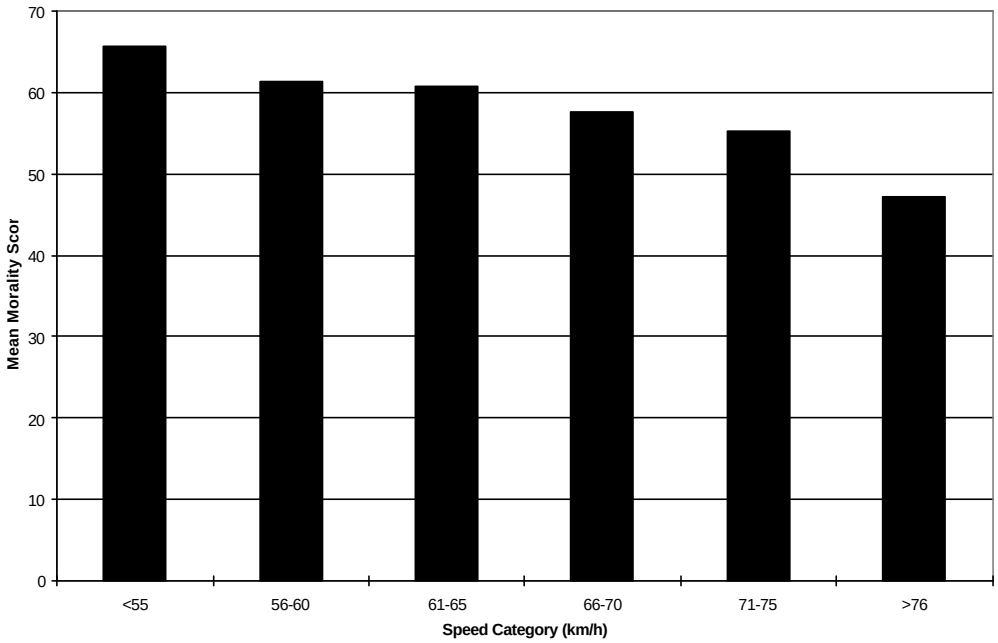

Figure 40: Relationship Between Observed Speed and Intolerance of Illegal Behaviour, Beach Road, Parkdale

Belmore Road, Balwyn

There was a significant negative relationship between intolerance of illegal behaviours and observed speed at Belmore Road, Balwyn ($r=-.186$, $p<.01$). Figure 42 illustrates this relationship.

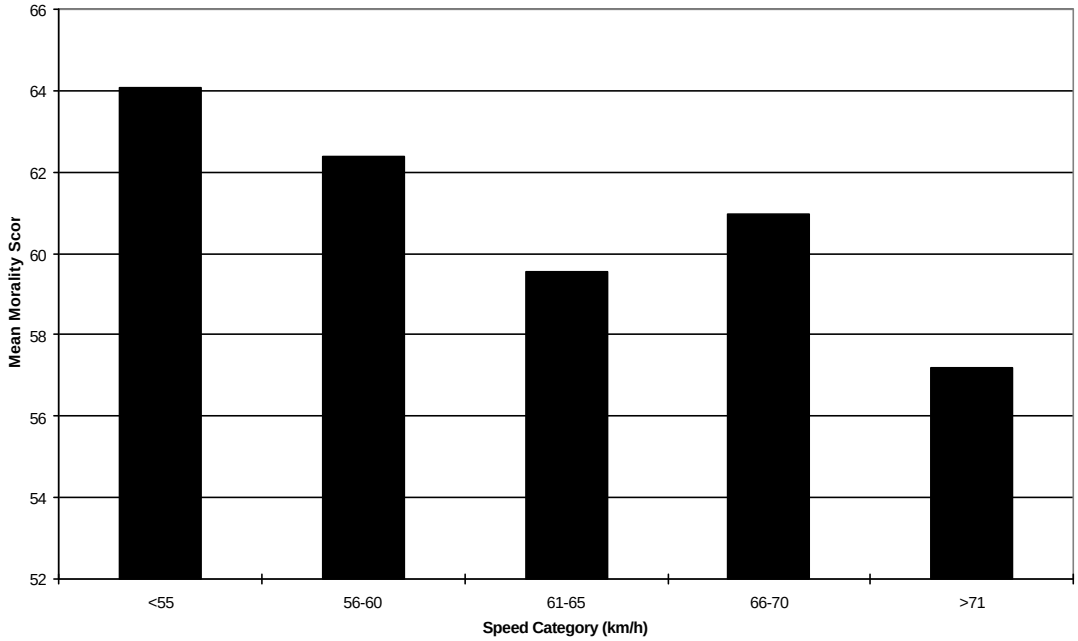

Figure 41: Relationship Between Observed Speed and Intolerance of Illegal Behaviour, Belmore Road, Balwyn

MULTIVARIATE ANALYSIS OF RELATIONSHIPS BETWEEN VARIABLES

The data were analysed using the factor analysis procedure in SPSS for Windows. Concerns about the relatively small number of participants necessitated the combination of the data from the three sites for the factor analysis. The data relating to observed speed, judgements about speed, and travel time were standardised within each site prior to combining the data for the factor analysis to ensure that site-specific speed characteristics did not affect the analysis.

The factor analysis was based on a principal components extraction of four factors using a Spearman (nonparametric) correlation matrix. The number of eigenvalues greater than one exceeded four factors, however after examining the Cattell scree plots it was considered that four factors provided the most parsimonious description of the underlying structure of the variables. Four factors explained 29.5% of the variance. Extraction of factors was followed by an oblique rotation of the factors. The results of the factor analysis are presented in Table 8.

Table 8: Pattern Matrix for Four-Factor Solution for the Characteristics Associated with Driving Speed after Oblique Rotation. (Factor loadings less than 0.25 have been suppressed)

Variable	Factor I	Factor II	Factor III	Factor IV
Driver age	.85			
Driving experience of driver	.83			
Driver displaying P-plates (dichotomous)	-.44			
Driver estimate of their own speed (standardised for each site)	-.38		-.38	.25
Self-reported tiredness rating	-.33			
Involvement in accidents in last five years (dichotomous)	.33			
Number of occupants in the car	.26			
Hours of television each weeknight	.25			
Current trip was business or work related (dichotomous)	-.35	.61		
Current trip was recreation or holiday related (dichotomous)	.33	-.50		.28
Distance driven each week		.49	-.33	
Car was classified as a large car (dichotomous)	.28	.48		-.28
Estimated year of manufacture of car		.46		
Driver owned the vehicle (dichotomous)		-.40		
Car was classified as a medium car (dichotomous)		-.37		-.25
Time until expected end of current trip (standardised for each site)		.35		
Time elapsed since start of current trip (standardised for each site)		.31	.30	
Percentage of driving in built-up areas		-.27		
Rating of danger when exceeding limit by 20 km/h			.66	
Highest comfortable speed at location (standardised for each site)			-.64	
Male (dichotomous)			-.55	
Intolerance of illegal behaviours	.29		.54	
Self-calibration of safety as a driver			.44	
Detected for speeding since licensing (dichotomous)		.26	-.42	
Perceived risk of detection for exceeding limit by 20 km/h			.34	
Observed speed of vehicle (standardised for each site)	-.28	.25	-.33	
Estimated speed of other drivers (standardised for each site)			-.27	.26
Car was classified as a small car (dichotomous)	-.26	-.26		.56
Current trip was related to domestic duties (dichotomous)				-.54
Driver was on time (dichotomous)				.49
Driver was ahead of schedule (dichotomous)				-.36

Factor I accounted for 10.4% of the variance and most likely reflects the age or driving experience of respondents. Drivers who scored high on this factor tended to be older, to have had more years of driving experience, and to have had more crashes. High-scorers were also less likely to have P-plates displayed on the car. They tended to have more occupants, reported being less tired than other drivers, and spend more time watching television. They were also more likely to estimate their own speed at the recording location as relatively low and were more likely to be driving relatively slowly.

Factor II accounted for 7.9% of the variance and appears to reflect car use oriented towards business or work. High scoring drivers were more likely to be involved in work-related driving, to drive further each week than others, to be in a larger, newer car, and to be in a car owned by someone else. They were also likely to be on a longer trip than other respondents. They also tended to be driving faster than other respondents and were more likely than others to have been detected speeding in the past.

Factor III accounted for 6.3% of the variance and appears to represent attitudes, beliefs, and behaviours associated with speed choice. Drivers with high scores on this factor tended to drive more slowly at the speed measurement sites, nominated a slower maximum speed at which they would feel comfortable driving at those sites, and nominated a slower speed for other traffic at that location. These drivers were more likely to be female, rated speeding as more dangerous than other drivers, and were less likely to have been detected speeding. High scorers on this factor tended to be less tolerant of illegal behaviour, considered themselves to be less safe than drivers who scored lower on this factor, and perceived a relatively high risk of detection for speeding. They tended to drive less distance per week and tended to estimate their own speed at the measurement location as relatively slow.

Factor IV accounted for 5.0% of the variance and most likely represents recreational vehicle use. The drivers who scored high on this factor were more likely to be driving a small sized car and less likely than others to be driving a medium or larger car. They were less likely to nominate domestic reasons and more likely to nominate recreational reasons for their current trip, and were likely to indicate that they were on schedule. They were likely to estimate that they had been driving relatively fast at the speed measurement location and to estimate relatively high speeds for other cars at that location.

The factor correlation matrix is presented in Table 9. There were no substantial correlations between the four factors.

Table 9: Factor Correlation Matrix

	Factor 1	Factor II	Factor III	Factor IV
Factor I	1.00			
Factor II	-.00	1.00		
Factor III	.07	-.06	1.00	
Factor IV	-.01	.02	.03	1.00

A subsequent factor analysis was conducted excluding the drivers who had had less than five years driving experience as there was some concern that their reduced opportunity to crash in the five years prior to the survey may have influenced the results in relation to the crash-involvement measures. The results of the factor analysis were stable, however, when these cases were excluded. Alternative methods to control for the possibility that this may have influenced the outcome of the factor analysis were investigated but were not appropriate for the analysis reported here.

An additional factor analysis was also conducted for the urban sites alone (ie. excluding Woodend) to ensure that any urban-rural differences did not influence the results of the analysis. Again, the factor analysis was relatively stable, indicating that separate analyses of the data for rural and urban drivers would produce similar results.

Fildes et al. (1991) conducted separate factor analyses for the rural and urban sites. For the rural sites, these authors extracted three factors which explained 35% of the variance. The first factor represented business travellers who travelled large distances, drove a vehicle they did not own and carried few passengers. The second factor comprised of older, more experienced drivers with a low accident rate and the third factor represented male drivers undertaking long recreational trips. The factor analysis for the urban sites also explained 35% of the variance. The first factor represented male drivers on long recreational trips, the second factor was comprised of younger, less experienced drivers with a high accident rate and the third factor was comprised of business travellers who did not own their own vehicle and a high weekly mileage.

The factor relating to business travellers was common to each study, as was the factor relating to age and experience. Fildes et al. (1991) did not include data from the attitude related questions, however, and one of the factors extracted in the current study was primarily related to attitudinal measures.

SUMMARY OF RESULTS

Table 10 shows a summary of the factors found by the current study, and those reported by Fildes et al. (1991).

Table 10. Summary of the Results of the Factor Analysis

Factors Extracted in the Current Study (and percentage of variance accounted for)	Fildes et al. (1991) (Order Rearranged)	
	Rural	**Urban**
Age/experience (10.4)	Age/experience	Age/experience
Business/work car use (7.9)	Business/work car use	Business/work car use
Attitudes/beliefs associated with speed choice (6.3)		
Recreational car use (5.0)	Recreation/holiday	Recreation/holiday

DISCUSSION

The purpose of the study was to investigate the relationship between a number of driver characteristics and driving speed, to examine the data in light of the model presented in the introduction, and to compare the current findings with those found by Fildes et al. in a similar study reported in 1991. The survey collected information about drivers' intentions and attitudes towards speed, certain vehicle and driver characteristics and their driving history. The relationship between these variables and their observed driving speed was investigated.

The critical results in terms both of the model discussed in the Introduction and the more general issues associated with the targeting of speed enforcement and public education programs are those from the factor analysis. For this reason, the Discussion presented here focuses primarily on these results, drawing on the descriptive analyses only as far as it is necessary to do so. The reader is referred to the summary tables presented throughout the Results sections for further details of these results.

It is important at this stage to emphasise that the results reported here are specific to the sample of drivers recruited from three locations. The extent to which it is appropriate to generalise beyond this sample to the general driving population is unknown. The use of three sites to collect data in the present study was appropriate given the interest in revisiting the results of Fildes et al. (1991), but the use of a small number of interview sites does potentially limit the generalisation of the results. This comment is tempered somewhat, of course, by the emphasis on attitudinal, demographic, and trip-purpose variables that are less likely than some other measures to have limited generalisability beyond the three survey sites. It is also important to note that the three sites sampled drivers on a rural highway, an urban arterial road, and an urban feeder road, which together provide a broad sampling of roads in the Victorian context.

THE SPEED MODEL

It will be recalled that the model developed earlier in this report was based on the notion that the behaviour of interest in understanding speeding behaviour was the speed-change response to specific external and internal pressures. The speed-change behaviour of a driver at any point in time was argued to be the net effect of many speed-up and slow-down responses to the many features of the driving environment and the drivers' own characteristics, with the speed at any particular point in time being the net effect of driving speed at an earlier point in time plus the speed-change behaviour of interest.

One consequence of this view of speed-related behaviours is that it relegates actual speed to the role of a surrogate measure of speed-behaviour when studies like this one seek to investigate the interactions between speed behaviour and other variables. Any direct relationships between contextual features, driver characteristics, and speed-change responses would be expected to be reflected only imperfectly in the observed speed of drivers at any point in time. More accurate estimates of these relationships would need to rely on a measure of speed change between speeds measured at two points in time or space with intervening changes in the driving environment which could be controlled by the researcher. Such an approach would provide a direct measure of the speed-change behavioural response to the action of particular characteristics of the driving environment.

It is clear, then, that the data collected here are unlikely to provide definitive answers to questions about the strength of relationships between the critical speed behaviour and the range of factors included in the study. It was considered, however, that the data collected here would at least allow some general conclusions about the possible validity of the model presented earlier. The extent to which the results of the factor analysis, for example, reflected a relationship between observed speed and variables included in the model might be considered to be a crude estimate of the validity of the model. More detailed testing of the model will, of course, require more substantial research.

The results of the factor analysis were largely consistent with expectations derived from the model.

Observed speed loaded most strongly on the factor which included loadings from most of speed-attitude related measures. Drivers who had relatively high driving speeds at the measurement locations (and who would therefore be expected to have a stronger tendency towards "speed-up" responses rather than "slow-down" responses) shared a number of other characteristics. They were more likely to feel comfortable driving at relatively high speeds, they clearly had a history of speeding (being more likely to have been detected speeding), and they believed that other drivers were going relatively fast. Under the model, feeling comfortable driving fast, perceptions that others are driving faster, and personal characteristics associated with speeding would be expected to add pressure for speed-up responses at any one point in time. These drivers were also less likely to rate travelling fast as dangerous, were less likely to be intolerant towards the range of illegal behaviours included in the survey, and considered themselves to be relatively safe compared to other drivers. These characteristics would also be expected to bias speed-change behaviours upwards. They had also been driving for longer than other drivers, and under the model one of the factors predicted to increase upward pressure on speed-change responses is the motivation to complete the trip. It may be the case that drivers who have been driving for relatively long time periods are more inclined to want to finish the trip relatively soon.

Observed speed also loaded (less strongly) on two other factors. One of these was the age-related factor (Factor I). In this factor, drivers who recorded relatively low speeds compared to other drivers at each site tended to be older and to be less tolerant of illegal behaviours. Most of the variables loading on this factor most likely did so as a reflection of the causal role of age – experience as a driver, type of car use and car size, and number of occupants in the car might all be expected to depend in part on the age of the driver. The role of age-related characteristics in speeding was discussed in the Introduction, and it would be expected that speed-change responses might be biased upwards amongst younger drivers for a number of social and developmental (maturational) reasons. The results here were less clear, however, and suggest that the main age effect on observed speed relates to older drivers where (see Figure 27) their speed distribution was biased towards excessively slow driving compared to the other two age groups.

The other factor which included a loading from observed speed was the factor which reflected work-related use of the car at the time of the interview. In this case, higher driving speeds were associated with business and work car use, driving a large, relatively new car owned by someone other than the driver, a relatively high level of driving exposure, being on a long trip and driving relatively little in built-up areas. High scorers on this factor (and relatively fast drivers) appear to be engaged in driving for their work or business, and it is possible that the trip-completion motivation likely in that context may bias speeds upwards.

The results of the factor analysis are, therefore, explicable in terms of the model outlined earlier. The strong covariation in items relating to speeding, comfort, self-calibration, rated danger of speeding, and intolerance of illegal behaviour suggests that there are a number of variables closely tied to speed-change responses or biases, and the low correlation between this factor and the other three factors suggest that the other factors less strongly associated with observed speed are less influential and independent of the speed-related attitudes.

Some of the findings reported here are of particular interest in the context of understanding the factors that might underlie speeding behaviour. The strong loading of the items relating to intolerance of illegal behaviours on the speed-attitudes factor is particularly interesting and might profitably be the focus of future research. It was suggested (but only in passing) in the Introduction that general attitudes relating to moral issues might bias speed changes upwards or downwards. It is widely accepted that there are developmental aspects to morality-related attitudes that result in a movement from attitudes about right and wrong which are based on the fear of punishment towards attitudes that are more closely based on principles and community welfare (Kohlberg, 1984). The results of the factor analysis and the earlier descriptive analyses indicate that the ratings made by drivers of the "badness" of certain illegal behaviours were correlated with observed speed such that faster drivers tended to have greater tolerance of illegal behaviours. Whether responses to these items reflect stages of moral development is an empirical question, but it is clear that the results reported here suggest that there may be some benefit in conducting additional research in this area.

The potential benefit of research in this area is twofold. To the extent that any results suggest that high-risk drivers are characterised by a lower stage of moral development, it may be possible to target increased enforcement efforts and public education at those drivers which is tailored to their particular focus on the risk of detection. Alternatively, there is some evidence that some approaches to psychological therapy can act to encourage further moral development (Little & Robinson, 1989; Putnins, 1997; Schulman, 1996, Lowenstein, 1989) and it may be possible to incorporate some ideas and techniques from these therapeutic techniques into public education or advertising material targeted at high risk drivers. This change in general moral attitude would be expected to reduce the likelihood that these drivers would speed.

It is also possible to discuss these results in terms of social deviance, where there is some evidence that anti-social attitudes or behaviours are associated with unsafe road use behaviours (eg. Barkley, Murphy, & Kwasnik, 1996; Beirness & Simpson, 1997). The items in the survey sought information about the attitude of the driver towards a series of illegal behaviours, and it is reasonable to conclude that social deviance would be associated with less negative attitudes towards these behaviours, which in turn were associated with higher driving speeds in the current study. The development of appropriate countermeasures targeting people with anti-social attitudes and behaviours is likely to require additional, more-focused research to further elaborate the characteristics of likely target groups. The authors believe this work to be important in the longer term. It is not inconceivable that the subgroup of drivers defined by anti-social attitudes and behaviours may represent a group who are less likely to be influenced by enforcement-oriented approaches to behaviour change (see Harrison, 1998 for a discussion of this issue in relation to drink-driving).

Another key result from the factor analysis relates to the correlation between observed speed and the variables associated with calibration. Faster drivers were more likely to consider themselves safe and to feel comfortable driving well above the speed limit. It is of some interest that these variables did not also load on the age-related factor in the factor analysis as it is generally believed that self-calibration is a particular issue for younger drivers (eg. Harrison et al., 1997). These results suggest that self-calibration problems may be more widespread than this and that drivers who engage in unsafe driving behaviours (such as driving fast) may also have self-calibration problems. While it is clear that self-calibration is the result of the driving experiences of individual drivers, it may be possible to influence calibration using media-based materials. This would need to be the focus of some additional research prior to suggesting a public education program based on this issue, but it is likely to be a potential area for further gains in road safety.

The final result to be discussed in relation to the factor analysis is the relationship between business and work-related driving and speed. The possibility that people driving for work-related purposes are more likely to drive relatively fast than other road users is of some interest for a number of countermeasure-related reasons. At one level, the likely daytime driving pattern of these road users may lead to a recommendation that enforcement programs could be targeted at them by increasing

the level of enforcement conducted during normal working hours, and perhaps using routes identified as carrying relatively high daytime (as opposed to peak) traffic loads. More potential, however, might arise from the use of daytime radio public education materials targeting the radio stations most listened to by road users who are driving for business-related reasons. These data would most-likely be available, and the potential to directly target higher-risk drivers while they are driving should be considered.

The contribution of business-related driving to speeding leads to another approach that could be considered. Corporations and other businesses often have policies concerning the use of fleet vehicles, including policies about how penalties resulting from offences detected under owner-onus legislation (in the case of automated enforcement) should be handled. As speed appears to be associated with business-related car use, encouraging corporations and businesses to introduce appropriate policies in relation to driving behaviour might be beneficial. This would target a level of society between the individual and the whole of the road network and may serve to produce generalised changes in driver behaviour. An extension to this approach would be to encourage the use of policies that are more subtly related to driving behaviour. It may be possible, for example, to encourage the use of fuel consumption as a measure of appropriate driving behaviour given the likely difficulty of driving unsafely while also minimising fuel consumption. This possibility needs further investigation and the implementation of a trial program.

TARGETING SPEEDING DRIVERS

The results of the factor analysis and the more-descriptive results reported earlier are potentially useful as a source of information to assist in the targeting of either enforcement programs or public education campaigns, although the data analysis techniques used here do not allow conclusions to be drawn about the causality of relationships between speed and other variables. In spite of this, the fact that speeding occurs within the context of some driving and personal characteristics suggests that public education material, at least, could use the relationships in one (or both) of two ways.

- The results could be used to guide the selection of characters in advertising material to ensure that the materials are closely relevant to target groups who are more likely to engage in speeding. This approach would make use of the characteristics outlined here as background characteristics of the people or contexts used in advertising material.
- The results could also be used to define target groups for advertising material more closely. The associations between speed and other factors outlined here point towards some groups of drivers as being potentially more risky than other groups.

Table 11 summarises some of the characteristics associated with speeding arising from this study and the potential implications of these characteristics for the development of public-education materials.

COMPARISON OF THE CURRENT STUDY WITH FILDES ET AL. (1991)

This study aimed to maintain the same methodology as the Fildes et al. study conducted almost ten years earlier. The questionnaires used were essentially the same, including a few minor changes with the removal of questions relating to appropriate fines and the addition of eight questions regarding drivers' tolerance of illegal behaviours. Changes were kept to a minimum to enable comparisons to be made between the studies if that was considered appropriate.

Table 11: Characteristics of Relatively Fast Drivers and Implications for Public Education Material

GENERAL CHARACTERISTICS	POTENTIAL IMPLICATIONS FOR PUBLIC EDUCATION CAMPAIGNS
SELF CALIBRATION: Faster drivers had lower ratings of the danger of speeding, felt they were generally safer than their age peers, and felt comfortable driving fast.	• Self calibration cannot easily be addressed directly through advertising campaigns as it is a direct outcome of safe driving experience. • It may be possible to have confident characters model a change in self-calibration resulting from speed-related near misses.
ENFORCEMENT: Faster drivers were more likely to have been detected speeding than other drivers but tended to believe the risk of detection was lower than other drivers	• This outcome stresses the need to move beyond deterrence models of enforcement toward models of enforcement and behaviour that stress the complexity of driving behaviour (see Harrison, in preparation). • Characters could model thinking styles that link actual experience (being caught) with perceptions of higher risks of detection – ie. they could model consistent thinking.
MORAL ATTITUDES or SOCIAL DEVIANCE: Faster drivers were more likely to be tolerant of a range of illegal behaviour – believing them to be less "bad" than other drivers.	• Publicity programs based on successful therapeutic approaches to moral development could be investigated. • Characters used in public education materials could model some characteristics associated with anti-social attitudes
ESTIMATES: Faster drivers estimated the speed of other drivers and their own speed as relatively high compared to slower drivers.	• The normative nature of driver speed-choice could be used here by presenting information (in an accessible form) showing that people are gradually slowing down
PERSONAL CHARACTERISTICS: Faster drivers were more likely to be male and to be younger.	• Targets need to be younger drivers and male drivers. • Material featuring male drivers and (separately) younger drivers is likely to reach the target audience
CAR USE: Faster drivers were more likely to be engaged in business driving and to be driving a newer, larger vehicle owned by another person or company.	• Targeting business and work-related driving behaviour may prove effective. These groups could be targeted directly or through employers. Employment-related material could stress financial costs both to the driver and (perhaps more powerfully) to the employer, and the uptake of policies relating to fuel consumption might prove effective • Material featuring business or work-related driving behaviour may be effective in advertising campaigns

The Results section of the present report details the main differences and similarities between the two studies,and these will be summarised here. However, it is important to be aware that there are substantial problems with the interpretation of any changes in the measures used in the two surveys over time which are discussed later.

Differences in mean speed over the data collection days was found for the urban sites, particularly for Beach Road, where a lower mean speed was noted. Fildes et al. (1991) generally had a higher proportion of males in their sample for all sites, but overall the samples did not differ substantially, in terms of the characteristics measured.

The Fildes et al. (1991) results were compared with the results of the current study. In the current study there was a higher representation of vehicles with one occupant at the Woodend site. The drivers sampled by Fildes et al. (1991) at this site were more likely to be on time and to have travelled longer distances before being stopped. The data for the other variables measured were similar between studies at the Woodend site. There was a higher representation of younger drivers at both Beach and Belmore Roads in the current study than sampled by Fildes et al. (1991). There was also a higher representation of females, P-plate drivers and recreational drivers in the current study at these sites. The Fildes et al. (1991) sample were more likely to be business travellers and less likely to be on time. The other variables were similar between the two studies at the Beach Road and Belmore Road sites.

The similarity of the questionnaires used by Fildes et al. (1991) and the current researchers has allowed for a comparison of attitudes related to speeding. There was a consistent finding that drivers can accurately estimate the speed they were travelling. Both Fildes et al. (1991) and the current study found strong positive correlations between observed speed and drivers' estimate of their own speed for all sites. The finding is not as consistent when observed speed is correlated with the estimated speed of other drivers. Both studies found a positive correlation between these variables at Beach Road, and Fildes et al. (1991) also found this relationship at Belmore Road. There was no correlation found by the current study at Belmore Road, and neither study found a correlation at Woodend, suggesting that there is a difference between rural and urban drivers in estimating the speed of other drivers.

It is perhaps of more relevance to study the relationship between drivers' estimate of their own speed and their estimate of the speed of other drivers in term of determining whether they believe other drivers are travelling at a similar speed. There were strong positive correlations between these variables for Woodend and Beach Road, and in the current study at Belmore Road, however Fildes et al. (1991) did not find a correlation between these variables at Belmore Road.

The correlations between observed speed and estimate of the speed limit were also compared over time. There were differences both at the Woodend and Beach Road sites. The current study found a positive correlation between observed speed and the estimate of the speed limit at these sites, however Fildes et al. (1991) did not find any correlation between these variables. It appears that the drivers sampled in the current study were travelling at what they believed the speed limit to be whereas the drivers sampled in 1990 were not. Neither study found a correlation between these variables at the Belmore Road site.

In both studies there was a strong correlation between the estimated speed limit and drivers' estimate of their own speed at Woodend and Beach Road. Fildes et al. (1991) did not find a correlation between these variables at Belmore Road however there was a positive correlation in the current study. This indicates that all drivers in the current study believed they were driving at what they estimated the speed limit to be. The drivers sampled at Belmore Road by Fildes et al. (1991) were the only group not to show this relationship.

The question relating to the maximum comfortable speed in the current study could not be compared with Fildes et al. (1991) due to a change in the wording. Fildes et al. (1991) asked drivers to nominate a safe speed along the section of road. As a matter of interest, Fildes et al. (1991) found a positive correlation between nominated safe speed and observed speed for all drivers, indicating that drivers believed they were travelling at a safe speed. The current study found positive correlations between maximum comfortable speed and observed speed for all drivers, indicating that all drivers were travelling at the upper limit of their comfort range.

Neither study found a relationship between drivers' observed speed and the perceived likelihood of being stopped by the police if speeding at the urban sites. A discrepancy was observed however between the studies at Woodend. The current study did not find a correlation between these variables, however Fildes et al. (1991) found a weak positive correlation, indicating that fast drivers nominated a greater risk of detection.

Perceived risk of detection was also explored in terms of its relationship with perceived danger. It appears that there is now a relationship between these constructs and that drivers associate detection by the Police with perceived danger when speeding. This relationship was not found in 1990. The current study also found that those drivers who estimated a higher travelling speed for themselves believed there was a lower risk of detection when speeding, though only for the sample at Beach Road. This was not found by Fildes et al. (1991).

Neither Fildes et al. (1991) nor the current study found a correlation between rating of speeding danger and observed speed at the Woodend or Belmore Road sites. There was a negative correlation between these variables at Beach Road for both studies, which indicates that the faster drivers nominate a lower perceived danger when speeding. Though this was the only site where the correlations were significant, there was still a trend in this direction at the other two sites. There does not appear to have been a change in the relationship between perceived danger and observed speed in the time between the two studies.

Both the current study and Fildes et al. (1991) conducted a factor analysis of the data, however the variables entered into the equation by the two studies differed slightly. The three common factors found by both studies were a factor relating to business travellers, a factor relating to age and experience, and one related to recreational car use at the time of the survey. The third factor in the current study represented attitudes, beliefs and behaviours associated with speed choice. These variables were not included in the Fildes et al. (1991) analysis.

The Fildes et al. study and the present study could potentially be viewed as before- and after-surveys where the intervening period was characterised by a substantial increase in the use of automated enforcement of speeding and the introduction and placement of emotive public education material, often speed-related, by the Transport Accident Commission. Under this approach, the repetition of similar surveys before and after the intervention of interest would allow conclusions to be drawn about the effect of the intervention. Such an approach would be inappropriate, however, as its primary assumption (that any differences between survey responses or speed distributions would be consequences of the intervening enforcement and public education efforts) is clearly inappropriate.

Any differences between the surveys could be the result of:

- Changes in economic conditions between the surveys leading to changes in road use patterns;
- Changes in the nature of road users between the surveys resulting from changes in the demographic characteristics of surrounding areas and changing road use patterns;
- Changes in employment patterns over time which would influence the timing and location of road use patterns amongst newly employed and newly unemployed people;
- The changing age distribution of populations in suburban areas feeding into the roads used in the study;

- Changes in road conditions and upgrading of roads leading to shifts in route usage over the intervening period; and/or
- Non-safety related changes in attitudes to legal behaviour relating to general aging of the population between the surveys.

It is clear that it would be inappropriate to draw any conclusions about causal factors for changes in measures between the surveys as they could relate to one or a number of factors that are unrelated to the enforcement and publicity changes that have occurred over that time. A more appropriate approach to this issue would have been tracking surveys at regular intervals which could then more-closely be matched to changes in enforcement and publicity intensity over shorter timeframes.

CONCLUSIONS

This project was conducted for a number of reasons.

- It provided an opportunity to compare some aspects of driving speed and driver characteristics almost ten years after a similar study was conducted at the same interview sites. The comparison between the current study and the earlier study do suggest some differences in a number of measures, although the interpretation of these differences is difficult.

- It provided an opportunity to investigate the nature of the relationships between a number of driver and situational characteristics and driving speed. This component of the study suggested that there were a number of driver attitudes, trip purposes, and driver characteristics that were predictive of driving speed. These characteristics were discussed in terms of their potential for assisting in the development and targeting of road safety programs.

- It also provided the opportunity to review some of the literature relating to speed behaviour. The outcome of the review was the development of a new view of speed choice behaviour which emphasises the role of cognitive processes in speed behaviours and the need to reconsider the critical behaviour in driving speed selection. This component of the current study presents an opportunity to improve both our general understanding of speed-related behaviours and, perhaps more importantly, to apply a new theoretical formulation to the development and improvement of countermeasures.

FUTURE DIRECTIONS

The results reported here and the subsequent discussion lead to a number of recommendations about potential areas for future research.

- The uncertainty expressed in the Discussion about the generalisation of these results to the wider population leads to a suggestion that a larger project targeting the collection of similar data from a number of sites may be appropriate

- The clear relationship between attitude variables, evidence that there are habitual speeding behaviours, and recent research in the drink-driving area (Harrison, 1998) and the speeding area (Harrison & Pronk, 1998) argue for greater efforts in understanding the psychological factors underlying speed choice and the application of these results to the development and targeting of public education programs. The potential practical benefits of this type of research are often underestimated. In the current high-enforcement context, it is clear that there are still drivers engaging in unsafe speed-related behaviour. Targeting these drivers relies entirely on improving our understanding of their characteristics, and especially those characteristics that may act against the effectiveness of current road safety programs.

- Although it is clear that there is a relationship between enforcement activity and driving behaviour, the mechanisms underlying this are poorly understood. The model proposed here emphasises the importance of cognitive factors, and recent theoretical development in the drink driving area (Harrison, 1998) could, if applied and tested in the speed enforcement area, provide the background for further countermeasure refinement. In addition to the need for further theoretical development in the speeding area, there is a need for supporting research to ensure that the development of a new understanding of speeding and enforcement leads to effective new programs to counter this behaviour.

- The potential for targeting work-related driving was raised a couple of times in the report. It is clear that driving speed is associated with work-related driving and the use of company vehicles, suggesting that there may be some merit in targeting corporate car-use policies and culture as a road safety measure. In addition to the direct effect such a program might have on the driving speed of company employees in targeted companies, it would also be expected to have a wider effect on driving speeds as the number of companies with such policies increases as drivers tend to model their driving speeds on the driving speeds of other drivers. This approach has some additional appeal as it targets a level of society between the individual and the broader society. It is recommended that this approach to road safety be investigated.

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APPENDIX A: PRELIMINARY SPEED DISTRIBUTION

A description of the preliminary speeds recorded prior to the study period is described below.

Calder Highway, Woodend

A sample of free speeds were measured over approximately four hours during one weekday prior to the collection of data at each site, to determine the distribution of vehicles' speeds and to establish speed categories for subsequent use in the collection of survey data. The free speeds observed on the Calder Highway, Woodend are shown in Figure 43. The distribution is normal but slightly positively skewed. As shown in the graph, most drivers were travelling below the speed limit of 100 km/h. The mean speed recorded at this site on this occasion was 85.5 km/h (SD=9.1).

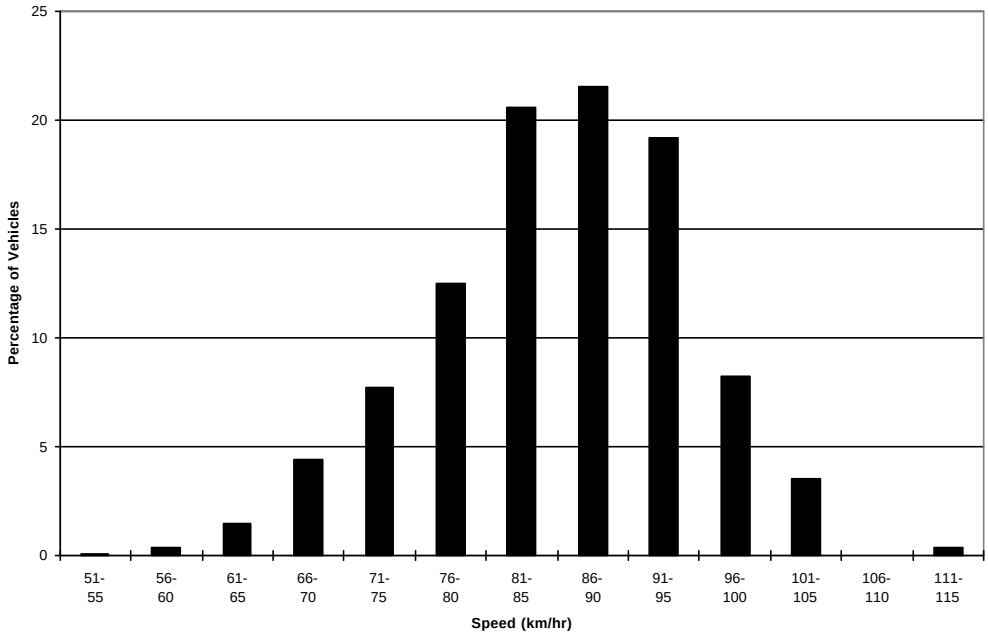


Figure 42: Free speeds of vehicles observed on the Calder Highway, Woodend in November, 1997

Speed bins were determined on the basis of the free-speed data collected on this occasion. They were created to maximise the likelihood that equal numbers of participants were grouped into each speed bin and that they represented the speed distribution of drivers along a particular section of road. Five speed categories were established at Woodend. These were 79 km/h or less, 80-88 km/h, 89-95 km/h, 96-100 km/h and 101 km/h or greater. These speed categories differ from those created by Fildes et al. (1991), which were 75km/h or less, 76-85km.h, 86-95km/h, 96-105km/h, 106-115km/h and 116km/h and above.

Beach Road, Parkdale

Figure 44 shows the free speed distribution observed at Beach Road, Parkdale. Again the graph approximates a normal distribution. The mean speed at this site was 66.4 km/h (SD=9.1). Six speed categories were established and these were 55 km/h or less, 56-60 km/h, 61-65 km/h, 66-70 km/h, 71-75 km/h and 76 km/h or greater.

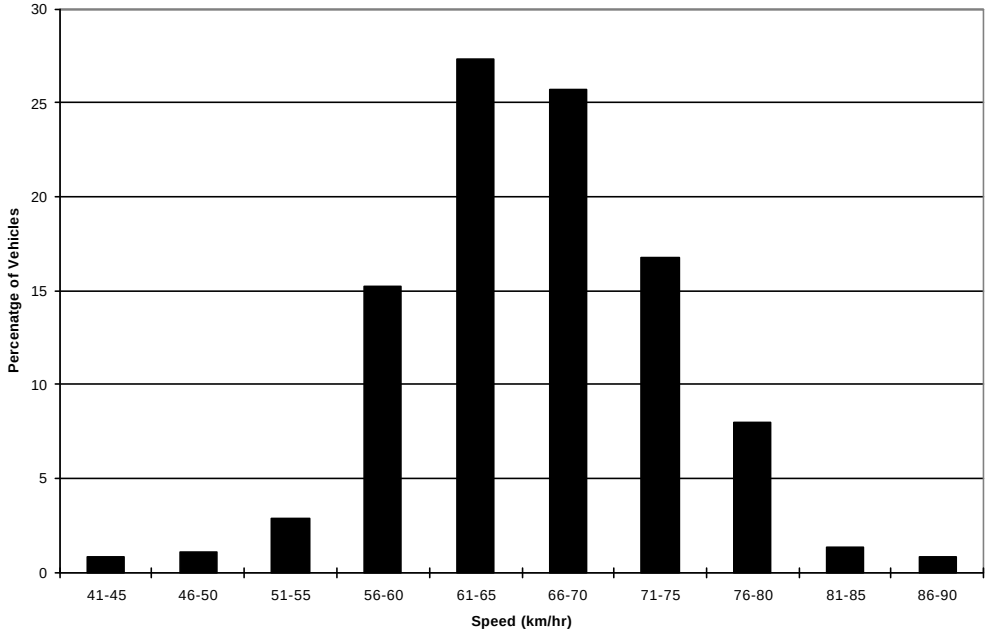


Figure 43: Free speeds of vehicles observed at Beach Road, Parkdale in February, 1998

During the free speed measurements, Fildes et al. (1991) found the mean speed to be 71 km/h (SD=9.1), and the speed categories used were 60km/h or less, 61-65 km/h, 66-70 km/h, 71-75 km/h, 76-80 km/h and greater than 80 km/h.

Belmore Road, Balwyn

Figure 45 shows the free speed distribution observed at Belmore Rd, Balwyn. The data approximated a normal distribution with a mean of 64.8 km/h (SD=6.9). Five speed categories were established and these were 55 km/h or less, 56-60 km/h, 61-65 km/h, 66-70 km/h and 71 km/h or greater.

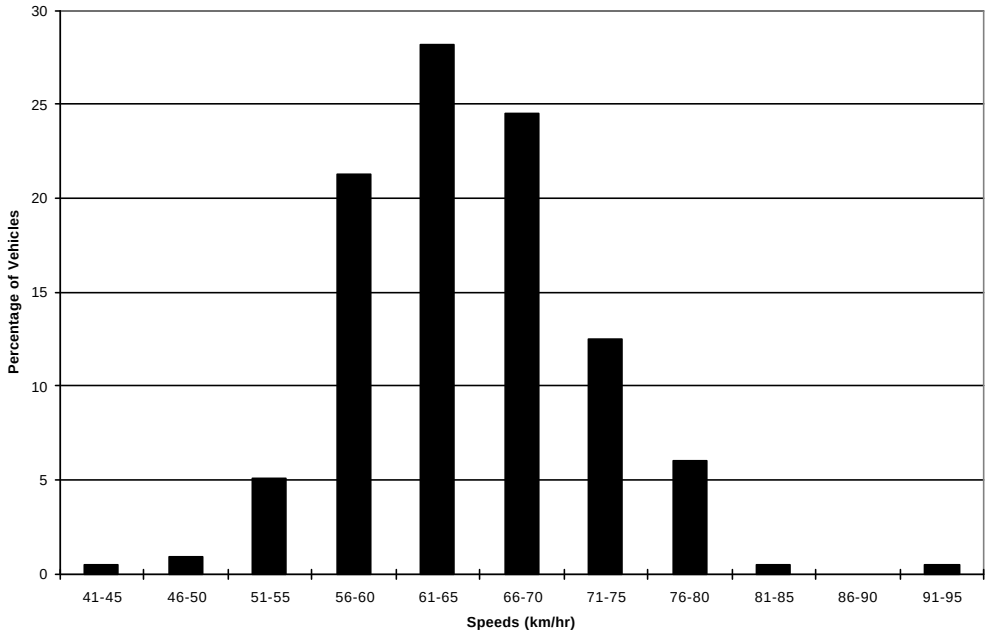


Figure 44: Free speeds of vehicles observed at Belmore Road, Balwyn in March, 1998

Fildes et al. (1991) found a similar speed distribution, and a mean speed of 67.1km/h (SD=7.5). The speed categories used were 50 km/h or less, 51-55 km/h, 56-60 km/h, 61-65 km/h, 66-70 km/h and greater than 70 km/h.

APPENDIX B: ROADSIDE QUESTIONNAIRE

MONASH UNIVERSITY ACCIDENT RESEARCH CENTRE

CHARACTERISTICS ASSOCIATED WITH DRIVING SPEED QUESTIONNAIRE

Day/Time: ☐ Registration Number: ☐

Vehicle Description: ☐

Did Respondent Accept a Diary? ☐

PRELIMINARY DETAILS:

ARE THESE ENTRIES **Estimated (Refused):** ☐ **ual Responses:** ☐

Make/Model: (eg. Ford Falcon) ☐

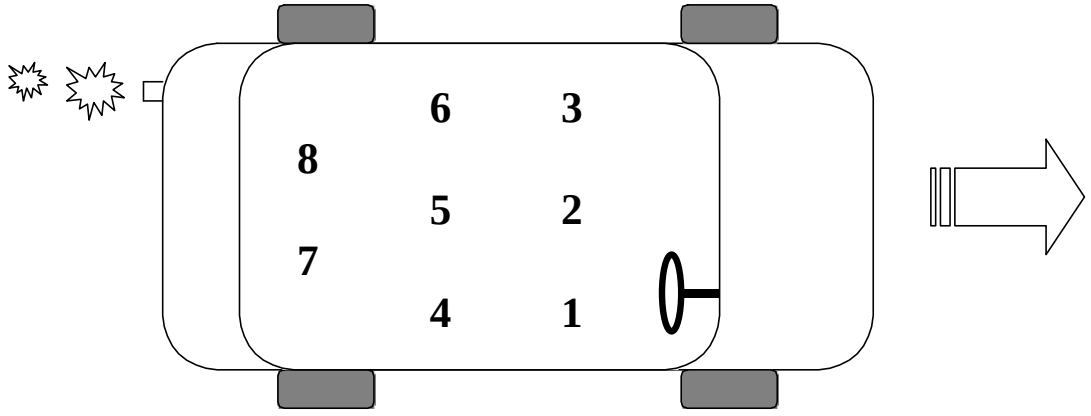
Body Type: (eg. sedan, wagon) ☐ Est. Year ☐

Is vehicle towing a caravan or trailer: Yes ☐ No ☐

Are P-plates displayed: Yes ☐ No ☐ ? ☐

Number of Occupants: ☐

Code occupant locations: Restrained Occupant: O Unrestrained Occupant: X



IF DRIVER REFUSED, ENTER OBSERVATIONS:

Sex: ☐ **Age Category**: ☐ ☐ ☐

18-29 30-59 60+

Reason for Refusal: ☐

Please try and answer each question as accurately and honestly as possible.

1 Are you the owner of this vehicle? Yes ☐ No ☐

2 How many years have you been driving? ☐
Years

3 Roughly how many kilometres do you normally drive each week:

less than 100	101-200	201-400	401-600	more than 600
☐	☐	☐	☐	☐

4 What Percentage of this driving would be in built-up areas? ☐ **%**

5 Is the purpose of this trip for:

Business	Recreation Holidays	Domestic Duties	Other
☐	☐	☐	☐

6 Can you tell me where and when you started this trip and where and when you hope to finish it?

Start of Trip		Planned End of Trip	
Where	How long ago	Where	How long from now
	hours		hours

7 Is this your first trip today? Yes ☐ No ☐

IF NO: **Not counting this one, how many trips have you made today?** ☐

8 How long is it since your last break on this trip? ☐ hours (99 = no break)

9 Using a scale from 0 to 10 where 0 means not at all tired and 10 means very tired, how tired do you feel at the moment? ☐

10 Are you currently:

Ahead of Schedule	On Time	Behind Schedule	Other

11 How ☐ do you travel a☐ his section of thi☐ l? ☐

Daily	Weekly	Monthly	Less than Yearly	Yearly	My first Time
☐	☐	☐	☐	☐	☐

GIVE PHOTOGRAPH TO PARTICIPANT

You travelled along this section of road a few minutes ago. The next questions relate to that particular section of road. Please keep in mind that the survey is for research only. Your answers will be treated in the strictest confidence and will not be shown to anyone else.

12 How fast do you think you were travelling when you drove along this section of road? ☐

13 In spite of the speed limit, what is the highest speed you would feel comfortable driving at along this section of road? ☐

14 What speed do you think most traffic would travel at along this section of road? ☐

15 What do you think is the speed limit along this section of road? ☐

Now, still thinking about when you were driving along that section of road in the photograph…

16 How certain do you feel that you could have been detected by the Police if you were driving 20km/h over the speed limit, using a scale from 0 to 10 where 0 means there is no chance that the Police would have detected you and 10 means that it is certain that they would have detected you. ☐

17 How dangerous do you feel it would be to drive along that stretch of road 20km/h over the speed limit, using a scale from 0 to 10 where 0 means it would not be at all dangerous and 10 means it would be extremely dangerous. ☐

18 If you had to drive along this section of road 20km/h over the speed limit, how safe would you be compared to other drivers your age?

Much Safer	Safer	Less Safe	Much Less Safe
☐	☐	☐	☐

In this section of the survey we are interested in your opinion about different types of offences.

Putting aside the possible consequences of these behaviours such as being fined or hurting someone, can you tell me how wrong or bad you feel the behaviours are on a scale of 0 to 10 where 0 means that the behaviour is not at all bad or wrong and 10 means that the behaviour is extremely bad or wrong.

19 Shoplifting something small	0 1 2 3 4 5 6 7 8 9 10
20 Speeding 30km/h over the limit in a residential area	0 1 2 3 4 5 6 7 8 9 10
21 Queueing across an intersection	0 1 2 3 4 5 6 7 8 9 10
22 Running an amber or yellow light	0 1 2 3 4 5 6 7 8 9 10
23 Drink-driving after a couple of hours at the pub	0 1 2 3 4 5 6 7 8 9 10
24 Speeding 10km/h over the limit in a residential area	0 1 2 3 4 5 6 7 8 9 10
25 A salary or wage earner cheating on their tax	0 1 2 3 4 5 6 7 8 9 10
26 Running a red light	0 1 2 3 4 5 6 7 8 9 10

In the last part of the survey we are interested in finding out about the number and severity of crashes drivers have had and what sort of contact they have had with the Police while driving. I need to stress that this information is completely confidential.

27 Have you been involved in any road accident in the last 5 years? Yes ☐ No ☐

IF YES:

How many? ☐

Could you give me a rough idea of when each accident occurred and if anyone needed medical assistance after the crash.

(Tick Appropriate Boxes)

Date of Accident	**Medical Treatment needed**	**No-one injured**

28 Have you ever been caught by the Police for

				For the most recent time: How Long Ago? (Months)	Were you fined (Y/N)
Speeding	Yes		No		
Other Traffic Offences	Yes		No		

29 When was the most recent time someone you know was caught speeding?

months ago
(or leave blank)

To make sure we have a true cross-section of people, I would like to ask you a few questions about yourself.

30 Could you please tell me which age group you are in:

18-20 21-24 25-34 35-44 45-54 55-69 70+

31 Observe SEX:

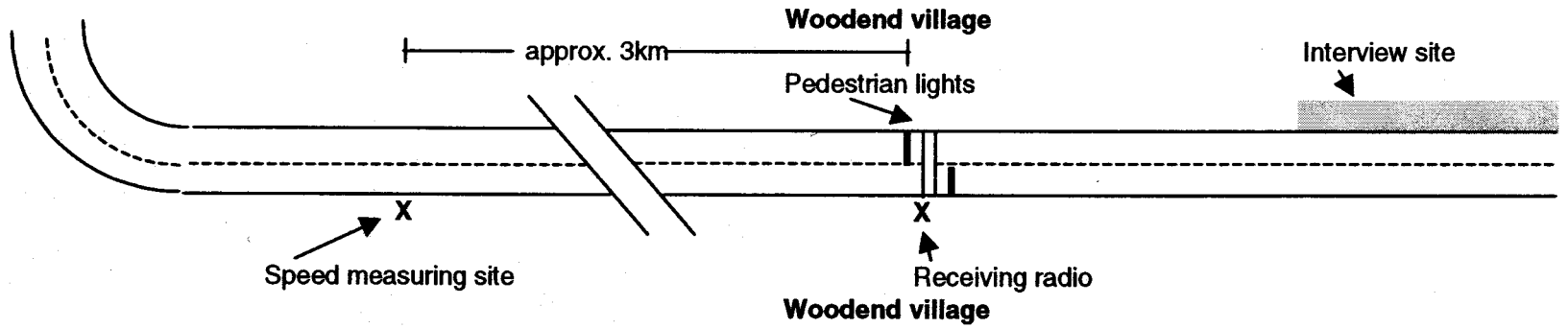
32 About how many hours of television would you watch on an average weeknight?

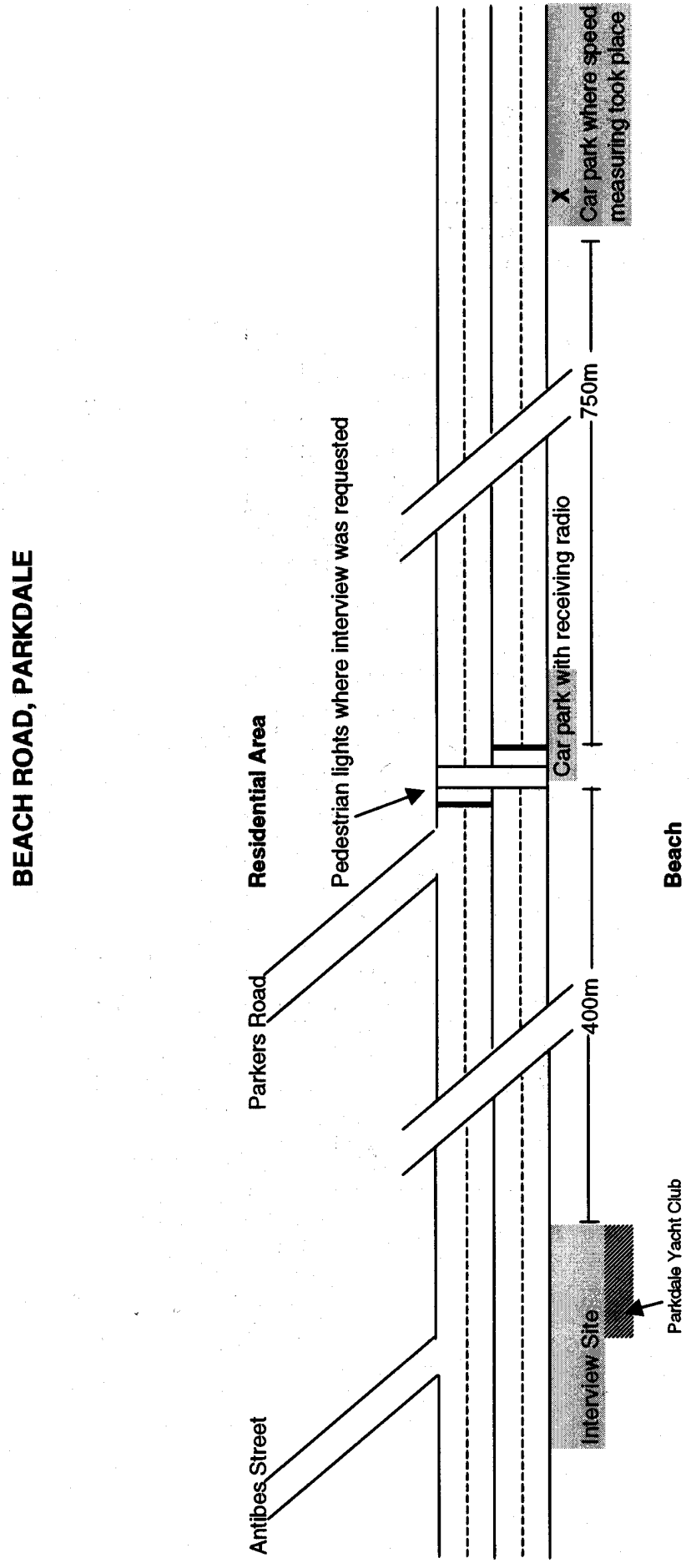
33 Could you tell me what your occupation is?

34 What do you think would be the most common reason for people driving faster than the speed limit?

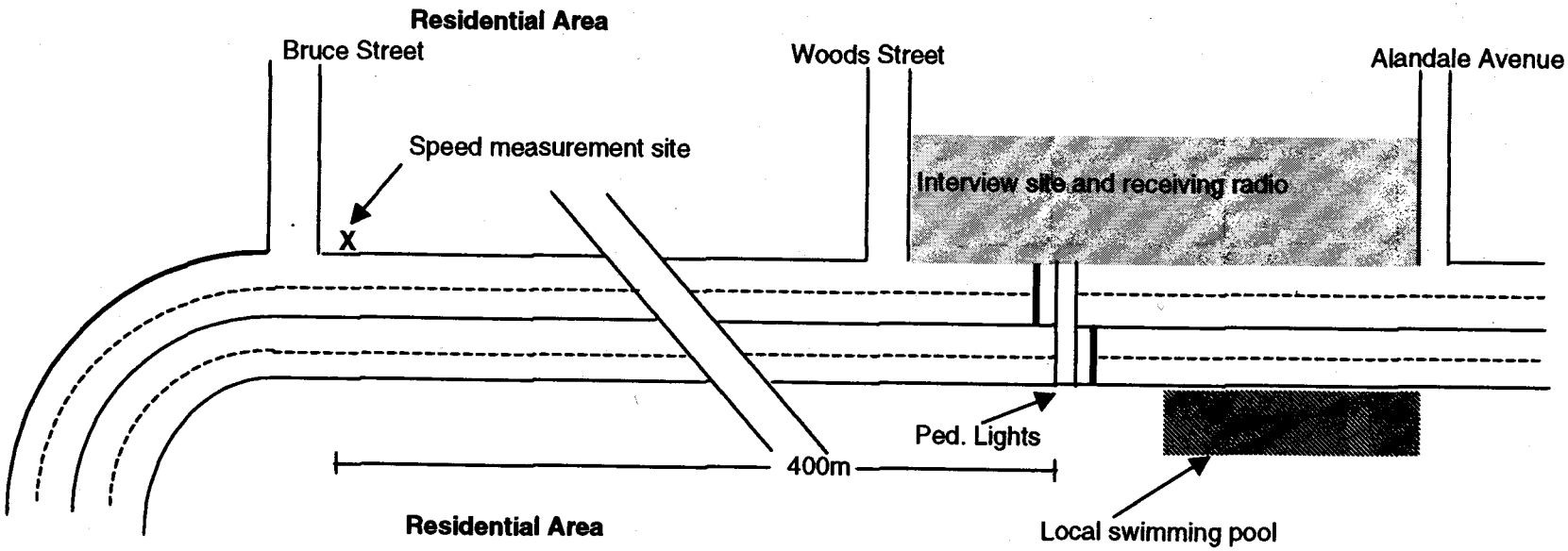
APPENDIX C: SITE MAPS

CALDER HIGHWAY, WOODEND




BEACH ROAD, PARKDALE
Residential Area
Pedestrian lights where interview was requested
Parkers Road
Car park with receiving radio
750m
X
Car park where speed measuring took place
Beach
400m
Antibes Street
Interview Site
Parkdale Yacht Club

BELMORE ROAD, BALWYN



APPENDIX D: CORRELATIONS OF ATTITUDES AND OBSERVED SPEED

Tables 12 to 14 are the complete nonparametric Spearman correlation tables of attitudes towards speeding and observed speed for each of the sites, followed by tables 15 to 17, which show Pearson correlations reported by Fildes et al. (1991).

Table 12: Spearman correlation coefficients (and significance levels) between attitudes measures and observed speed, Calder Highway, Woodend

	Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger	Intolerance of Illegal Behaviour
Observed Speed	**.365**	**.291**	**.045**	**.203**	**-.020**	**-.124**	**-.257**
	(.000)	**(.001)**	**(.632)**	**(.029)**	**(.828)**	**(.176)**	**(.005)**
Estimated Speed	1.000	.732	.485	.712	.033	-.061	-.151
		(.000)	(.000)	(.000)	(.712)	(.501)	(.099)
Comfortable Max. Speed		1.000	.421	.585	-.031	-.342	-.290
			(.000)	(.000)	(.730)	(.000)	(.001)
Estimated Speed of Others			1.000	.422	-.055	-.055	-.005
				(.000)	(.546)	(.551)	(.959)
Estimated Speed Limit				1.000	.063	.173	-.044
					(.495)	(.057)	(.637)
Risk of Detection					1.000	.375	.245
						(.000)	(.007)
Rating of Speeding Danger						1.000	.414
							(.000)

Table 13: Spearman correlation coefficients (and significance levels) between attitudes measures and observed speed, Beach Road, Parkdale

	Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger	Intolerance of Illegal Behaviour
Observed Speed	**.583**	**.370**	**.232**	**.255**	**-.199**	**-.237**	**-.352**
	(.000)	**(.000)**	**(.003)**	**(.001)**	**(.134)**	**(.002)**	**(.000)**
Estimated Speed	1.000	.334	.313	.259	-.229	-.201	-.367
		(.000)	(.000)	(.001)	(.003)	(.009)	(.000)
Comfortable Max. Speed		1.000	.286	.132	-.147	-.510	-.375
			(.000)	(.087)	(.057)	(.000)	(.000)
Estimated Speed of Others			1.000	.201	-.081	-.198	-.132
				(.009)	(.296)	(.010)	(.088)
Estimated Speed Limit				1.000	-.079	.054	-.077
					(.306)	(.490)	(.318)
Risk of Detection					1.000	.153	.280
						(.049)	(.000)
Rating of Speeding Danger						1.000	.322
							(.000)

Table 14: Spearman correlation coefficients (and significance levels) between attitudes measures and observed speed, Belmore Road, Balwyn

	Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger	Intolerance of Illegal Behaviour
Observed Speed	**.503**	**.176**	**.041**	**.046**	**.022**	**-.053**	**-.186**
	(.000)	**(.012)**	**(.567)**	**(.519)**	**(.757)**	**(.454)**	**(.009)**
Estimated Speed	1.000	.388	.258	.224	.033	-.096	-.177
		(.000)	(.000)	(.001)	(.647)	(.173)	(.014)
Comfortable Max. Speed		1.000	.323	.277	.022	-.319	-.199
			(.000)	(.001)	(.755)	(.000)	(.005)
Estimated Speed of Others			1.000	.148	.099	-.036	.023
				(.037)	(.163)	(.614)	(.755)
Estimated Speed Limit				1.000	-.122	-.052	.052
					(.088)	(.468)	(.477)
Risk of Detection					1.000	.256	.139
						(.000)	(.054)
Rating of Speeding Danger						1.000	.341
							(.000)

Table 15: Pearson correlation coefficients (and significance levels) between attitudes measures and observed speed, Calder Highway, Woodend (Fildes et al.,1991)

	Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger
Observed Speed	**.457**	**.283**	**.119**	**.047**	**.144**	**-.055**
	(.000)	**(.000)**	**(.071)**	**(.284)**	**(.038)**	**(.251)**
Estimated Speed	1.000	.758	.402	.618	.019	-.336
		(.000)	(.000)	(.498)	(.409)	(.000)
Safe Speed (Nominated safe speed)		1.000	.446	.536	-.082	-.400
			(.000)	(.000)	(.157)	(.000)
Estimated Speed of Others			1.000	.421	-.166	-.227
				(.000)	(.076)	(.002)
Estimated Speed Limit				1.000	-.071	.229
					(.192)	(.002)
Risk of Detection					1.000	.106
						(.096)
Rating of Speeding Danger						1.000

Table 16: Pearson correlation coefficients (and significance levels) between attitudes measures and observed speed, Beach Road, Parkdale (Fildes et al., 1991)

	Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger
Observed Speed	**.520**	**.348**	**.300**	**.119**	**.118**	**-.346**
	(.000)	**(.000)**	**(.000)**	**(.061)**	**(.064)**	**(.000)**
Estimated Speed	1.000	.731	.420	.352	.040	-.477
		(.000)	(.000)	(.000)	(.298)	(.000)
Safe Speed		1.000	.392	.310	.085	-.479
(Nominated safe speed)			(.000)	(.000)	(.123)	(.000)
Estimated Speed of Others			1.000	.303	-.079	-.290
				(.000)	(.140)	(.000)
Estimated Speed Limit				1.000	.114	-.198
					(.060)	(.003)
Risk of Detection					1.000	.036
						(.311)
Rating of Speeding Danger						1.000

Table 17: Pearson correlation coefficients (and significance levels) between attitudes measures and observed speed, Belmore Road, Balwyn (Fildes et al., 1991)

	Estimated Speed	Highest Safe Speed	Estimated Speed of Others	Estimated Speed Limit	Risk of Detection	Rating of Speeding Danger
Observed Speed	**.121**	**.338**	**.138**	**.077**	**-.071**	**-.083**
	(.045)	**(.000)**	**(.034)**	**(.155)**	**(.757)**	**(.137)**
Estimated Speed	1.000	.063	-.007	.000	.007	.055
		(.202)	(.465)	(.498)	(.466)	(.235)
Safe Speed		1.000	.433	.197	.006	-.437
(Nominated safe speed)			(.000)	(.004)	(.467)	(.000)
Estimated Speed of Others			1.000	-.060	-.094	-.317
				(.216)	(.109)	(.000)
Estimated Speed Limit				1.000	.005	-.063
					(.472)	(.202)
Risk of Detection					1.000	.097
						(.100)
Rating of Speeding Danger						1.000