isa - UK

intelligent speed adaptation

Overall Field Trial Results

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Frank Lai, Kathryn Chorlton and Oliver Carsten

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UNIVERSITY OF LEEDS MIRA

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EXECUTIVE SUMMARY

Introduction

This report covers the behavioural and attitudinal analysis of set of four successive field trials with a fleet of twenty cars equipped with Intelligent Speed Adaptation (ISA). This is a system in which the vehicle "knows" the speed limit and that knowledge can be used to constrain the vehicle's speed below the legal speed limit. The main focus of the trials was on driver behaviour and attitudes when using ISA over a relatively long period. The trial involved driving an ISA car on a daily basis for six months; the first month driving without ISA, the next four months driving with ISA, and the final month driving without ISA. The first month of driving served as a baseline for comparison with the ISA activated period, and the final month of driving provided the opportunity to identify any carry-over effect as a result of experiencing the ISA system.

Four successive trials were conducted:

- Trial 1: Leeds area with private motorists
- Trial 2: Leeds area with fleet motorists
- Trial 3: Leicestershire with private motorists
- Trial 4: Leicestershire with fleet motorists

The Leeds trial was in a major urban area, although the speed limit data cover the whole of the Leeds Metropolitan District, which includes some outlying rural areas and villages. The Leicestershire area is mainly rural and small-town.

There were 20 participants involved in each trial. Each of the participants was given the use of an ISA car for the trial period. These vehicles appeared and behaved like normal cars apart from the ISA feature. The ISA system was overridable by the drivers, by means of a button on the steering wheel or a kick-down on the throttle pedal.

The ISA car's on-board speed limit database covered the local area (Leeds for Trials 1 and 2, South-West Leicestershire, including the city of Leicester, for Trials 3 and 4) as well as the national trunk road network. The intention was to give drivers ISA support for almost all their regular driving during the ISA-active phase.

Method

Participants for the private field trials were recruited in response to adverts placed in local newspapers. Participants for the fleet trials were recruited from local organisations — in Leeds from employees of Leeds City Council (LCC), and in Leicestershire from various local authorities (including Leicestershire County Council, Leicester City Council, and Hinckley and Bosworth Borough Council) as well as a private company (Kingstone and Mutual Clothing Co). There were a number of participants withdrawing from the final trial due to due to personal reasons (e.g. sickness and accidents unrelated to the trial). Although replacement participants were recruited, the amount of data collected from the last participant did not warrant their inclusion in the final analysis. Therefore the data analysis only included 79 participants.

Within each trial we aimed to balance the number of participants equally across various driver characteristics: male/female, young (25–40) or old (41–60), and intender/non-intender (prior intention to speed as defined by a Theory of Planned Behaviour questionnaire). It proved difficult however to recruit the target number of some groups of participants (e.g. female drivers who were old and were an intender) in addition to other recruitment criteria (e.g. annual mileage and travel patterns etc) within a viable recruitment period. Overall, 44 males (age range 22–59 years, M = 40.30, SD = 11.73) and 35 females (age range 30–60 years, M = 41.43, SD = 8.05) took part in the four trials. Table 1 shows the distribution of the participants across gender, age group and speeding intention.

Table 1: Characteristics of participants

Gender	Age	Intention to Speed	Number
Male	23–39	Intender	11
Male	23–39	Non-Intender	8
Male	40–60	Intender	13
Male	40–60	Non-Intender	12
Female	23–39	Intender	6
Female	23–39	Non-Intender	11
Female	40–60	Intender	11
Female	40–60	Non-Intender	7

Driving data at 10 Hz was collected for 570,660 km throughout the trials, of which 352,109 km was during the period when the ISA system was activated.

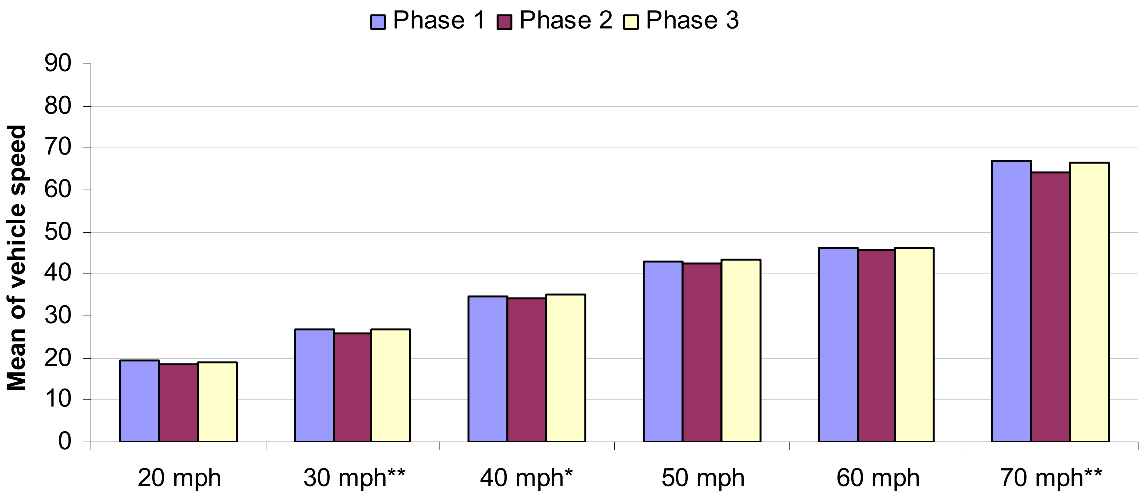
Major results

Behavioural results

As indicated above, the trial was divided into three phases:

Phase 1: one month with no ISA, to serve as the baseline
Phase 2: four months with the ISA system active
Phase 3: one month with the ISA once more inactive, for the study of carry-over effects

ISA effectively minimised the amount of speeding across all speed limits, with the exception of 60 mph roads where there had been little speeding during Phase 1 and 3, primarily due to constraints imposed by road geometry. The typical pattern was for speeding to reduce in Phase 2 as compared to Phase 1, and then for there to be at least a partial return to the baseline behaviour in Phase 3, resulting in a V-shaped patterns of speed-related statistics. This can be seen in Figure 1, which shows mean and 85th percentile speed across trial phase and speed limit. The figure also shows that there was a much larger effect of ISA at the top end of the speed distribution than there was on the mean.



Note: * p< .05, ** p< .01 ***, p< .001

Figure 1: Comparison of key statistics of the speed distribution across trial phases

The effect can be seen even more strongly when looking at the relative amount of speeding in the three phases, as shown in Figure 2. With ISA, there was a statistically significant reduction in the proportion of distance travelled over the speed limit for all speed limits apart from 20 mph and 60 mph. However, there was no overall reduction in the amount of speeding from Phase 1 to Phase 3, although in some of the individual trials a carry-over effect of ISA had been observed.

When looking in detail at the speed distributions within a given speed limit by phase of study, it can be seen that the general effect of ISA was to strongly reduce speeding without changing the speed distribution below the speed limit. ISA produced a bulge in the distribution just below and just above the limit[1]. This effect of transforming the distribution of speed can be seen in Figure 3 for 30 mph roads and Figure 4 for 70 mph roads.

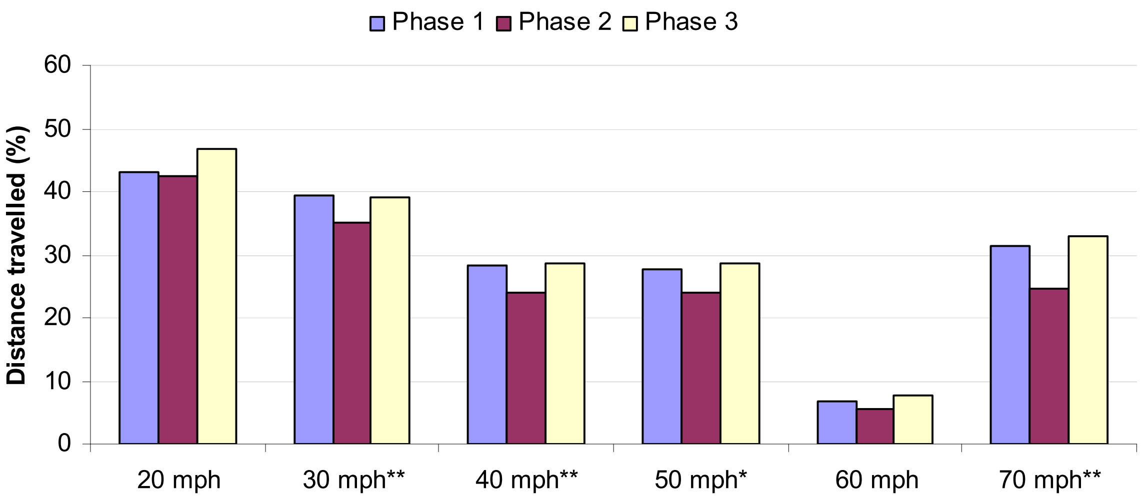


Figure 2: Comparison of percentage of distance travelled over speed limit across trial phases

[1] Considering that trial participants might encounter a wide variety of road gradients, tolerance was given to the throttle cut-off thresholds allowing the vehicle to be able to reach the speed limits on uphill roads. This design however led to the vehicle being able to exceed the speed limits somewhat on flat or downhill roads.

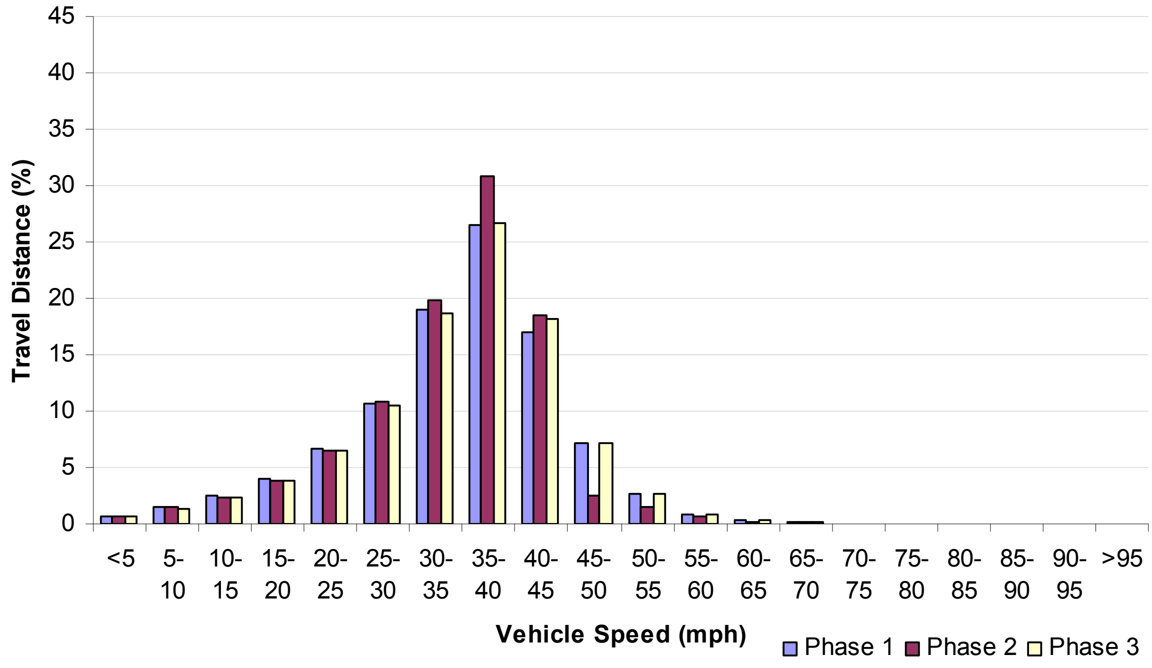


Figure 3: Speed distribution by phase on 30 mph roads

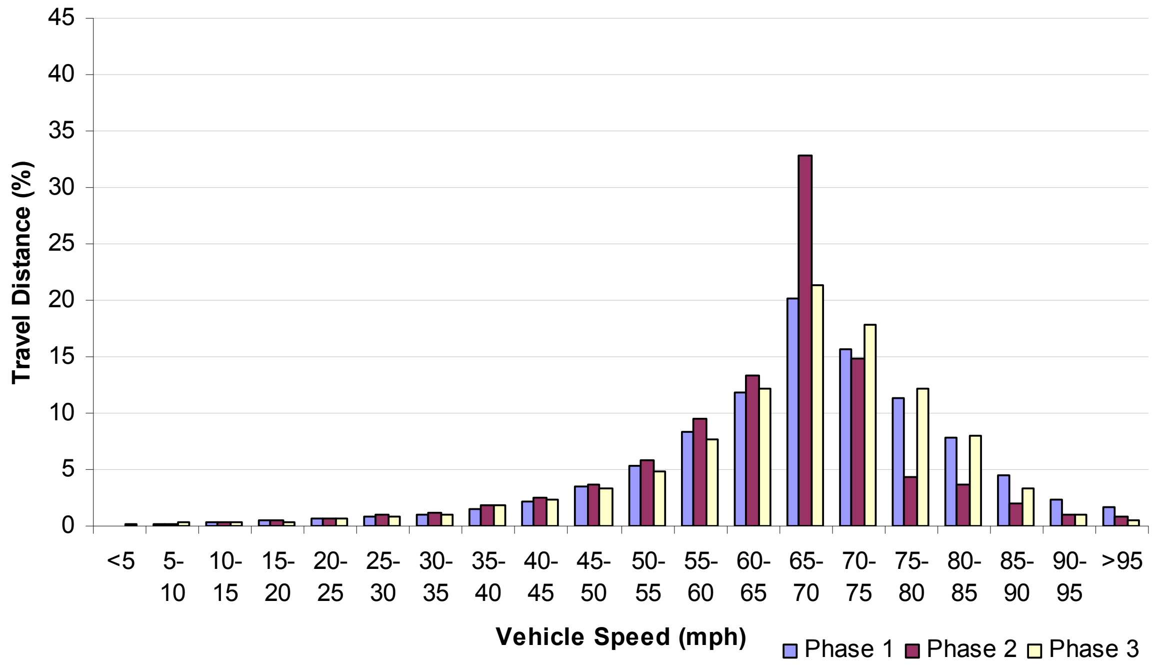


Figure 4: Speed distribution by phase on 70 mph roads

The use of an overridable ISA system also provides an opportunity to examine where drivers were willing to accept the control of the ISA system and where they chose to override it. ISA was overridden most often on 70 mph roads (see Figure 5).

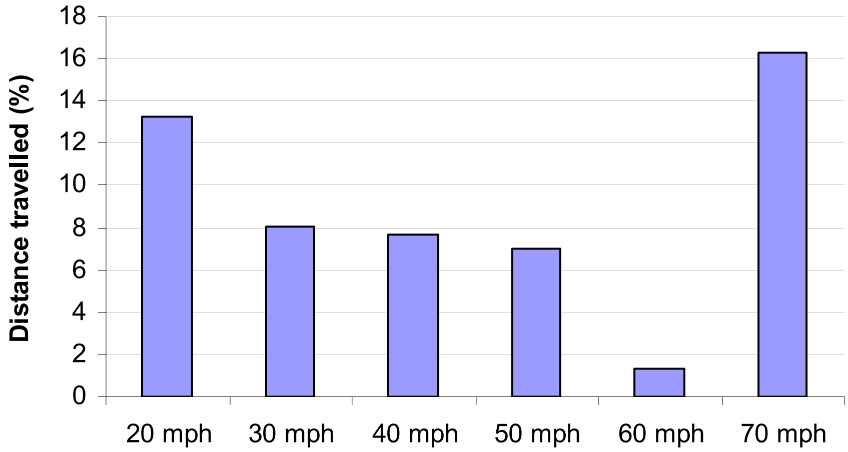


Figure 5: Proportion of distance travelled with ISA when the system was overridden

Overriding behaviour can also be examined by driver group. In general, young drivers overrode more than older drivers, males more than females and intenders to speed more than non-intenders and the private motorists slightly more than the fleet drivers (see Figure 6).

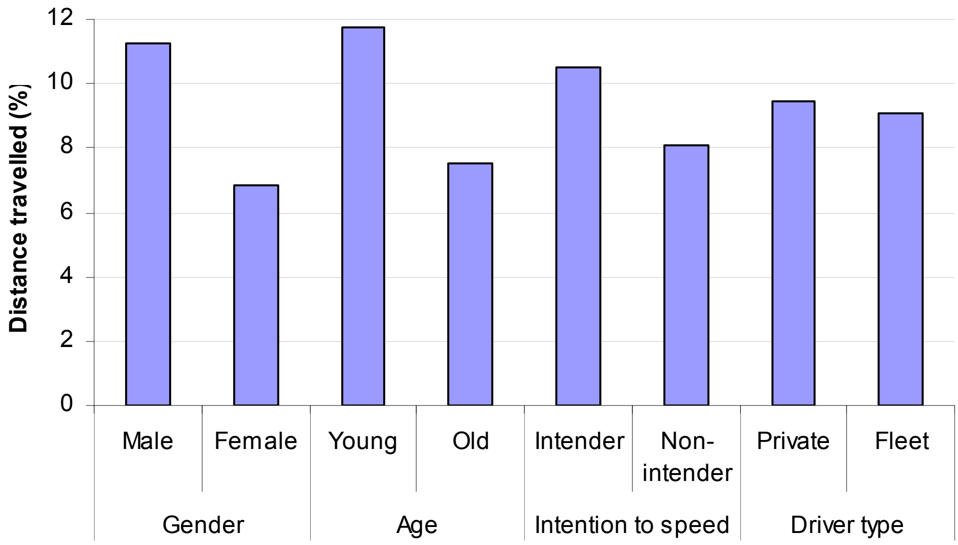


Figure 6: Comparison of overall overriding behaviour across driver groups

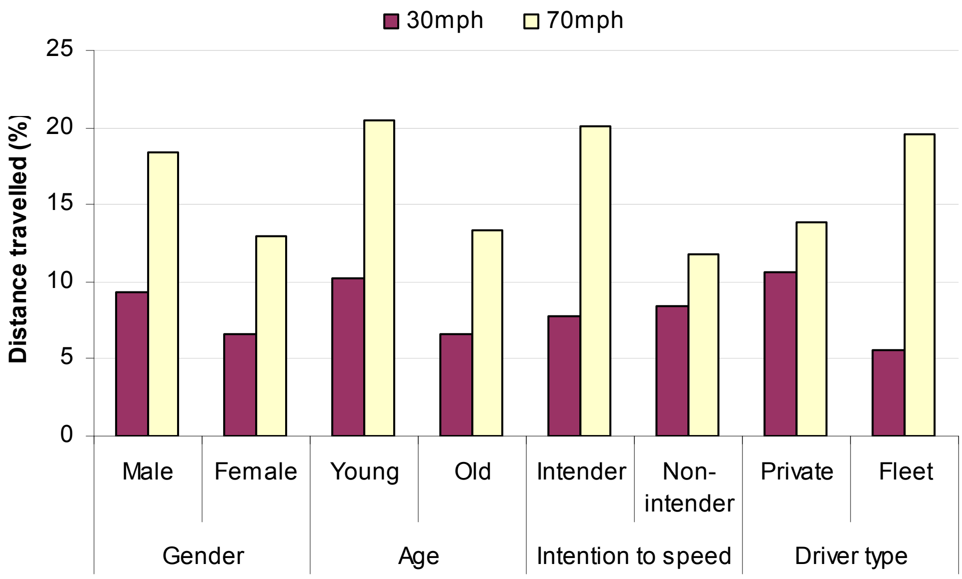


Figure 7: Comparison of overriding behaviour on 30 and 70 mph roads across driver groups

Figure 7 examines the extent of overriding of the ISA system on 30 mph roads which are typical of urban areas and 70 mph roads which are generally inter-city dual carriageways (often motorways). It can be seen that the patterns by gender and age are the same for the two road categories. However, intenders and non-intenders had similar behaviour on urban roads but behaved differently on 70 mph roads. There was a notable difference in behaviour between the private motorists and the fleet drivers: private motorists overrode more frequently than fleet drivers on urban roads, while fleet drivers overrode more frequently than private motorists on 70 mph roads. This suggests that the need to comply with the speed limits on urban roads may have been instilled in the fleet drivers, but those same drivers feel little compunction about speeding on fast roads.

Analysis of overriding behaviour revealed that there is a general tendency for those who need it most to use it least. This suggests that there may be a role for incentives to keep ISA active and discouragement of overriding when ISA is deployed on a voluntary or fleet basis. In addition to improved speed limit compliance, ISA also contributes to diminished negative driving behaviour across all groups, as revealed by the observation drives.

Attitudinal results

Predicting speeding behaviour with the Theory of Planned Behaviour

Prior to experience with the ISA system, attitudes were assessed using the Theory of Planned Behaviour (TPB; Ajzen, 1991) as a model. In contrast to much of the TPB work in the driving domain which is limited to looking at intention, here the relationship between cognitions and actual behaviour was assessed. Examination of the correlations between the TPB variables suggested:

- Perceived susceptibility to an accident was the strongest correlate. Those who perceived speeding would increase the risk of an accident demonstrated a weaker propensity to engage in the behaviour.
- Moral norm was the second most powerful correlate. Participants displaying higher moral norms showed a weaker propensity to speed than those expressing weaker moral norms.

- The propensity to speed was stronger amongst participants who believed that the stated control factors facilitated exceeding the speed limit.
- Past behaviour was the fourth most powerful correlate. Participants who had frequently engaged in speeding in the past were more likely to do so in the future compared to those who had not.
- Although highly significant, intention was only the fifth strongest correlate such that those who intended to speed demonstrated a stronger propensity to engage in this behaviour than those who did not.
- Participants expressing favourable attitudes towards exceeding the speed limit were also more likely to engage in speeding than those possessing less favourable attitudes.
- Similarly those believing that more positive outcomes would result from speeding also demonstrated a greater propensity to speed.

Given evidence of multi-collinearity, it was not possible to test a full TPB model. Hence the predictive utility of the simple TPB was tested. *Intentions* were found to reliably predict participants' propensity to speed, explaining 11% of the variance. *Perceived behavioural control* (PBC, i.e. how much control participants felt they had over the behaviour) did not have an effect on either intentions or behaviour, which suggests that speeding is to a large extent under an individual's volitional control. However, it should be noted that other studies have found an effect of PBC.

The impact of experience with ISA on TPB cognitions

Given speculation in the literature that experience or habit can alter attitudes, it was expected that experience with the ISA system would affect the participants' intention to speed and some of the predictors of that intention. Cognitions were investigated at three time points during the trial:

Time 1: prior to initial vehicle handover
Time 2: on completion of Phase 2, i.e. at the end of month 5
Time 3: on completion of Phase 3, i.e. at the end of month 6

Figure 8 shows the change over time for intention to speed. There was a significant effect of time. Intentions measured at time 3 were significantly lower than those measured at time 1.

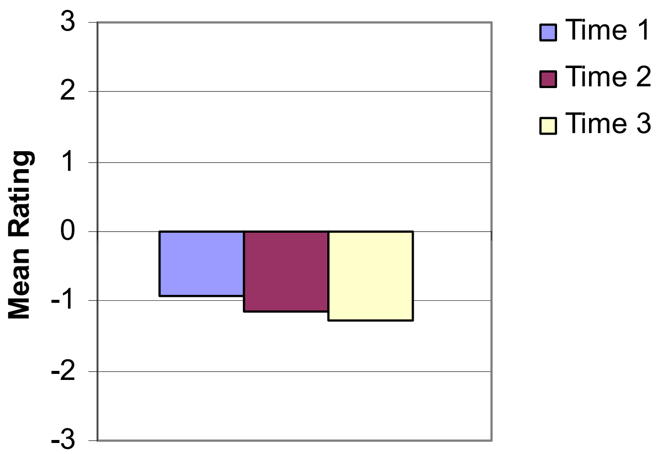


Figure 8: Mean intention to speed over time

An intervening ISA system might be presumed to affect the Perceived Behavioural Control (i.e. how much control an individual feels that he has over his behaviour) element in the TPB model. However, there was in fact no change in Perceived Behavioural Control over speeding, perhaps because the participants were able to override the system (see Figure 9). Following experience with ISA, participants did feel that they were in significantly greater control of their ability to disengage the system. This is perhaps a reflection of the participants' realisation of the ease at which they could override the system.

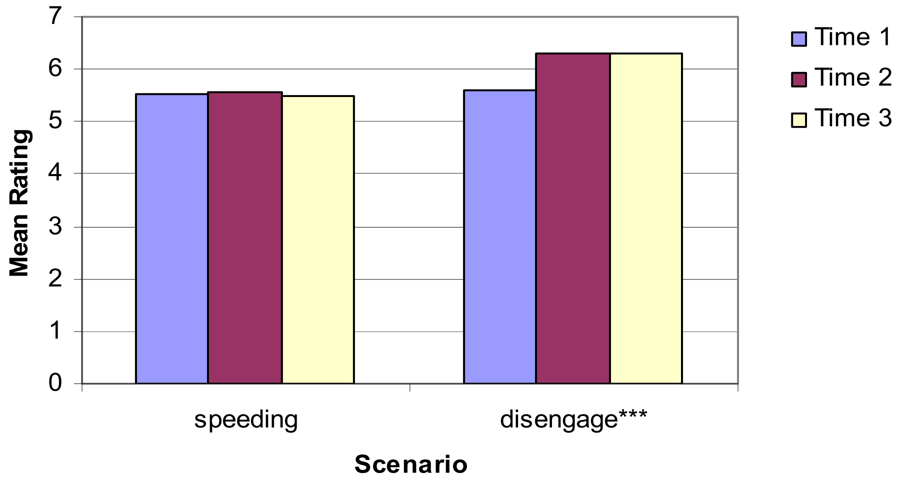


Figure 9: Mean perceived behavioural control score by scenario

In terms of *belief*, the attitudinal questionnaires reveal that, following experience with ISA, participants were significantly less likely to believe that speeding would get them to their destination more quickly. Thus they seem to have become aware that ISA did not have a drastic effect on journey time.

On the other hand, in terms of the belief that "*speeding would make me feel good*" participants were more likely to believe that speeding would make them feel good following experience with the ISA system. So ISA did not reduce the enjoyment of speeding — on the contrary there was evidence that this increased.

The impact of ISA on other attitudes and self-reported behaviour

In order to determine changes in acceptability, attitudes towards the ISA system and workload experienced when driving with ISA, questionnaires were administered at four time points:

Time 1: at initial vehicle handover,
Time 2: following one month of ISA control,
Time 3: following four months of ISA control, and
Time 4: following a one-month return to non-ISA-controlled driving.

Measures of subjective workload were specifically taken following a prearranged observation drive which took place according to the time points listed above. These drives provided an opportunity to monitor subjective workload as experienced when completing a fixed route.

The Driver Behaviour Questionnaire (Parker et al., 1995) was used to measure self-reported aberrant driving behaviours committed before during and after their experience with ISA. The results are shown in Figure 10. All the types of aberrant behaviour — lapses, errors and violations — significantly declined over time and continued to decline after ISA was removed. Thus experience with ISA apparently reduced all error types, including the most serious.

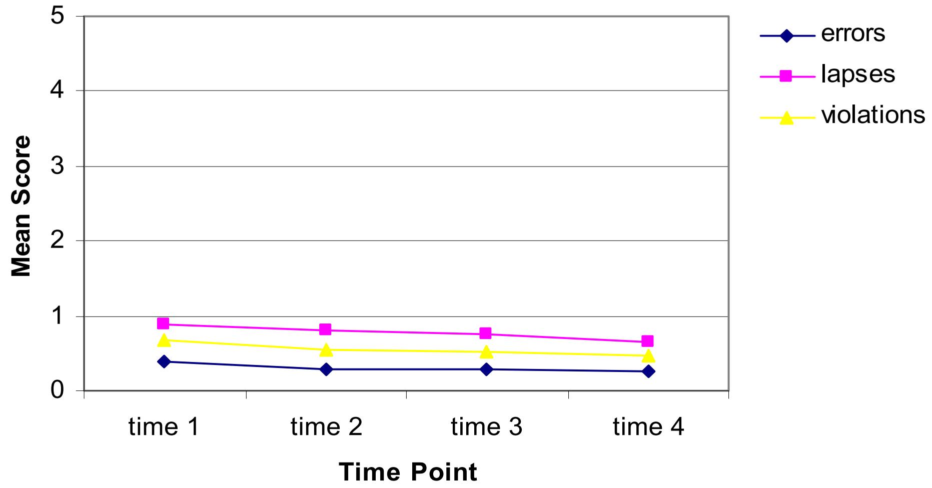


Figure 10: Mean error, lapse and violation score on DBQ over time

Driver acceptance of the ISA system was measured using an acceptability scale developed by Van de Laan et al. (1997) which measures the two dimensions of usefulness and satisfaction. The overall results are shown in Figure 11. There were no significant changes over time in usefulness, but there are indications that initial experience with the system decreased participants' appreciation of the usefulness of ISA as compared with their preconception, but that this appreciation increased with prolonged experience and continued at a high level even when the system was removed. Female participants rated the ISA system as more useful than male participants. Speed intenders rated the ISA system as significantly less useful than non-intenders.

Ratings of *satisfaction* generally improved over time. The figure suggests that satisfaction dipped following early exposure to the system, but that it subsequently rose steadily and was highest after the removal of ISA support. Speed intenders rated the ISA system significantly less satisfying than did non-intenders.

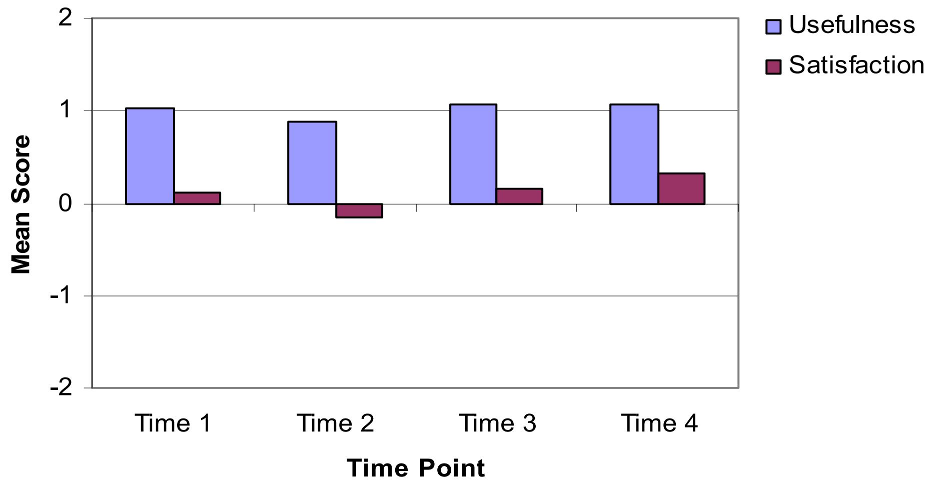


Figure 11: Acceptability ratings for the dimensions of "usefulness" and "satisfaction" over time

Workload was measured by NASA-RTLX (Byers et al., 1989), shown in Figure 12. Significant trends over time were found for physical demand (decrease) and time pressure (increase).

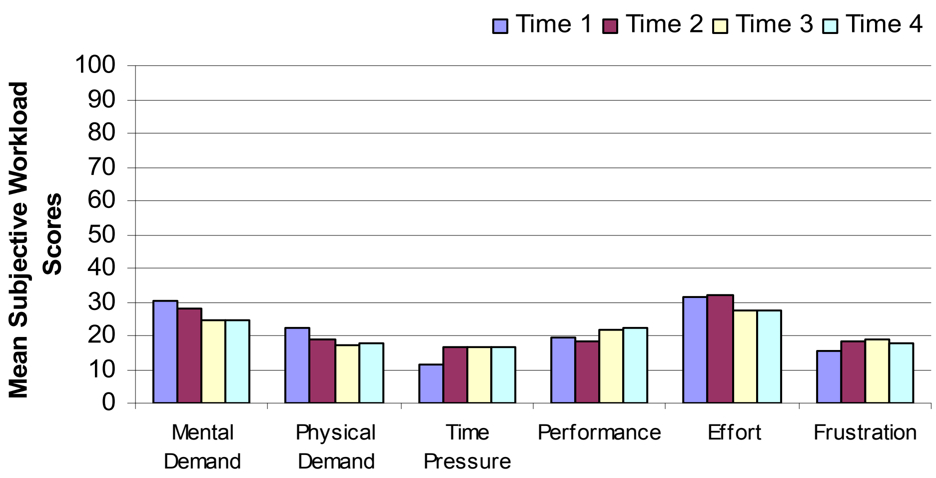


Figure 12: Individual workload dimension scores over time

Participants' perceptions of risk with ISA were ascertained over time. In the majority of conditions, participants considered driving with ISA safer than driving in an unsupported car. However, participants felt at increased risk with ISA when overtaking or driving in fast moving traffic. They also indicated a slight increase in perceived risk when driving on motorways. Thus when wishing to put on a burst of speed or keep up with fast traffic, ISA is seen as problematic.

On the other hand, participants' ratings of the quality of their driving generally improved with ISA. They indicated that their anticipation of conflicts, attention to other road users and pedestrians increased whilst driving with ISA compared to unsupported driving. Perhaps, unsurprisingly, participants' awareness of speed limits also increased when driving with ISA.

In terms of attitudes to the introduction of ISA more widely, 54% of participants were willing to have ISA installed in their vehicles if its use was voluntary. Participants' willingness to pay for the system ranged from paying nothing to £500. On average participants would be willing to pay £111. Sixty-two percent of participants approved of requiring the fitment of ISA on all new vehicles and 56% approved of compulsory usage of ISA by all drivers.

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1. INTRODUCTION

The ISA project has as its major objective to investigate user behaviour with Intelligent Speed Adaptation (ISA) by means of field trials. Twenty identical vehicles were converted and provided with the capability to provide a voluntary (overridable) ISA system and to record data on each single drive. Four successive trials were conducted:

Trial 1: Leeds area with private motorists
Trial 2: Leeds area with fleet motorists
Trial 3: Leicestershire with private motorists
Trial 4: Leicestershire with fleet motorists

The Leeds trial was in a major urban area, although the speed limit data cover the whole of the Leeds Metropolitan District, which includes some outlying rural areas and villages. The selected Leicestershire area is mainly rural and small-town.

The trials were designed to be non-intrusive — the vehicles appeared and behaved like normal cars apart from the ISA feature, data was logged automatically, and summary data was collected after each trip through a GSM link. The ISA system was overridable by the drivers. The intention was to give drivers ISA support for almost all their regular driving.

Eighty drivers in total participated in the trials. Within each trial, twenty drivers were recruited and each of them used the ISA vehicle for a six-month period.

The main focus of the trials was on driver behaviour and attitudes when using ISA over a relatively long period. The trial involved driving an ISA car on a daily basis for six months; the first month driving without ISA, the next four months driving with ISA, and the final month driving without ISA. The first month of driving served as a baseline for comparison with the ISA activated period, and the final month of driving provided the opportunity to identify any carry-over effect as a result of experiencing the ISA system.

This report provides the results of behavioural and attitudinal analysis of the pooled data from all four trials. Detailed information on the results of the individual trials can be found in earlier deliverables of the project (Lai et al, 2005a; Lai et al, 2005b; Lai et al, 2006; Lai et al, 2007). Those reports also contain information on:

- The "cluster"[2] trial carried out in Trial 1;
- The "cluster" trial carried out in Trial 3;
- The observed drives carried out in all four trials.

[2] The cluster trials involved deliberately bringing the participants together onto one stretch of road in order to investigate behaviour with ISA at higher levels of penetration.

2. FIELD TRIAL METHODOLOGY

2.1 The ISA system

2.1.1 Hardware

The ISA system was installed on a fleet of 20 Skoda Fabia Elegance 1.4 litre estate (Figure 1). The system consisted of two computers installed in the boot of the host vehicle (Figure 2). One of the two computers provided the information function, i.e. vehicle position and current speed limit, and the other provided speed limiting and data recording. There were also additional hardware elements wired to the vehicle's fuel and brake systems, the instrument panel, and the steering wheel. The appearance of the ISA vehicles was as an ordinary Skoda Fabia. The speed limit map installed on one of the computers in the vehicle's boot provided essential information for the ISA system to function correctly.

Figure 1: One of the ISA vehicles

Figure 2: The main ISA equipment installed under the luggage storage area

2.1.2 Human Machine Interface

There were three control interfaces allowing the user to manually interact with the ISA system:

- ISA system opt-in and opt-out buttons on the top surface of the steering wheel (Figure 3)
- ISA system opt-out via "kick-down" via full depression of the accelerator pedal
- ISA system Emergency Disable button in the central control cluster (Figure 4)

There were also two display modalities conveying information to the user:

- An ISA status/information display panel was located centrally in the vehicle instrument panel (Figure 3)
- A beep was delivered every time when the status of the ISA system was changed (e.g. opt-out, system kicking-in, or out of survey area, etc.)

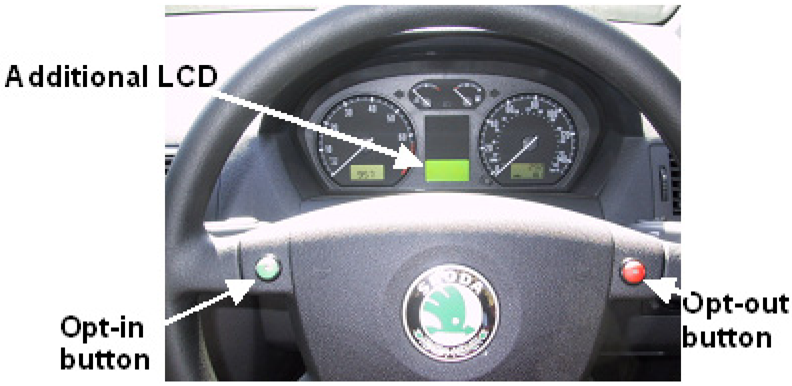


Figure 3: Steering-wheel-mounted buttons and ISA screen

Figure 4: ISA Emergency Disable button

The overall concept was to integrate ISA system components and functionality into the base vehicle so that the user would feel that the system had been installed as original equipment. It was acknowledged that it was necessary to package the additional ISA system hardware in such a manner that it did not compromise "normal" storage space within the vehicle, as well as minimising the potential for tampering. Therefore, a goal was to design and install hardware that was stylistically comparable to the manufacturer's equipment and was compatible with the interior layout. For this reason space behind the glove box and in the boot spare wheel well was utilised to allow the system to be hidden.

The original equipment manufacturer (OEM) accelerator pedal demand (i.e. pedal angle) was determined by a twin potentiometer sensor unit. To facilitate ISA control intervention an interface was provided between the OEM pedal sensors and the Engine Control Unit. This enabled the throttle demand requested by the driver to be routed through the ISA control system.

The standard radio aerial was replaced with a combined GPS/GSM and radio antenna. An additional LCD was mounted centrally within the instrument cluster and could display a wide range of ISA system status and Speed Limit information. It was easily seen through the steering column and had character sizing, contrast and format similar to the other OEM-supplied LCD displays in the cluster. The only other visible elements of the ISA system accessible to the driver were the two illuminated steering wheel mounted ISA accept and reject buttons (one green and one red) and an extra button set within the dashboard (see Figure 3 and Figure 4).

An analogue I/O interface board was fitted to the rear of the glove box and an electrically driven pneumatic pump was housed in the engine bay to power an actuator fitted to the brake pedal (Figure 5).

Figure 5: ISA brake actuator

Two embedded computers, a proprietary sensor box that housed a GPS receiver, a yaw sensor, a speed pickup and direction of travel signal, together with the associated power supplies were all fitted in a unit installed in the well next to the spare wheel (see Figure 2).

A major part of the final installation was the signal and power cabling between the driver's location displays, controls and control modules and boot/roof mounted controllers and processors. An additional wiring loom was designed and installed to provide this.

2.1.3 Operational states of the ISA system

When the vehicle speed was much less than the current speed limit, the driver's throttle demand was passed straight through to the engine ECU. When the vehicle speed was within 10% of the current speed limit the ISA system calculated the throttle demand to maintain the vehicle speed at the speed limit, compared this demand with the demand from the driver and passed the smaller value to the engine ECU. The following descriptions illustrate the various states of the ISA system as displayed to the driver following start-up of the vehicle.

2.1.3.1 ISA waiting

At the start of a journey the ISA waiting display might be seen as shown in Figure 6. This indicated that the ISA system was waiting for a message from the navigation system.

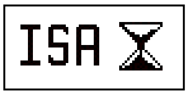


Figure 6: ISA display with ISA waiting

2.1.3.2 ISA on, no speed limit

When the ISA system was unable to establish a speed limit for the current link the display would show two question marks (see Figure 7). There were several reasons for the system being unable to display a speed limit:

- The vehicle was not on a recognised link in the digital map such as a car park or a private drive
- The current link did not have a speed limit associated with it (i.e. outside the speed-mapped area)
- The navigation system was trying to establish which link the vehicle was on (e.g. weak GPS signals due to driving through tunnels or under heavy foliage.

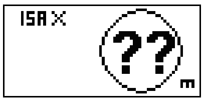


Figure 7: ISA display with no speed limit

2.1.3.3 ISA on

The display shown to the driver when the ISA system was active and the speed limit was 30 mph is shown in Figure 8. In order to limit the vehicle to the desired speed limit the ISA system intercepted the signal sent from the electronic throttle pedal to the Engine Control Unit (ECU). The ISA system could review this signal and determine the value that was required to limit vehicle speed to the maximum speed limit set for the road. The ISA system compared the current vehicle speed with the speed limit. If the vehicle speed exceeded the speed limit then the throttle signal to the engine control unit was reduced. If the vehicle speed exceeded the speed limit by more than 2% then the ISA brake was applied until the vehicle speed fell to the speed limit. If the driver tried to exceed the speed limit by increasing the throttle demand, the ISA system would activate a vibrating motor fitted to the accelerator pedal in situations when the driver demand exceeded the calculated maximum throttle demand by 40%. This gave the driver tactile feedback that the throttle demand requested was in excess of that required by the current speed limit.

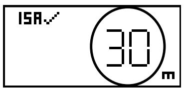


Figure 8: ISA display with ISA on, 30 mph speed limit

2.1.3.4 Opt-out

If the driver wished to exceed the current speed limit, perhaps to pass a slow-moving vehicle quickly, he could opt out of ISA control by either pressing the red button on the steering wheel or by depressing the throttle pedal fully to reach the "kick-through" position. When the opt-out signal was received the ISA system responded by generating a sound, removing the circle from around the displayed speed limit (see Figure 9) and passing the driver throttle demand directly to the ECU.

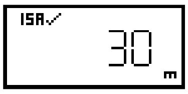


Figure 9: ISA display with opt-out, 30 mph speed limit

ISA control could be restored in two ways:

- The driver could press the green button (opt-in) to reinstate control to the prevailing speed limit.
- The vehicle speed fell below the current speed limit and the system automatically restored speed control.

2.1.3.5 Speed limit change

When the vehicle passes from one speed limit to another the driver was informed visually through the ISA display and by the new speed limit sound. The change in ISA display moving from a 30 mph limit to a 40 mph limit is shown in Figure 10.

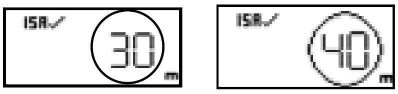


Figure 10: ISA display, moving from a 30 mph limit to 40 mph limit

2.1.3.6 ISA system fault

If certain fault conditions were identified during a trip then ISA control was suspended. The driver was informed visually through the ISA display (see Figure 11) and by the ISA Fault sound.

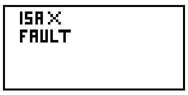


Figure 11: ISA display with fault

The fault could only be cleared and ISA control returned by terminating the current journey and starting another through key-off and key-on.

2.1.3.7 Emergency Disable

The ISA Emergency Disable button (Figure 4), a modified Skoda switch, was clearly located directly above the vehicle radio/cassette on the control console, next to the ASR and below the hazard light buttons. It was for disabling the ISA system in the unlikely event of system failure. This was only to be used in an ISA failure situation and was not to be used to opt-out of ISA control in normal driving.

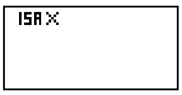


Figure 12: ISA display with system disabled

If the override button was pressed then all normal controls returned and there was no speed control. The ISA display is shown in Figure 12. It should be noted that logging of the various locations, speed limits and vehicle speeds continued. The override button was reset at key-off.

2.2 Trial design

The field trial adopted an 'A-B-A' (i.e. ISA on, ISA off, ISA on) design with three distinct phases over a six-month trial duration, as illustrated in Figure 13.

Phase 1	Phase 2	Phase 3
ISA OFF	**ISA ON**	**ISA OFF**
28 days	112 days	28 days

Figure 13: Field trial phases

Each participant was assigned to a vehicle and asked to undertake their normal travel behaviour for four weeks (i.e. Phase 1). This period allowed the measurement of baseline driving behaviour, and therefore any changes in behaviour in the presence of ISA could be evaluated. At the end of the phase, participants attended an observation drive accompanied by two members of the research team. Upon finishing the observation drive, the ISA system was switched on, and participants subsequently started driving with ISA activated on a full-time basis (i.e. Phase 2).

When participants had driven the car with ISA activated for four weeks, they attended the second observation drive, and then carried on another 12-week driving period with ISA activated. This extended period of ISA driving over sixteen weeks provided the participants with the opportunity of experiencing all kinds of traffic scenarios and environments, and minimised the occurrence of novelty effects in the data collected.

At the end of Phase 2, participants attended the third observation drive. Upon finishing the observation drive, the ISA system was switched off. Participants subsequently started driving for another four weeks (i.e. Phase 3). When participants had completed Phase 3, they also attended the fourth observation drive. This phase of the trial was designed to assess any carry-over effects that ISA may have imposed on participants' driving style.

2.3 Survey boundaries and the digital speed limit map

The survey boundaries of the trials are shown in Figure 14 and Figure 15 for the Leeds trials (Trial 1 and 2) and Leicestershire trials (Trial 3 and 4) respectively. All roads within the survey boundaries were coded in the digital speed limit map. Motorway and trunk road networks across England, Wales, and Scotland were also included in the digital speed limit map.

Figure 16 illustrates the distribution of road networks in the survey areas. It should be noted that lengths of motorways and trunk roads outside the boundaries outlined in Figure 14 and Figure 15 are not included in the distribution figures.

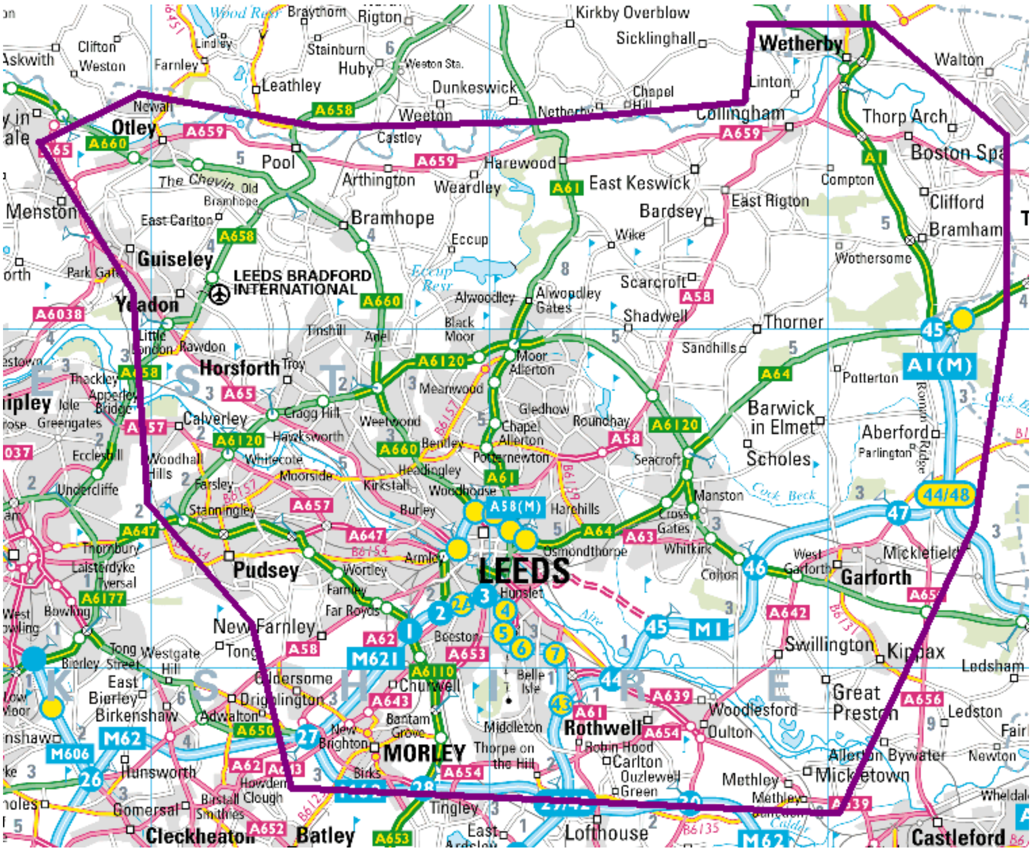


Figure 14: Boundary of the Leeds Metropolitan District speed limit map

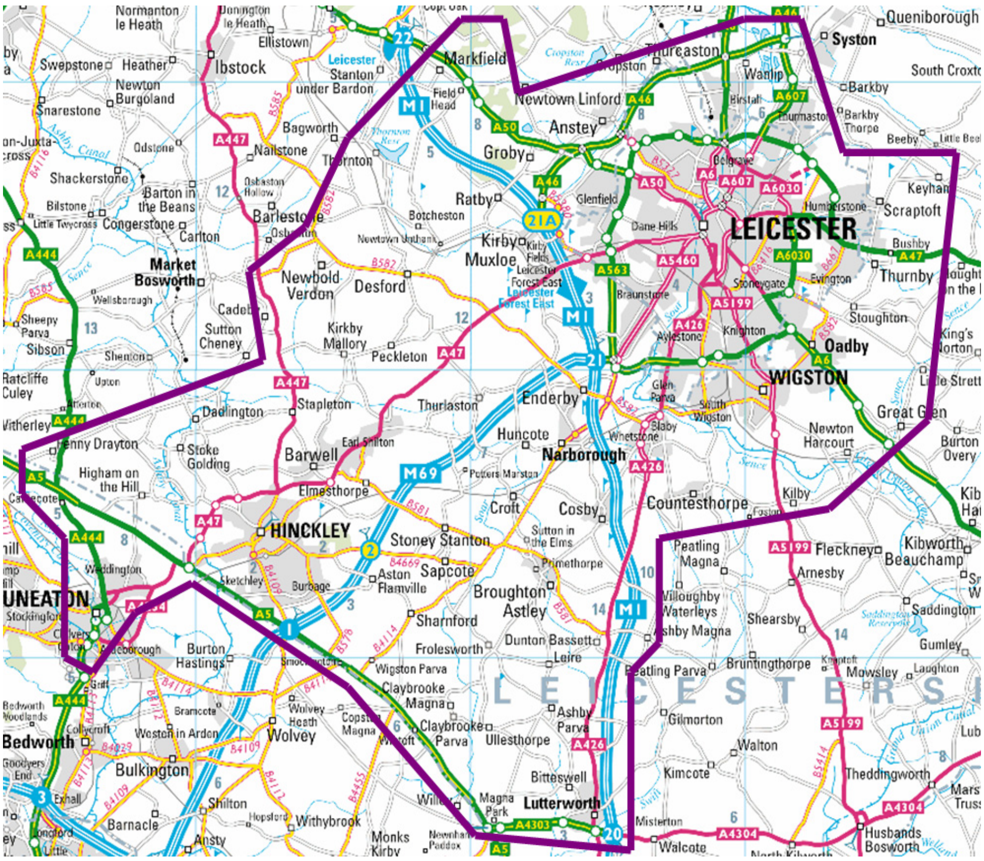


Figure 15: Boundary of the South-West Leicestershire speed limit map

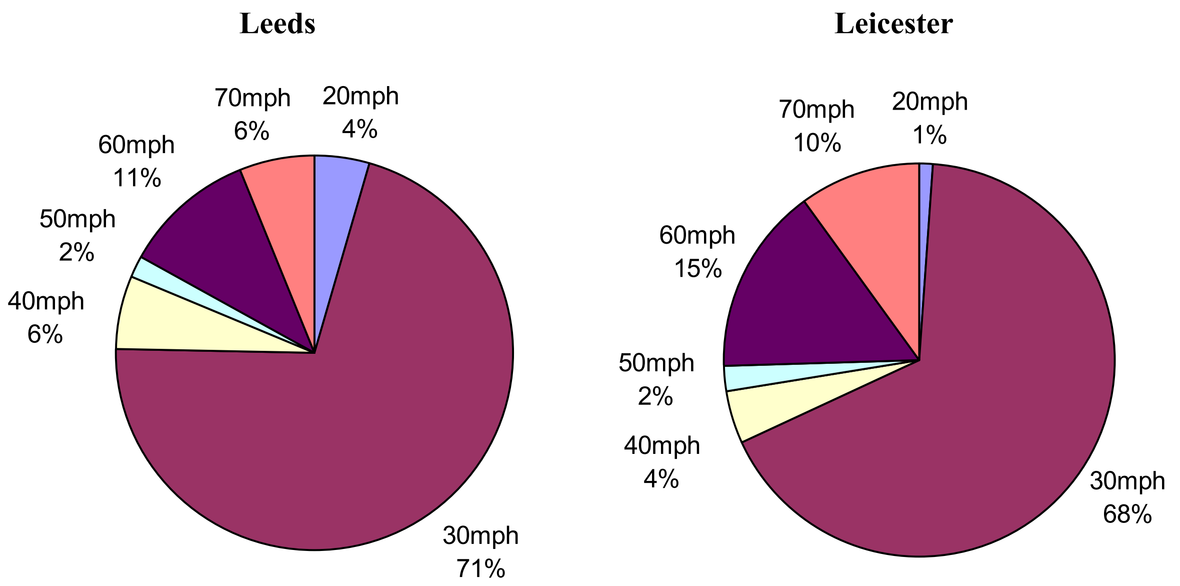


Figure 16: Comparison of distribution of road networks in the survey areas

2.4 Participant recruitment

Participants were recruited according to a number of criteria:

Current vehicle status: Details were sought relating to the participants' current vehicle in order to exclude participants volunteering in order to "drive a new car for a while". Respondents were also asked to state the proportion of their driving spent in this car in order to exclude multi-vehicle users (as this would introduce noise into the data).

Exposure: In order to maximise data collection participants were required to have an average annual mileage exceeding 10,000 miles and undertake at least 80% of their driving within the specified map area.

Accidents and driving convictions: In order to minimise the likelihood of serious incidents, participants who had been convicted of offences such as driving under the influence of alcohol and those who have been involved in more than two accidents in the previous three years were discarded.

Demographics: The aim was to balance the sample for gender and age. Participants were split into two age groups (25–39 and 40–60).

Participants for the private field trials were recruited in response to adverts placed in local newspapers (Yorkshire Evening Post, The Leicester Mercury). Participants for the fleet trials were recruited from local organisations. In the Leeds fleet trial participants were recruited from employees of Leeds City Council (LCC). Two information mornings were held at LCC's head office in order to recruit members of staff who worked together and regularly used their car as part of their work. It was initially intended that all participants would be recruited from the same department within the council. However due to low interest in the project, the sample was widened to other departments. Similarly it was hoped that participants taking part in the Leicestershire fleet trial would also be recruited from a council department. Again, however, volunteer rates were low and a number of departments had existing company car fleets in place.

The selected participants were therefore recruited from employees of local authorities (including Leicestershire County Council, Leicester City Council, and Hinckley and Bosworth Borough Council) as well as a private company (Kingstone and Mutual Clothing Co). Participants selected to take part in the trial were then required to sign an agreement (see Appendix A) between the University of Leeds and themselves covering issues such as data collection, insurance claims and car maintenance procedures.

There were a number of participants who withdrew from the final trial due to personal reasons (e.g. sickness and accidents unrelated to the trial). Although replacement participants were recruited, the amount of data collected from the last participant did not warrant their inclusion in the final analysis. Therefore the data analysis only includes 79 participants.

In addition, it proved difficult to recruit the participants according to the desired selection criteria; for example, it was difficult to recruit younger or female participants accruing a large enough annual mileage within a viable recruitment period. Consequently, 44 males (age range 22–59 years, M = 40.30, SD = 11.73) and 35 females (age range 30–60 years, M = 41.43, SD = 8.05) took part in the four trials. However, given the surveys were lengthy in nature a number of participants failed to complete some items in the questionnaire, the number of participants included in the present analysis therefore varies throughout.

2.4.1 Demographic and driving characteristics

Several items sought information about key demographic and driving characteristics in order to give a brief overview of the sample. Using intention to speed measures based upon the Theory of Planned Behaviour (see section 4.1.2.1 for discussion of theory) participants were classified as intenders and non-intenders. Intenders were defined as those expressing a stronger intention to exceed the speed limit (falling above the median) and non-intenders were defined as those expressing a weaker motivation to exceed the speed limit (falling on or below the median). As can be seen in Table 1, it was difficult to recruit participants at the extremes of the age group ranges with the majority aged within the 30–50 year age bracket.

Table 1: Age by attitude group

	N	Mean	Standard Deviation	Minimum	Maximum
Intenders	38	39.71	10.11	22	59
Non-Intenders	41	41.97	10.32	23	60

Figure 17 suggests that non-intenders were more likely to be married or living with a partner. Overall 73% of those participants who responded were married or living with a partner. Forty five percent of the participants also had one or more children aged 18 or under living with them.

When comparing participants' National Statistics Socio Economic classification there was little variation across the groups (see Figure 18).

Table 2 provides an overview of the participants' self-reported mileage and trip frequency. As required the participants generally accrued an average annual mileage that exceeded 10,000 miles and spent at least 80% of their time driving within the mapped areas.

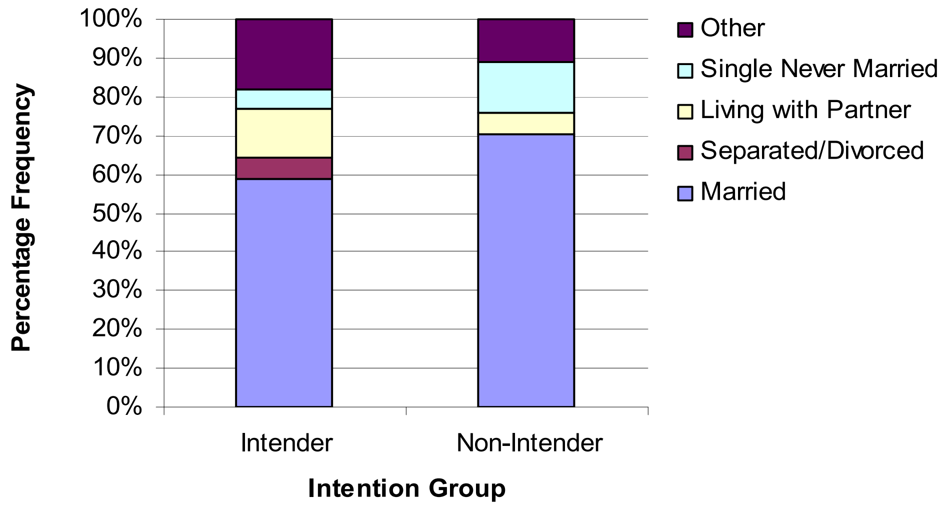


Figure 17: Marital status by intention group

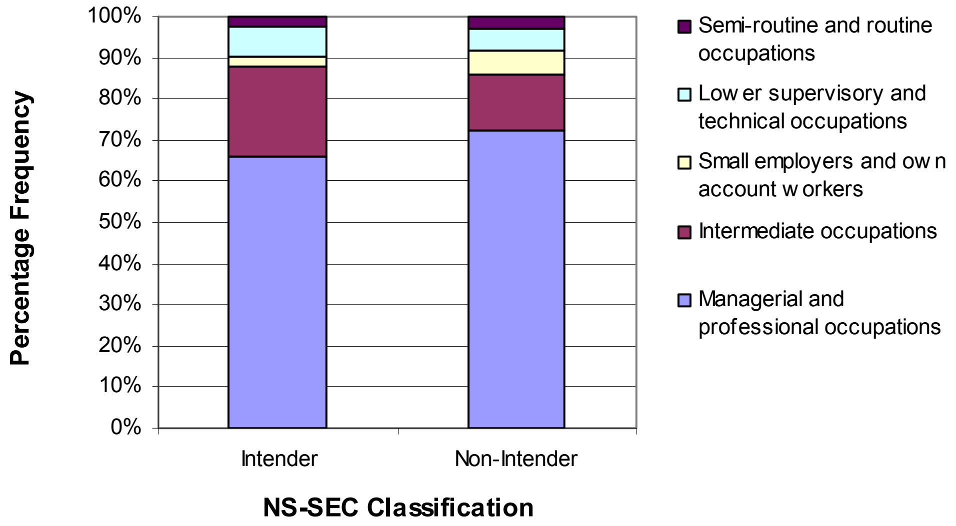


Figure 18: NS-SEC classification by intention group

Table 2: Participants' mileage and trip statistics

	Intenders	Non-Intenders
Weekday mileage within survey boundaries	175.85	174.09
Weekend mileage within survey boundaries	50.46	58.61
Total weekly mileage within survey boundaries	226.31	232.71
Monthly mileage within survey boundaries	905.24	930.82
Annual mileage within survey boundaries	11768.11	12100.67
Total annual mileage	14637.62	15226.42
% of driving within survey boundaries	84.18	84.53
Number of weekday trips	28.10	26.18
Number of weekend trips	7.41	7.87
Total weekly trips	35.51	34.05

2.5 Data collection

A wide range of data was collected during the trial, including objective measures recorded by the vehicle and subjective measures obtained through questionnaires. These are specified in the following sections, followed by a description of the data management system.

2.5.1 Objective measures

Although the focus of this project is travelling speed and speed limits, many other parameters were recorded during the course of a trip, such as time stamps and coordinates etc, at 10 Hz (i.e. 10 records per second) by the data logging system installed in the vehicle. The purpose of recording coordinates was to enable replication of a trip should it be required at a later date. Many trip based parameters, for example trip length, trip duration and fuel usage, were also recorded by the vehicle's logging system.

2.5.2 Questionnaires

A number of questionnaires based upon the Theory of Planned Behaviour were administered to examine specific changes in cognitions following experience with the ISA system. Employing the TPB also allowed us to identify the key determinants of drivers' propensity to speed using objectively assessed and ecologically valid behavioural data. Since research outside the UK has shown that experience with ISA increases drivers' acceptance of various ISA systems, a number of additional items within the questionnaire also allowed us to determine the impact of experience on drivers' acceptance of and attitudes to the mandatory ISA system. These questionnaires included the Driver Behaviour Questionnaire (Parker et al., 1995), NASA-RTLX (Byers, Bittner and Hill, 1989), an acceptability scale of advanced transport telematics (Van der Laan et al., 1997) and various items relating to drivers' perceived safety and frustration when driving with the ISA system.

2.5.3 Data management

2.5.3.1 In-vehicle data logging system

Data collected by the vehicle was stored in three separate files at the end of each trip. These are specified as follows:

The main data file is a continuous ASCII stream recording vehicle speed, speed limits, coordinates, and time stamps etc at 10 Hz.

The summary file contains trip based information such as time stamps and coordinates of the origin and destination, date, trip length, fuel usage, ISA usage etc.

The error log file records any system failures during the trip and is only used for fault investigations.

All of the above files were stored on the hard disk in the vehicle. Identical files were also duplicated on a second hard disk to reduce the potential impact of data loss due to failure of a hard disk. The available space on each disk was checked during each trip. When the capacity had fallen below 20% of the full capacity, a warning message was sent to the research team at Leeds University and MIRA.

2.5.3.2 SMS workstation

Although the summary file was recorded on the in-vehicle hard disks, it was also sent as an SMS message through mobile phone network at the end of each trip to a dedicated workstation at Leeds University. The workstation was equipped with a SMS receiver. After the SMS had reached the workstation, the content was converted and written into a Microsoft Access database via a Java application, Swiftnote. The software was developed by NCL Ltd, Ireland, and was provided to the project free of charge on an academic licence.

2.5.3.3 Data server

The ISA data server was equipped with an Intel Xeon processor and 1GB memory which run Microsoft SQL Server 2000. The data files stored in the vehicles were downloaded to a laptop at the end of each trial phase, and were subsequently converted and written into the SQL database. The SQL database contained various tables hosting data from different sources and provided links to integrate data across the tables facilitating data extraction for analysis.

3. ANALYSIS OF VEHICLE DATA

3.1 Introduction

This chapter presents analysis of vehicle data. An overview of the data collected through the four field trials is addressed in the next section, followed by analyses of the effect of ISA. In addition to analyses on an overall level, the effect of ISA intervention was also examined by demographic factors in terms of gender, age, intention to speed, and types of driver (in terms of private motorists or fleet drivers).

3.2 Overview of the data

3.2.1 Completeness of data collection

During the trial, each participant was expected to generate 168 days of travelling data. Interruption to data collection was attributable to occasional ISA system malfunctions. Table 3 presents the completion rate achieved in each trial as well as the overall completion rate. The completion rate dropped from Trial 1 to Trial 2, which was primarily attributable to a significant increase in one particular hardware failure; the coin battery attached to the circuit board of the control computers failed to function correctly. This fault was promptly rectified when the ISA fleet was refurbished before the start of Trial 3, which boosted the completion rate of the last two trials back to the similar level achieved in Trial 1.

Table 3: Comparison of data completeness across trials

	Across all trial phases	**Phase 2 only**
Trial 1	96.7 %	95.9 %
Trial 2	91.0 %	88.1 %
Trial 3	96.2 %	95.8 %
Trial 4	95.4 %	94.3 %
Overall	**94.8 %**	**93.5 %**

3.2.2 Vehicle utilisation

Table 4 presents the number of days when data were generated during the trial, i.e. when the ISA cars were driven. It is notable that the private motorists used the vehicle more frequently than the fleet drivers (in the Leeds trial the private motorists drove more than the fleet drivers whereas in the Leicestershire trials private and fleet drivers drove roughly the same total distance). This pattern in fact corresponds to the trial design. Participants in the two private trials were recruited based on their general usage of a vehicle, while those in the two fleet trials were recruited based on the characteristics of their work trips, which do not always extend to weekends.

Table 4: Comparison of vehicle utilisation across trials

All data				Phase 2 only			
	Leeds	**Leicester**	**Total**		**Leeds**	**Leicester**	**Total**
Private	3,264	3,001	6,265	Private	2,097	1,890	3,987
Fleet	2,784	3,070	5,854	Fleet	1,723	1,783	3,506
	6,048	6,071	12,119		3,820	3,673	7,493

Based on the trial design, each participant was given an ISA vehicle for 168 days (112 days for Phase 2). If each vehicle was used on a daily basis by all 80 participants, a total of 13,440 vehicle days would have been achieved (8,960 vehicle days for Phase 2 only). Taking the completeness of data collection reported in the previous section into account, Table 4 indicates that the overall utilisation of the vehicles was 95.1% [12119/(13440×94.8%)] across all trial phases, and 89.4% [7493/(8960×93.5%)] for Phase 2 only. The marginally lower usage of the ISA vehicles during Phase 2 is however considered to be attributable to the asymmetric duration of trial phases, rather than indicating a decrease of usage of the vehicle because ISA was activated. Participants' absence (e.g. holidays) occurred more frequently during Phase 2, as it lasted four times longer than Phase 1 or 3. Overall, the level of vehicle utilisation is considered to be satisfactory with respect to accumulating sufficient experience of using the ISA system.

3.2.3 Travel distance

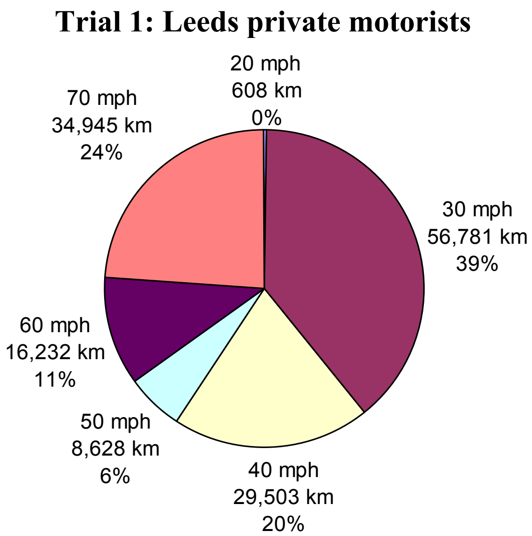
Table 5 compares vehicle kilometres accumulated across the four trials, which reveals two noticeable trends. Private motorists drove more distance than fleet drivers, which seems to be in line with the private motorists using the vehicles more frequently (i.e. Table 4). In addition, participants recruited from Leicestershire travelled more distance than those residing in Leeds, which is presumably attributable to different travel patterns between these two groups of participants.

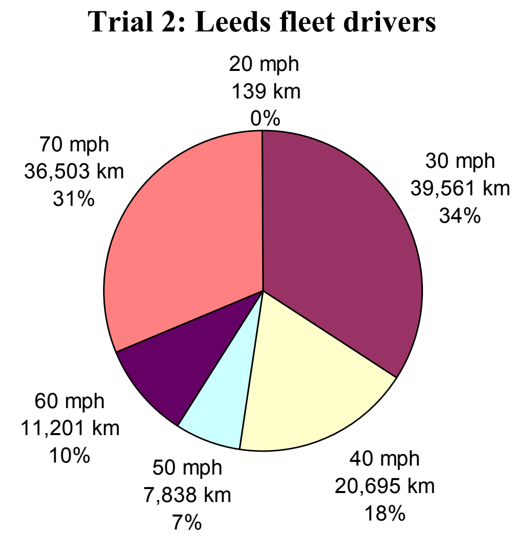
Table 5: Comparison of vehicle kilometres across trials

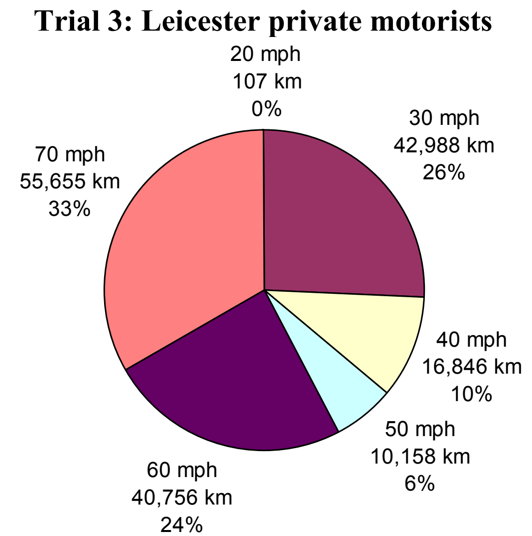
All data				Phase 2 (ISA activated) only			
	Leeds	**Leicester**	**Total**		**Leeds**	**Leicester**	**Total**
Private	146,697	166,509	313,206	Private	95,705	102,556	198,261
Fleet	115,937	141,517	257,454	Fleet	68,467	85,381	153,848
	262,633	308,027	570,660		164,172	187,937	352,109

Figure 19 illustrates the distribution of distance travelled in different speed zones across the four trials. Participants from Trial 3 travelled more on rural roads as opposed to those from the other three trials, with the travel distance on 60 mph roads being nearly a quarter of the total travel distance. As 60 mph roads are primarily between towns and villages, this may have contributed to the longer accumulated travel distance from Leicestershire trials depicted in Table 5.

However, in all four trials the distance travelled on 30 and 70 mph zones accounts for the majority of total distance travelled, ranging from 59% (Trial 3) to 70% (Trial 4). Due to the fundamental similarity in the travel patterns across trials, it was considered to be appropriate to pool the data together to conduct an overall analysis on the vehicle data.







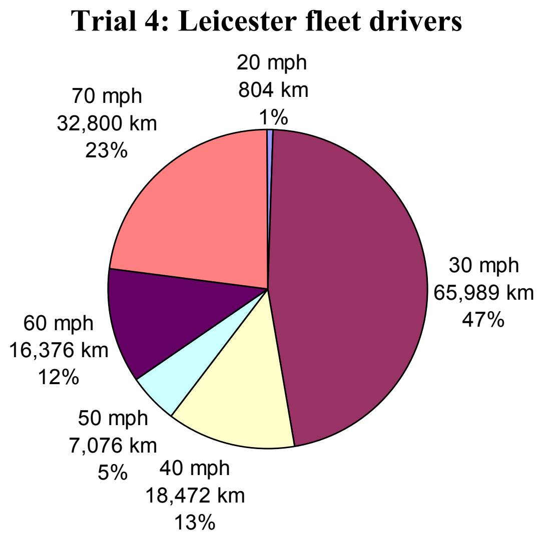


Figure 19: Comparison of travel patterns across trials

Figure 20 illustrates the distribution of overall distance travelled across speed zones. It demonstrates that the largest portion of distance travelled was attributable to 30 mph zones, followed by 70 mph zones. It is worth noting that distance travelled in 20 mph zones was less than 1% of the total distance. In fact, only 40 out of the 80 participants had travelled in 20 mph zones, many of which had contributed fairly short distances. This implies that the data collected from 20 mph zones are less representative of the true travel pattern in the driving population, in comparison with data collected from other speed zones.

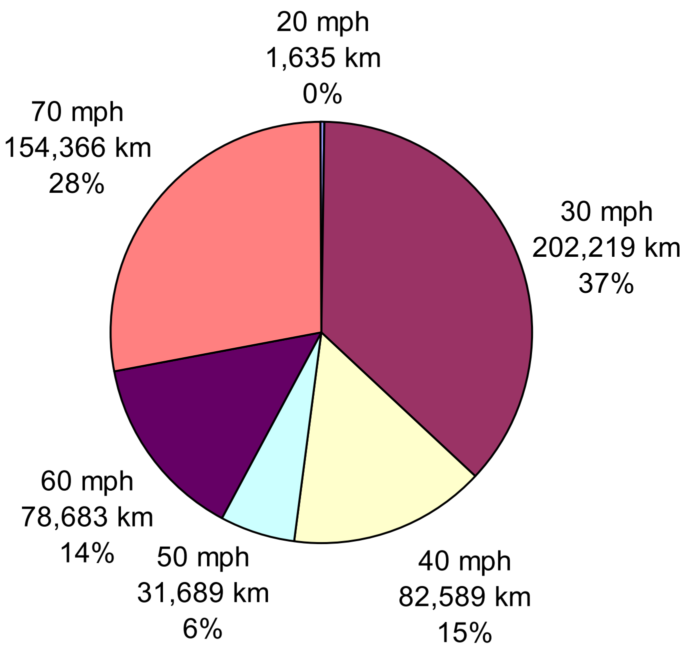


Figure 20: Distribution of overall distance travelled across speed zones

3.2.4 Data processing

Although the data logging system in the vehicle recorded data at 10Hz (i.e. 10 records per second), data used for analysis was distance-based rather than time-based. While time-based data is intuitively valid, it introduces undue weight to the data stream when vehicle speed is zero (e.g. the vehicle stops at junctions) or very low (e.g. the vehicle moves slowly on a congested road). Conversion algorithms were therefore developed for extracting a record per 5 metres of travelling distance from the data stream. This data processing also filtered out records without a valid speed limit attached to them, attributable to the vehicle being driven on roads which were not given speed limits by Navteq, such as private roads (e.g. supermarket car parks) or non-trunk roads outside the speed limit map boundaries. The original data file contained over 138 million records. After the data processing was completed, there were over 110 million valid records across all four trials in the final data file ready for analysis.

Weighting across participants to equalise individuals' contribution of travel distance during the trial to the data was considered in order to prevent the data from being possibly distorted by participants with high annual mileage. However, after careful consideration, weights were not applied in order to retain a valid representation of the sample against the whole driving population, as annual mileage inherently differs from one driver to another.

3.3 Speed distribution

Figure 21 to Figure 26 illustrate speed distribution across speed zones from 20 mph to 70 mph respectively. Each figure consists of two graphs: the top graph shows speed distribution across trial phases, and the bottom graph shows speed distribution in Phase 2 only (i.e. when ISA was switched on), with a breakdown of system engaged (Opt-In) and system overridden (Opt-Out). Each bottom graph also shows the percentage of distance travelled during Phase 2 when the ISA system was opted out.

It is worth noting that participants seemed to have adapted their reference for their chosen speed between trial phases. During Phase 1 and 3 when the ISA system was turned off, many participants were observed to obey the speed limits with reference to the speedometer reading. During Phase 2, most participants were observed to rely on the ISA system (i.e. throttle feedback) instead of the speedometer reading. The ISA system used in the trials did not precisely restrict vehicle speed to posted speed limits (i.e. the speed limits provided by the digital speed limit map stored in the vehicle) all the time. Considering that trial participants might encounter a wide variety of road gradients, tolerance was given to the throttle cut-off thresholds allowing the vehicle to be able to reach the speed limits on uphill roads. This design however led to the vehicle being able to exceed the speed limits on flat or downhill roads.

As a result, there is a slight drift of the speed distribution in Phase 2 around the legal speed limits, especially in lower speed zones. For example, a considerable amount of data clusters within the higher speed band immediately next to the legal speed limits (e.g. Figure 21 and Figure 22). Nevertheless, the trial results undoubtedly demonstrate the effectiveness of the ISA system on reshaping speed distribution.

The effect of ISA intervention on the shape of the speed distribution is prominent across speed zones, except for the 60 mph zones, in which speeding behaviour had already rarely been recorded before ISA was activated (i.e. Phase 1). This is considered to be primarily due to the constraints on driving speed imposed by road geometry and traffic, as the 60 mph speed limit is generally applied on rural single carriageway roads. According to DfT data, only 10% of cars exceed the speed limit on 60 mph roads in free-flow conditions (Department for Transport, 2006). In addition, the shapes of the speed distribution from Phase 1 and Phase 3 were generally very similar, which implies that, although ISA effectively changed the speed distribution, the carry-over effect was not that prominent.

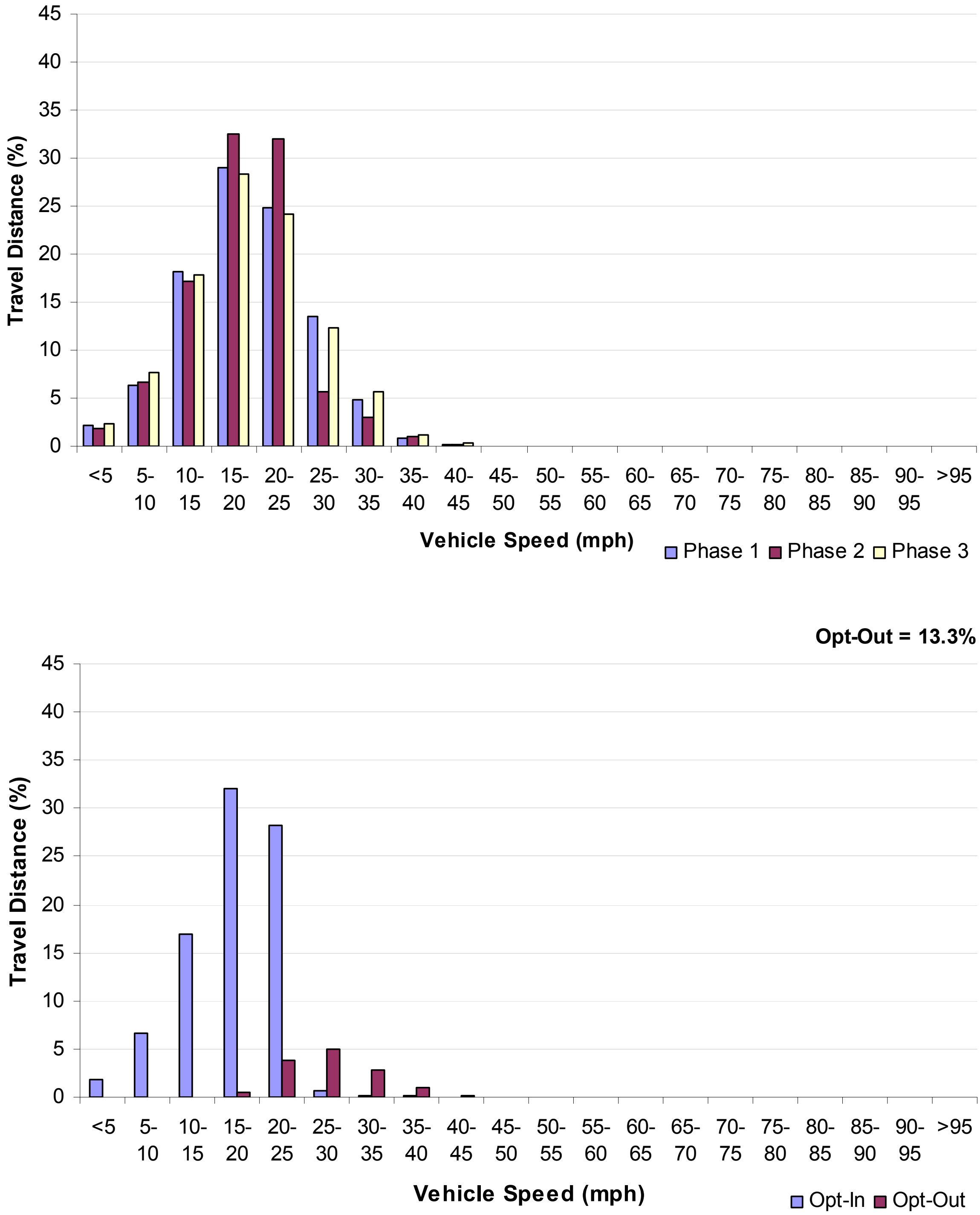
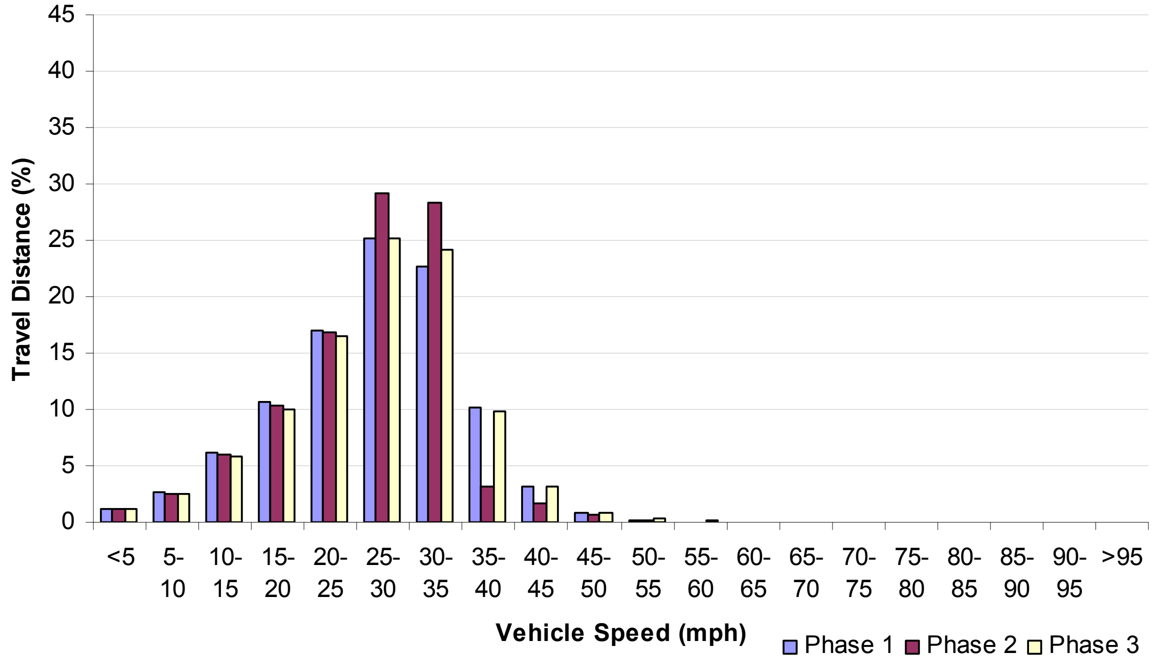


Figure 21: Overall speed distribution in 20 mph zones



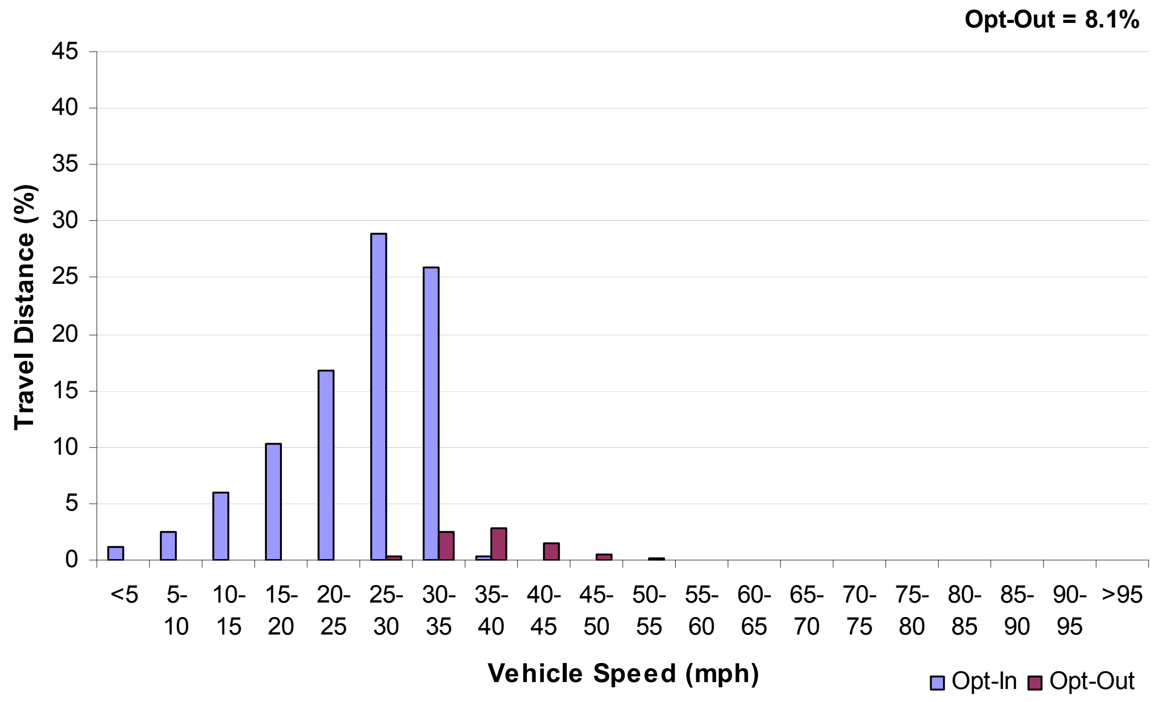
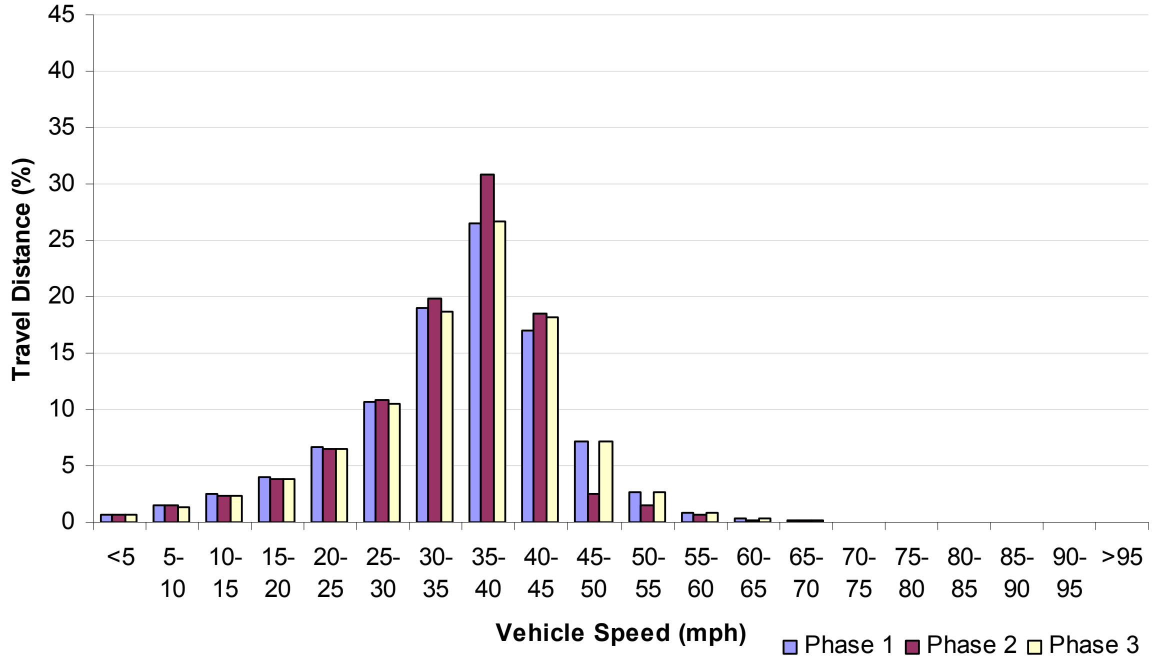


Figure 22: Overall speed distribution in 30 mph zones



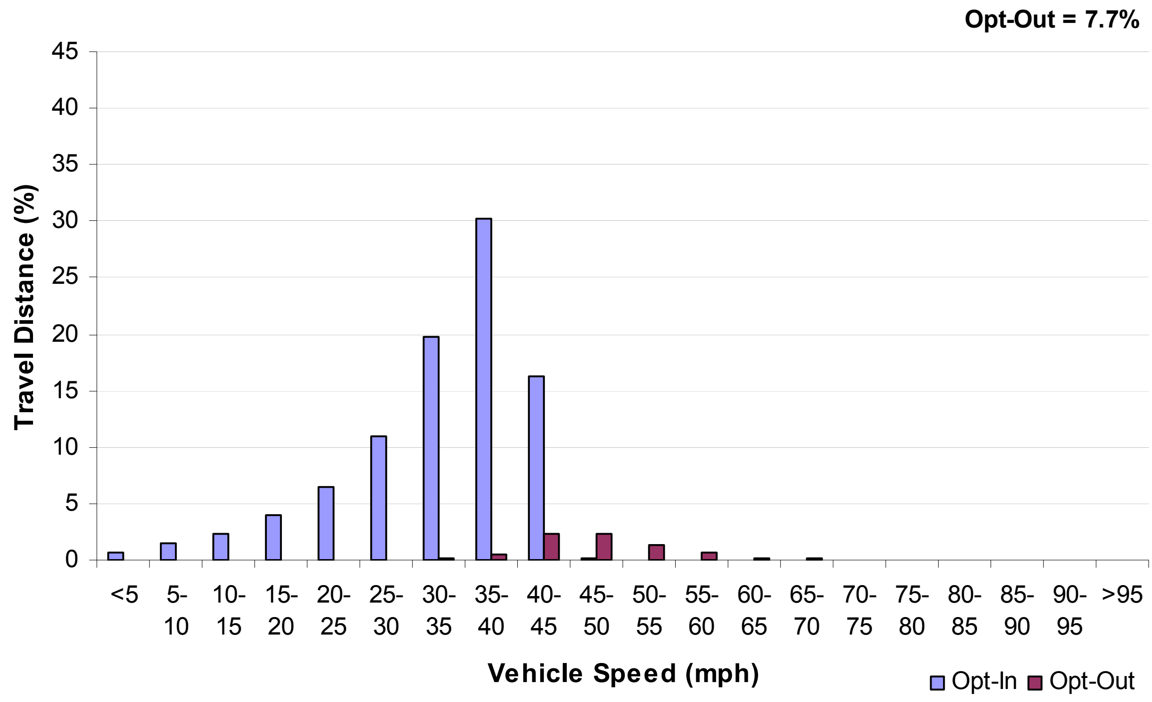
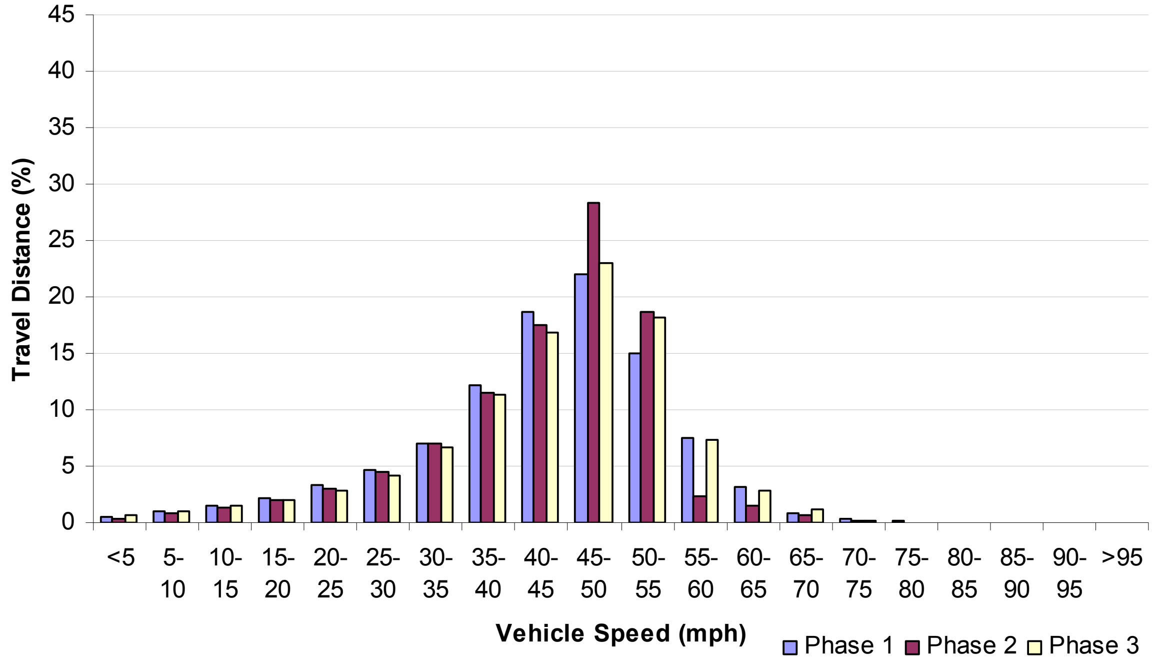


Figure 23: Overall speed distribution in 40 mph zones



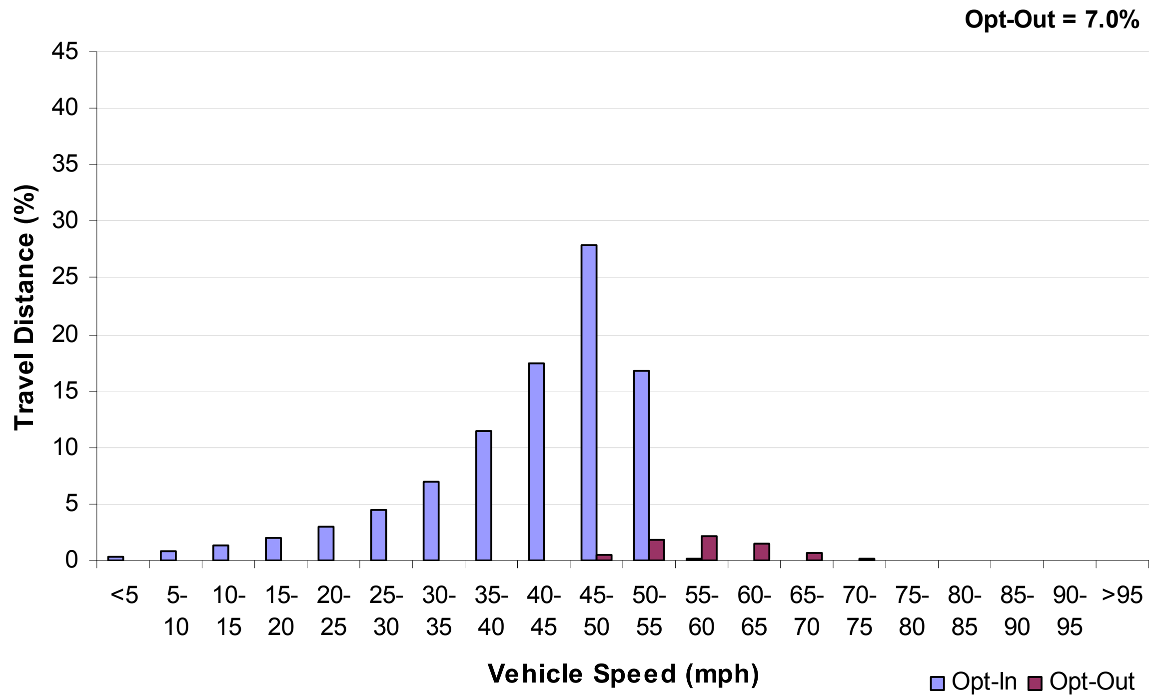
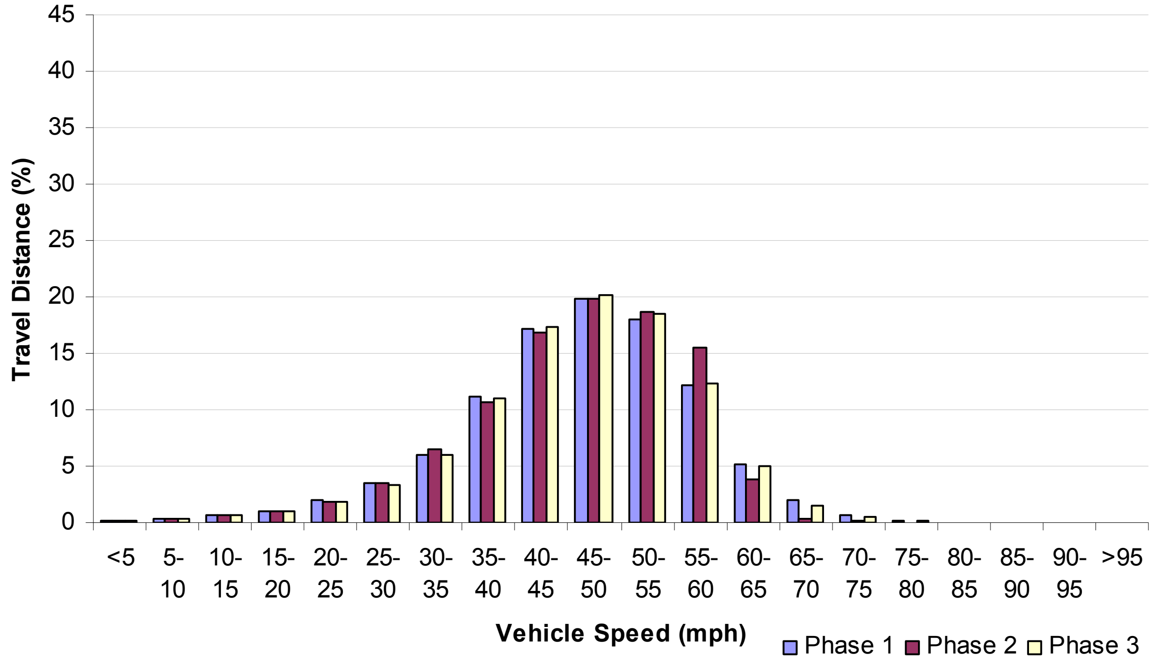


Figure 24: Overall speed distribution in 50 mph zones



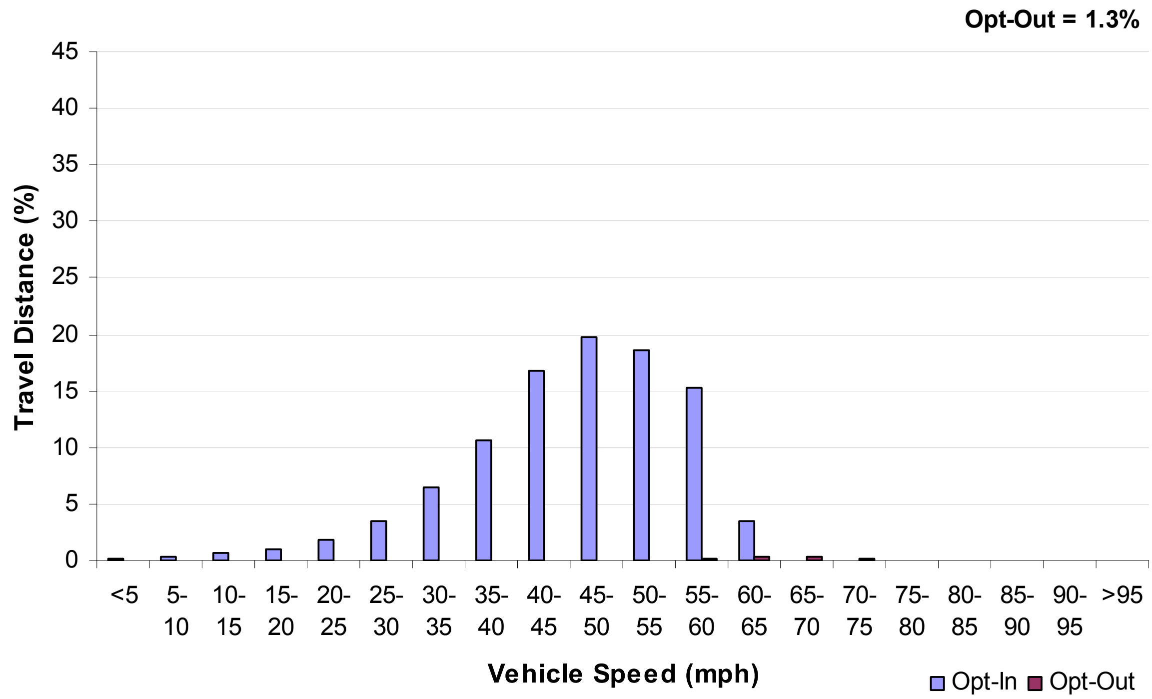
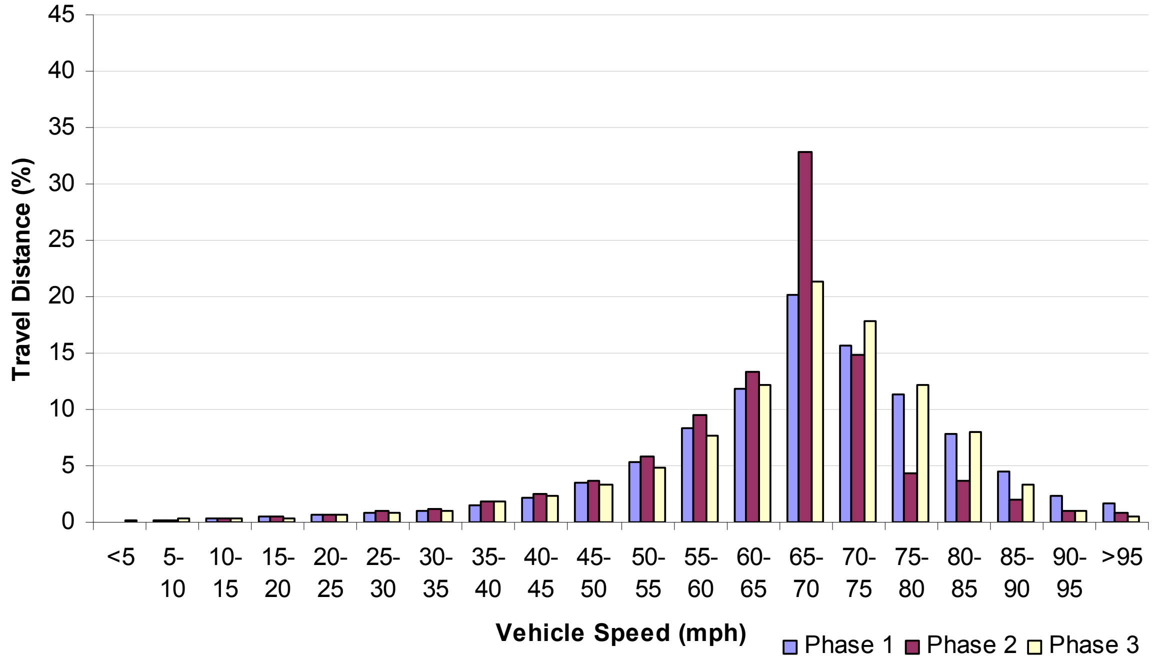


Figure 25: Overall speed distribution in 60 mph zones



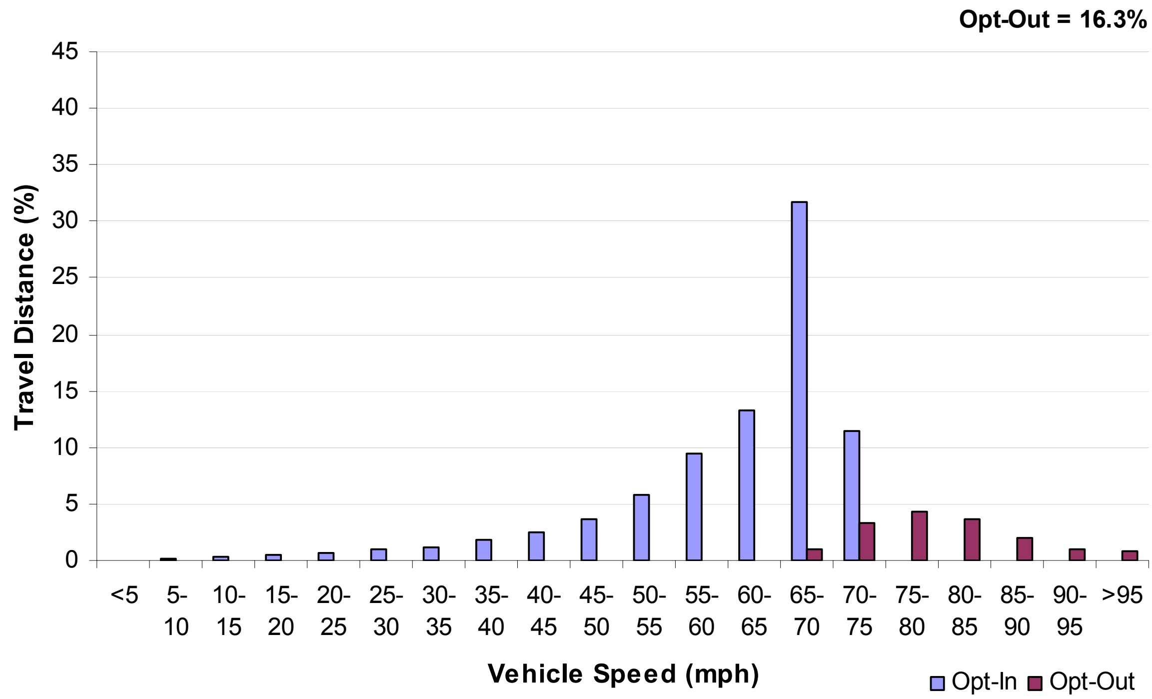


Figure 26: Overall speed distribution in 70 mph zones

3.4 Compliance with ISA intervention

Figure 27 compares the observed overriding behaviour across speed zones, and shows that ISA was overridden most frequently on 70 mph roads. Participants may have felt that speeding on 70 mph roads (mainly motorways) was acceptable whereas speeding on urban roads was not. However, participants' overriding behaviour on urban roads is still of concern: on 20 mph roads ISA was overridden for 13% of distance travelled, on 30 mph roads and 40 mph roads for 8%. These are the roads where drivers are most likely to encounter conflicts with vulnerable road users such as pedestrians and cyclists.

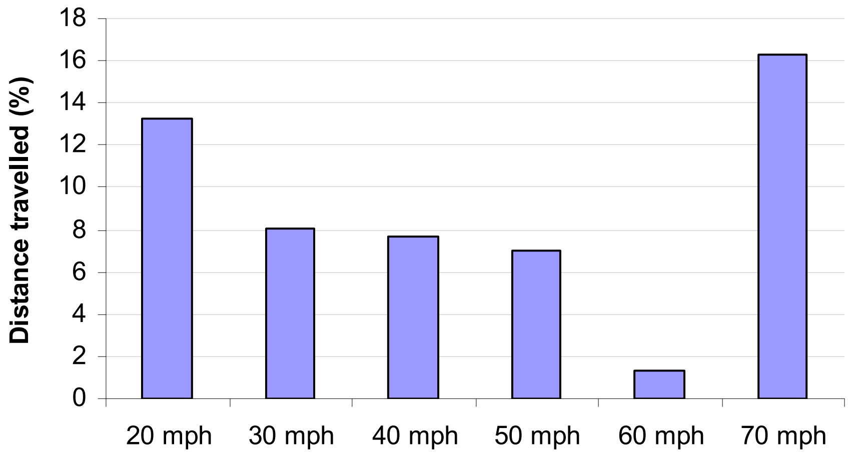


Figure 27: Comparison of overriding behaviour across speed zones

Participants' overriding behaviour was also investigated against system exposure as a way of examining long-term behavioural adaptation. Similar to considerations given to data processing addressed in Section 3.2.4, system exposure could be measured by time or distance travelled. The reliability of a time-based measure (i.e. number of weeks of experiencing the ISA system) was explored. Figure 28 illustrates the potential biases of examining the data on a week-by-week basis. Comparisons across the four selected participants demonstrate a considerable within-participant difference in distance travelled per week and suggest that a week-by-week based analysis might not reliably reflect accumulated exposure to the ISA system.

In contrast, defining exposure in terms of distance travelled (i.e. per 500 km) was considered to be a more reliable measure as this allows identification of behavioural adaptation as experience with the system increased. But, since annual mileage naturally varies from one driver to another, sample size would unavoidably decrease along an increase in exposure. As illustrated in Figure 29, the full sample size can only be secured in the first two exposure bands and the sample size starts to drop from the third band onwards. While the upward trend in the mean frequency of opt-out appears to reduce after 2500 km of system exposure, it is in fact difficult to determine whether the indication that the frequency of opt-out started to level and then drop was a representation of the true underlying trend or was simply attributable to the reduced sample size.

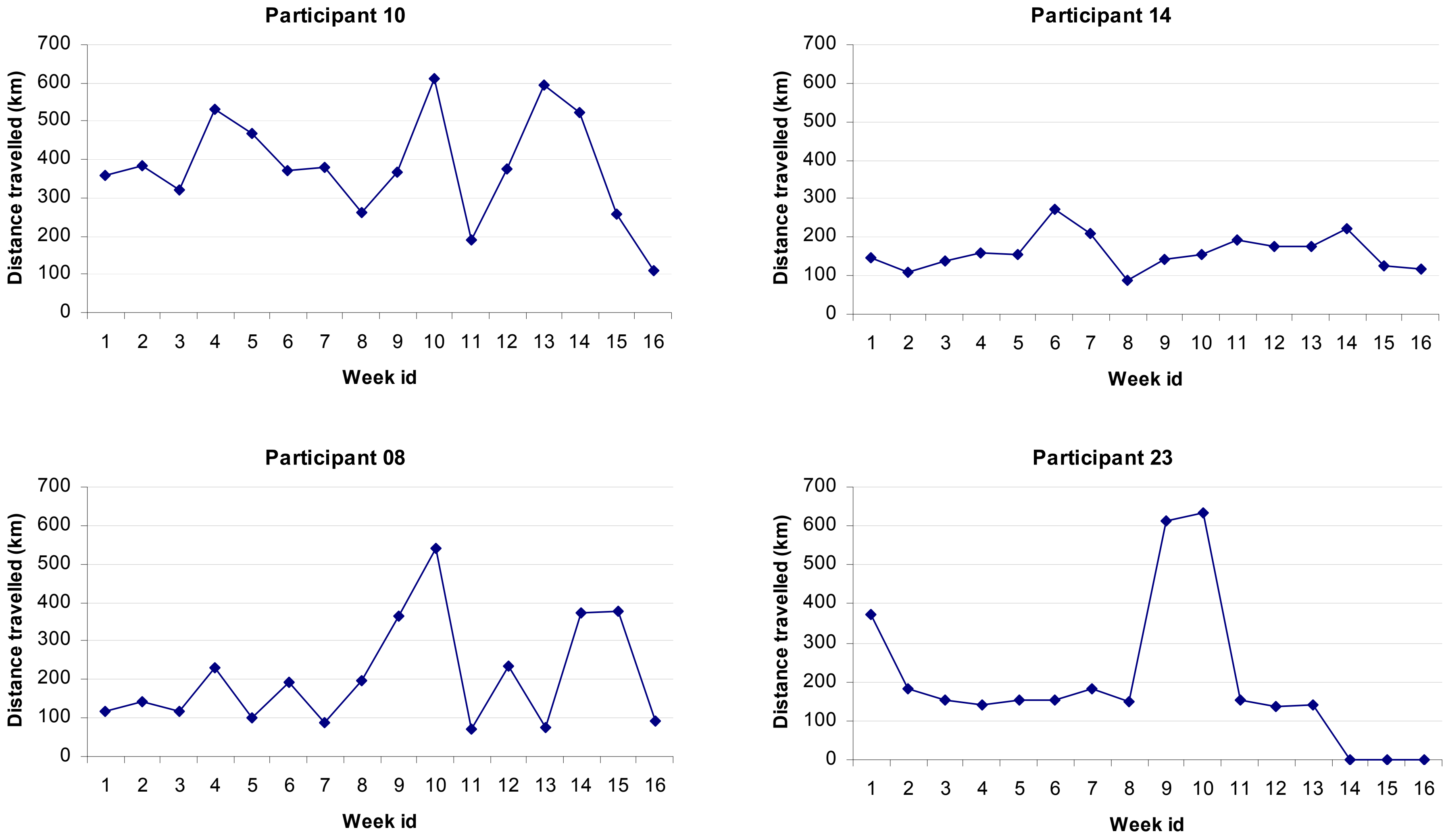


Figure 28: Comparison of distance travelled per week

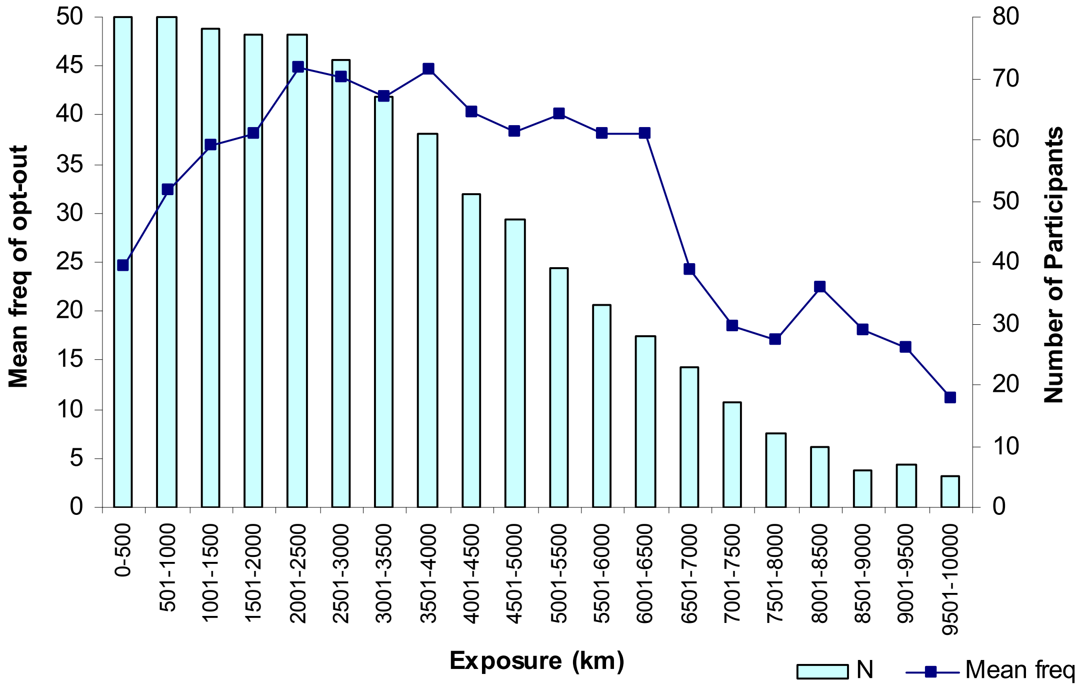


Figure 29: Mean frequency of opt-out against sample size along system exposure

To overcome this problem, participants were therefore grouped based on bands of total kilometres driven, i.e. grouping participants by multipliers of 500 or 1000 km etc. Figure 30 illustrates the distribution of total distance driven by each participant during Phase 2 of the trial (i.e. when ISA was activated), which suggests that grouping participants by 1000 km bands secures a reasonable number of samples in most bands, except for the lower and higher ends of the distribution, as depicted in Table 6. Thus, for comparison of overriding behaviour, participants who drove between 1000 km and 2000 km during the trial period were grouped together, and so forth. This ensures that the sample size of a group of participants remains unchanged along system exposure and variations in mean frequency of opt-out along system exposure would not be affected by inconsistent sample sizes across the distance bands, with the added benefit of being able to compare driver behaviour based on annual travel distance.

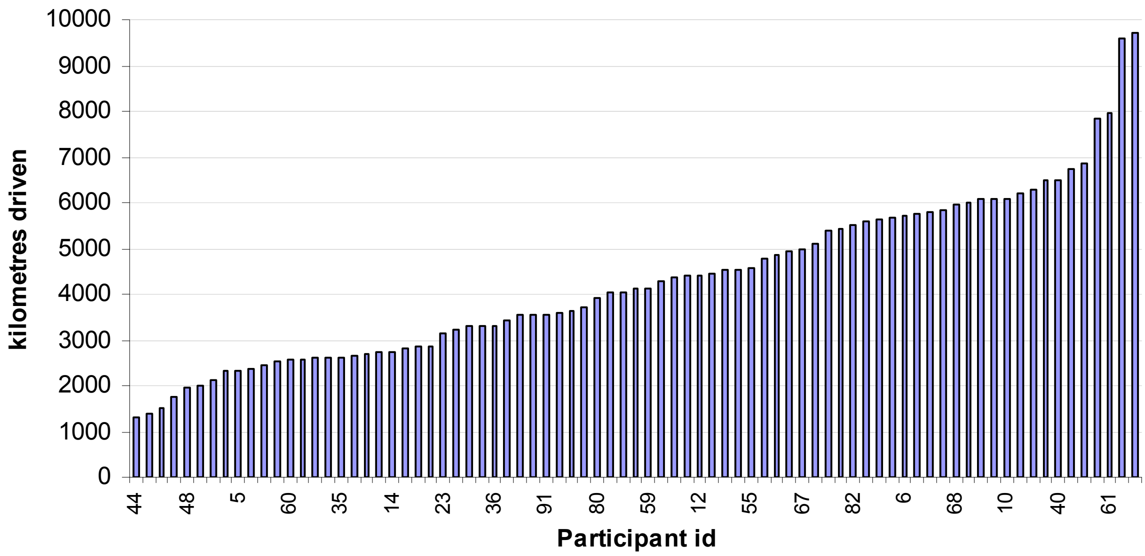


Figure 30: Distribution of total kilometres driven

Table 6: Categorisation of participants based on system exposure

Exposure bands (km)	Number of participants
0 – 1999	6
2000 – 2999	18
3000 – 3999	13
4000 – 4999	16
5000 – 5999	13
6000 – 6999	9
7000 – 7999	2
8000 – 8999	0
Over 9000	2

Figure 31 compares the mean frequency of opt out among four groups of exposure bands. Participants who drove up to 1999 km demonstrated very similar pattern to those who drove between 2000 – 2999 km, and hence their graph is not shown in Figure 31. The graph of those drove between 4000 – 4999 km is excluded from Figure 31 for the same reason. The two bands, 7000 – 7999 and over 9000 km, are not presented due to extremely small sample size, which may affect the reliability of the analysis result.

As shown in Figure 31, participants demonstrated an upward trend of overriding the ISA system along system exposure. Annual mileage seems to be influential on the patterns of overriding the system; participants whose accumulated travel distance was between 5000 – 5999 km seemed to demonstrate a calmer upward trend than others. It is however difficult to suggest a generalised turning point of behavioural adaptation (e.g. 3000 km, 4000 km, or 5000 km accumulated experience) at which the upward trend plateaus consistently across different kilometre bands. This suggests that there is no fixed stabilisation point.

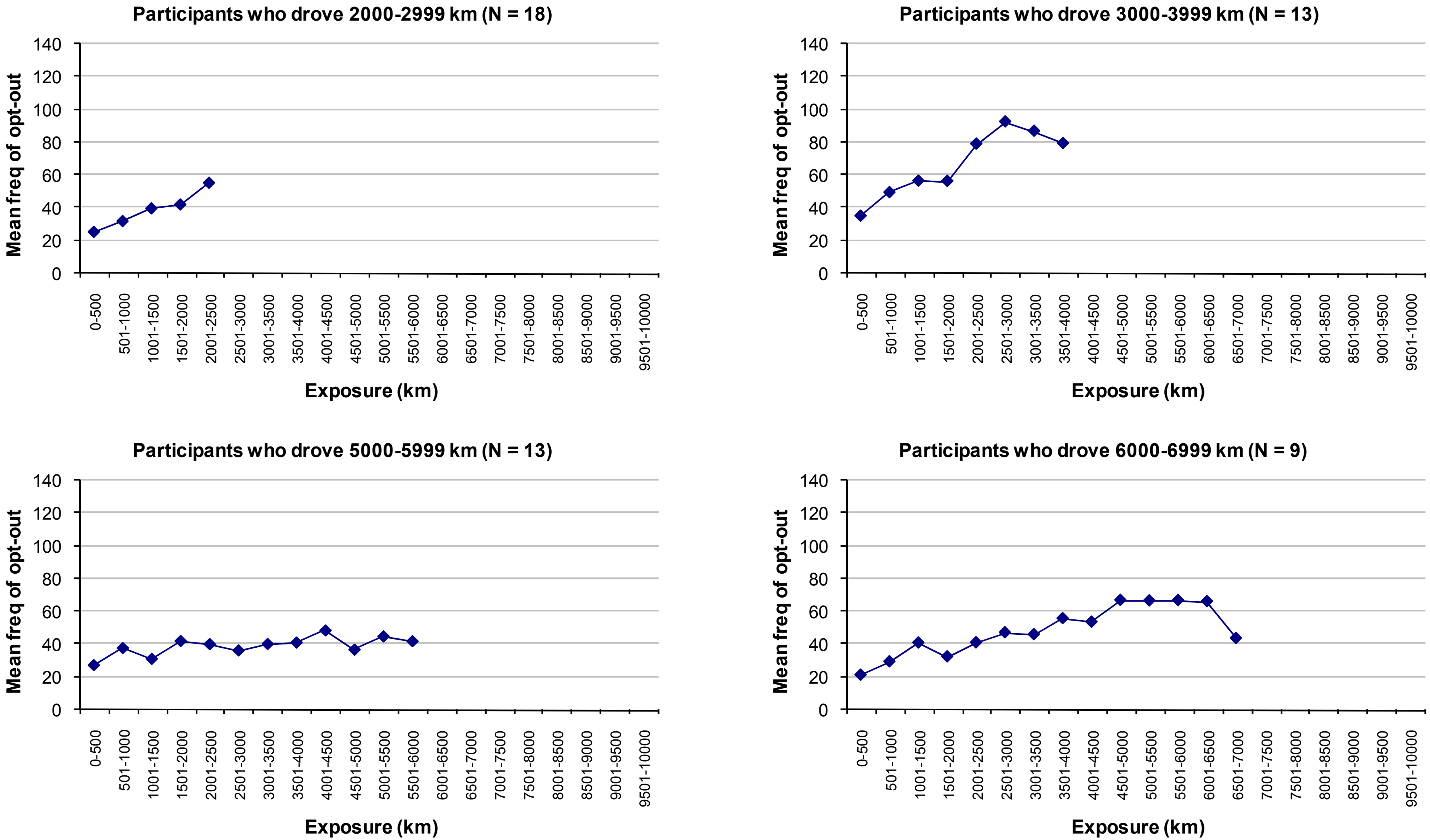


Figure 31: Comparison of mean frequency of opt out by total distance driven

3.5 Comparison of vehicle speed across trial phases

The statistical differences among speed distributions were examined by central tendency (e.g. mean, median, and mode) as well as key percentiles towards the right end of the distribution (e.g. the 85th, 90th and 95th percentile). The high percentiles of the speed distribution offer very useful information for inspecting the presence of speed violation, especially the 85th percentile which closely corresponds to one standard deviation above the mean of a normal distribution. Moreover, traffic engineers have commonly used the 85th percentile of the speed of free flow traffic for determining speed limits. Therefore, a reduced value of the 85th (as well as the 90th and the 95th) percentile speed would be an indication of diminished speed violation. Given that the ANOVA results and the trend of changes across trial phases were very similar for the three statistics indicating central tendency and across the three high percentiles, one measure was chosen to reflect each. Due to the importance of the mean and the 85th percentile of the speed distribution to research into subjective choice of speed, only these two statistics are presented and discussed as follows.

Figure 32 illustrates comparison of these two key statistics across trial phases in each speed zone, which suggests that ISA effectively reduced the mean and the 85th percentile of the speed distribution with the most prominent effect shown in lower speed zones; i.e. a 'V' shape, the statistic in question goes down from Phase 1 to Phase 2, then rises again from Phase 2 to Phase3.

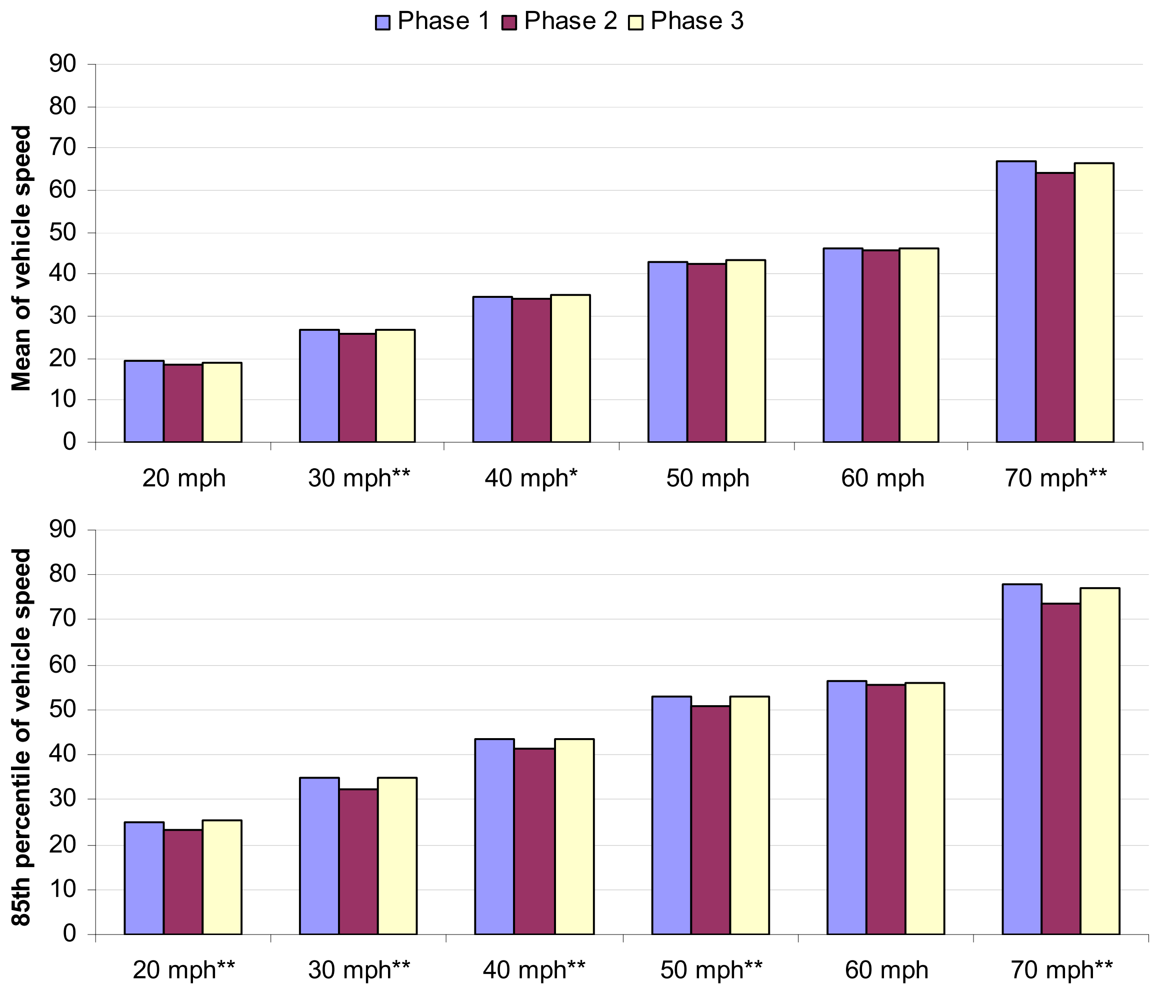


Figure 32: Comparison of key statistics of the speed distribution across trial phases

Table 7 presents the test results of a series of ANOVAs, which suggests that ISA intervention was more effective in reducing excessive speed than mean speed, which is demonstrated by larger effect sizes derived from the 85th percentiles than from the mean speeds across speed zones. It is worth noting that the results presented here include the travel distance when ISA was overridden in Phase 2, which demonstrates that the effectiveness of ISA intervention in diminishing excessive speed was prominent even the ISA system was overridable. Since injury severity is related to speed reduction (Nilsson, 1981), the reduction of excessive speed delivers promising implications to road safety.

Table 7: Results of ANOVA for key statistics of the speed distribution

Statistic	Speed zone	Phase 1	Phase 2	Phase 3	ANOVA: *F* statistic	ANOVA: significance	ANOVA: Effect size	Post-hoc t-tests: PH1 vs PH2	Post-hoc t-tests: PH1 vs PH3	Post-hoc t-tests: PH2 vs PH3
Mean speed	20	19.19	18.48	19.15	F(2,167) = 1.34	0.265	0.016	×	×	×
	30	26.70	25.97	26.95	F(2,235) = 6.63	0.002**	0.053	**	×	**
	40	34.64	33.95	34.86	F(2,235) = 3.10	0.047*	0.034	×	×	*
	50	43.09	42.69	43.51	F(2,230) = 1.83	0.163	0.016	×	×	×
	60	46.25	45.89	46.15	F(2,235) = 0.13	0.875	0.001	×	×	×
	70	67.12	64.05	66.37	F(2,232) = 5.40	0.005**	0.045	**	×	*
85th percentile	20	25.13	23.44	25.22	F(2,167) = 5.15	0.007**	0.058	**	×	*
	30	34.69	32.15	34.81	F(2,235) = 37.1	< 0.0005**	0.240	**	×	**
	40	43.44	41.35	43.48	F(2,235) = 11.9	< 0.0005**	0.092	**	×	**
	50	52.83	50.98	53.04	F(2,230) = 8.63	< 0.0005**	0.070	**	×	**
	60	56.26	55.65	55.99	F(2,235) = 0.42	0.656	0.004	×	×	×
	70	77.99	73.74	76.89	F(2,235) = 8.10	< 0.0005**	0.065	**	×	**

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Figure 33 compares participants' percentage of distance travelled over speed limits across trial phases. ISA effectively diminished the percentage of distance travelled over speed limits across all speed zones (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; the test results are depicted in Table 8. Apart from 20 and 60 mph zones, ISA significantly reduced the percentage from Phase 1 to Phase 2. It is worth noting that the differences between Phase 2 and Phase 3 were also significantly, which suggests that the diminished speeding behaviour was not carried over after ISA was turned off. However, the differences between Phase 3 and Phase 1 were not significant, which indicates that speeding behaviour recorded in Phase 3 was not any worse than Phase 1.

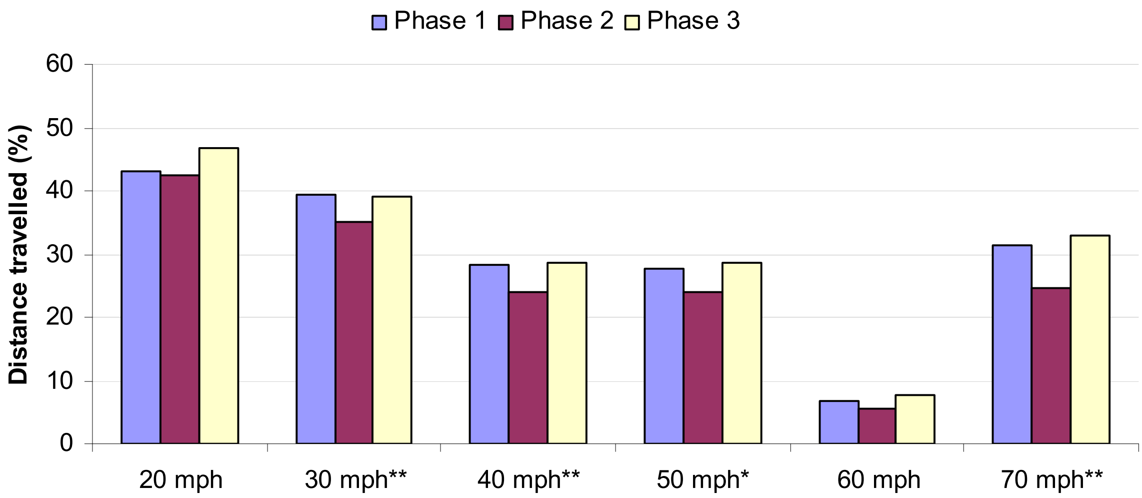


Figure 33: Comparison of percentage of distance travelled over speed limit across trial phases

Table 8: Results of ANOVA for percentage of distance travelled over speed limit

Speed zone	Phase 1	Phase 2	Phase 3	Repeated measures ANOVA			Post-hoc t-tests		
				F statistic	significance	Effect size			
								PH2	PH3
20	43.16	42.41	46.76	F(2,80) = 0.92	0.402	0.023	PH1	×	×
							PH2		×
								PH2	PH3
30	39.51	34.98	39.03	F(2,156) = 19.9	< 0.0005**	0.204	PH1	**	×
							PH2		**
								PH2	PH3
40	28.40	23.85	28.49	F(2,156) = 12.7	< 0.0005**	0.140	PH1	**	×
							PH2		**
								PH2	PH3
50	27.77	24.05	28.66	F(2,146) = 4.33	0.015*	0.056	PH1	*	×
							PH2		**
								PH2	PH3
60	6.82	5.68	7.58	F(2,156) = 2.29	0.104	0.029	PH1	×	×
							PH2		*
								PH2	PH3
70	31.32	24.51	33.01	F(2,150) = 6.00	0.003**	0.074	PH1	**	×
							PH2		**

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

3.6 Speed variability

Coefficient of variation (CV) is a dimensionless measure that allows comparison of the variation of populations having considerably different mean values, which is of particular use for this analysis since the speed zones range from 20 mph to 70 mph. CV in the context of vehicle speed analysis denotes the variability of vehicle speed, which has been argued to be significantly correlated with accident occurrence in urban areas (Taylor, Lynam, and Baruya, 2000; Taylor, Baruya, and Kennedy, 2002).

Figure 34 compares the CV across trial phases within individual speed zones, which suggests that ISA reduced the variability of vehicle speed, as the CV derived from Phase 2 was consistently smaller than that from Phase 1 or 3 (i.e. a ‘V’ shape) across all speed zones. It is however worth noting that the effect of the ISA intervention on reducing speed variability appeared to be most effective in urban areas (e.g. 20 and 30 mph zones) and be less prominent in rural areas (e.g. 60 and 70 mph zones). This echoes the modelling work by Taylor et al. (2000; 2002) and delivers a promising implication of implementing ISA to accident reduction.

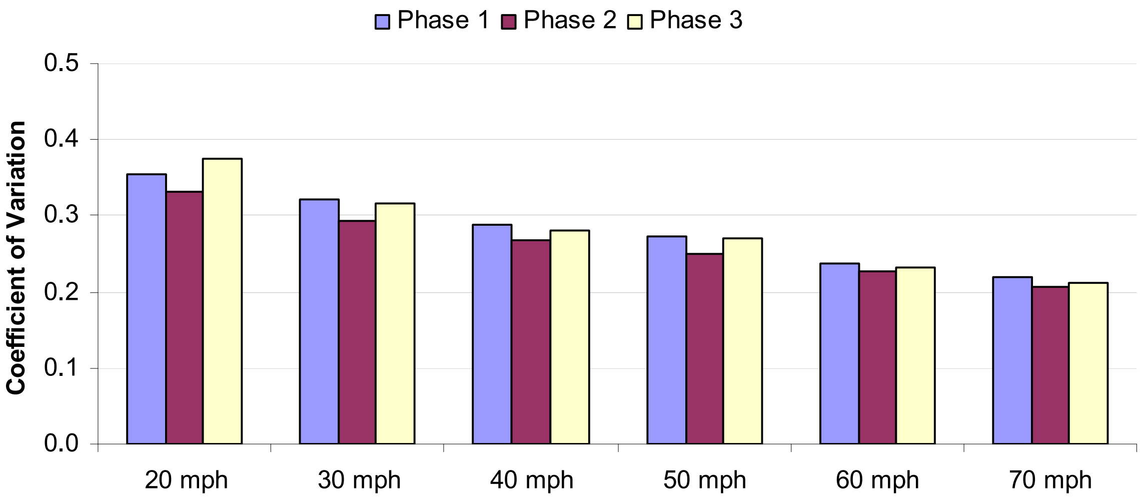


Figure 34: Comparison of coefficient of variation across trial phases

3.7 Jerks

It has been widely argued that braking is the most common evasion manoeuvre in traffic conflicts, ranging from 63% to 98% of traffic conflicts (van der Horst, 1984; Hyden, 1987; Garder, 1990; Hantula, 1994). Jerks, the sudden onset of *severe* deceleration, would therefore provide a useful indication of the occurrence of potential traffic conflicts.

The number of jerks was identified from the data stream, as shown in Table 9. Although Phase 2 appeared to cause more jerks than Phase 1 and 3 by the frequency of the jerks, this is in fact a distorted picture due to Phase 2 having lasted four months while Phase 1 and 3 each only lasted one month. When travelling distance in each trial phase was taken into account, Phase 2 demonstrated a diminished probability of jerk occurrence per vehicle-kilometre in comparison with Phase 1 and 3. Moreover, when the occurrence of jerk was analysed by dichotomous categories (i.e. ISA present against no ISA), ISA clearly demonstrated a diminished probability of jerk occurrence per vehicle-kilometre in comparison with no ISA, as presented in Table 10.

Table 9: Analysis of jerk based on trial phases

Participant ID	Trial phase		
	Phase 1	**Phase 2**	**Phase 3**
7		1	
9		1	
16			1
17	2	2	
37		1	1
39		1	
40		1	
41		1	
43		1	
45		1	
46		1	
49		2	
50	2		
51			1
52		1	
53		1	
55	1		
57		1	
61			1
69			1
80			2
81	1		
82		1	
83			2
85	1	1	
86	1		
88		2	
89	1	1	
90	2	1	
97	1		
Frequency of jerk	12	22	9
Veh-km	113,389	339,889	97,903
Prob of jerk occurrence (per veh-km)	**0.011 %**	**0.006 %**	**0.009 %**

Table 10: Analysis of jerk based on dichotomy

	ISA	**No ISA**
Frequency of jerk	19	24
Veh-km	308,320	242,860
Prob of jerk occurrence (per veh-km)	**0.006 %**	**0.010 %**

It is worth noting that no video data were collected from this trial and hence the identified jerks from the data stream were not able to be confirmed by video evidence. However, the above analyses suggest that ISA *could* reduce the occurrence of potential traffic conflicts. In addition, it is not surprising that the number of jerks identified from this trial was small. According to Nygård (1999), only 6 serious traffic conflicts occurred during a field trial involving 24,080 samples of junction negotiation (i.e. 0.02%).

3.8 Analysis of the effect of ISA on driver characteristics

This section presents analysis of the logged vehicle data in terms of participants' characteristics: gender, age, and intention to speed. The number of participants in each group used in the analysis is specified in Table 11. Analyses were also carried out with respect to types of driver; i.e. private motorists (recruited from Trial 1 and 3) and fleet drivers (recruited from Trials 2 and 4).

Table 11: Number of participants by demographic categories

	Male		Female		Total
	Intender	Non-Intender	Intender	Non-Intender	
Young	11	8	6	11	36
Old	13	12	11	7	43
Total	25	20	17	18	79

Note: There was incomplete data for one young male intender resulting in 79 instead of 80 participants.

3.8.1 Gender

Table 12 depicts a breakdown of vehicle kilometres across trial phases, speed zones and participants' gender groups, which shows that male participants contributed a considerably larger amount of data than female participants. Figure 35 further compares the distribution of travel distance between the two gender groups, which reveals that male participants travelled on motorways (i.e. 70 mph zones alone) more than female participants, and female participants travelled in urban area (i.e. 30 and 40 mph zones) more than male participants.

Table 12: Vehicle kilometres across gender groups, trial phases, and speed zones

Speed zone	Male			Female		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
20 mph	250	691	197	98	308	91
30 mph	23,147	68,498	20,629	18,546	56,253	15,146
40 mph	9,113	26,516	8,122	7,531	24,752	6,555
50 mph	3,093	10,639	2,942	3,123	9,239	2,653
60 mph	8,586	24,251	6,675	8,028	24,736	6,407
70 mph	21,262	58,927	19,047	10,612	35,079	9,439
Sum	312,587			238,594		

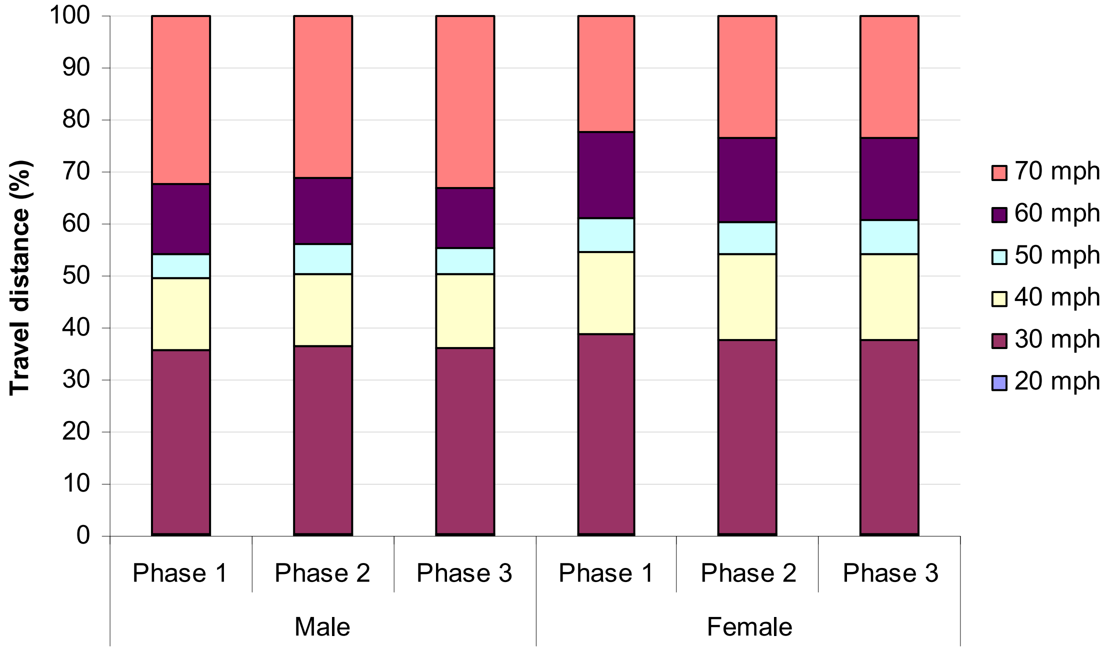


Figure 35: Comparison of patterns of travel distance between gender groups

Figure 36 to 41 compare speed distribution across trial phases between the two gender groups, which show that ISA effectively reshaped the speed distribution for both groups across speed zones. Similar to the overall analyses presented in Section 3.3, the effect of ISA in 60 mph zones was not as prominent as in other speed zones. Speeding behaviour had already rarely been recorded before ISA was activated (i.e. Phase 1). This is considered to be primarily due to the constraints on driving speed imposed by road geometry and traffic, as the 60 mph speed limit is generally applied on rural single carriageway roads where there is comparatively little observed speeding.

Male participants were observed to have overridden the system more frequently than female participants, apart from in the 20 mph zones. Again, similar to the considerations given in the overall analysis presented in Section 3.3, the robustness of the results derived from 20 mph zones might suffer from the sample size, as not all participant drove in 20 mph zones during the trial. From those who did, the amount of data collected was also far less than from other speed zones.

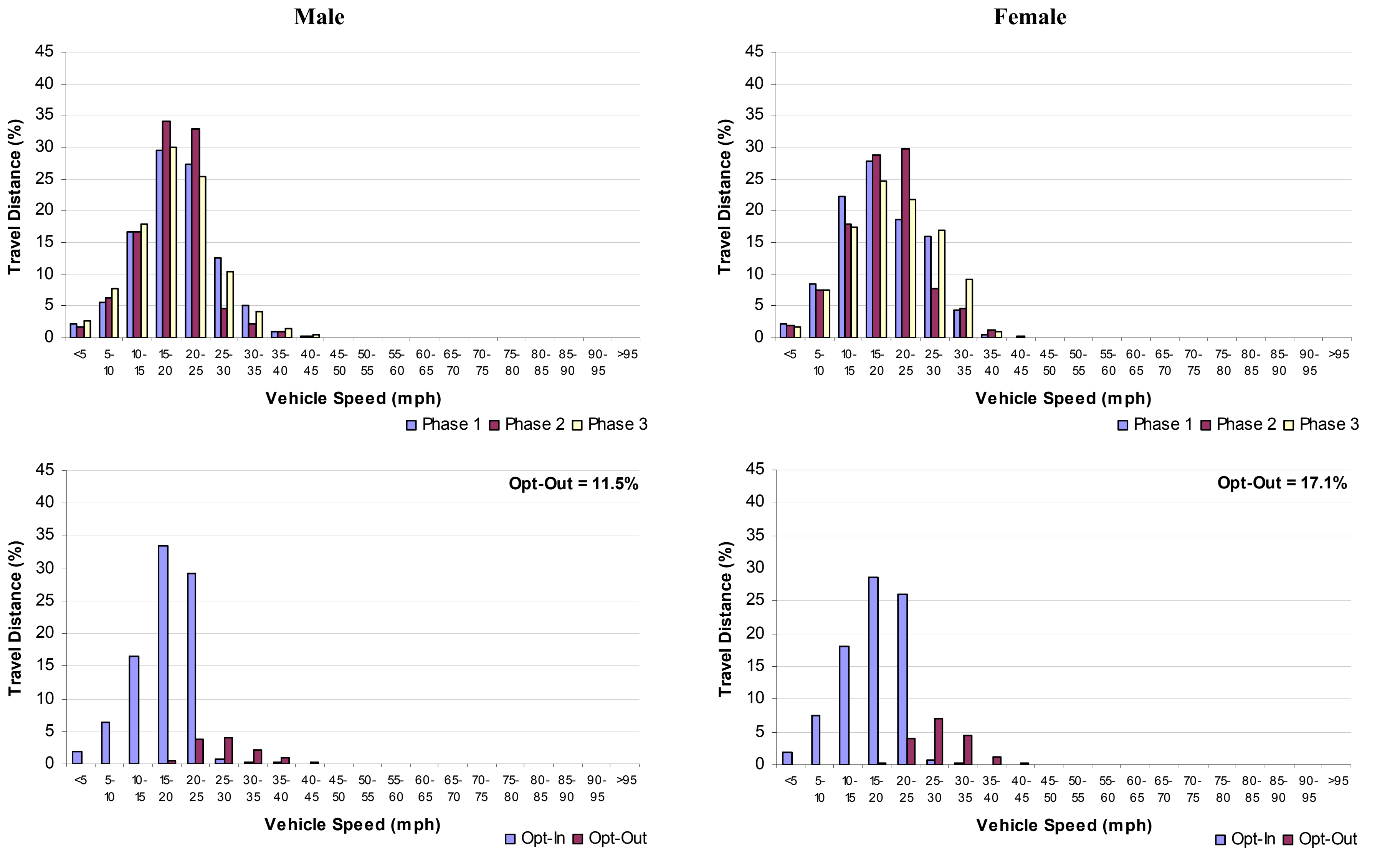


Figure 36: Comparison of the speed distribution in 20 mph zones between gender groups

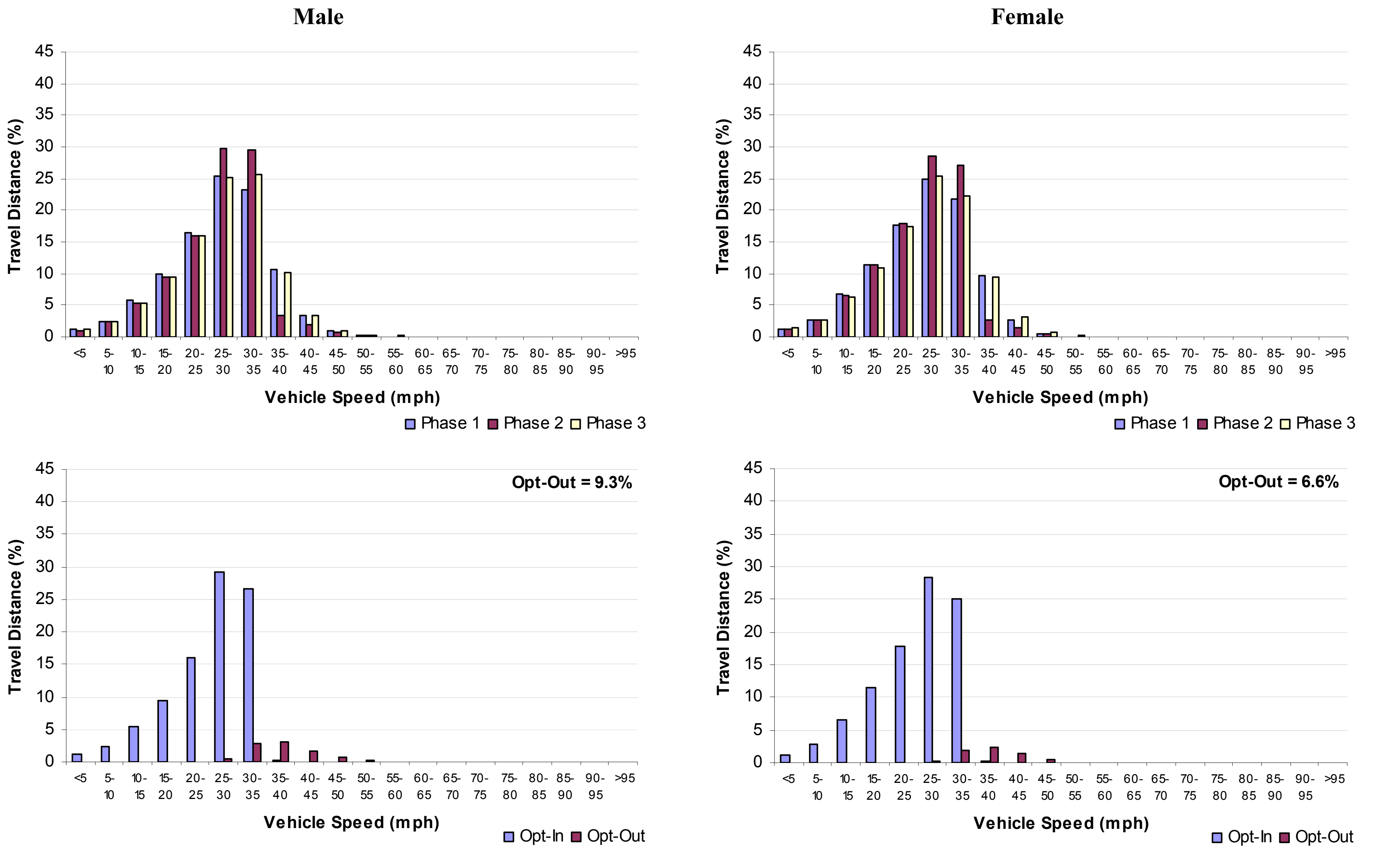


Figure 37: Comparison of the speed distribution in 30 mph zones between gender groups

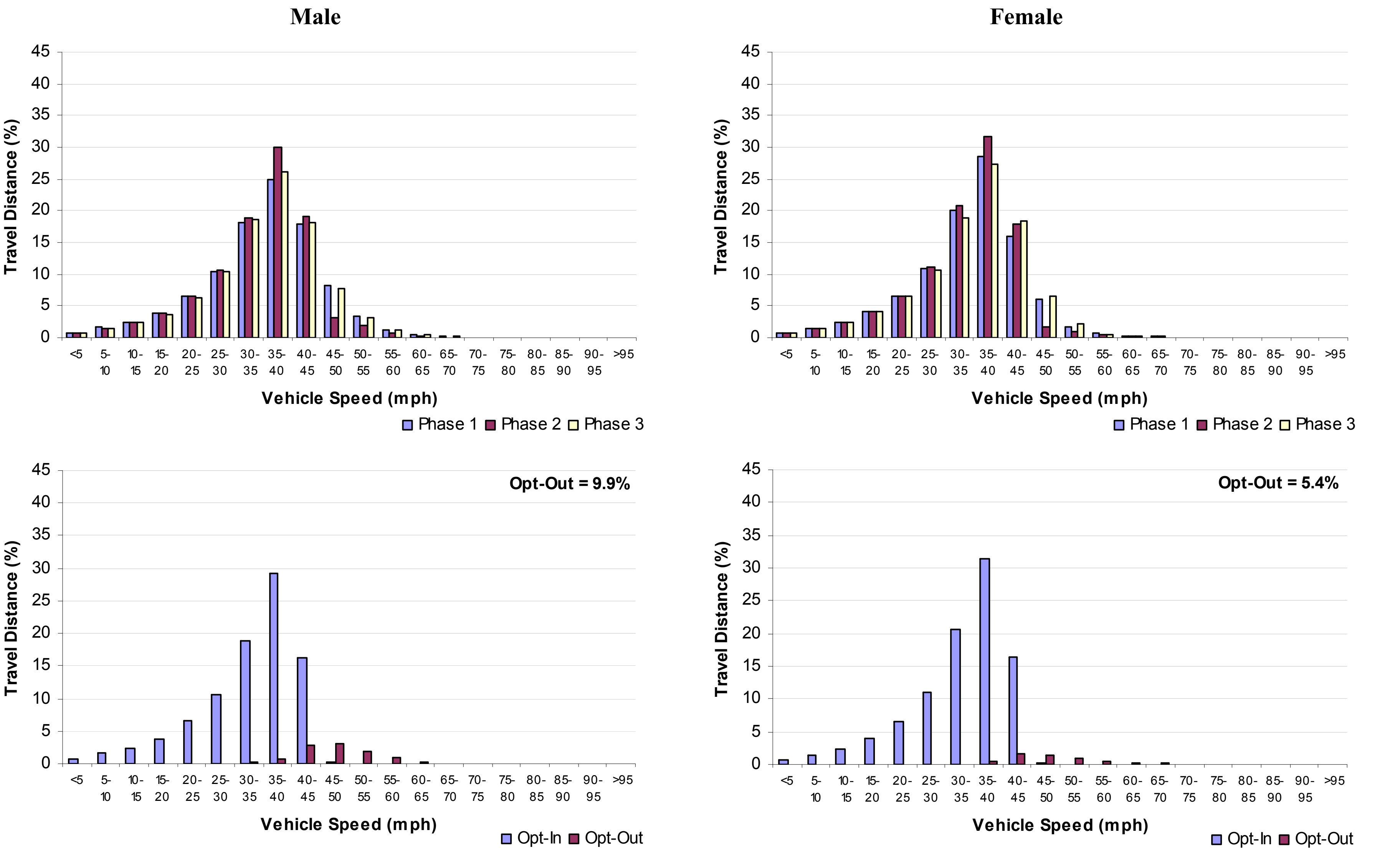


Figure 38: Comparison of the speed distribution in 40 mph zones between gender groups

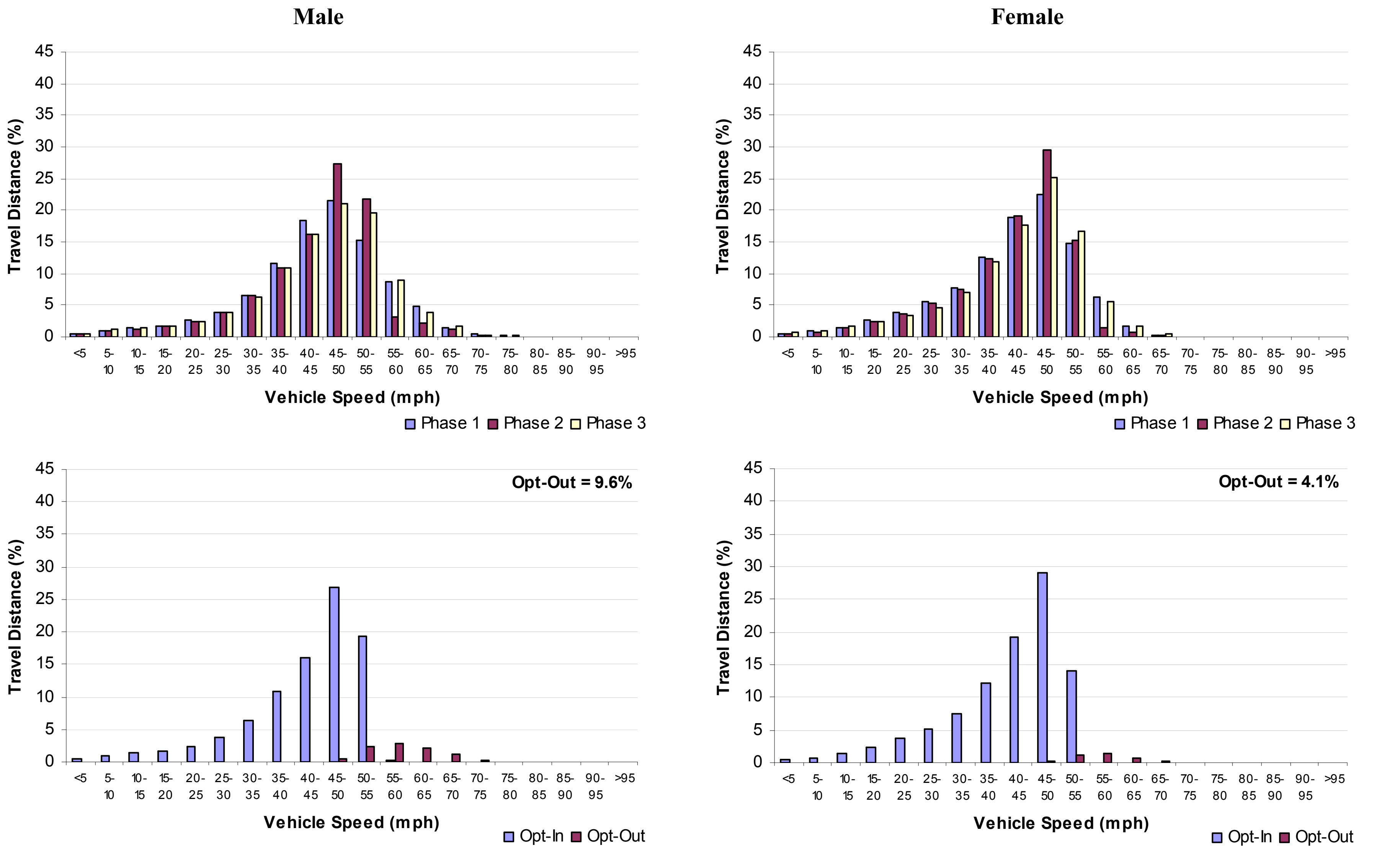


Figure 39: Comparison of the speed distribution in 50 mph zones between gender groups

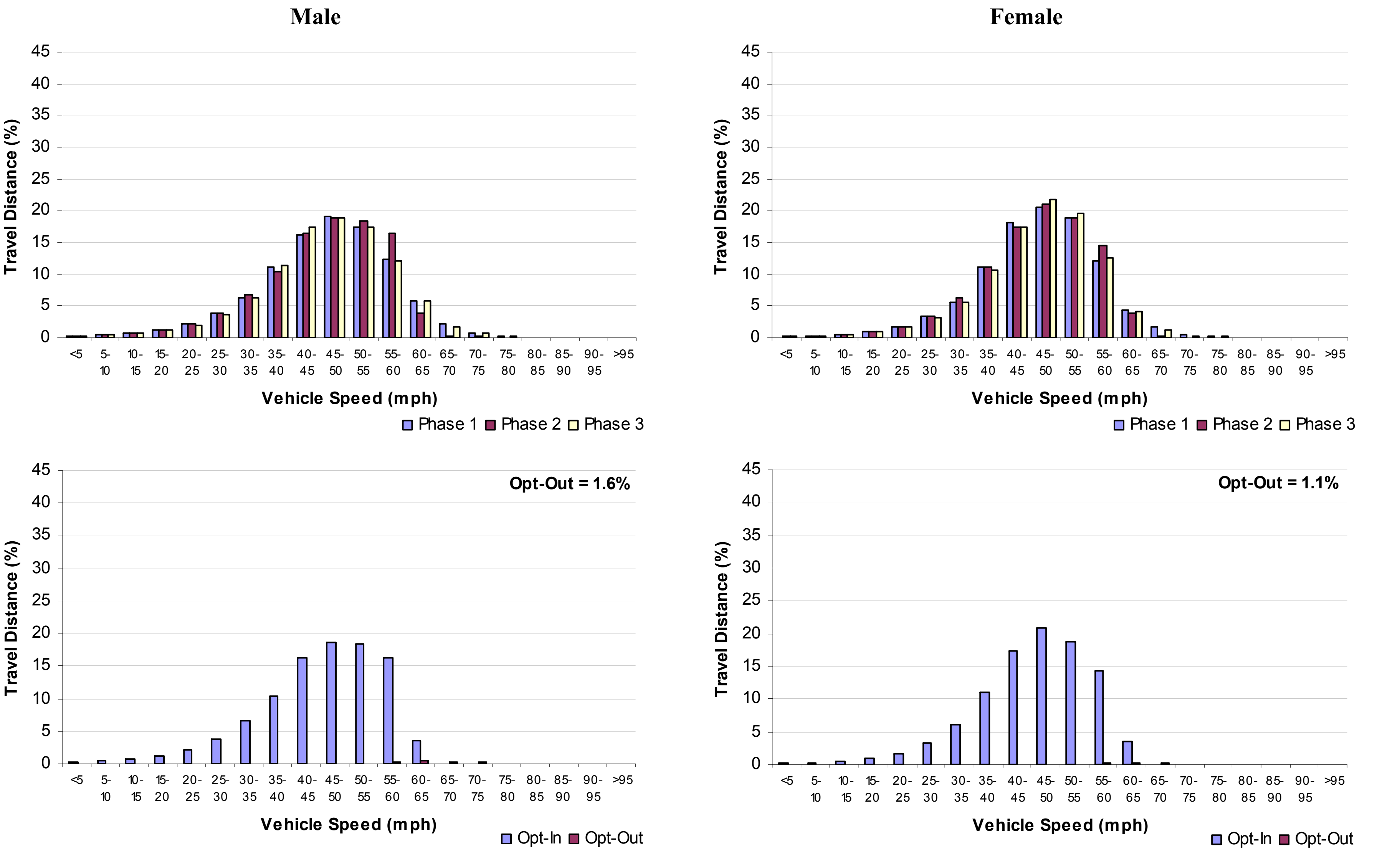


Figure 40: Comparison of the speed distribution in 60 mph zones between gender groups

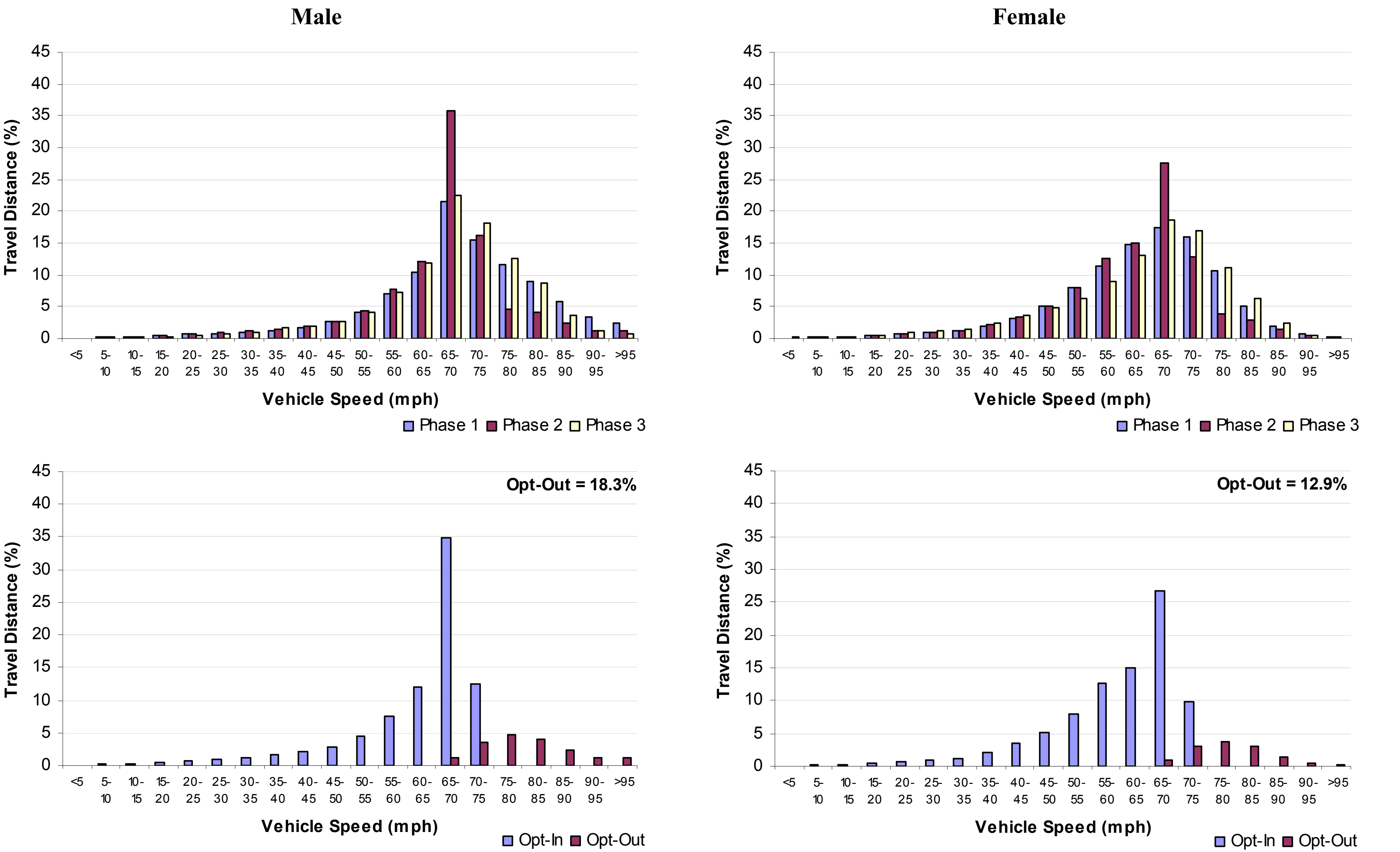


Figure 41: Comparison of the speed distribution in 70 mph zones between gender groups

Figure 42 compares the mean and the 85th percentile across trial phases in each speed zone between the two gender groups, which shows that ISA led to a reduction in vehicle speed for both gender groups across speed zones (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Table B1 and B2). Male participants generally demonstrated slightly higher vehicle speeds than female participants. The ANOVA test results also suggest that ISA seems to be more effective in diminishing male participants' speed than female participants' speed.

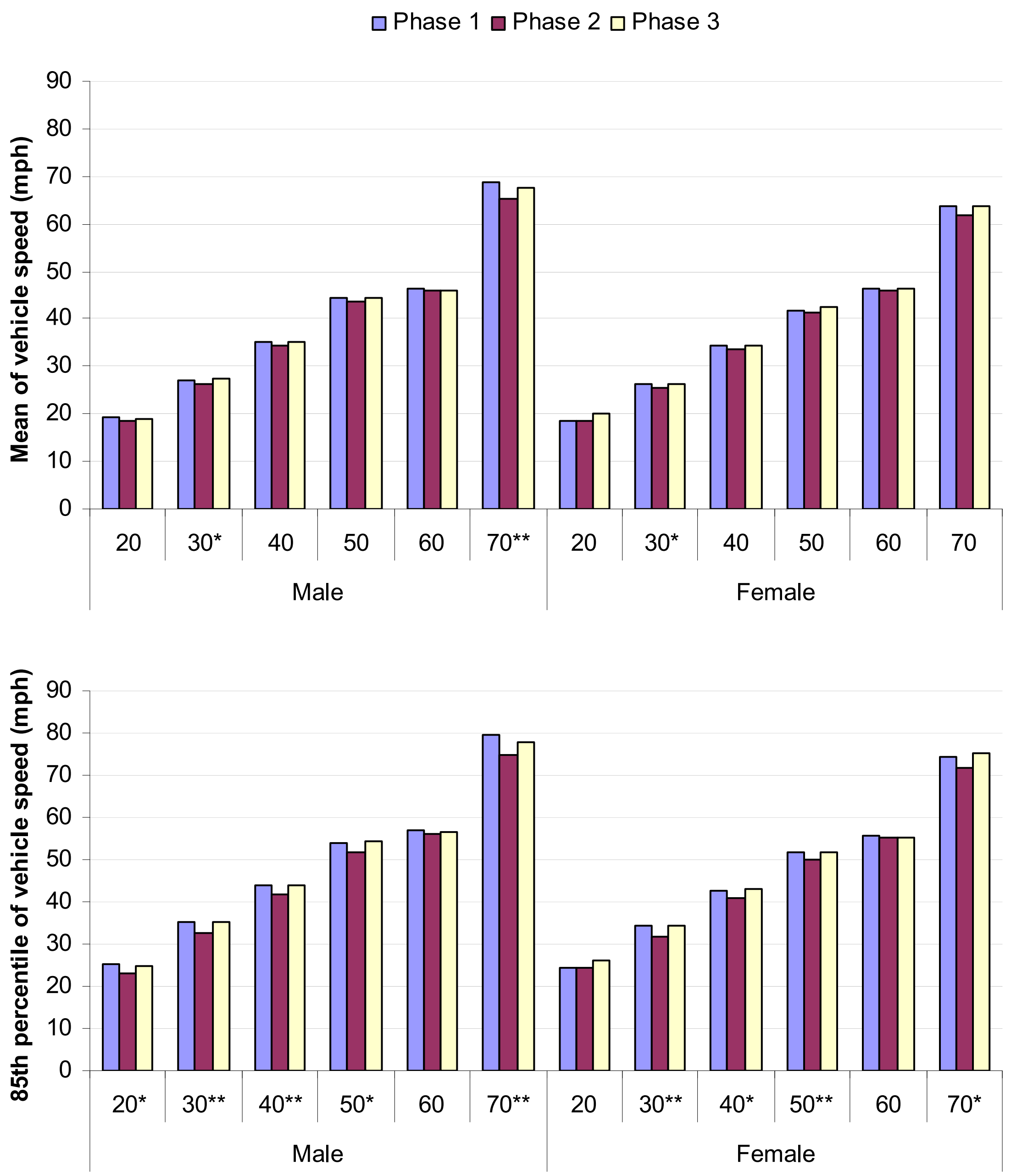


Figure 42: Comparison of key statistics of the speed distribution across trial phases between gender groups

Figure 43 compares the percentage of distance travelled over speed limits across trial phases between male and female participants. ISA effectively diminished the percentage of distance travelled over speed limits for both groups of participants (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Table B3). Male participants consistently demonstrated a higher percentage of distance travelled over speed limits than female participants.

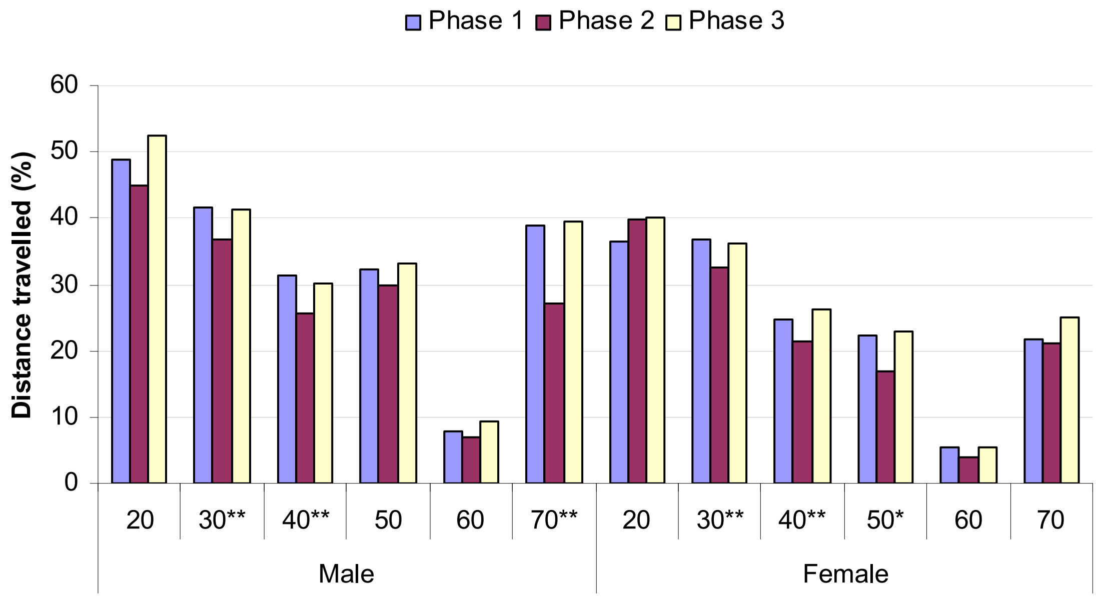


Figure 43: Comparison of percentage of distance travelled over speed limit across trial phases between gender groups

Figure 44 compares the coefficient of variation of vehicle speed across trial phases between male and female participants. ISA effectively diminished the CV for both groups of participants (i.e. a 'V' shape), which delivers positive implications for road accident reduction.

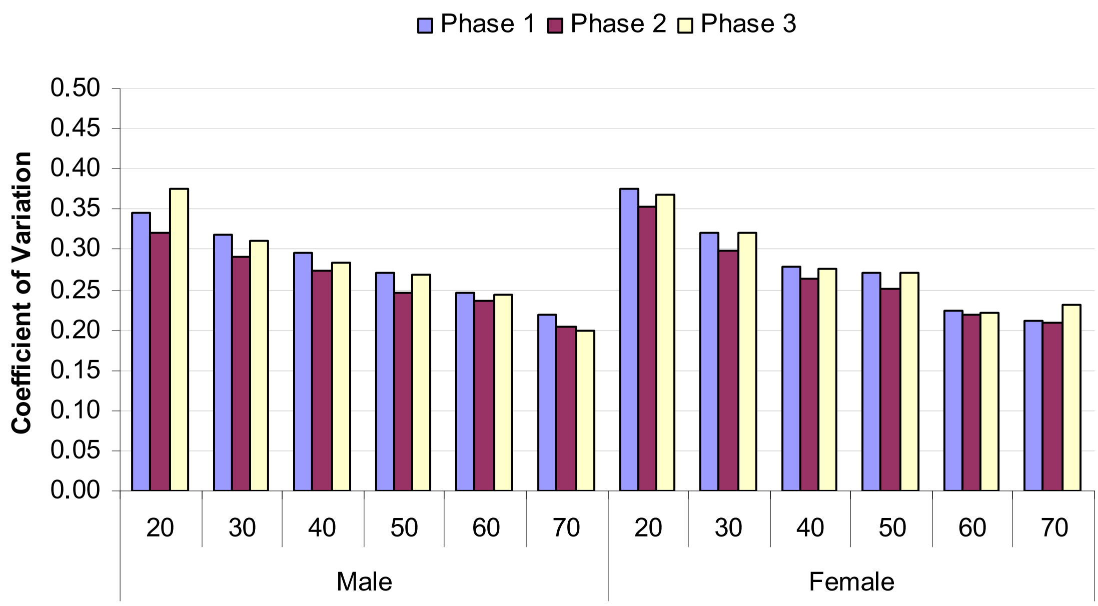


Figure 44: Comparison of coefficient of variation across trial phases between gender groups

3.8.2 Age

Table 13 depicts a breakdown of vehicle kilometres across trial phases, speed zones and participants' age groups, which shows that old participants contributed a considerably larger amount of data than young participants. Figure 45 further compares the distribution of travel distance between the two age groups, which suggests that travel patterns of the two age groups of participant were remarkably similar.

Table 13: Vehicle kilometres across age groups, trial phases, and speed zones

Speed zone	Young			Old		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
20 mph	159	554	164	189	445	124
30 mph	16,599	49,556	13,854	25,093	75,196	21,920
40 mph	7,243	22,799	6,219	9,401	28,468	8,457
50 mph	3,074	10,136	2,620	3,142	9,742	2,976
60 mph	6,509	18,921	4,353	10,105	30,066	8,729
70 mph	12,441	38,842	11,762	19,433	55,164	16,724
Sum	225,806			325,376		

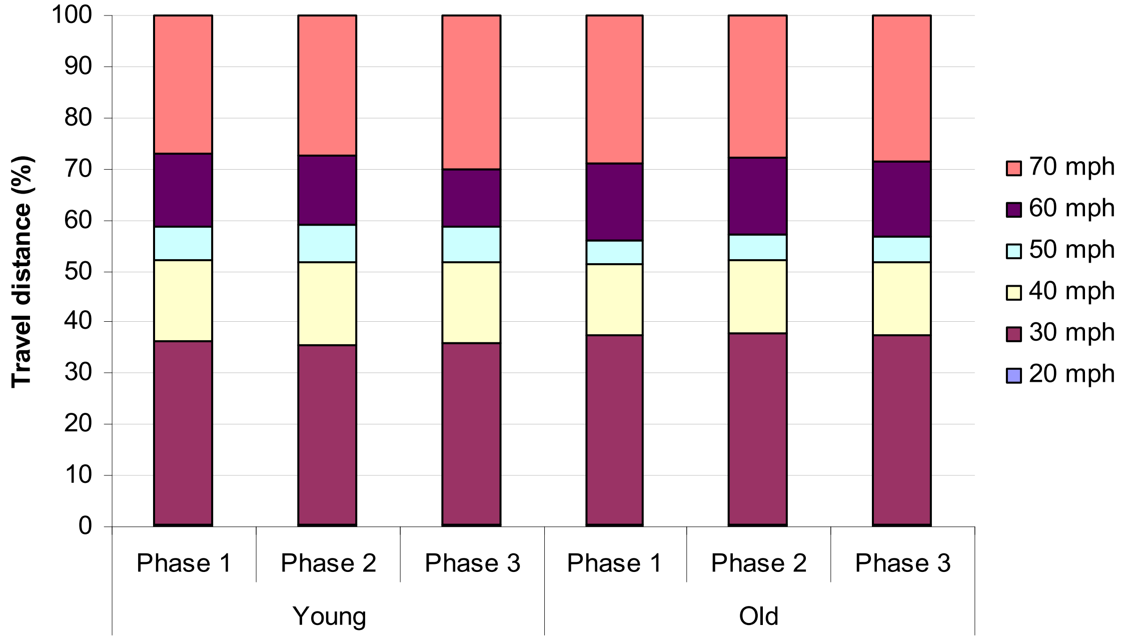


Figure 45: Comparison of patterns of travel distance between age groups

Figure 46 to Figure 51 compare speed distribution across trial phases between the two age groups, which show that ISA effectively reshaped the speed distribution for both groups across speed zones. Similar to the overall analyses presented in Section 3.3, the effect of ISA in 60 mph zones was not as prominent as other speed zones, as speeding behaviour had already rarely been recorded when ISA was not activated. In addition, young participants were observed to have overridden the system more frequently than old participants, apart from in the 20 mph zones. However, as discussed in relation to the overall analysis presented in Section 3.3, data collected from 20 mph zones suffer from a lack of representativeness, as not all participants drove in 20 mph zones during the trial.

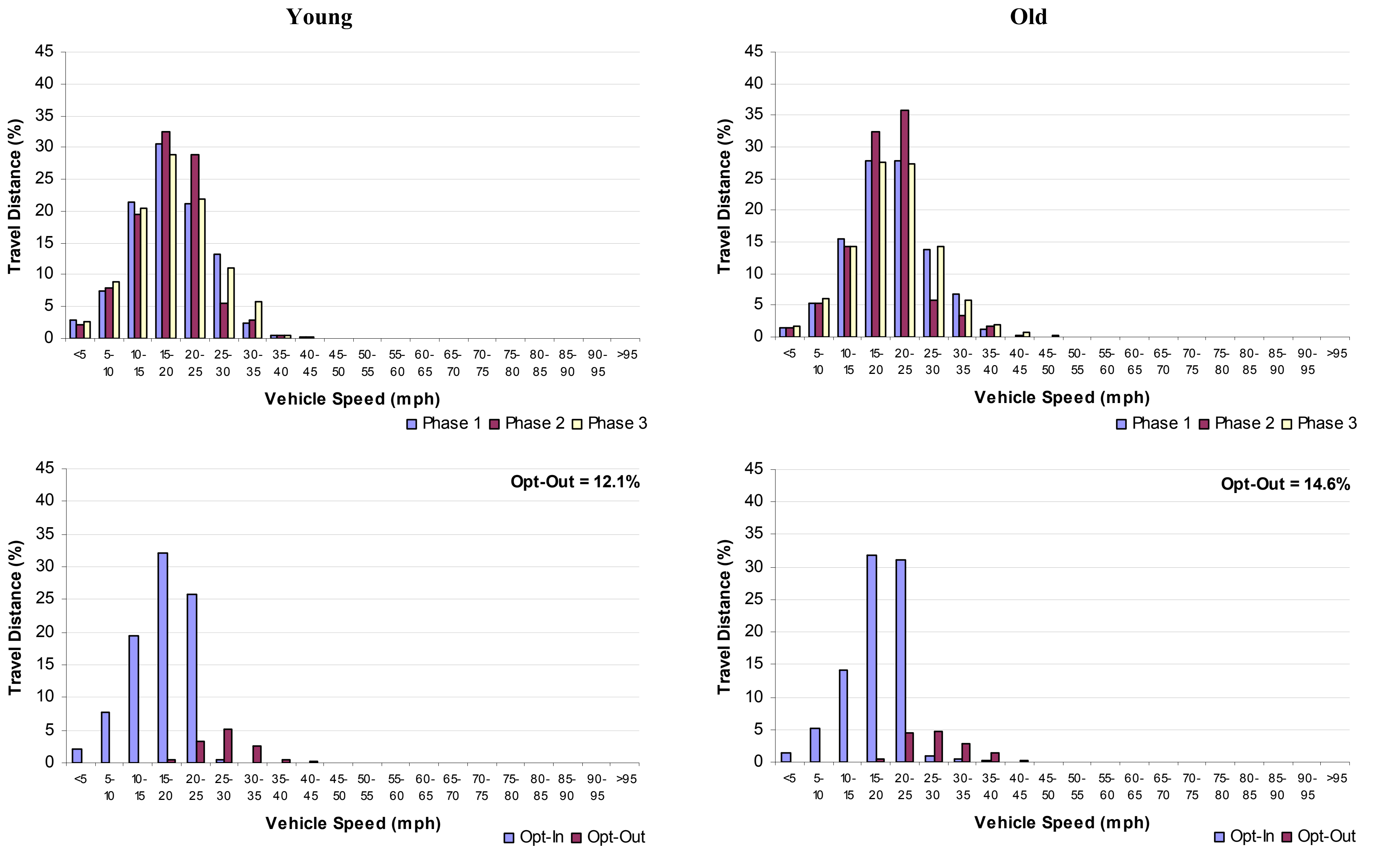


Figure 46: Comparison of the speed distribution in 20 mph zones between age groups

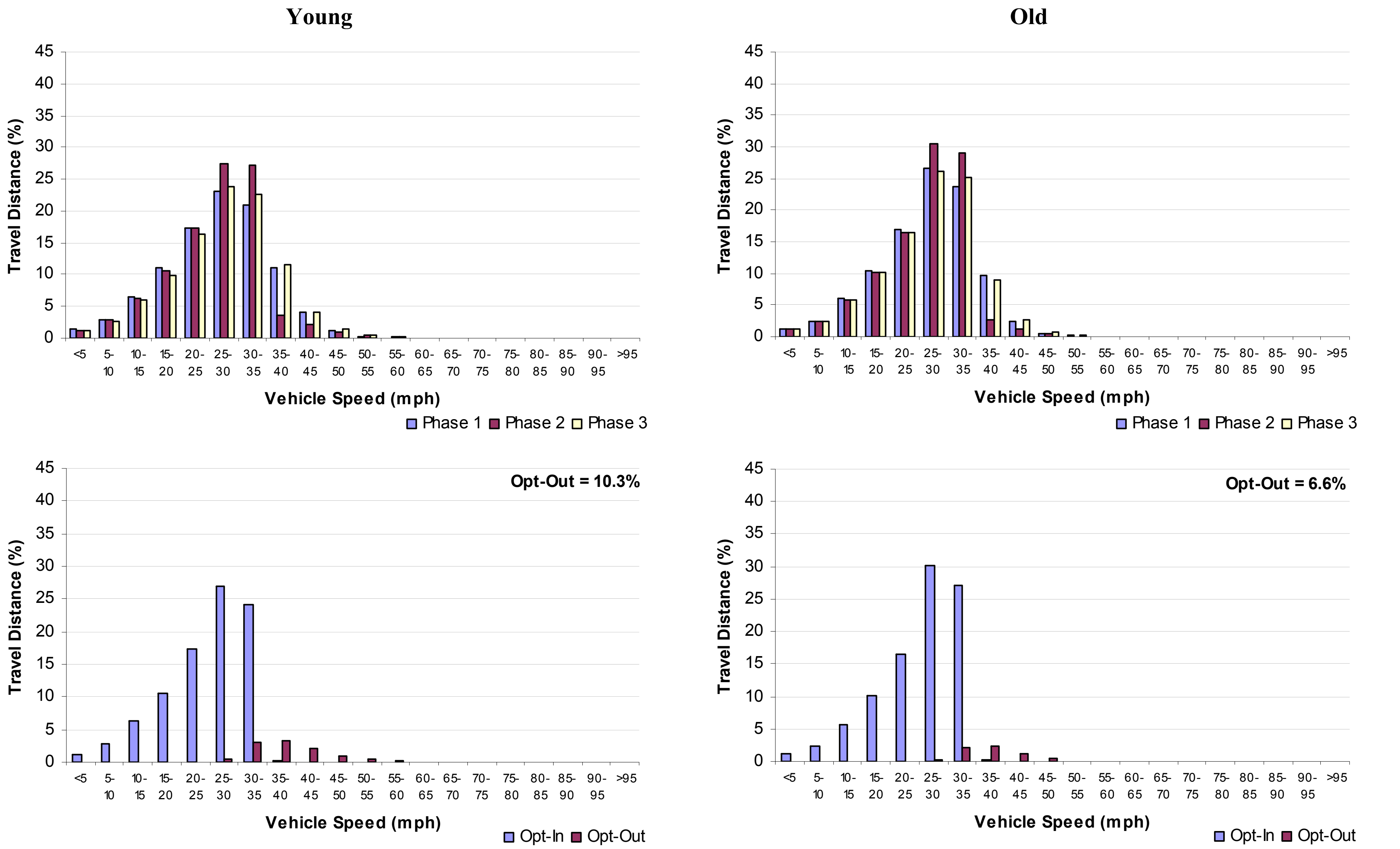


Figure 47: Comparison of the speed distribution in 30 mph zones between age groups

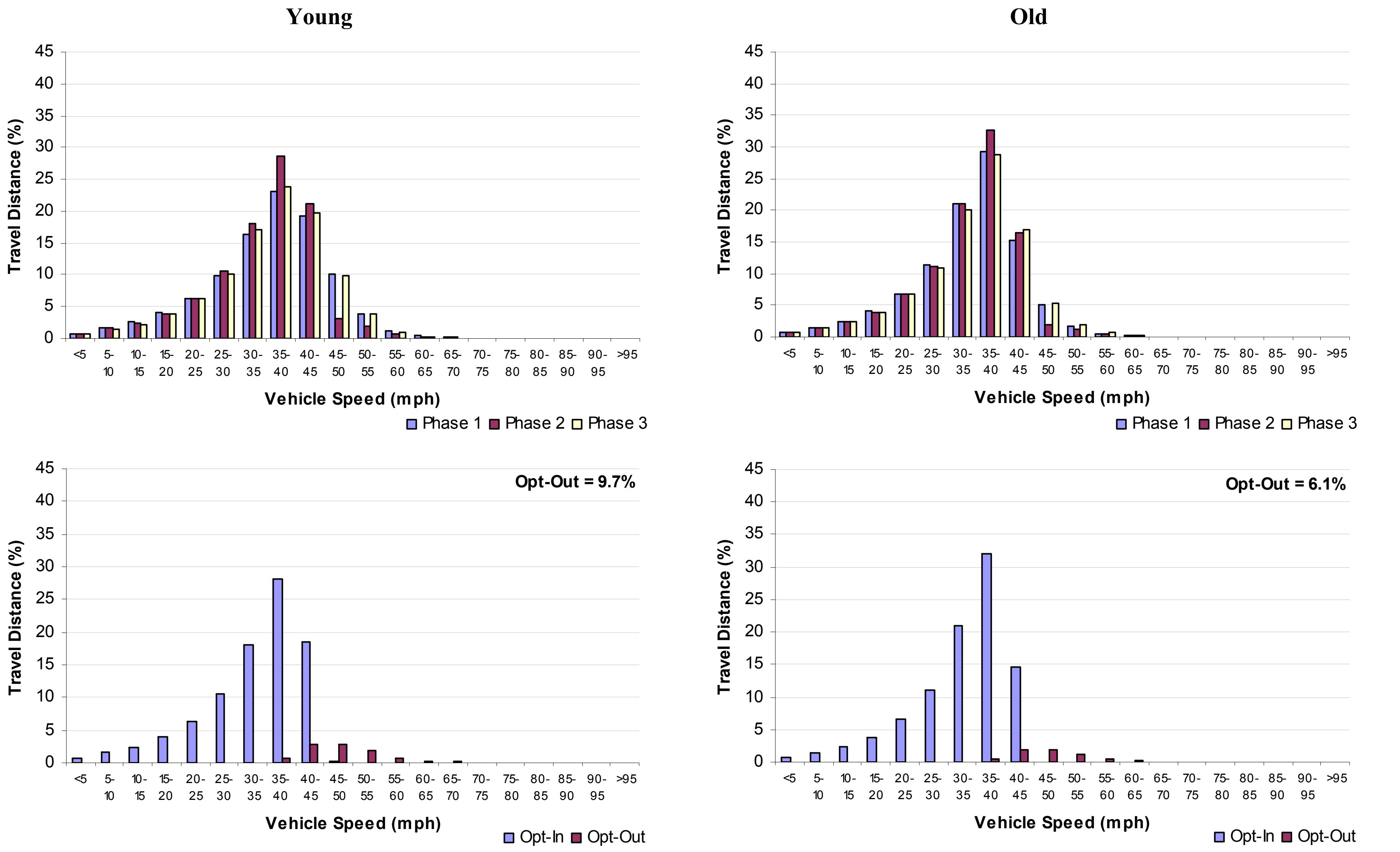


Figure 48: Comparison of the speed distribution in 40 mph zones between age groups

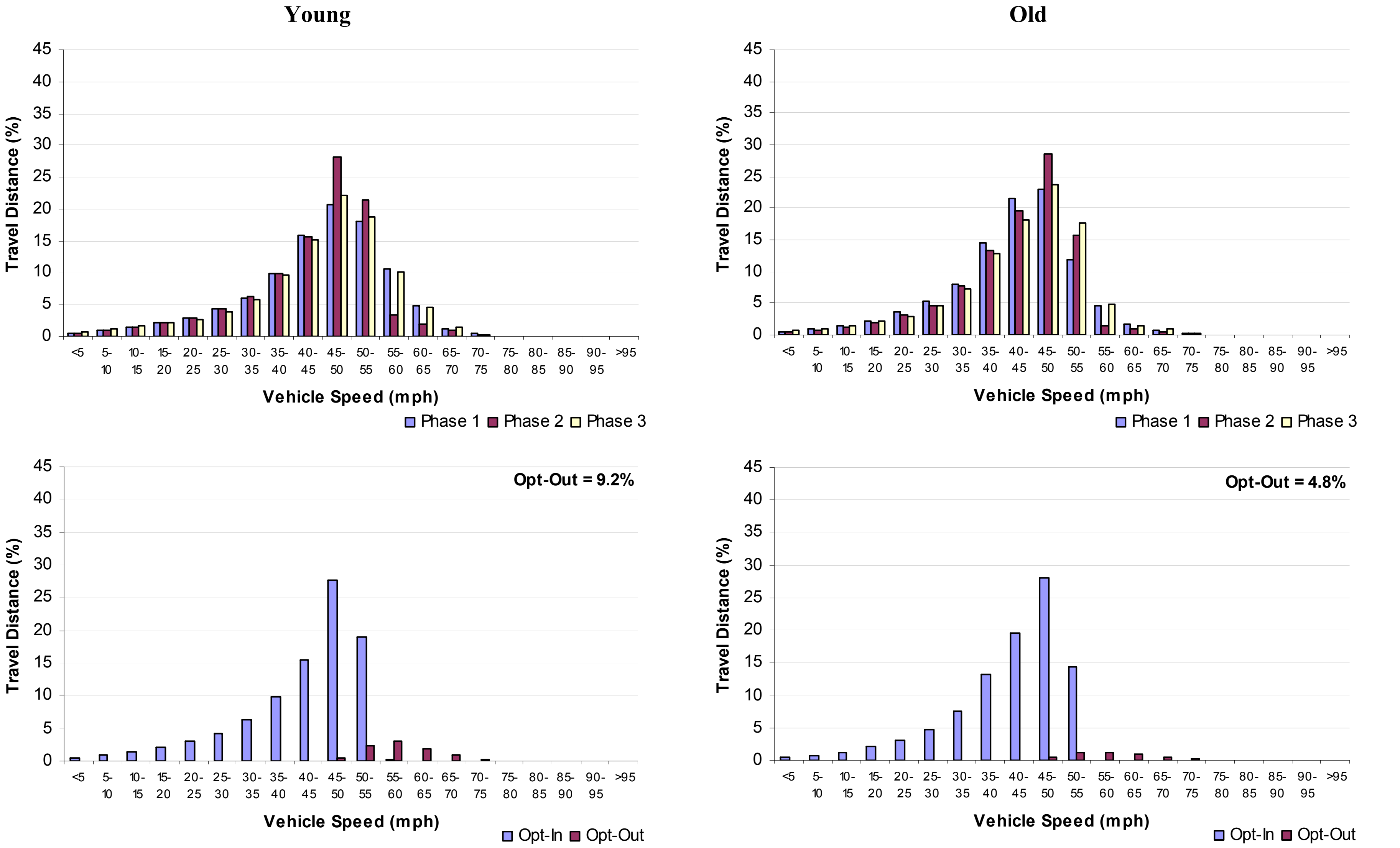


Figure 49: Comparison of the speed distribution in 50 mph zones between age groups

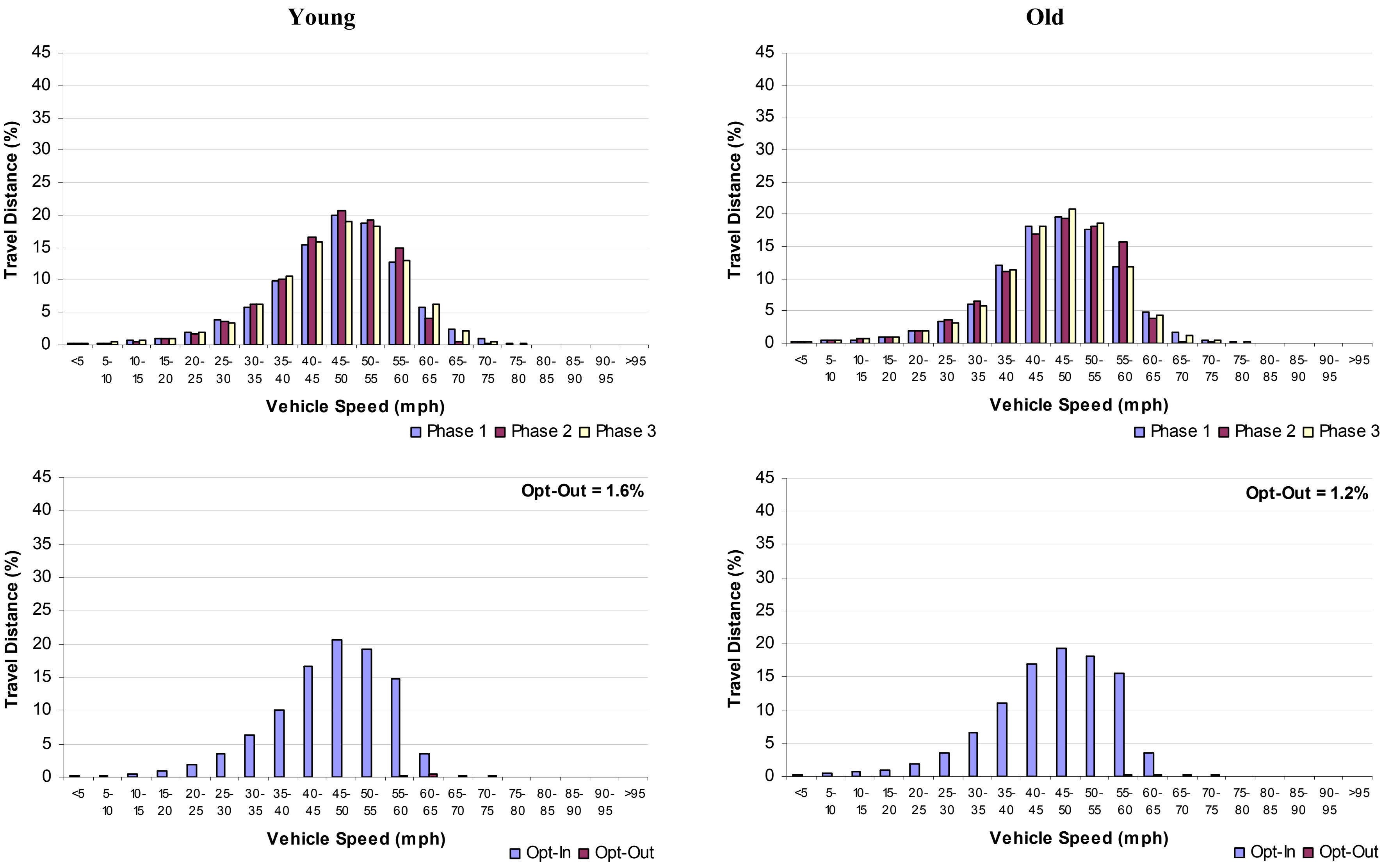


Figure 50: Comparison of the speed distribution in 60 mph zones between age groups

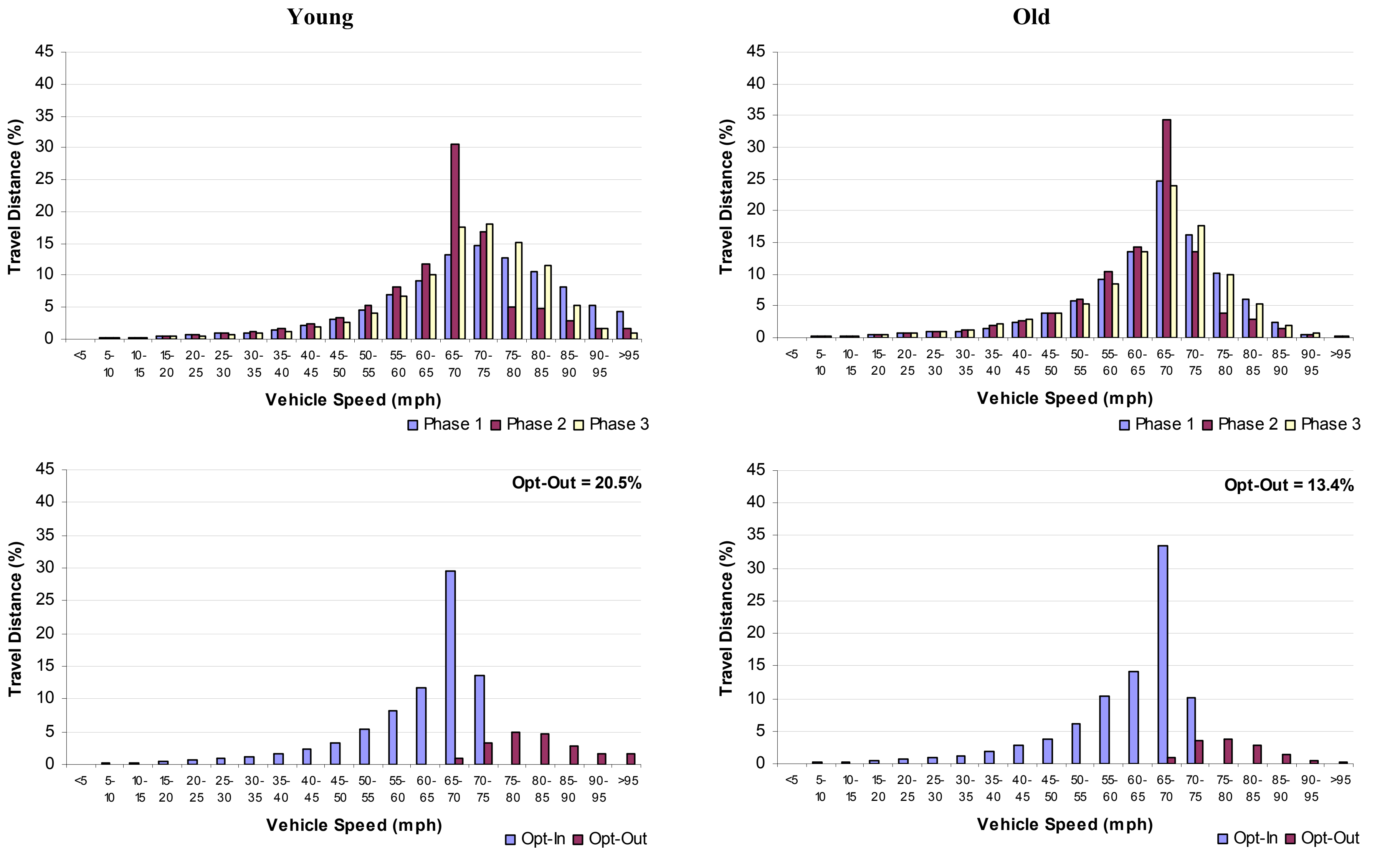
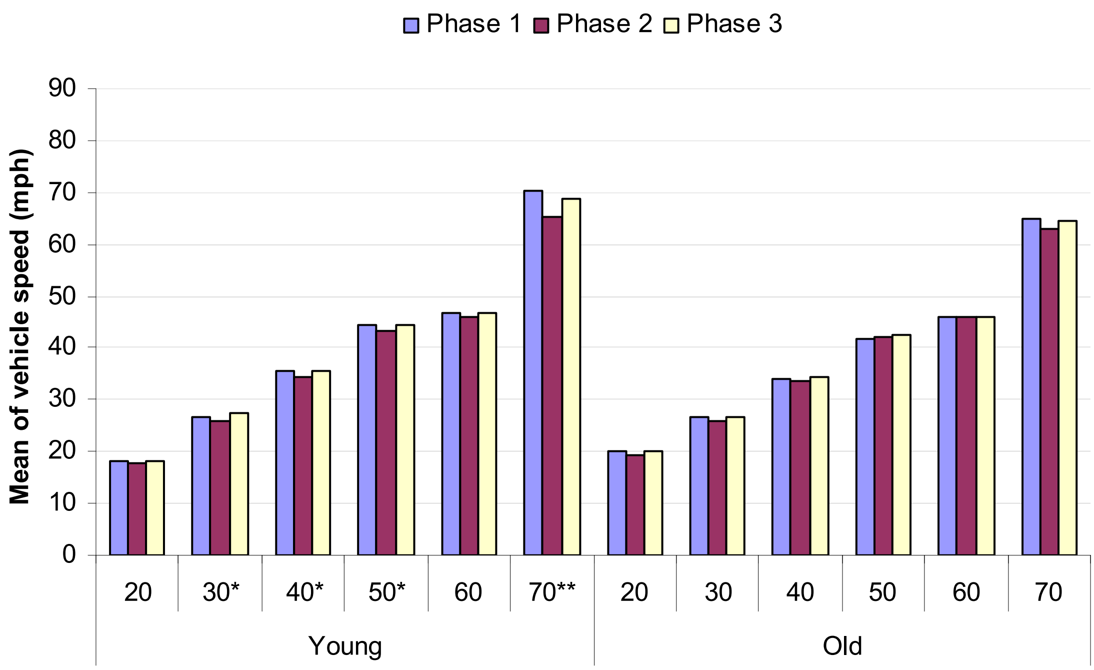


Figure 51: Comparison of the speed distribution in 70 mph zones between age groups

Figure 52 compares mean and 85th percentile speed across trial phases in each speed zone between the two age groups. It shows that ISA led to a reduction in vehicle speed for both age groups across speed zones (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Tables B4 and B5). Young participants generally demonstrated slightly higher vehicle speeds than old participants. The ANOVA test results also suggest that ISA appears to be more effective in diminishing young participants' speed than older participants' speed.



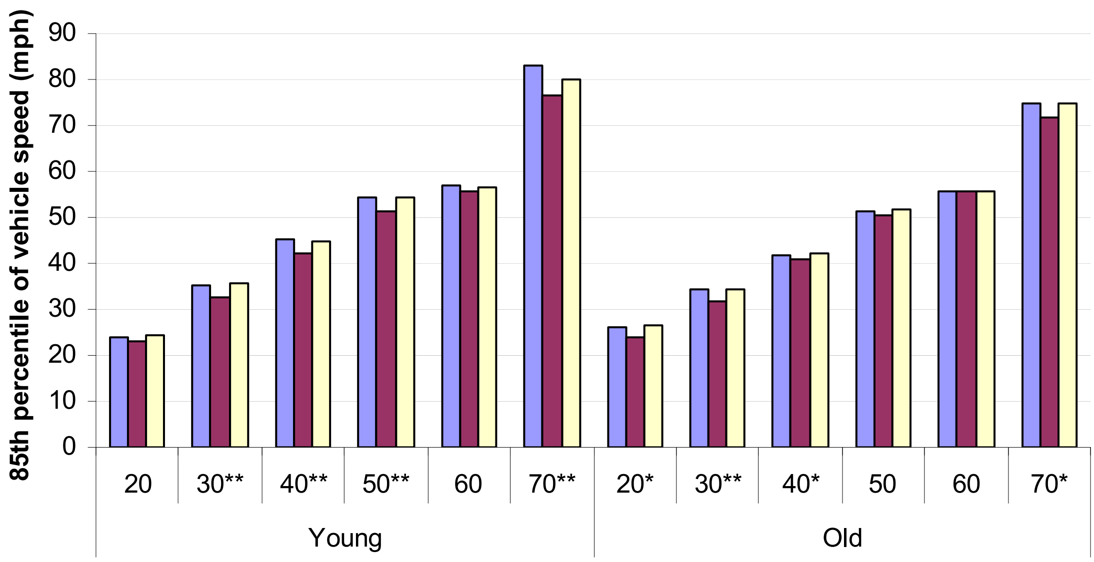


Figure 52: Comparison of key statistics of the speed distribution across trial phases between age groups

Figure 53 compares the percentage of distance travelled in excess of speed limits across trial phases between young and old participants. ISA effectively diminished the percentage of distance travelled over speed limits for both groups of participants (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Table B6). Young participants consistently demonstrated a higher percentage of distance travelled over speed limits than old participants. However, the ANOVA test results also suggest that ISA seems to be more effective for young participants than old participants.

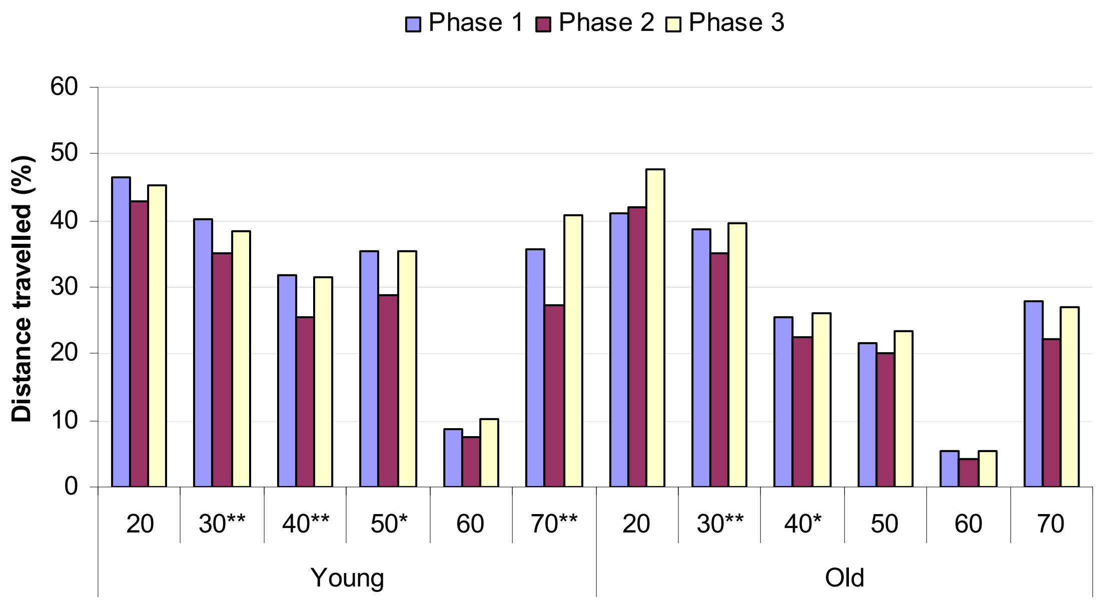


Figure 53: Comparison of percentage of distance travelled over speed limit across trial phases between age groups

Figure 54 compares the coefficient of variation of vehicle speed across trial phases between the two groups of participants. ISA effectively diminished the CV for both groups of participants (i.e. a 'V' shape), which delivers positive implications for road accident reduction.

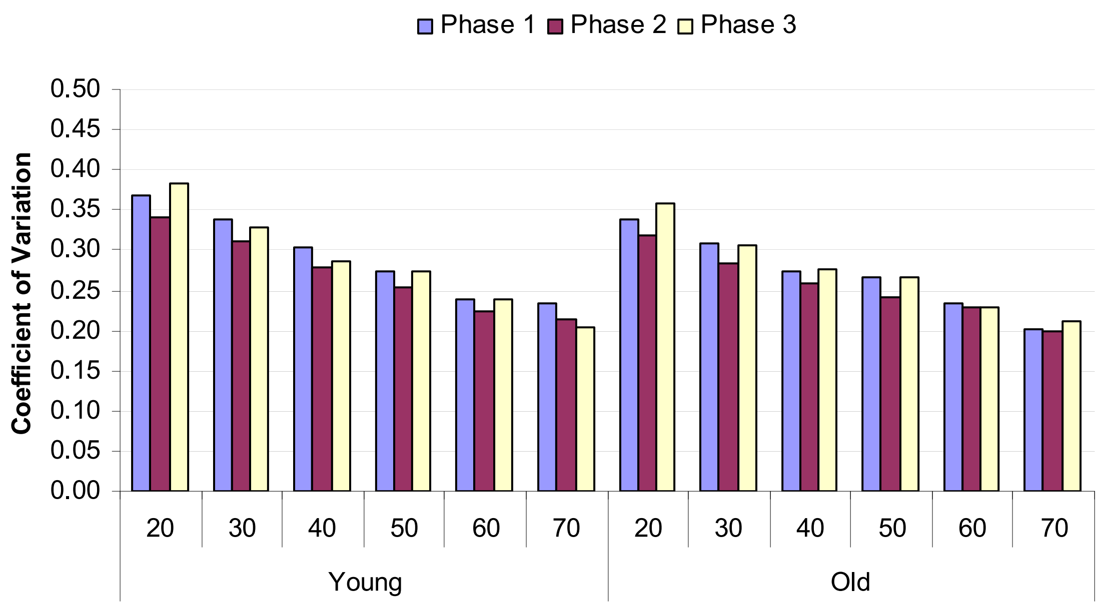


Figure 54: Comparison of coefficient of variation across trial phases between age groups

3.8.3 Intention to speed

Table 14 depicts a breakdown of vehicle kilometres across trial phases, speed zones and participants' intention to speed, which shows that intenders contributed a slightly larger amount of data than non-intenders. Figure 55 further compares the distribution of travel distance between the two gender groups, which reveals that non-intenders travelled marginally more in urban environments (i.e. 30 and 40 mph zones) than intenders. Intenders, however, travelled more on motorways than non-intenders.

Table 14: Vehicle kilometres across intention groups, trial phases and speed zones

Speed zone	Intender			Non-intender		
	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
20 mph	175	482	144	173	517	144
30 mph	22,830	62,645	19,258	18,862	62,107	16,517
40 mph	9,048	25,226	7,708	7,597	26,042	6,969
50 mph	3,426	9,444	2,572	2,790	10,433	3,024
60 mph	8,552	22,485	6,052	8,062	26,503	7,030
70 mph	19,783	50,980	15,952	12,091	43,025	12,534
Sum	286,762			264,419		

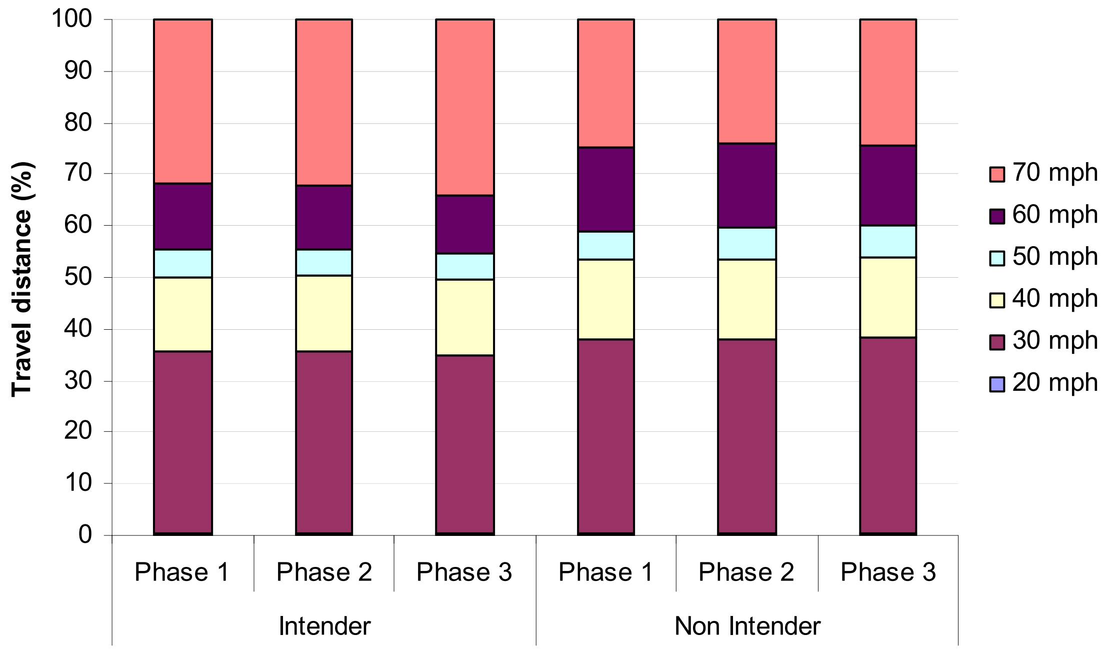


Figure 55: Comparison of patterns of travel distance between intention groups

Figure 56 to Figure 61 compare speed distribution across trial phases between the two intention groups, which show that ISA effectively reshaped the speed distribution for both groups across speed zones. Interestingly, intenders were observed to have overridden the system more than non-intenders on 50 and 70 mph roads but not in urban environments, which implies that the intenders seemed to be overriding the system 'selectively', rather than driving aggressively all the time.

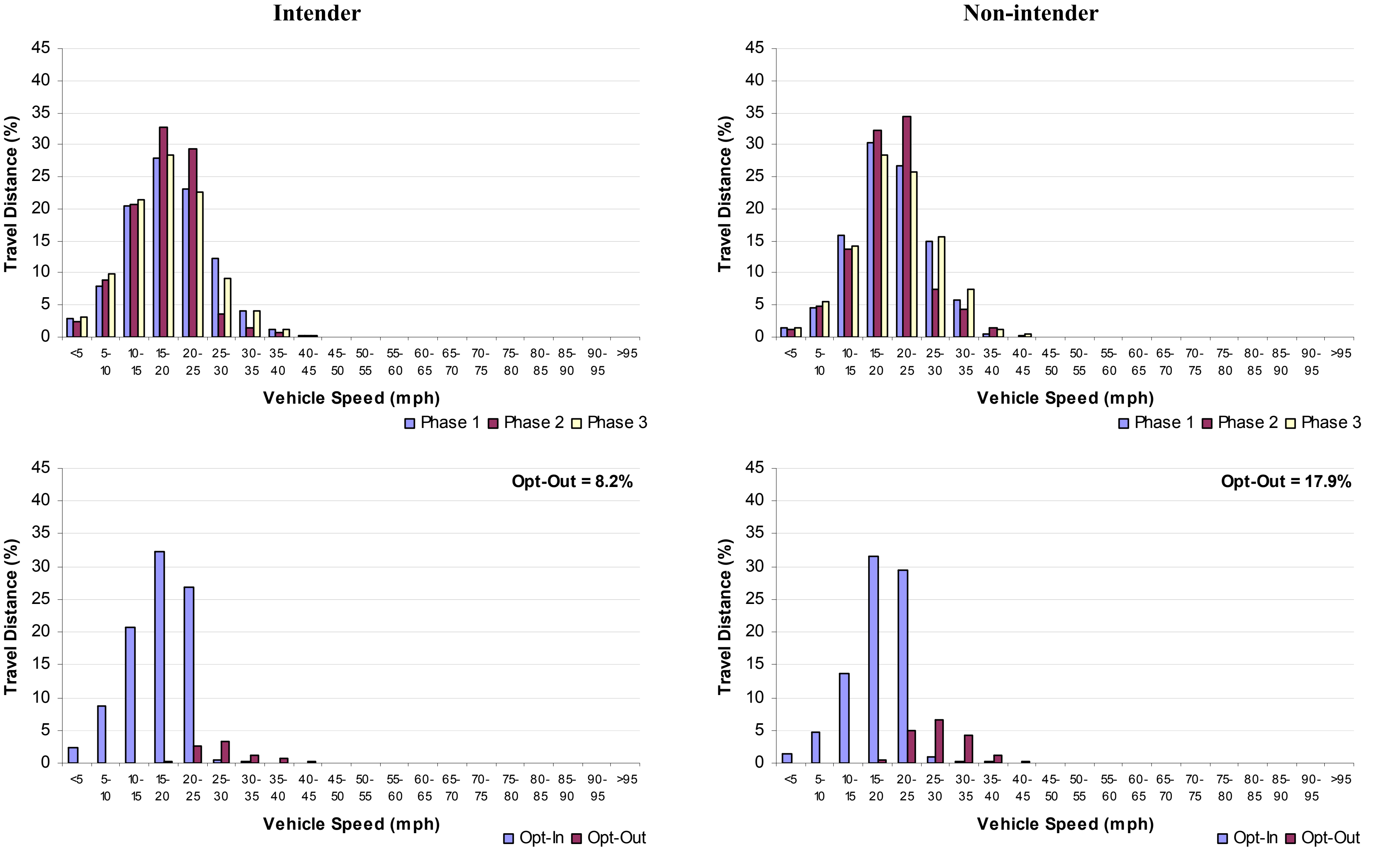


Figure 56: Comparison of the speed distribution in 20 mph zones between intention groups

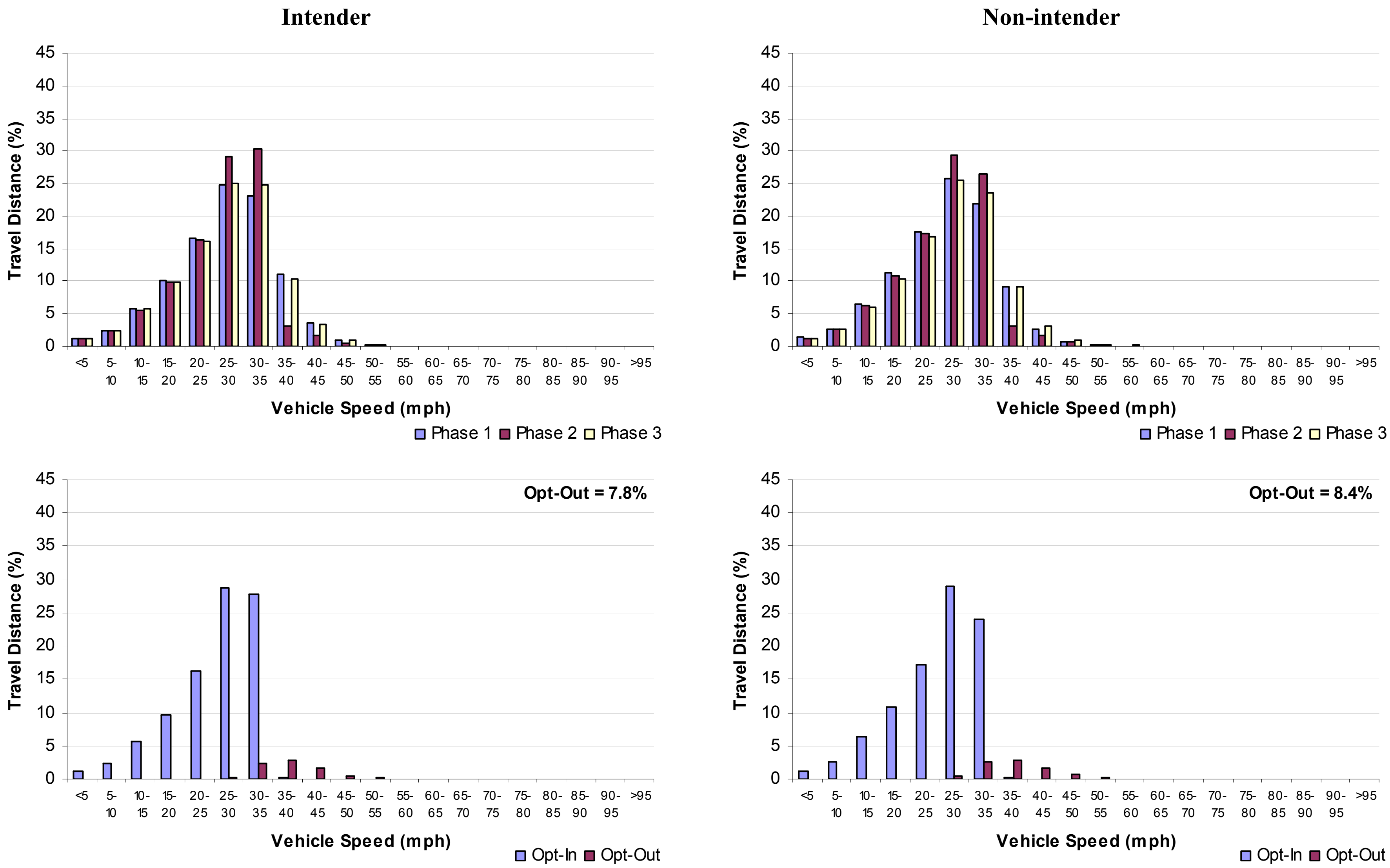


Figure 57: Comparison of the speed distribution in 30 mph zones between intention groups

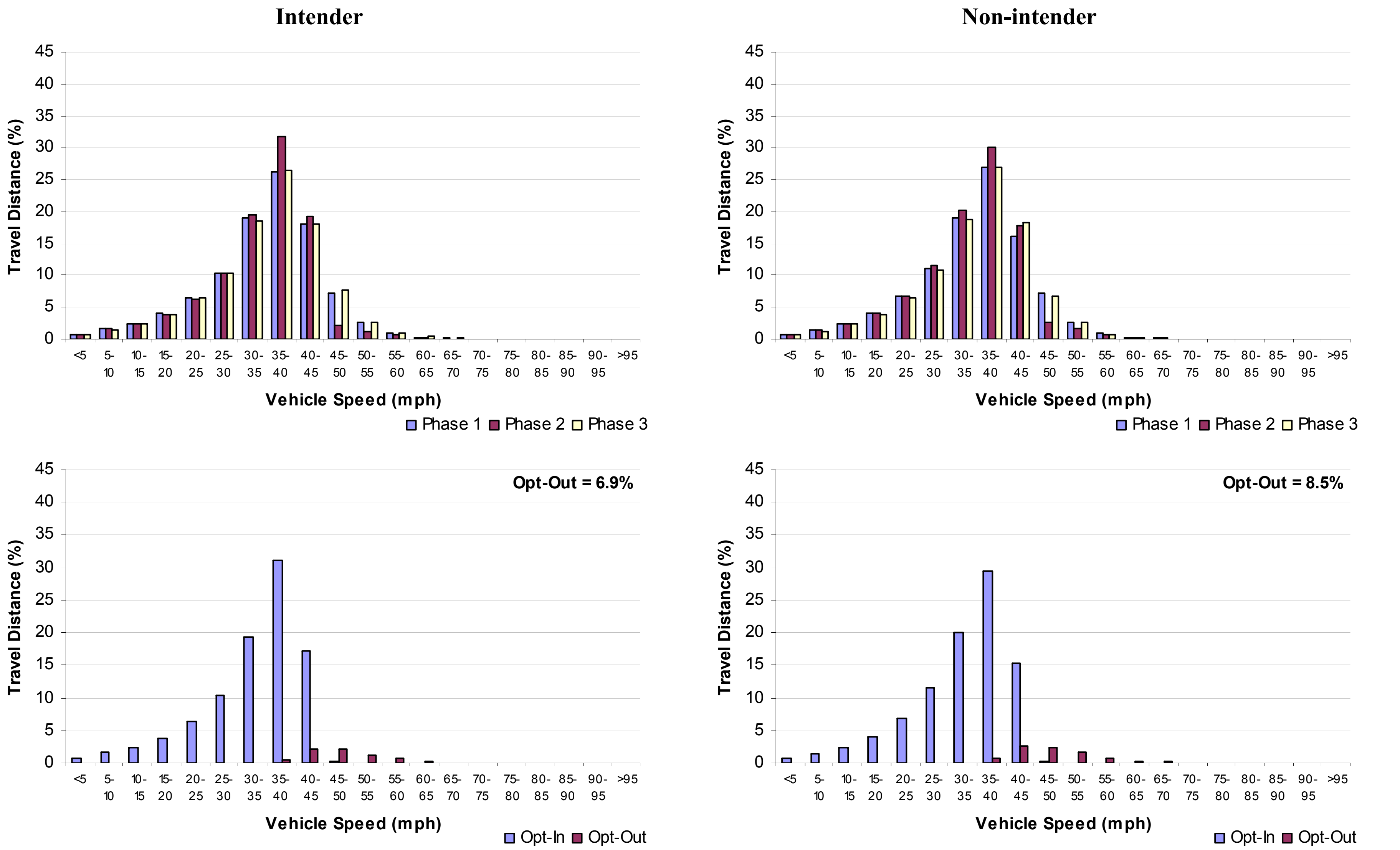


Figure 58: Comparison of the speed distribution in 40 mph zones between intention groups

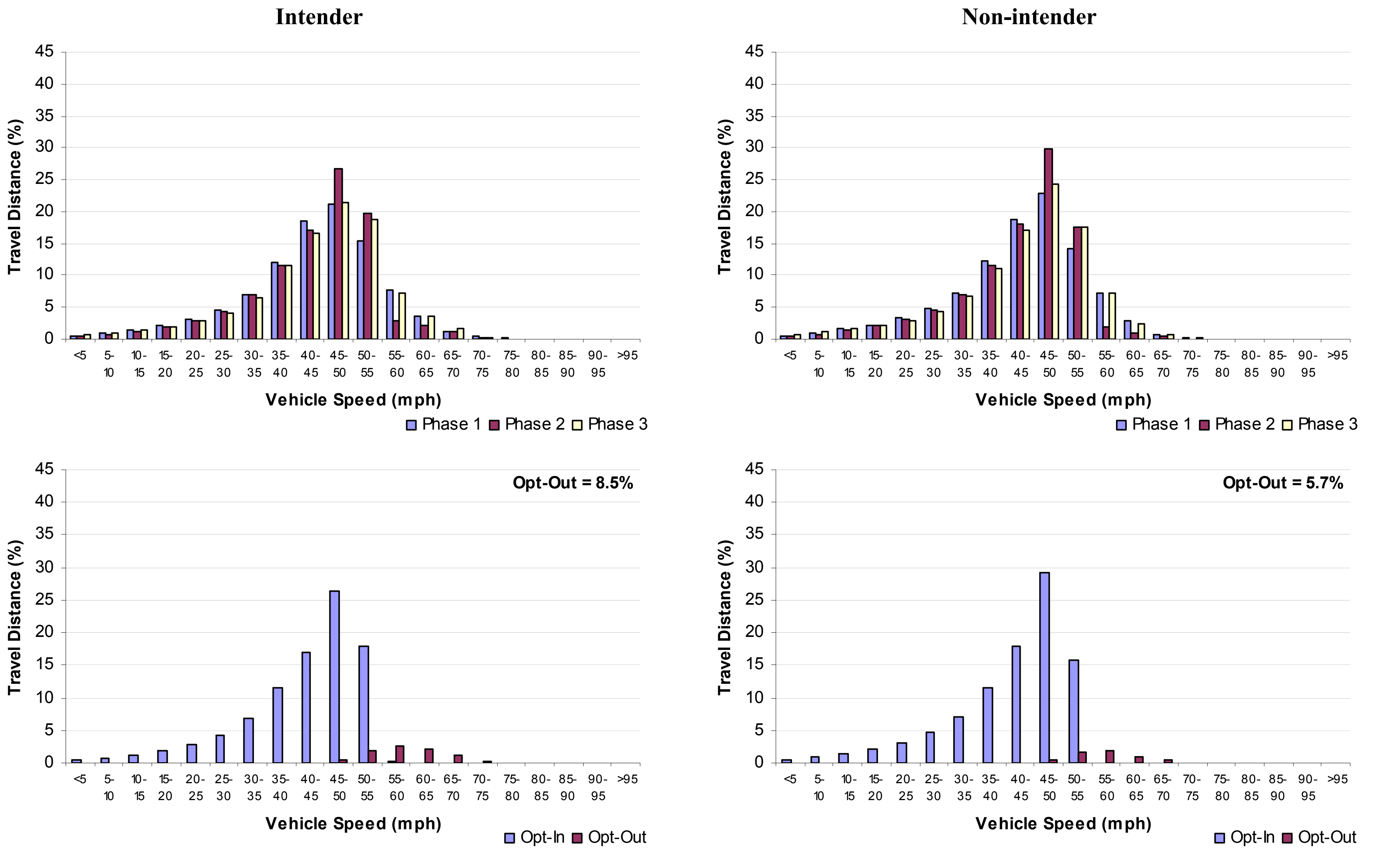


Figure 59: Comparison of the speed distribution in 50 mph zones between intention groups

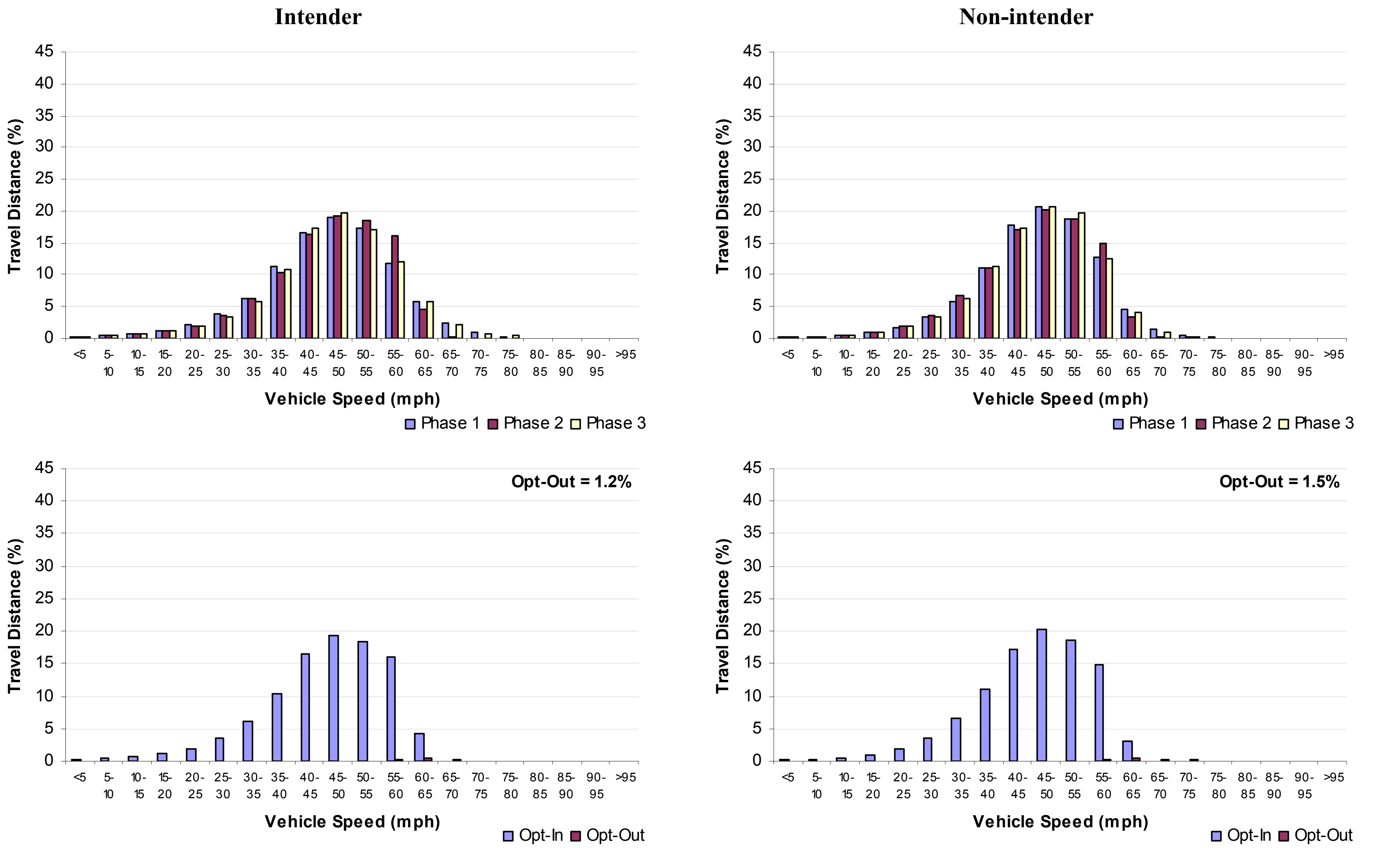


Figure 60: Comparison of the speed distribution in 60 mph zones between intention groups

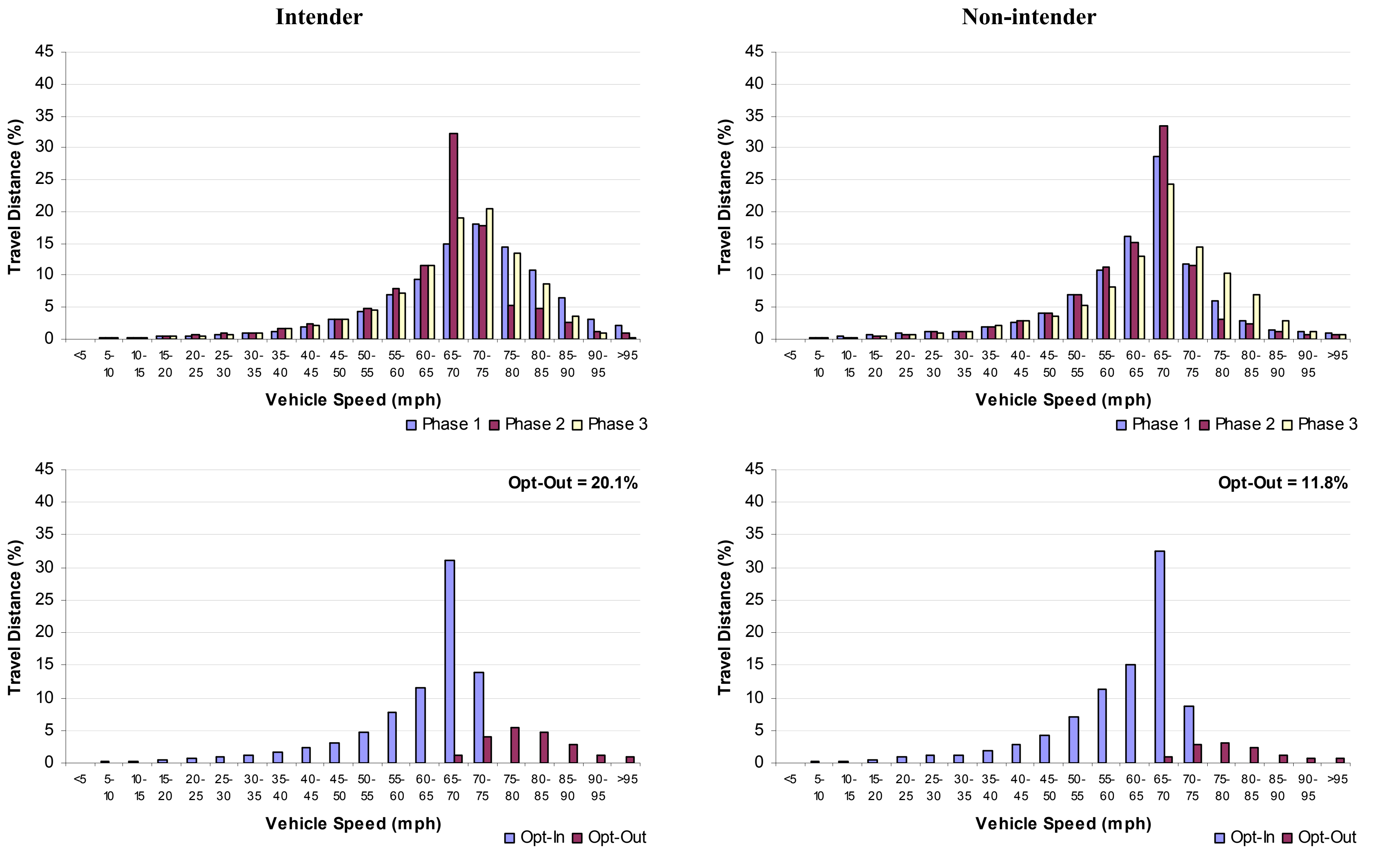


Figure 61: Comparison of the speed distribution in 70 mph zones between intention groups

Figure 62 compares the mean and the 85th percentile across trial phases in each speed zone between the two intention groups, which shows that ISA led to a reduction in vehicle speed for both groups across speed zones (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Table B7 and B8). In addition, intenders appeared to have driven marginally faster than non-intenders in most speed zones.

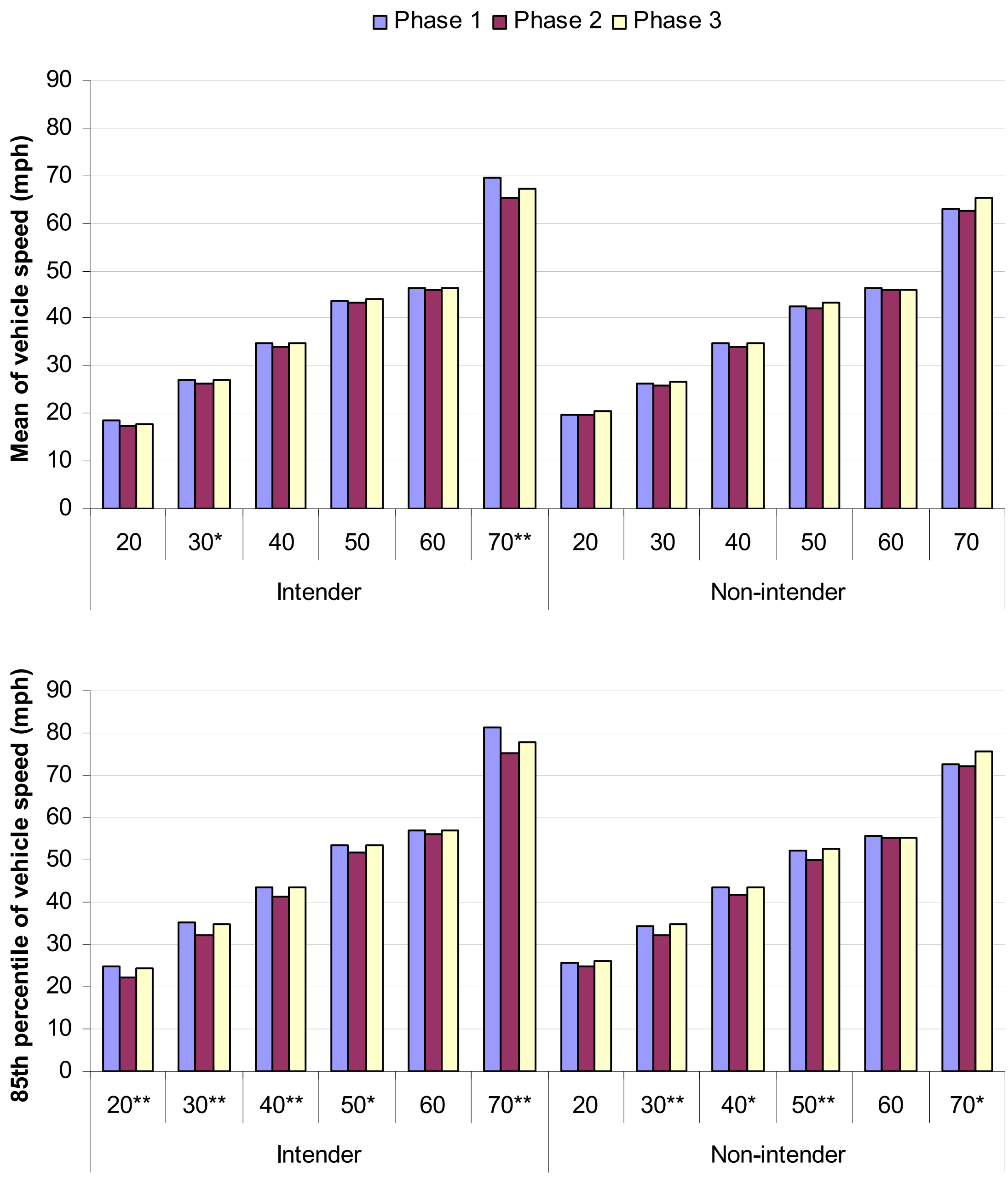


Figure 62: Comparison of key statistics of the speed distribution across trial phases between intention groups

Figure 63 compares the percentage of distance travelled in excess of speed limits across trial phases between intenders and non-intenders. ISA effectively diminished the percentage of distance travelled over speed limits for both groups of participants (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Table B9). Intenders demonstrated a slightly higher tendency to speed than non-intenders, but ISA appeared to be equally effective for both groups of participants.

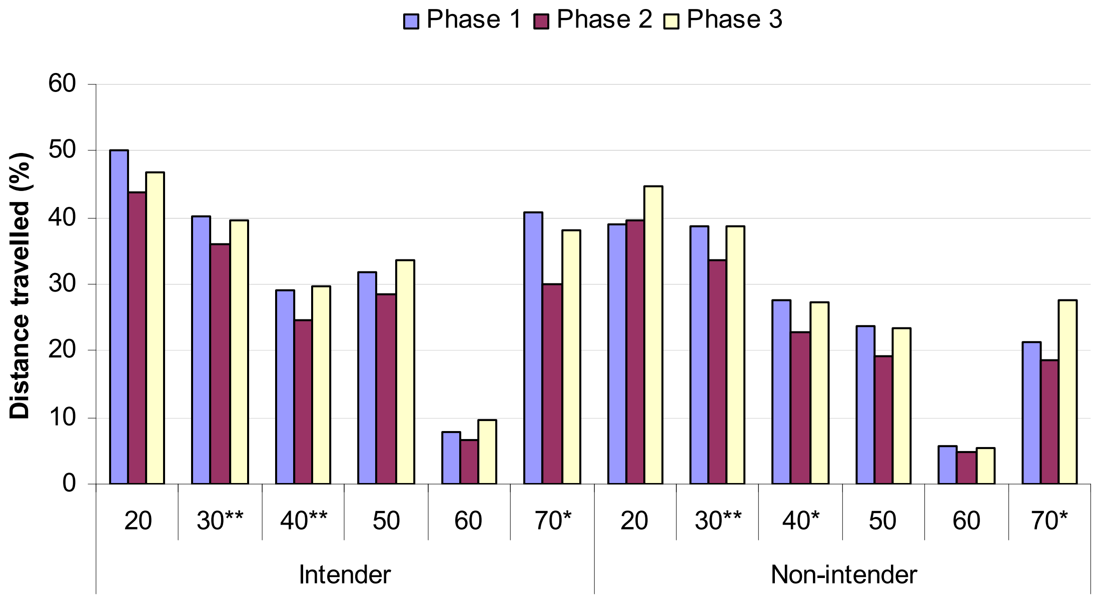


Figure 63: Comparison of percentage of distance travelled over speed limit across trial phases between intention groups

Figure 64 compares the coefficient of variation of vehicle speed across trial phases between the two groups of participants. ISA effectively diminished the CV for both groups of participants (i.e. a 'V' shape), which delivers positive implications for road accident reduction.

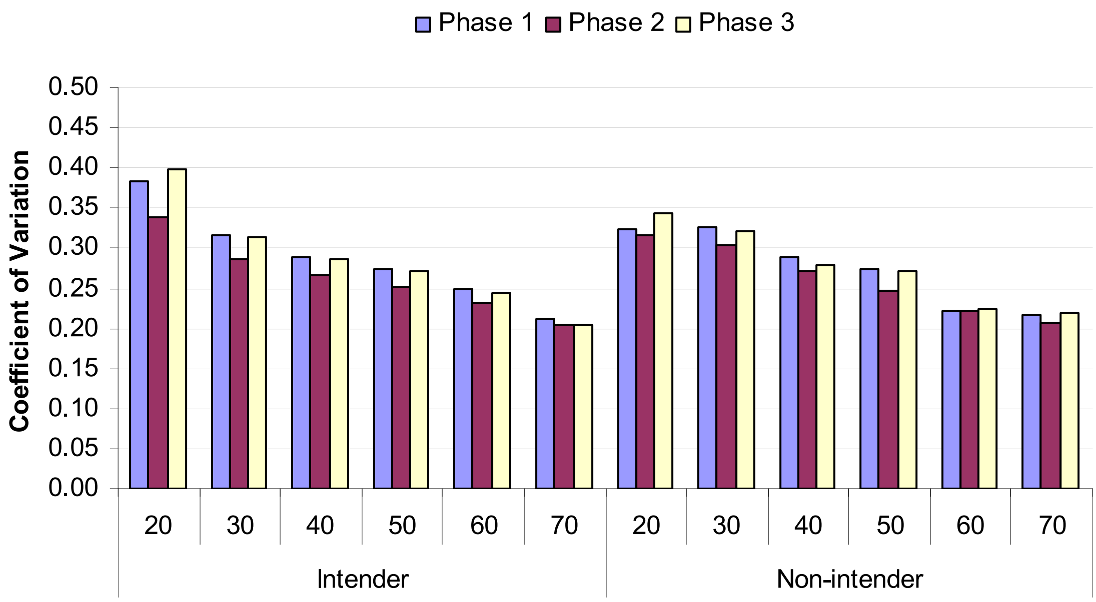


Figure 64: Comparison of coefficient of variation across trial phases between intention groups

3.8.4 Types of drivers

Table 15 depicts a breakdown of vehicle kilometres across trial phases, speed zones and types of drivers, which shows that private motorists contributed a slightly larger amount of data than fleet drivers. Figure 65 further compares the distribution of travel distance between the two groups of participants, which reveals that fleet drivers travelled more frequently in urban environments (i.e. 30 and 40 mph zones) than private motorists, which presumably was due to the fact that participants from Leeds City Council (Trial 2) and Kingstone Clothing Ltd (Trial 4) primarily drove in urban areas.

Table 15: Vehicle kilometres across types of drivers, trial phases and speed zones

Speed zone	Private drivers			Fleet drivers		
	Phase 1	**Phase 2**	**Phase 3**	**Phase 1**	**Phase 2**	**Phase 3**
20 mph	149	432	118	199	567	170
30 mph	18,366	62,475	16,768	23,326	62,277	19,007
40 mph	8,079	28,328	7,867	8,566	22,940	6,810
50 mph	2,870	11,465	3,213	3,345	8,413	2,382
60 mph	10,144	32,886	8,591	6,470	16,102	4,491
70 mph	16,926	52,912	16,841	14,948	41,094	11,645
Sum	298,432			252,750		

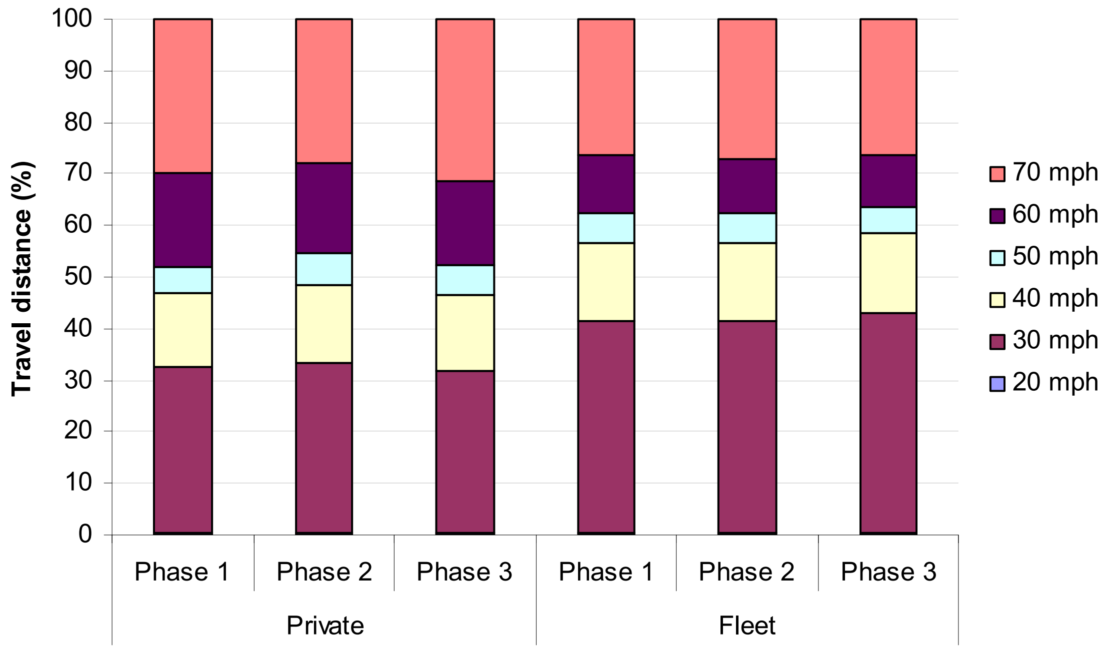


Figure 65: Comparison of patterns of travel distance between types of drivers

Figure 66 to Figure 71 compare speed distribution across trial phases between the two groups of participants, which show that ISA effectively reshaped the speed distribution for both groups across speed zones. Private motorists were observed to have overridden the system more than fleet drivers across all speed zones apart from 60 and 70 mph roads.

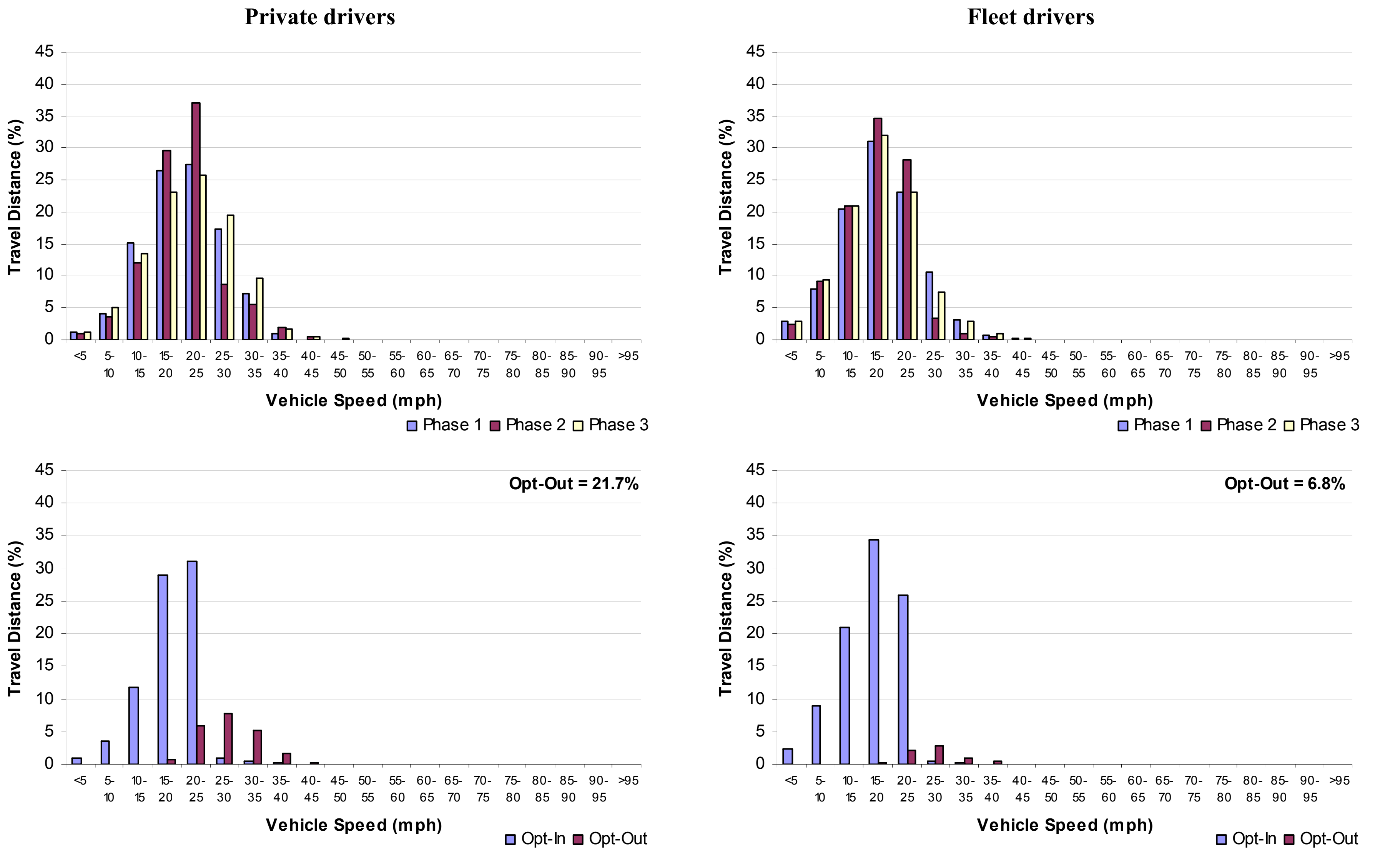


Figure 66: Comparison of the speed distribution in 20 mph zones between types of drivers

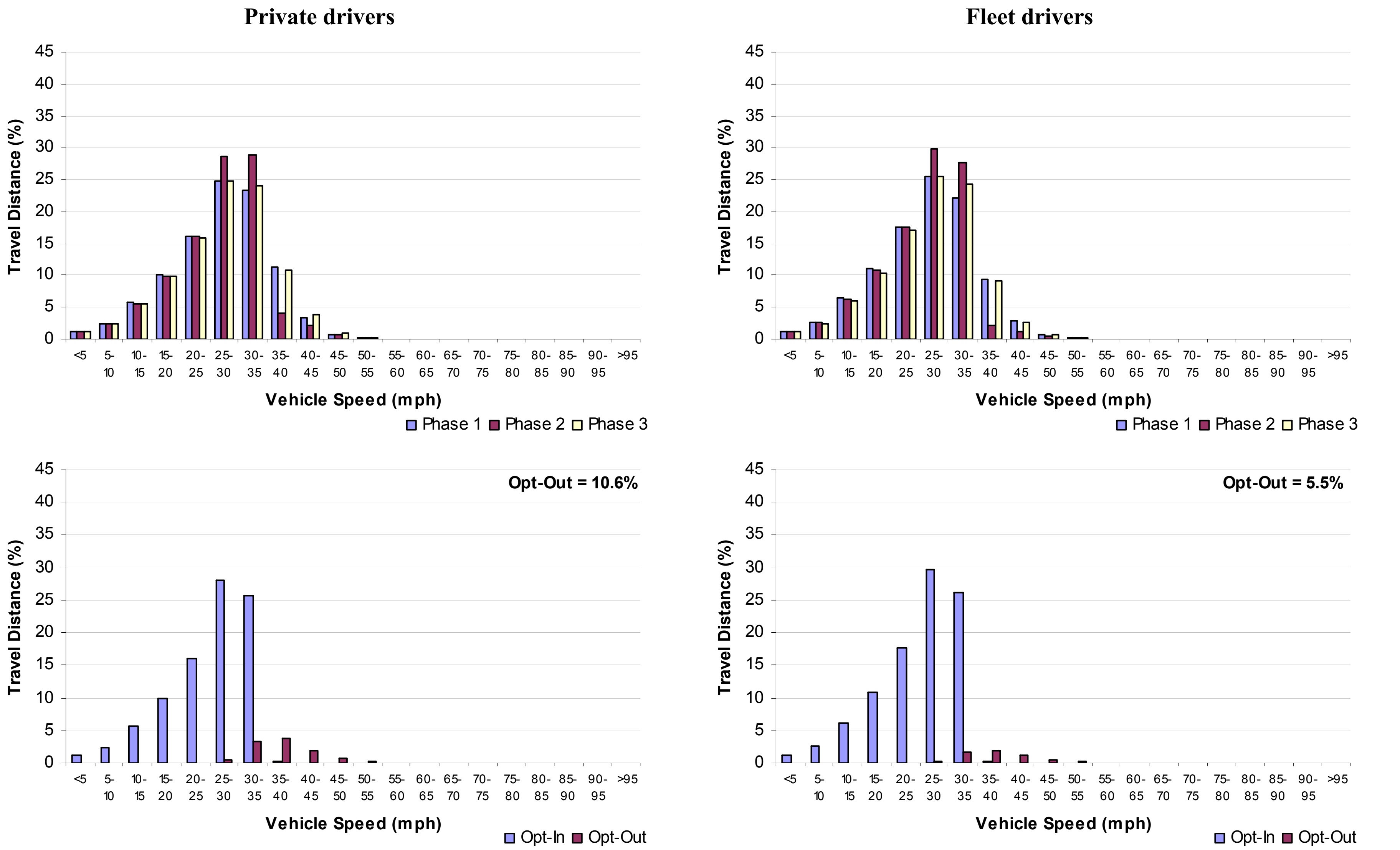


Figure 67: Comparison of the speed distribution in 30 mph zones between types of drivers

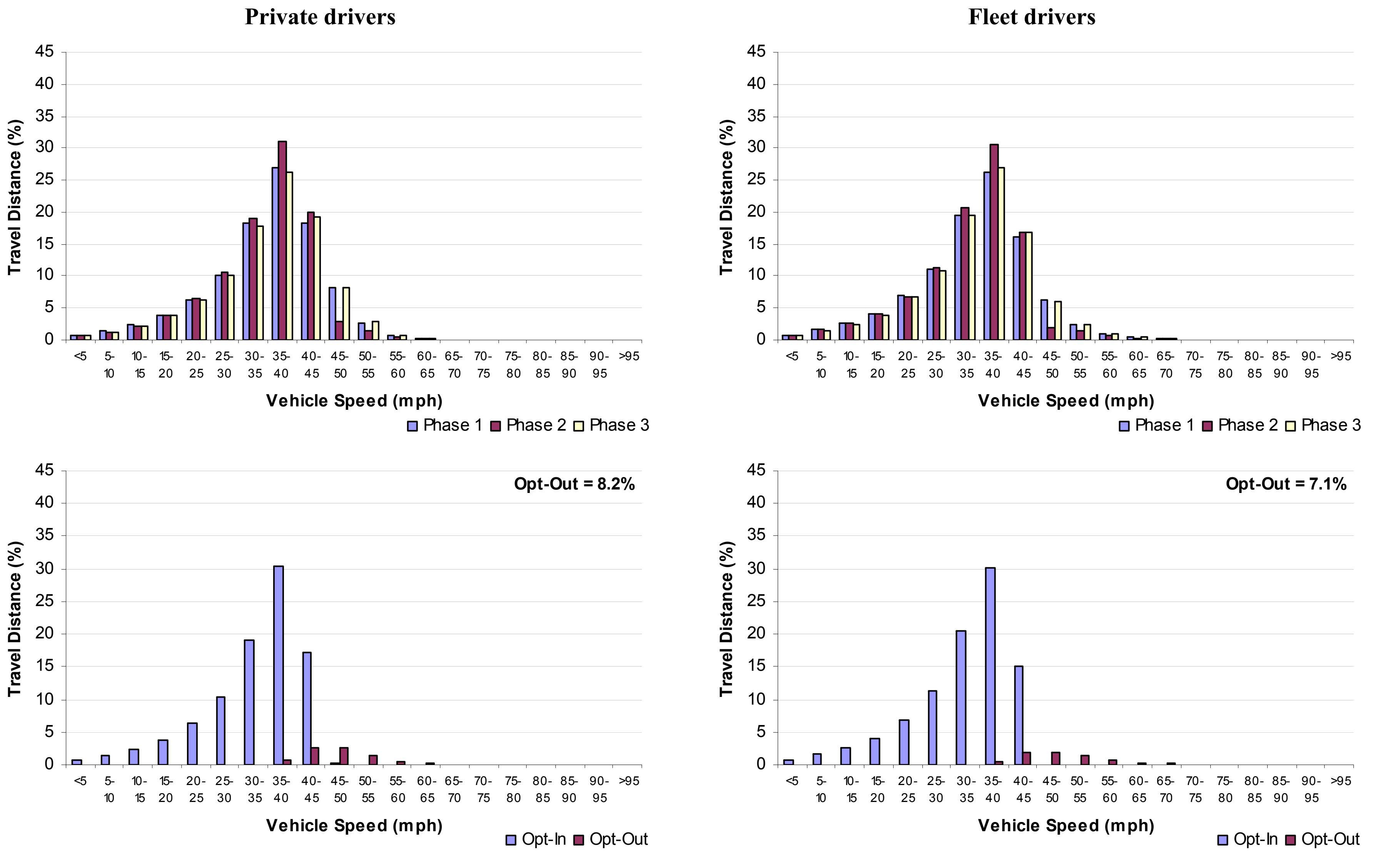


Figure 68: Comparison of the speed distribution in 40 mph zones between types of drivers

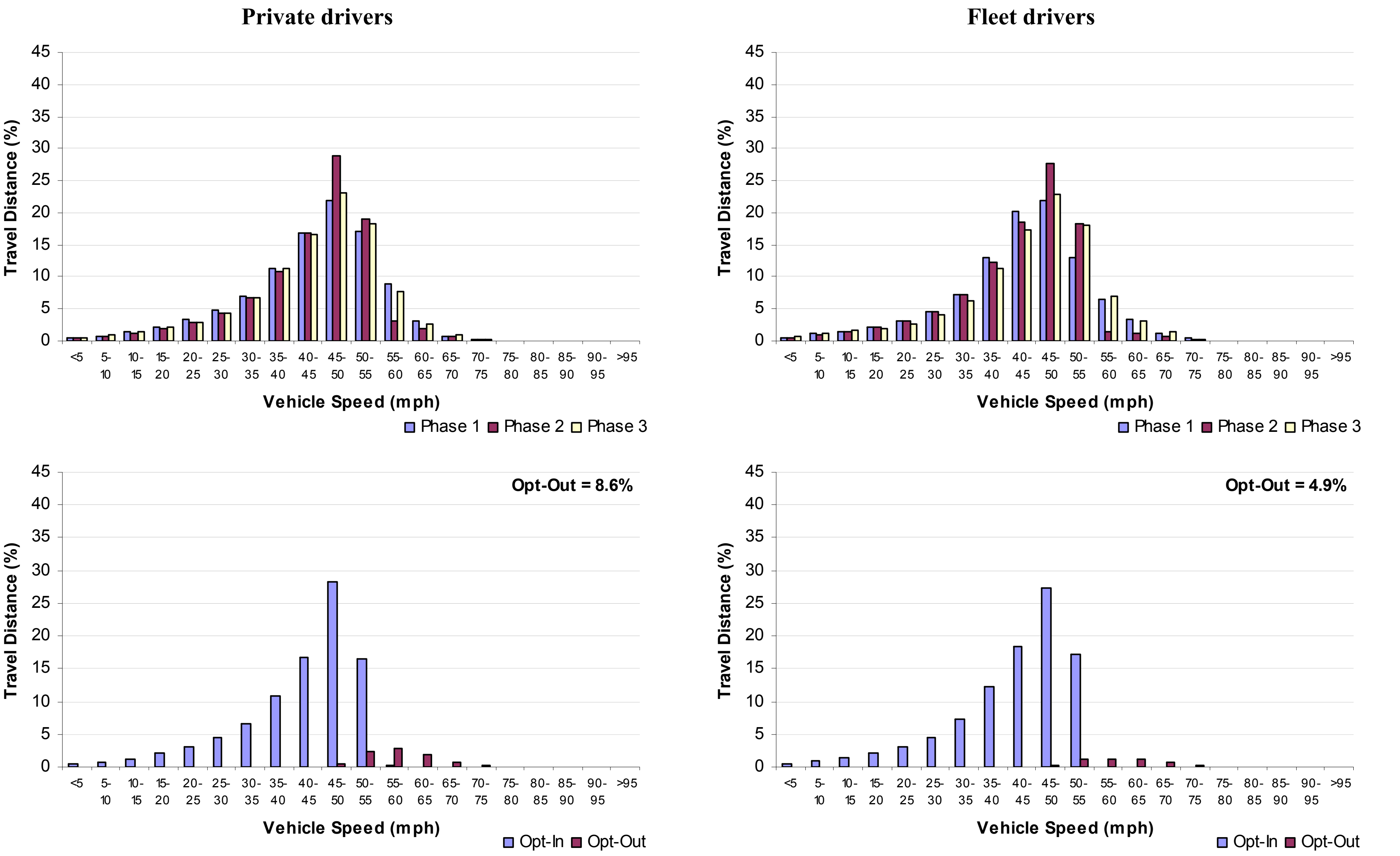


Figure 69: Comparison of the speed distribution in 50 mph zones between types of drivers

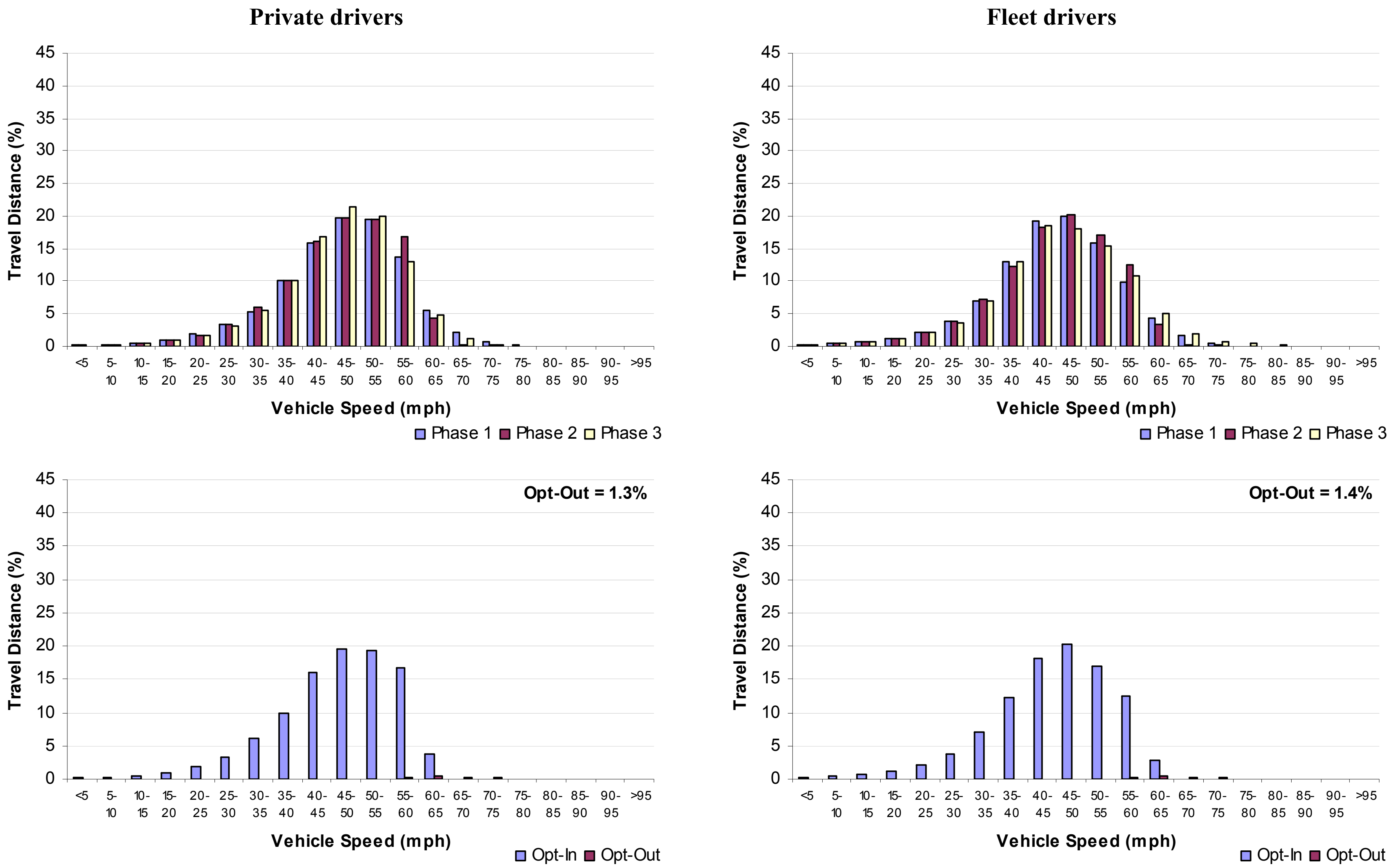


Figure 70: Comparison of the speed distribution in 60 mph zones between types of drivers

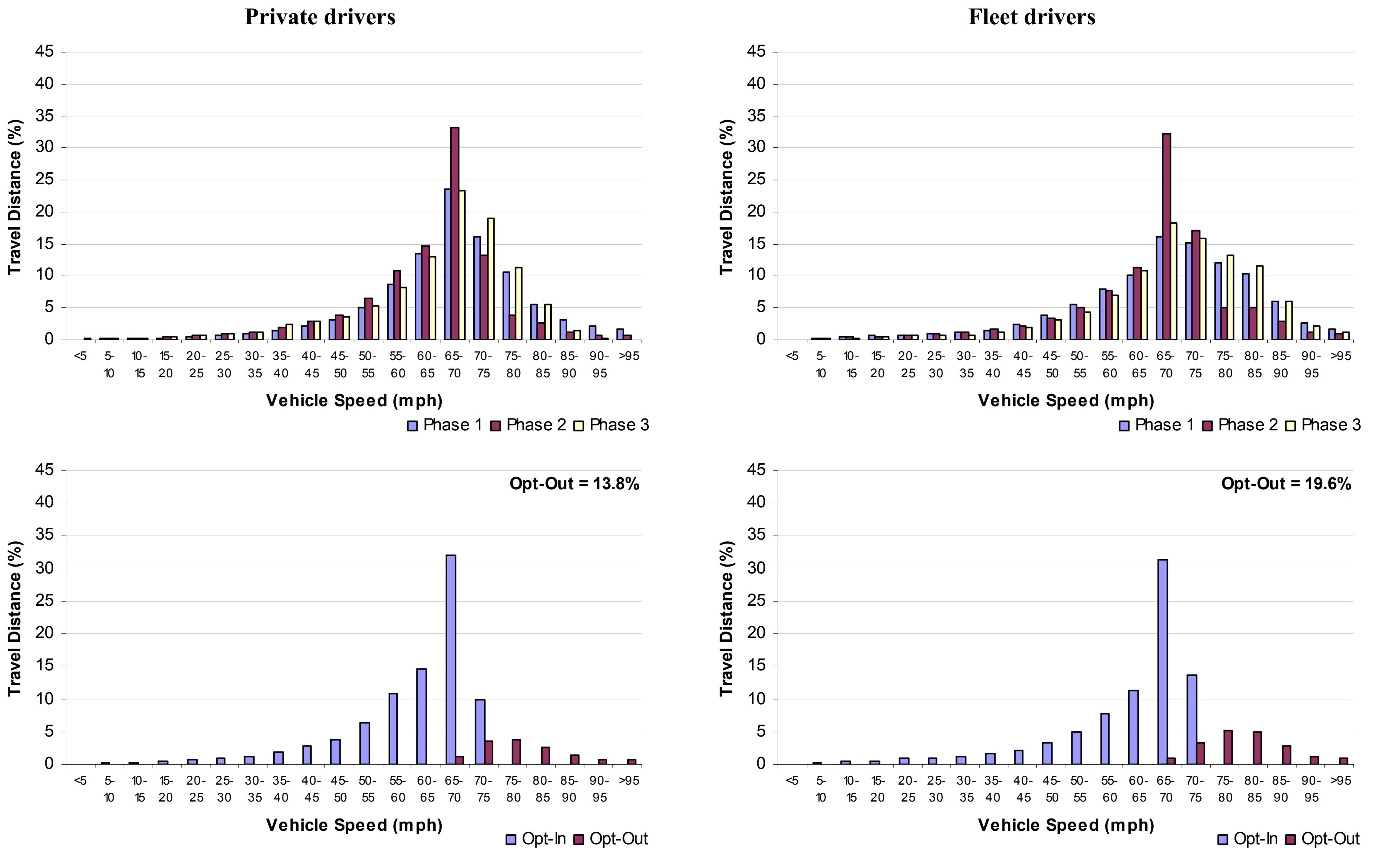


Figure 71: Comparison of the speed distribution in 70 mph zones between types of drivers

Figure 72 compares the mean and the 85th percentile across trial phases in each speed zone between the two groups of participants, which shows that ISA led to a reduction in vehicle speed for both groups across speed zones (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Tables B10 and B11). In addition, private motorists appeared to have driven marginally faster than fleet drivers in urban environments, but fleet drivers drove faster on motorways.

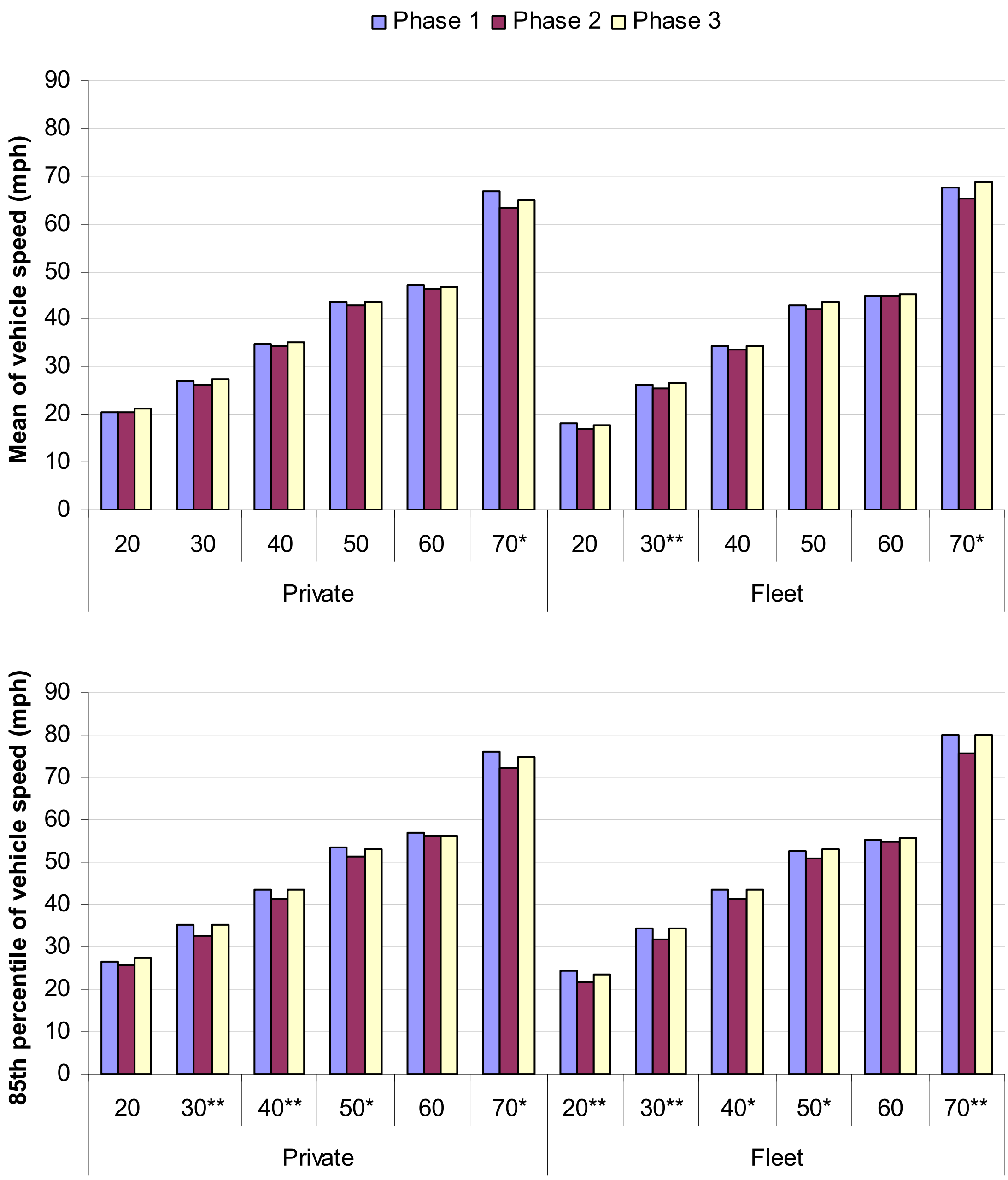


Figure 72: Comparison of key statistics of the speed distribution across trial phases between types of drivers

Figure 73 compares the percentage of distance travelled in excess of speed limits across trial phases between private and fleet drivers. ISA effectively diminished the percentage of distance travelled over speed limits for both groups of participants (i.e. a 'V' shape). A series of ANOVAs were carried out to confirm the difference across trial phases in individual speed zones; significant results are annotated in the graph but detailed test results are given in Appendix B (Table B12). Private motorists demonstrated a higher tendency to speed in the urban environment, but fleet drivers exceeded the speed limit more frequently in rural environments.

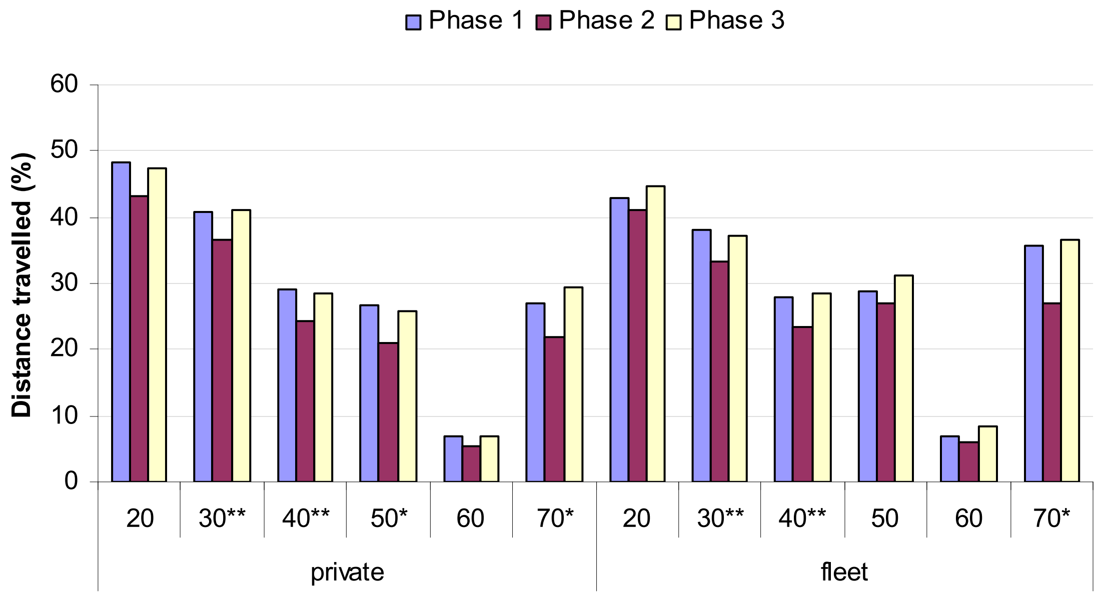


Figure 73: Comparison of percentage of distance travelled over speed limit across trial phases between types of drivers

Figure 74 compares the coefficient of variation of vehicle speed across trial phases between the two groups of participants. ISA effectively diminished the CV for both groups of participants (i.e. a 'V' shape), which delivers positive implications for road accident reduction.

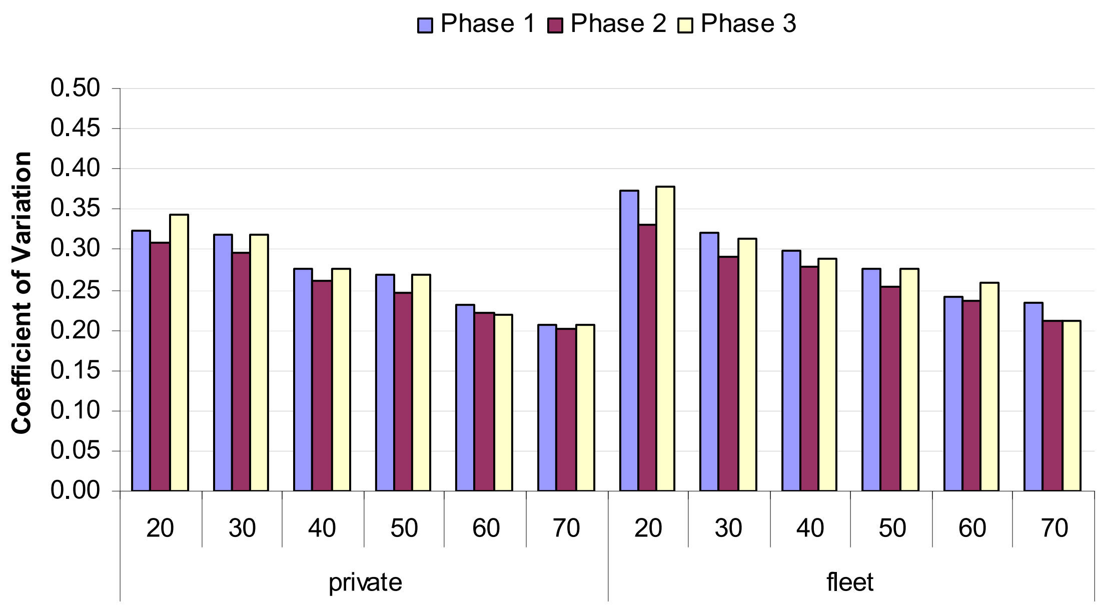


Figure 74: Comparison of coefficient of variation across trial phases between types of driver

3.8.5 Compliance with ISA intervention

As presented in the previous sections, ISA intervention influenced the shape of the speed distribution, and led to a reduction in vehicle speeds, percentage of distance travelled over speed limit, and speed variations *regardless of driver characteristics*. However, compliance with ISA intervention varied across participant characteristics as well as road environments (i.e. different speed zones), as highlighted in those speed distribution graphs presented in individual sections.

Figure 75 shows participants' overriding behaviour in general, highlighting that male drivers, young drivers, intenders, and private motorists overrode the ISA system more often than their counterparts, although the difference between private motorists and fleet drivers was marginal. Figure 76 further analyses the influence of environment factors (i.e. built-up areas and motorways) on the tendency to override the ISA system, which highlights interactions between the two intention groups and between the two types of driver.

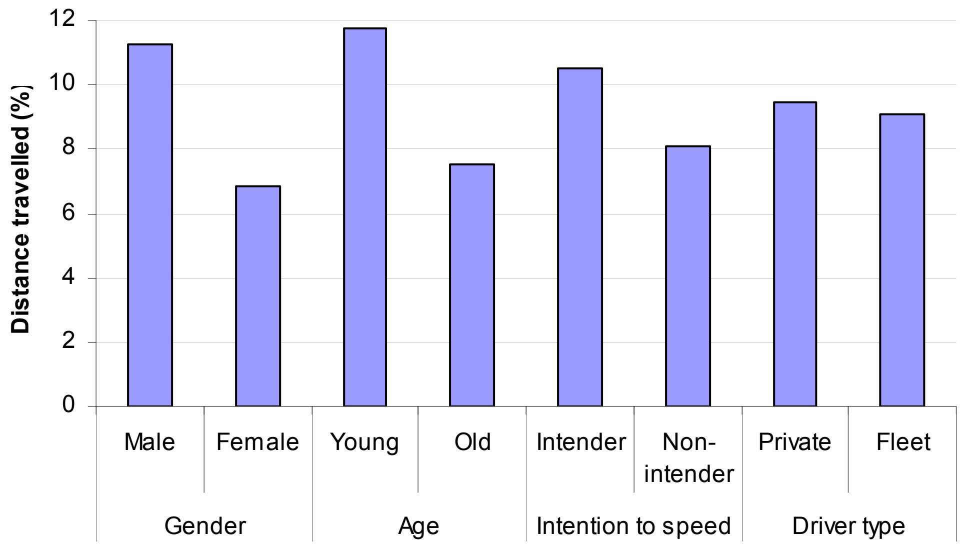


Figure 75: Comparison of overall overriding behaviour across driver groups

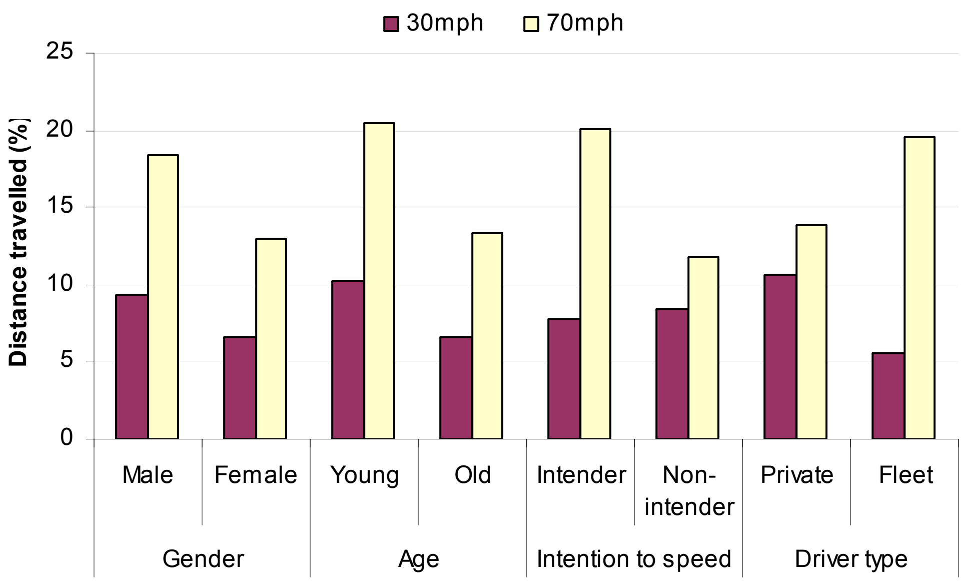


Figure 76: Comparison of overriding behaviour on 30 and 70 mph roads across driver groups

Several implications can be drawn from Figure 75 and Figure 76:

- Male drivers overrode the ISA system more than female drivers regardless of driving environments.
- Young drivers overrode the ISA system more than old drivers regardless of driving environments.
- Intenders and non-intenders did not appear to behave differently in built-up areas, but intenders overrode the ISA system more than non-intenders on motorways.
- Private motorists overrode more frequently than fleet drivers in built-up areas, while fleet drivers overrode more frequently than private motorists on motorways.

In addition to the overall percentage of distance travelled, participants' compliance with the ISA system was also analysed against the duration of exposure, as shown in Figure 77, Figure 78, Figure 79, and Figure 80. Some bands had extremely small numbers of participants in each group and some bands had a very imbalanced number of participants across the two contrast groups in question; these are therefore not presented.

It is noticeable that participants demonstrated an upward trend in overriding the ISA system along system exposure, although some appeared to be calmer than others (e.g. those whose accumulated driving distance was between 5000 and 5999 km). It is difficult to suggest a generalised turning point in behavioural adaptation (e.g. 3000 km, 4000 km, or 5000 km) at which the upward trend plateaus consistently across different kilometre bands.

However, it is identifiable that male participants generally showed a stronger tendency to override the system than female participants, that young participants generally showed a stronger tendency in overriding the system than old participants, and that private motorists generally showed a stronger tendency in overriding that system than fleet drivers. The intention groups demonstrated a less clear picture across total kilometre bands. It is worth noting that these analyses on long-term behavioural adaptation are based on data collected from all speed zones. Attempts were made to split the sample by speed zones within bands of total kilometres driven, but the sample size in individual sub-groups tended to be extremely small, which caused difficulty in producing meaningful comparisons.

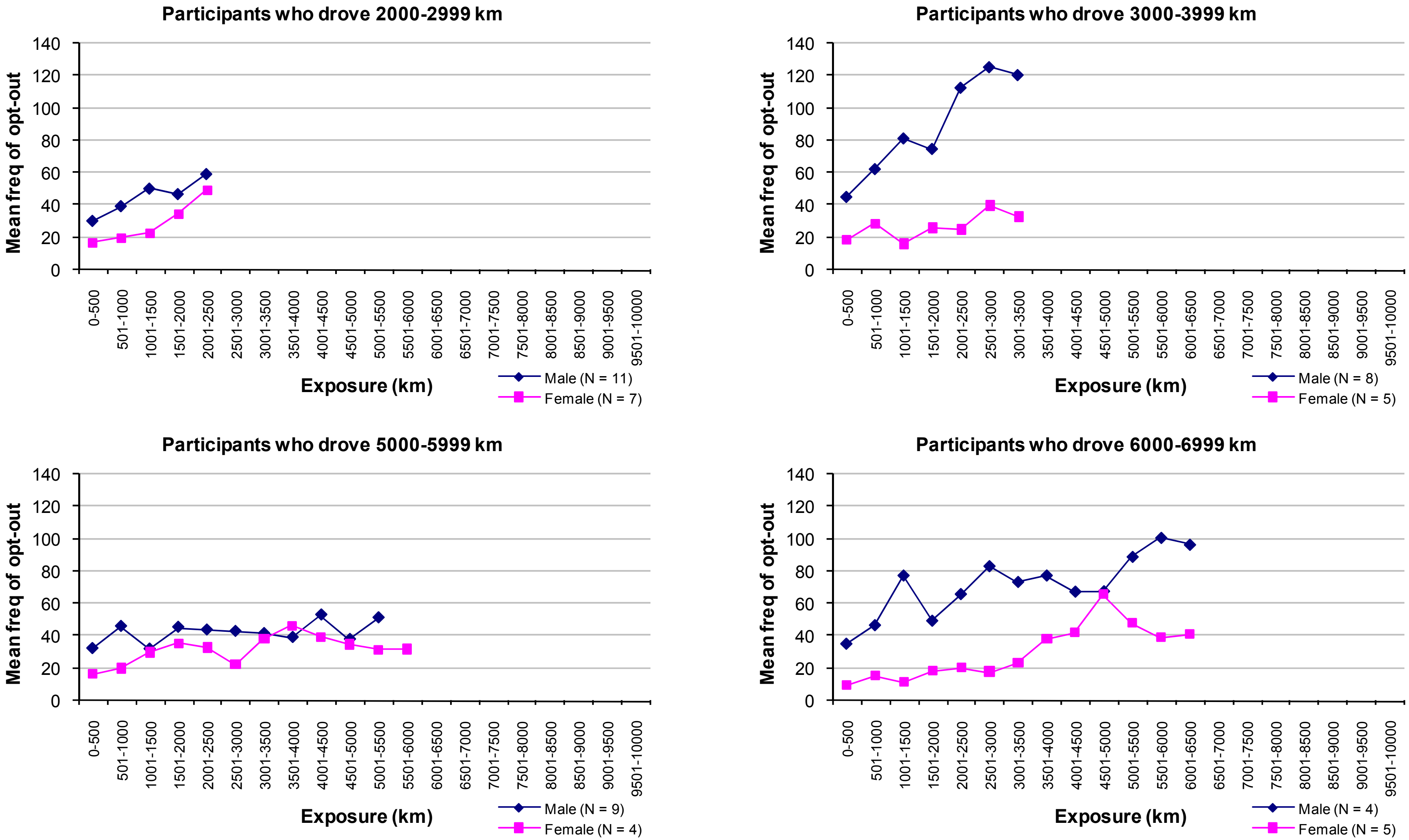


Figure 77: Comparison of mean frequency of opt out by total distance driven between gender groups

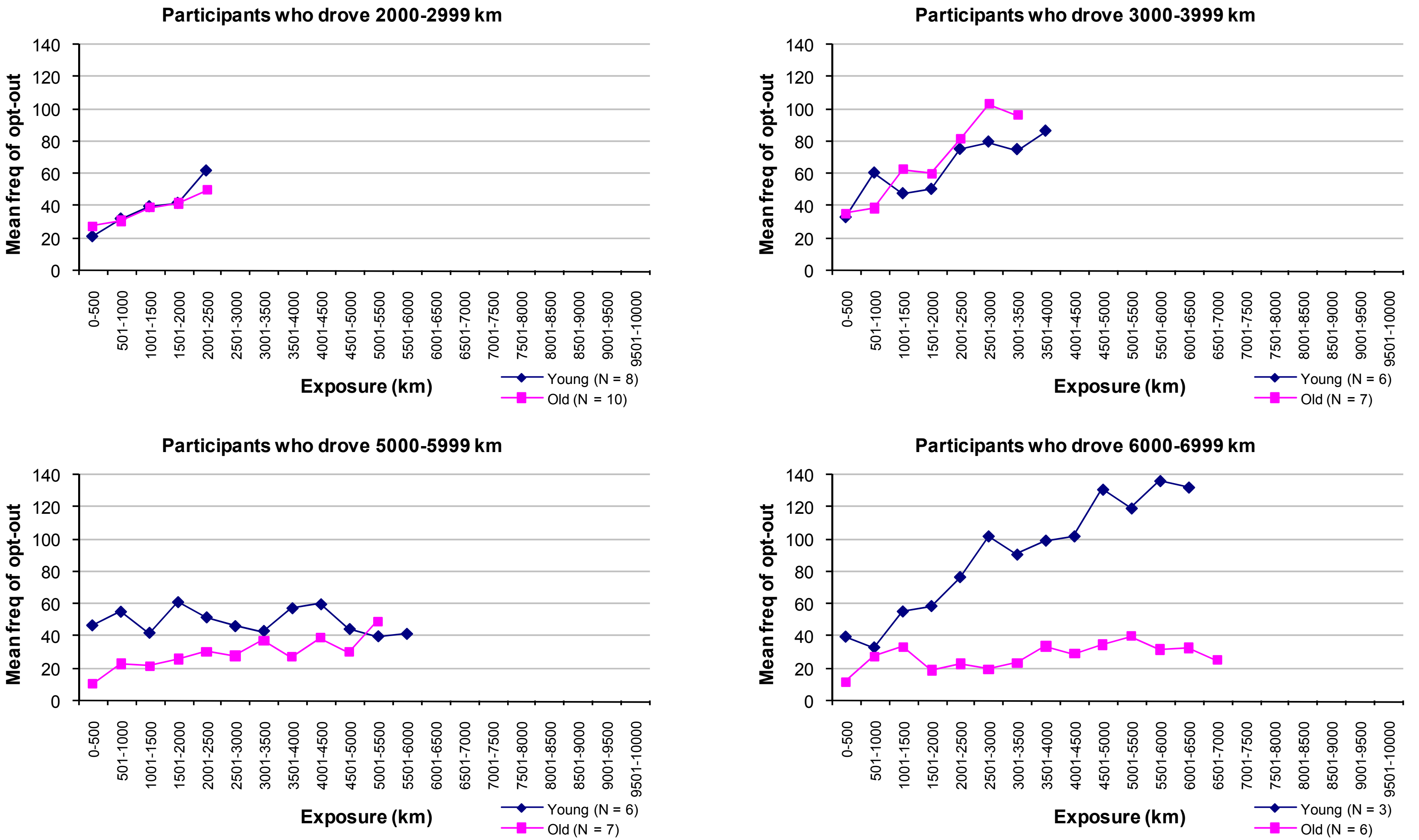


Figure 78: Comparison of mean frequency of opt out by total distance driven between age groups

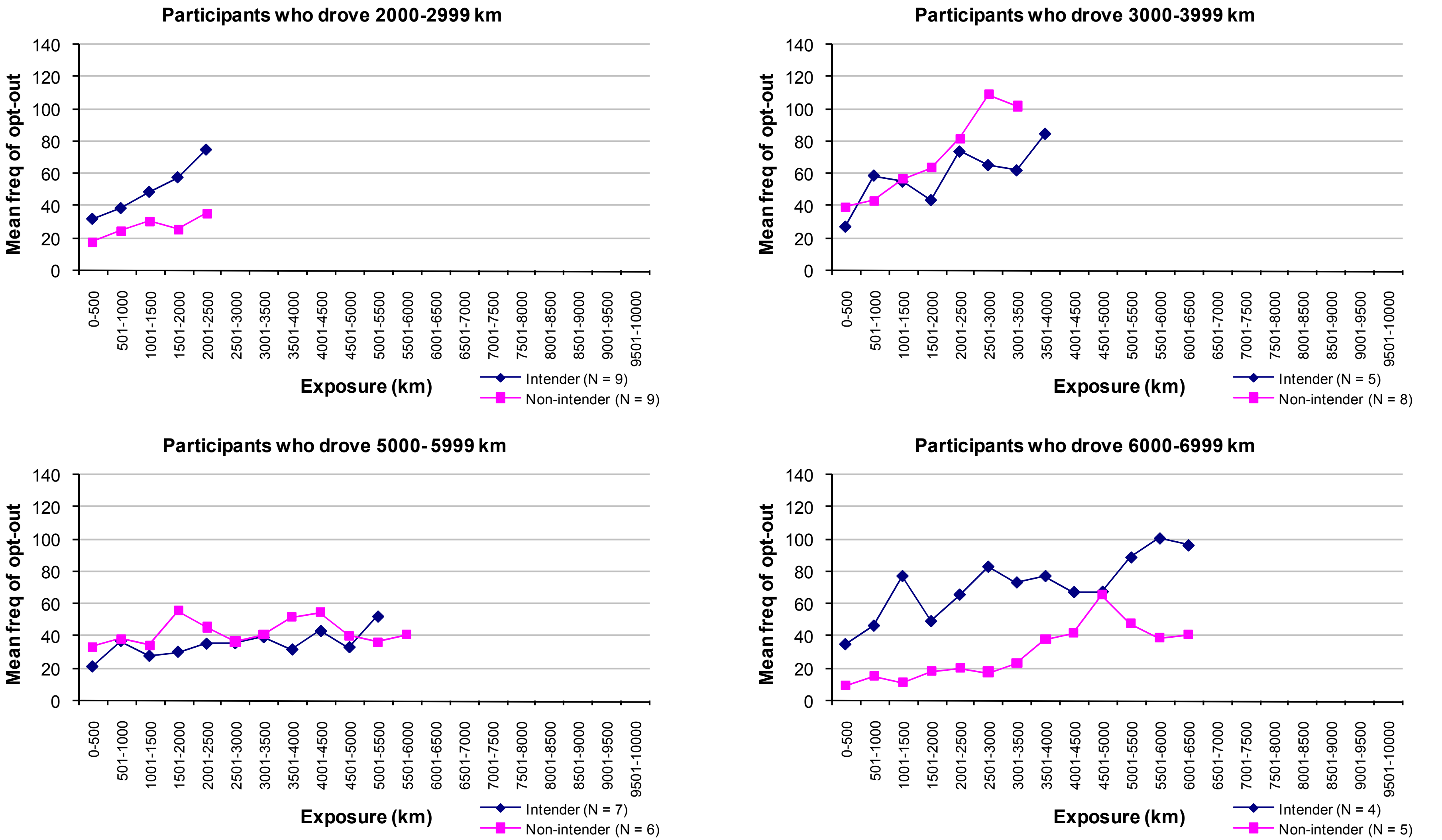


Figure 79: Comparison of mean frequency of opt out by total distance driven between intention groups

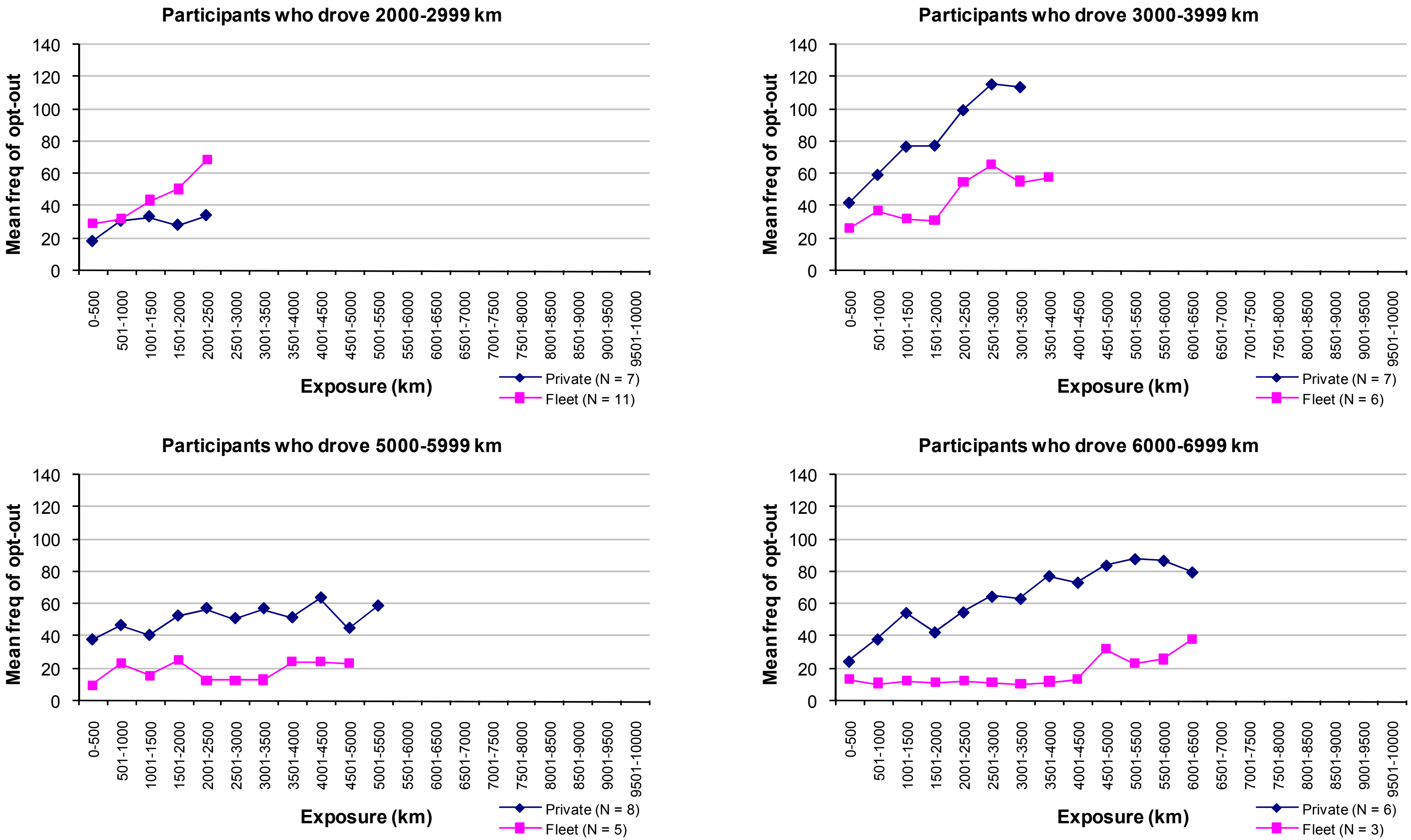


Figure 80: Comparison of mean frequency of opt out by total distance driven between types of drivers

3.9 Discussion

Based on the analyses presented in this chapter, it can be demonstrated that the ISA system led to a distinctive effect in terms of transformation of the speed distribution. When ISA was switched on, a large proportion of the speed distribution initially spread over the speed limits was shifted to around or below the speed limit. Most participants were observed to have adapted their reference for their chosen speed between trial phases. During Phase 1 and 3 when the ISA system was turned off, many participants were observed to obey the speed limits with reference to the speedometer reading. During Phase 2, most participants were observed to rely on the ISA system (i.e. throttle feedback) to indicate the limit instead of using a speedometer reading. This caused a slight distortion in Phase 2 in that, for each speed limit, there is an increase in the amount of driving in the speed band immediately above the legal speed limit. Nevertheless, the trial results undoubtedly demonstrate the effectiveness of the ISA system in reshaping the speed distribution.

The effect of ISA intervention in reshaping of the speed distribution was less prominent in the 60 mph zones, where speeding behaviour was rare even in the absence of ISA. This is primarily due to the constraints on driving speed imposed by traffic road geometry on rural single carriageways. The minimal amount of speeding behaviour recorded on 60 mph roads in these trials is in line with national data.

The changes in speed distribution as a result of ISA intervention were confirmed by statistical tests. The results also indicate that ISA intervention was more effective in reducing excessive speed (i.e. 85^{th} percentile speeds) than mean speed. Since injury severity is related to speed reduction (Nilsson, 1981; Nilsson 2004), the reduction in excessive speed has promising implications for road safety. The ISA system also led to a reduction in speed variability. The reduction in speed variability was particularly prominent on urban roads with a limit of 30 or 40 mph. This again has positive implications for accident occurrence, as speed variability is related to accident rate (Taylor et al., 2000). In addition, the ISA system led to a diminished probability of jerk occurrence. This implies that driving with ISA could reduce the likelihood of being involved in serious traffic conflicts in comparison with driving without ISA, as it has been widely argued that braking is the most common evasive manoeuvre in serious traffic conflicts, ranging from 63% to 98% of traffic conflicts (van der Horst, 1984; Hydén, 1987; Gårder, 1990; Hantula, 1994).

The analysis of participants' overriding behaviour also suggests a need to consider incentives to encourage compliance with the ISA system. In particular, the occurrence of system overriding in urban environments (i.e. Figure 27 in Section 3.4), where speed compliance is crucial for road safety, would need to be discouraged. In term of sub-groups within the driving population, it was revealed that male drivers and young drivers overrode the system more than their counterparts regardless of speed zones, that intenders overrode the system more frequently than non-intenders on motorways, and that private motorists were more likely to override in built-up areas while fleet drivers more frequently overrode on motorways. These findings indicate that different groups would need specific targeting in terms of incentives and of road safety campaigns.

4. ANALYSIS OF QUESTIONNAIRE DATA

Questionnaire data collected within the project allowed us to investigate a number of issues relating to speeding in general and to the impact of the ISA system. The Theory of Planned Behaviour (TPB: Ajzen 1985, 1988, 1991) was employed as a means of monitoring changes in cognitions following experience with the ISA system using specific psychological theory. However, the TPB is primarily used as a model to identify variables which explain behaviour with a view to changing behaviour. In this project measures collected within the project also allowed us to identify the key determinants of drivers' propensity to speed as measured by objectively assessed and ecologically valid behavioural data. Research outside the UK has shown that experience with ISA increases drivers' acceptability of various ISA systems. Therefore a number of additional items were included within the questionnaires to allow us to determine the impact of experience on drivers' acceptance of and attitudes to the ISA system.

The following sections therefore aim to evaluate:

1. The key determinants of drivers' intentions and propensity to speed (section 4.1)
2. The impact of experience with ISA upon drivers' cognitions relating to speeding (section 4.2)
3. The impact of experience with ISA upon drivers' acceptance of and attitudes towards ISA (section 4.3)

4.1 Predicting speeding behaviour: an application of the TPB

4.1.1 Introduction

Over the last decade, the Theory of Planned Behaviour (TPB: Ajzen 1985, 1988, 1991) has emerged as a potential model on which to base road safety interventions. Successfully applied to a range of health and safety behaviours (see Armitage and Conner, 2001), the TPB provides a simple, parsimonious, deliberative processing model (Conner and Sparks, 1996) of the proximal determinants of behaviour.

The TPB advocates that intentions and perceived behavioural control (PBC) are the key predictors of behaviour. Intentions reflect the cognitive representation of an individual's readiness to perform a given behaviour (Ajzen, 1991). PBC describes the individual's perception of the ease or difficulty of performing any given behaviour (Ajzen, 1991).

Just as intentions and PBC are held to be direct antecedents of behaviour, the model also states that intentions are influenced by three additional factors. Attitudes, subjective norms and PBC are direct determinants of intentions:

- *Attitudes* towards a behaviour reflect the degree of positive or negative evaluation the individual has towards performing the behaviour. Attitudes are regarded as beliefs about the likely outcomes of the behaviour multiplied by the individual's evaluations of these outcomes.
- *Subjective norms* refer to the perceived social pressure to engage or not engage in a behaviour. These are understood to be the sum of normative beliefs concerning what salient referents believe about the individual enacting the behaviour, multiplied by the individual's motivation to comply with this group.

- *PBC* again reflects the perceived ease or difficulty of undertaking a given behaviour. An individual's perception of control is assumed to be the product of the individual's evaluation of factors likely to facilitate/inhibit the performance of a behaviour and the frequency of their occurrence. These control beliefs can be both internal and external in their nature.

As the relative importance of intentions and PBC in predicting behaviour can differ across behaviours and populations, so too can the importance of attitudes, subjective norms and PBC in the prediction of intentions.

Figure 81 provides a schematic representation of the TPB.

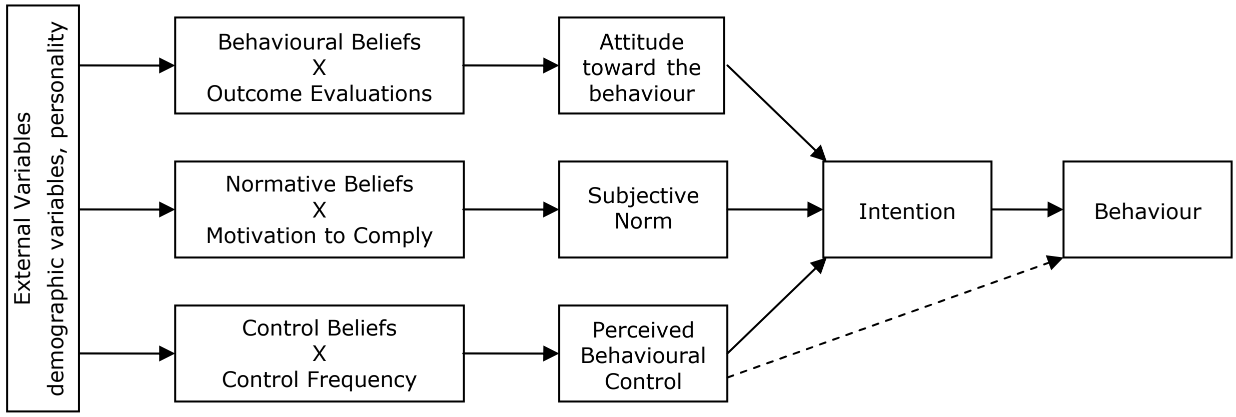


Figure 81: The Theory of Planned Behaviour (Ajzen, 1988)

Since the early 1990's research has sought to apply the TPB to predicting aberrant driving behaviours and has provided consistent support for the independent and direct effect of attitudes, subjective norms and PBC upon drivers' intention to speed (Conner, Smith and McMillan, 2003; Conner, Parker, Lawton, Chorlton, Manstead and Stradling, 2007; Parker, Manstead, Stradling, Reason, and Baxter, 1992) and intention to comply with the speed limit (Elliot, Armitage and Baughan, 2003; Elliot, Armitage and Baughan, 2005; Elliot, Armitage and Baughan, 2007). A number of these studies have gone on to extend the TPB model, demonstrating the value of additional constructs such as past behaviour, moral norm, anticipated regret and self-identity in predicting speeding intentions and self-reported behaviour. *Moral norms* are the individual's perception of the moral correctness or incorrectness of performing a behaviour (Ajzen, 1991) and take account of, "…personal feelings of….responsibility to perform, or refuse to perform, a certain behaviour" (Ajzen, 1991, p.199). *Anticipated regret* is defined as the "expected affective consequences of breaking those rules" (Eagly and Chaiken, 1993, p.129). Research has demonstrated that these personal norms predict intentions to speed over and above the constructs of the TPB (Department for Transport, 2000; Conner et al., 2007). Indeed, both moral norm and anticipated regret are believed to be especially relevant, since committing driving violations such as speeding is a socially undesirable behaviour that may evoke anticipatory feelings of negative or indeed positive affect (Parker et al., 1995). *Past behaviour, or habit*, has also been added to the model and is typically the strongest predictor of intention and behaviour, explaining variance over and above that accounted for by the TPB variables (see Ajzen, 1991; Conner and Armitage, 1998; Ouellette and Wood, 1998). Elliott et al. (2003) have demonstrated the impact of habit on intention and note a direct independent effect of habit on drivers' self-reported propensity to comply with the speed limit. *Self-identity* refers to an individual's perception of their societal role and reflects "the extent to which an actor sees him- or herself as fulfilling the criteria for any societal role" (Conner and Armitage, 1998, p.1444). Involvement in role-congruent behaviour validates an individual's self-concept and membership of that particular role (Callero, Howard and Piliavin, 1987). Thus individuals are motivated to make behavioural decisions that are consistent with their self concept. Work has also supported the independent role of self-identity in predicting intention to speed, explaining variance over and above that accounted for by the TPB variables (Department for Transport, 2000).

The TPB has been criticised for its failure to accommodate individuals' risk perceptions or perceived susceptibility (e.g. Norman and Conner, 1996). Recent work within the TPB has therefore put forward risk or susceptibility perceptions as a potential predictor of intentions and behaviour and evidence has demonstrated its direct influence upon intentions (Norman, Conner and Bell, 1999) and behaviour (Conner, Kirk, Cade and Barret, 2001). Given the inherent risks involved in behaviours such as speeding, *perceived susceptibility* may provide the motivating force behind the adoption of pro-safety driving behaviours. In light of this evidence, the project aimed to evaluate the potential of these five additional key variables as independent predictors of drivers' intention to speed.

Despite the successful application of the TPB to speeding and other aberrant driving behaviours, the majority of studies have been confined to predicting intentions to engage in the certain driving behaviours. While intentions and behaviour might be expected to be correlated (Armitage and Conner (2001) report an intention-behaviour correlation of .47 across 48 studies), the size of the relationship in the driving domain remains to be adequately demonstrated.

In order to address this, previous research has applied the TPB to self-reported speeding. Elliott et al. (2003) for example, report an intention-behaviour relationship of .67. However, employing a self-report measure of behaviour can lead to an overestimation of the relationships between intentions and behaviour. In the meta-analysis of the TPB by Armitage and Conner (2001) a marked difference was observed between studies employing self-report and those employing objectively assessed behaviour. In the former case, across 44 tests, intentions and PBC explained 31% of the variance in behaviour, while in the latter case, across 19 tests, intentions and PBC explained only 20% of the variance in behaviour. Identifying the impact of TPB variables on objectively assessed speeding behaviour is therefore clearly important. Elliott et al. (2007) and Conner et al. (2007) go beyond self-report in their examination of observed speeding behaviour on a driving simulator with both reporting that intention and PBC significantly predicted subsequent speeding behaviour. However, whilst the use of a simulator provides a more objective measure of speeding behaviour, simulators can be criticized for their lack of ecological validity (Neale and Liebert, 1986) since those social and motivational pressures common to everyday driving are removed. More realistic data might therefore be gained from on road studies. To date, only two previous studies have attempted to predict objectively assessed real world driving. One of two studies reported in Conner et al. (2007) used unobtrusive on-road speed camera assessments. Here, 17% of the variance in speed as assessed on-road was accounted for, with intentions and moral norm being significant predictors. However, findings here were based on a retrospective design, thus the causal ordering of the cognition and behaviour was not preserved. Warner and Åberg (2006) used an instrumented vehicle to provide a measure of drivers' general speeding behaviour. Unfortunately, whilst this provided an ecologically valid measure of speeding behaviour, this study did not include a measure of intention and thus did not test the full conceptual framework of the TPB.

In response to these limitations, data collected within this project study was also used to extend previous research which had used an instrumented vehicle to provide a measure of participants' general speeding behaviour across a range of road environments. This would provide the first prospective test of an extended TPB model (including moral norm, anticipated regret, self-identity, perceived susceptibility and past behaviour) using objectively assessed and ecologically valid real-world speeding behaviour. The analysis also sought to examine the beliefs underlying attitudes, PBC and subjective norms within the TPB. Since Fishbein and Ajzen (1975) argue that underlying beliefs will distinguish between groups, analysis of these beliefs should provide useful targets for intervention.

4.1.2 Measures

4.1.2.1 TPB scenarios

The TPB was applied to three speeding scenarios. These behaviours were:

Speeding on a motorway: Imagine you are driving along a motorway. It is a fine, dry day and the traffic is fairly light. The speed limit of the road is 70 mph.

Speeding on a residential road: Imagine you are driving along a residential road with cars parked either side or connecting side roads at various points. Pedestrians are also visible. The speed limit of the road is 30 mph.

Speeding on an urban road: Imagine you are driving along an urban road. The traffic is fairly light. Although there are houses either side of the road there do not appear to be many pedestrians. The speed limit of the road is 40 mph.

A TPB questionnaire examining cognitions relating to disengaging the ISA system was also administered. Analysis relating to this scenario was confined to examining changes in cognitions following experience with the ISA system (see section 4.2 for analysis). However for ease, details of the measures are included within this section.

Disengaging an ISA system: Imagine you are driving a car that is fitted with Intelligent Speed Adaptation. When you start up the car you are automatically speed limited. You cannot drive above the posted speed limit unless you decide to press one of the override buttons and disengage the system. If you disengage the system you are free to travel at your desired speed.

TPB questionnaires were administered at three time points; prior to drivers' collection of the ISA vehicle (Time 1, month 0), upon completion of Phase 2 (Time 2, month 5) and upon completion of Phase 3 (Time 3, month 6). This design provided a test of the predictive utility of the TPB in relation to actual speeding behaviour and also allowed the TPB to be used as a model for evaluating changes in cognitions as a result of using the ISA system for an extended period (see section 4.2).

4.1.2.2 Individual TPB measures

The questionnaires included direct and indirect measures of the TPB constructs. **Intention** was assessed using three items_(e.g., 'I would intend to exceed the 70 mph speed limit on a motorway', strongly disagree-strongly agree, scored −3 to +3). The mean of these three items produced a composite scale for each of the four questionnaires. Higher scores reflected stronger intentions to engage in the behaviour. Reliability scores for the intention measures were generally good, as shown in Table 16.

Table 16: Reliability scores of intention measures

Scenario	Time 1	Time 2	Time 3
Motorway 70 mph	0.89	0.95	0.95
Residential 30 mph	0.85	0.86	0.79
Urban 40 mph	0.83	0.90	0.88
Overall speeding	0.83	0.72	0.75
Disengage ISA	0.68	0.75	0.81

Perceived behavioural control (PBC) was assessed using six items. These items were differentiated in terms of perceived difficulty (two items; e.g., 'For me to disengage the ISA system would be…', difficult-easy, scored +1 to +7), perceived control (three items; e.g., 'How much control would you have over exceeding the speed limit on a motorway?', no control-complete control, scored +1 to +7) and self efficacy (one item; 'How confident are you that you will be able to exceed the 30 mph speed limit on a residential road?', not very confident-very confident, scored +1 to +7), as proposed by Conner and Sparks (1996) and Trafimow, Sheeran, Conner and Finlay (2002). Factor analysis with varimax rotation revealed inconsistent loading onto the three factors (perceived difficulty, perceived control and self efficacy) across the four questionnaires. Therefore the three indices for perceived behavioural control were collapsed to form one scale. The mean of these six items produced a composite scale for each of the behaviours. Higher scores reflected greater perceptions of control in the commission of the behaviour. Reliability scores for the PBC measures were generally good, as shown in Table 17.

Table 17: Reliability score for PBC measures

Scenario	Time 1	Time 2	Time 3
Motorway 70 mph	0.75	0.83	0.78
Residential 30 mph	0.79	0.83	0.83
Urban 40 mph	0.84	0.90	0.88
Overall speeding	0.87	0.88	0.91
Disengage ISA	0.80	0.85	0.84

Attitude was assessed by eight semantic differential scales following the statement 'Exceeding the 40 mph speed limit on an urban road would be…' Following Lawton et al's (1997) distinction, the seven point scales measured both instrumental (useless-useful, harmful-beneficial, negative-positive, bad-good) and affective attitudes (unsafe-safe, unsatisfying-satisfying, not enjoyable-enjoyable, reckless-cautious). Factor analysis with varimax rotation revealed inconsistent loading onto two factors across the four questionnaires. The two separate indexes for instrumental and affective attitudes were collapsed to form one attitude scale for each behaviour. The mean of the eight items (all scored −3 to +3) produced a composite scale for each of the behaviours such that higher scores indicated attitudes that were in favour of the commission of the behaviour. Reliability scores for the attitude measures were generally good, as shown in Table 18.

Table 18: Reliability scores for attitude measures

Scenario	Time 1	Time 2	Time 3
Motorway 70 mph	0.90	0.94	0.94
Residential 30 mph	0.92	0.94	0.94
Urban 40 mph	0.94	0.95	0.97
Overall speeding	0.81	0.78	0.84
Disengage ISA	0.87	0.91	0.91

Behavioural belief composites were derived from the product of the behavioural belief strength (the perceived likelihood of modal outcomes) and outcome evaluation (evaluation of those outcomes). **Behavioural beliefs** were measured using nine items (e.g., 'Exceeding the 70 mph speed limit on a motorway would risk causing an accident', unlikely-likely, scored −3 to +3). Higher scores reflected beliefs that the outcome was likely. **Outcome evaluations** were assessed using nine items (e.g., 'Making rapid progress would be…, bad to good, scored −3 to +3). Higher scores reflected outcome evaluations that were positive.

Normative belief composites[3] were derived from the product of the normative belief strength (expectations of significant others) and motivation to comply (the motivation to comply with significant others). **Normative beliefs** were measured using five items. Five salient referents were identified; the police, family, friends, other road users and other spouse/partner (e.g., 'The police would disapprove of me exceeding the 70 mph speed limit on a motorway, strongly disagree-strongly agree, scored −3 to +3). Higher scores reflected normative beliefs that opposed the behaviour. **Motivations to comply** were assessed using five items (e.g., 'Generally speaking how much do you want to do what your family think you should do?', not at all-very much, scored +1 to +7). Higher scores reflected a stronger motivation to comply with the referents.

Control belief composites were derived from the product of the control belief frequency (the frequency of occurrence of factor which would either facilitate or inhibit the behaviour) and the control belief power (the perceived power of these factors to facilitate or inhibit the behaviour). **Control Beliefs** were measured using seven items ('Driving at night-time makes my exceeding the 40 mph speed limit', unlikely-likely, scored −3 to +3). Higher scores reflected beliefs that the outcome was likely. **Frequency** of beliefs was measured using seven items ('I drive on urban roads at night-time', never-frequently, scored +1 to +7). Higher scores reflected behaviours that were more frequent.

Moral norm was assessed using a single seven-point item ('It would be quite wrong for me to exceed the 30 mph on a residential road, strongly disagree-strongly agree, scored +1 to +7). Higher scores reflected stronger moral norms. Reliability scores for the overall moral norm measures were good, as shown in Table 19.

Table 19: Reliability scores for overall moral norm measures

Scenario	Time 1	Time 2	Time 3
Overall speeding	0.74	0.72	0.79

[3] Note that direct measures of subjective norm were not included as it has been suggested that individuals may find it difficult to average out the manner in which all significant others would expect them to behave (McMillan, 1998).

Anticipated regret was measured as the mean of two seven-point items (e.g., 'I would regret exceeding the 40 mph speed limit on an urban road', unlikely-likely, scored −3 to +3). Higher scores reflected stronger feelings of anticipated regret. Reliability scores for the anticipated regret measures were good, as shown in Table 20.

Table 20: Reliability scores for anticipated regret measures

Scenario	Time 1	Time 2	Time 3
Motorway 70 mph	0.89	0.92	0.94
Residential 30 mph	0.93	0.94	0.96
Urban 40 mph	0.83	0.94	0.93
Overall speeding	0.86	0.88	0.87
Disengage ISA	0.88	0.94	0.95

Past behaviour was tapped by two seven point items (e.g., 'In the past I have frequently exceeded the 70 mph on a motorway, strongly disagree-strongly agree, and scored 1 to 7). Higher scores reflected more frequent commission of the behaviour in the past. Reliability scores for the past behaviour measures were good, as shown in Table 21.

Table 21: Reliability scores for past behaviour measures

Scenario	Time 1	Time 2	Time 3
Motorway 70 mph	0.97	0.92	0.91
Residential 30 mph	0.98	0.88	0.83
Urban 40 mph	0.91	0.82	0.87
Overall speeding	0.77	0.76	0.80
Disengage ISA	–	0.83	–

Self-identity was measured using one single item (e.g., 'I see myself as a safe driver', strongly disagree-strongly agree, scored +1 to +7). Higher scores reflected a stronger sense of self-identity.

Perceived susceptibility was assessed using two items (e.g., What is the risk of being involved in an accident if you exceed the 70 mph speed limit?', very low risk-very high risk, scored -3 to +3; What is the risk of being involved in an accident if you don't exceed the 70 mph speed limit?', very low risk-very high risk, scored -3 to +3). For each respondent the difference between the two scales was calculated for each scenario, by subtracting the score if they did engage in the behaviour from that for if they did not. Thus the greater the difference the greater the effect of engaging in the behaviour, with a positive score suggesting that engaging in the behaviour made them more susceptible and a negative score suggesting it made them less susceptible. Reliability scores for the perceived susceptibility measures were good, as shown in Table 22.

Table 22: Reliability scores for perceived susceptibility measures

Scenario	Time 1	Time 2	Time 3
Overall speeding	0.83	0.81	0.85

4.1.2.3 Behaviour measure

Although a number of measures of speeding behaviour were available from the logged data, a measure that was closely matched to the TPB measures and also possessed a degree of fidelity was required. The chosen measure of speeding behaviour was defined as the percentage of distance travelled during Phase 1 of the trial in which the driver exceeded the speed limit on three classes of road (70 mph, 40 mph and 30 mph roads). Distance-based data was preferred since time-based data can often introduce undue weight to the data stream when vehicle speed is zero (e.g. the vehicle stops at junctions) or very low (e.g. the vehicle moves slowly on a congested road). Conversion algorithms were therefore developed for extracting a record per 5 metres of travelling distance from the data stream. Records without a valid speed limit (e.g. when the vehicle was driven on a road outside the mapped area, on a private road etc) were removed from the analysis. Across the three speeding scenarios, the percentage of distance travelled exceeding the speed limit measure showed good consistency within participants for each phase (see Table 23).

Table 23: Reliability scores for the behaviour measure

	Phase 1	Phase 2	Phase 3
Behaviour	0.60	0.57	0.65

4.1.2.4 Sensation seeking

The Arnett (1996) Sensation Seeking Scale was used. Although the Sensation Seeking Scale Form V (Zuckerman, 1994) is one of the most popular and widely used sensation seeking scales (especially in driver behaviour research, see Jonah, 1997) it was felt that the 40 forced choice items would overload the respondents given the lengthy nature of the TPB questionnaires. As Arnett points out, it is often hard for individuals to choose between these items when both or neither applies. Secondly, since many of the items relate to physical activity, it may be that any age differences in responses would indicate differences in physical strength and not sensation seeking. The Arnett sensation seeking scale provided a short 20 item questionnaire which asked respondents to rate how likely each described them. The scale is composed of two dimensions; novelty and intensity. The internal reliability of each was tested.

Novelty subscale: 10 items measured novelty (e.g., ‘I think it fun and exciting to perform or speak in front of a group’, does not describe me at all-describes me very well, scored +1 to +4; Cronbach’s α =0.39). **Intensity** subscale: 10 items assessed intensity (e.g., ‘When I listen to music I like it to be loud’, does not describe me at all-describes me very well scored +1 to +4; Cronbach’s α = 0.63). Higher scores reflected a higher level of sensation seeking on each sub-scale.

4.1.2.5 Conscientiousness

The facets of conscientiousness were measured using a questionnaire developed as part of the International Personality Item Pool. Five facets were taken to represent those in the NEO-PI-R (http://ipip.ori.org/newNEOKey.htm)

Self efficacy: 10 items measured self efficacy (e.g., ‘complete task successfully’, very inaccurate-very accurate scored +1 to +5; Cronbach’s α = 0.79). **Orderliness:** 10 items measured orderliness (e.g., ‘like order’, very inaccurate-very accurate scored +1 to +5; Cronbach’s α = 0.84). **Dutifulness:** 10 items measured dutifulness (e.g., ‘try to follow the rules, very inaccurate-very accurate scored +1 to +5; Cronbach’s α = 0.71). **Achievement Striving:** 10 items measured achievement striving (e.g., 'demand quality' very inaccurate-very accurate scored +1 to +5; Cronbach's α = 0.78). **Self Discipline:** 10 items measured self discipline (e.g., 'get chores done right away', very inaccurate-very accurate scored +1 to +5; Cronbach's α = 0.85). **Cautiousness:** 10 items measured cautiousness (e.g., 'Avoid mistakes' very inaccurate-very accurate scored +1 to +5; Cronbach's α = 0.83). Higher scores reflected a higher level of conscientiousness on each sub-scale.

4.1.2.6 Demographic and driving characteristics

The following demographic variables were measured: age, gender (1 = male, 2= female), marital status (1 = married/living with partner, 2 = not married/living with partner), child dependency status (1= 1 or more dependent children living at home, 2 = no dependent children living at home) and National Statistics Socio-economic Classification[4] (1 = managerial/profession, 2 = intermediate occupations, 3 = small employers and own account workers, 4 = lower supervisory and technical occupations, 5 = semi routine and routine occupations). Several driving measures were also assessed: annual mileage, experience (total number of years driving), accident involvement (1= accident involved in last five years, 2 = not accident involved in last five years), driver status (1 = fleet driver[5], 2 = private driver) and area of residence (1 = urban, 2 = rural).

4.1.3 Results

Given the high internal reliability demonstrated across the three speeding scenarios, items were aggregated to provide general measures of cognitions and speeding behaviour.

4.1.3.1 Prediction of intention

In Table 24 means, standard deviations and zero order correlation coefficients for the selected measures are reported. Responses from 72 participants[6] (age range 22-60 years, M = 40.31, SD = 10.26) are included in the analysis. Participants had on average 20.69 (SD = 4.78) years of driving experience, accruing an average annual mileage of 15078 (SD = 6716) miles a year. In general, participants had not been involved in any accidents during the last five years (M = 1.75).

Generally, scores for the personality measures centred round the mid-point, although participants scored slightly higher on the facets of dutifulness (M = 4.15), self efficacy (M = 3.99) and achievement striving (M = 3.99).

Participants expressed weak intentions to exceed the speed limit (M = -0.90) and held relatively neutral attitudes towards exceeding the speed limit (M = -0.70). Typically, participants' perceived behavioural control over exceeding the speed limit was reasonably high (M = 5.47), but participants on the whole perceived there to be slightly more negative than positive outcomes of engaging in this behaviour (M = -1.93). On average, participants expressed a weak belief that significant others would disapprove (M = 4.98) and the mean scores for the control factors suggested that participants perceived that factors were more likely to inhibit than to facilitate exceeding the speed limit (M = -4.22). Participants were typically morally opposed to exceeding the speed limit (M = 5.32), but were unlikely to anticipate regretting engaging in this behaviour

[4] The National Statistics Socio-economic Classification (NS-SEC), introduced in 2001, is used for all official statistics and surveys. It replaces Social Class (SC) based on Occupation (formerly Registrar General's Social Class) and Socio-economic Groups (SEG). http://www.statistics.gov.uk/methods_quality/ns_sec/default.asp

[5] Here fleet driver refers to those drivers using their vehicle as part of work. It should be noted however that these participants were not professional drivers and thus rarely spent the majority of their working day driving the ISA vehicles.

[6] The number of drivers is reduced here due to listwise deletion (i.e. participants not completing every questionnaire item).

(M = -0.02). The frequency with which participants had sped in the past was average (M = 4.32). Mean perceived susceptibility scores suggested that the participants appreciated that exceeding the speed limit may make them more susceptible to being involved in an accident (M = 2.05). The mean self-identity score (M = 5.94) suggested that participants considered themselves to be "safe drivers".

Examination of the zero order correlations suggested that older participants expressed weaker intentions to exceed the speed limit than younger participants. Similarly more experienced participants also demonstrated weaker intentions to exceed the speed limit than less experienced participants. Participants demonstrating higher levels of sensation seeking also expressed stronger intentions to exceed the speed limit compared to those with lower levels of sensation seeking. Examination of the facets of sensation seeking suggested that participants scoring highly on the intensity subscale expressed stronger intentions to exceed the speed limit compared to those with low scores. Participants with lower levels of conscientiousness expressed stronger intentions to exceed the speed limit than those with higher levels of conscientiousness. Participants with low scores on the subscale of orderliness also expressed stronger intentions to exceed the speed limit than those with scoring highly. Similarly, participants exhibiting low levels of dutifulness expressed stronger intentions to exceed the speed limit than those scoring highly (Table 24).

Examination of the TPB constructs revealed that past behaviour provided the strongest significant correlate with intentions. Where speeding had been frequent in the past, intentions to violate were stronger. Attitudes were the second most powerful predictor; those participants who held positive attitudes towards exceeding the speed limit (they felt it was a safe, useful, beneficial behaviour etc) tended to express stronger intentions to commit the violation. A tendency to regret exceeding the speed limit was also associated with weaker intentions to engage in speeding behaviour. Participants displaying higher moral norms showed weaker intentions to speed. Intentions were stronger if participants felt that the stated control factors facilitated exceeding the speed limit. Participants who felt that their significant others would disapprove of their exceeding the speed limit held weaker intentions to engage in speeding behaviour. Those participants believing that positive outcomes were more likely to result from exceeding the speed limit reported stronger intentions to commit the violation. Intentions were weaker if participants perceived speeding would increase the risk of an accident. Higher levels of perceived behavioural control were associated with stronger intentions to engage in speeding behaviour. Self-identity was the weakest correlate with intentions. Here a stronger self-identity as a safe driver was associated with weaker intentions to engage in speeding behaviour. Comparisons of the intercorrelations amongst the TPB variables and intentions suggested there was evidence of some multicollinearity. Intercorrelations between the variables were generally higher than those observed in previous studies particularly those such as intention and past behaviour ($r = 0.81$) and intention and attitude ($r = 0.76$) (Table 24).

Table 24: Correlations and descriptive statistics for intentions and propensity to exceed the speed limit (N =72)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	31.	32.	M	SD
1. Sex	-	0.06	0.00	-0.29	-0.02	-0.07	0.05	-0.04	0.14	0.22	-0.10	-0.16	-0.10	-0.20	-0.01	-0.21	0.25	0.00	-0.08	0.09	-0.07	-0.35	-0.38	0.17	-0.30	-0.35	0.06	0.21	0.12	0.21	0.20	-0.03	1.43	0.50
2. Age		-	-0.12	0.03	0.10	0.16	0.05	-0.02	0.41	-0.06	-0.28	-0.19	0.09	0.07	0.04	-0.21	0.04	0.08	0.13	0.10	-0.26	-0.39	-0.48	0.21	-0.31	-0.49	0.08	0.22	0.27	0.11	0.08	0.18	40.31	10.26
3. Marital Status			-	0.27	0.32	-0.05	-0.12	0.07	-0.16	0.17	0.06	0.00	0.04	-0.19	0.06	-0.12	-0.10	-0.02	0.23	-0.08	-0.05	0.26	0.28	-0.05	0.23	0.25	0.14	-0.17	0.07	0.11	0.05	-0.29	1.29	0.46
4. Dependant Children				-	0.06	0.12	0.00	0.17	0.18	-0.19	-0.18	-0.09	-0.01	0.10	-0.02	-0.08	-0.06	0.03	0.11	-0.09	-0.13	0.11	0.23	-0.10	0.24	0.16	-0.15	-0.22	0.02	-0.07	0.02	-0.06	1.56	0.50
5. NS-SEC					-	-0.16	0.10	0.29	0.09	0.08	-0.17	-0.14	-0.08	-0.21	0.07	-0.15	0.01	0.01	0.16	0.15	-0.22	0.01	0.11	-0.06	0.05	0.13	-0.05	0.00	0.09	-0.11	0.08	-0.25	1.57	1.05
6. Annual Mileage						-	-0.04	0.07	0.17	-0.13	0.00	0.01	0.06	0.15	0.05	-0.09	0.15	0.10	0.05	-0.11	0.03	0.04	-0.09	0.11	-0.09	-0.07	0.07	0.14	0.05	0.09	0.08	0.09	15077.98	6716.53
7. Accident Involvment							-	0.12	0.16	0.05	-0.02	-0.04	-0.12	0.07	0.00	-0.11	0.01	0.01	-0.03	-0.04	-0.12	-0.07	-0.09	0.03	0.00	-0.13	0.00	0.06	-0.01	-0.15	-0.01	0.17	1.75	0.44
8. Business Driver								-	0.19	-0.01	0.02	0.04	-0.03	0.03	-0.12	-0.01	-0.09	-0.05	-0.09	-0.06	0.00	0.08	-0.08	-0.11	-0.19	0.03	-0.18	-0.04	-0.12	-0.18	0.06	-0.09	1.38	0.49
9. Experience									-	-0.12	-0.24	-0.19	-0.28	-0.08	0.12	-0.22	0.09	0.13	0.12	0.27	-0.28	-0.25	-0.35	0.01	-0.21	-0.37	-0.09	0.07	-0.09	-0.08	0.11	0.07	20.69	4.78
10. Area										-	0.04	-0.01	-0.09	-0.20	0.10	0.06	0.07	0.13	-0.03	0.17	-0.02	-0.16	0.14	-0.23	0.03	0.19	-0.08	-0.18	-0.25	-0.04	-0.12	-0.37	1.49	0.50
11. Intention											-	0.76	0.44	0.55	-0.60	0.68	-0.69	-0.70	-0.27	-0.48	0.81	0.33	0.38	-0.32	0.18	0.44	-0.13	-0.24	-0.34	-0.21	-0.31	-0.23	-0.90	1.26
12. Attitude												-	0.51	0.53	-0.62	0.69	-0.63	-0.63	-0.20	-0.57	0.79	0.30	0.43	-0.29	0.32	0.41	-0.19	-0.24	-0.26	-0.16	-0.30	-0.18	-0.70	0.98
13. PBC													-	0.35	-0.41	0.50	-0.33	-0.51	-0.07	-0.46	0.52	0.02	0.18	0.01	0.16	0.15	0.03	0.02	0.11	0.00	-0.06	-0.01	5.47	0.97
14. BB X OE														-	-0.64	0.44	-0.61	-0.48	-0.10	-0.53	0.56	0.23	0.14	-0.16	0.12	0.12	-0.20	-0.13	-0.22	-0.10	-0.18	0.03	-1.93	1.81
15. NB X MC															-	-0.51	0.63	0.62	0.19	0.58	-0.52	-0.19	-0.21	0.24	-0.09	-0.24	0.33	0.19	0.17	0.25	0.27	-0.02	4.98	5.49
16. CB X P																-	-0.46	-0.52	-0.20	-0.44	0.75	0.36	0.33	-0.27	0.19	0.36	-0.17	-0.14	-0.25	-0.23	-0.35	-0.12	-4.22	4.19
17. Moral Norm																	-	0.74	0.14	0.53	-0.63	-0.37	-0.36	0.31	-0.25	-0.35	0.25	0.31	0.22	0.27	0.31	0.07	5.32	1.27
18. Anticipated Regret																		-	0.05	0.52	-0.70	-0.23	-0.21	0.16	-0.13	-0.21	0.17	0.08	0.12	0.21	0.20	-0.02	-0.02	1.59
19. Self Identity																			-	0.10	-0.23	-0.02	-0.07	0.28	0.05	-0.14	0.20	0.28	0.14	0.21	0.30	0.15	5.94	1.10
20. Perceived Susceptibility																				-	-0.50	-0.39	-0.19	0.11	-0.17	-0.16	0.11	0.14	0.01	0.07	0.15	-0.02	5.33	2.05
21. Past Behaviour																					-	0.36	0.39	-0.24	0.22	0.42	-0.11	-0.14	-0.29	-0.18	-0.27	-0.12	4.32	1.60
22. Behaviour																						-	0.49	-0.02	0.41	0.42	0.07	-0.07	0.00	-0.04	-0.08	0.06	33.50	13.30
23. Sensation Seeking																							-	-0.34	0.81	0.88	-0.05	-0.37	-0.27	-0.15	-0.24	-0.39	2.48	0.38
24. Conscientiousness																								-	-0.19	-0.37	0.78	0.78	0.74	0.78	0.83	0.72	3.84	0.45
25. Novelty																									-	0.45	0.01	-0.27	-0.15	-0.05	-0.14	-0.20	2.68	0.39
26. Intensity																										-	-0.09	-0.35	-0.30	-0.19	-0.26	-0.45	2.29	0.49
27. Self Efficacy																											-	0.41	0.61	0.71	0.59	0.45	3.99	0.47
28. Orderliness																												-	0.43	0.45	0.62	0.53	3.73	0.71
29. Dutifulness																													-	0.50	0.47	0.53	4.15	0.48
30. Achienvement Striving																														-	0.73	0.32	3.99	0.53
31. Self Discipline																															-	0.42	3.65	0.65
32. Cautiousness																																-	3.53	0.68

Note: r > 0.23, p<0.05., r > 0.30,p <0.01., r > 0.38, p<0.001.

Given the limited sample and evidence of multicollinearity, we were unable to test the extended TPB model in terms of predictive power. A decision was therefore made to test the basic TPB model.

Intention to exceed the speed limit was regressed on the measures of attitude, normative beliefs and PBC (see Table 25). As can be seen the three independent variables accounted for 60.9% of the variance in participants' intentions to exceed the speed limit (R^2 = 0.61, F (3,74) = 38.48, p < .001). Both attitude (β = 0.64, p < .001) and normative beliefs (β = -0.19, p < .05) proved significant and independent predictors of intentions.

Table 25: Regression analysis for intentions to exceed the speed limit (N = 78)

Step/Predictor	R^2	F	B
1.			
Attitude	0.61	38.48	0.64***
PBC			0.01
Normative beliefs			-0.19*

Note: * p < .05, ** p < .01 ***, p < .001

Those demonstrating stronger intentions to exceed the posted speed limit, compared to those who did not:

- expressed more favourable attitudes towards speeding
- perceived less social pressure not to engage in speeding.

4.1.3.2 Prediction of behaviour

Descriptives for the TPB variables are as before (see section 4.1.3.1). On average, 34% of the distance travelled in participants' first month of driving was spent exceeding the speed limit (M = 33.50).

Significant correlations between behaviour and gender suggested that males showed a stronger propensity to exceed the speed limit than females. Similarly younger participants were more likely to exceed the speed limit than older participants. Participants who were married or living with a partner were less likely to exceed the speed limit. Although the overall measure of sensation-seeking did not correlate with behaviour, the two facets (novelty and intensity) provided significant correlates. Participants scoring highly on the intensity subscale demonstrated a stronger propensity to exceed the speed limit compared to those with low scores. Also participants scoring highly on the novelty subscale expressed a stronger propensity to exceed the speed limit compared to those with low scores.

Examination of the TPB constructs suggested that perceived susceptibility was the strongest correlate with behaviour. Those who perceived speeding would increase the risk of an accident demonstrated a weaker propensity to engage in the behaviour. Moral norm was the second most powerful predictor. Participants displaying higher moral norms showed a weaker propensity to speed than those expressing weaker moral norms. The propensity to speed was stronger amongst participants who believed that the stated control factors facilitated exceeding the speed limit. Past behaviour was the fourth most powerful correlate. Participants who had frequently engaged in speeding in the past were more likely to do so in the future compared to those who had not. Although highly significant, intention was only the fifth strongest correlate such that those who intended to speed demonstrated a stronger propensity to engage in this behaviour than those who did not. Participants expressing favourable attitudes towards exceeding the speed limit were also more likely to engage in speeding than those possessing less favourable attitudes. Similarly those believing that more positive outcomes would result from speeding also demonstrated a greater propensity to speed. PBC, normative beliefs, anticipated regret and self-identity did not correlate with observed speeding behaviour.

In accordance with the previous analysis, the basic TPB was utilised to predict observed speeding behaviour, thus overcoming the issues of the limited sample and evidence of multi-collinearity.

Behaviour was regressed on the measures of intention and PBC (see Table 26). As can be seen, the two independent variables accounted for 11.0% of the variance in participants' propensity to exceed the speed limit (R^2 = 0.11, F (2,74) = 4.59, p < .05). Only intention proved a significant predictor of behaviour (β = 0.37, p < .01).

Table 26: Regression analysis for participants' propensity to exceed the speed limit (N = 77)

Step/Predictor	R^2	F	β
1.			
Intention	0.11	4.59	0.37**
PBC			-0.15

Note: * p < .05, ** p < .01 ***, p < .001

Those demonstrating a greater propensity to exceed the posted speed limit, compared to those who did not:

- expressed stronger intentions to exceed the speed limit.

4.1.3.3 Distinguishing intenders from non-intenders

In order to examine any systematic differences in those participants who intend to exceed the speed limit and those who do not, statistical comparisons were made across behavioural beliefs, outcome evaluations, normative beliefs, motivations to comply, control beliefs and power. Full details of the analysis can be found in Appendix C.

The majority of beliefs and evaluations served to distinguish intenders from non-intenders suggesting that these could provide useful targets for intervention. Findings suggested that participants' evaluations of the likelihood of an accident and the benefits of speeding (saving time, positive emotive reactions) account for the differences in participants' motivations to speed and provide much more useful effective targets for intervention. There were fewer differences in perceptions of the likelihood and evaluation of the legal implications of speeding (e.g. being stopped by the police, being against the law, getting prosecuted and fined). This implies that both intenders and non-intenders recognise and accept the link between speeding and the law (the outcome is seen as likely and evaluated negatively) and suggests that referring to these risks may not provide an effective focus for campaigns designed to reduce speeding behaviour.

All five referent groups (police, other road users, family, friends, spouse/partner) emerged as groups that were perceived differently by intenders and non-intenders. Those not intending to exceed the speed limit perceived significantly more social pressure from their significant others and in general expressed a greater motivation to these groups. The police were the most influential referents.

Intenders rated all the stated control factors as significantly less inhibiting than non-intenders. Positive affective reactions to speeding were seen to facilitate speeding amongst intenders whilst inhibiting the behaviour in non-intenders. Since behavioural belief measures had suggested intenders were significantly more likely to feel good when speeding compared to non-intenders, positive affective reactions seem an important factor relating to participants' intentions to speed.

4.1.4 Discussion

This analysis initially intended to provide the first test of an extended TPB model with respect to objectively measured speeding behaviour. Evidence of multi-collinearity and a limited sample size however made it impossible to test the proposed extensions of a TPB. The analysis has therefore concentrated on testing the predictive utility of the basic TPB model.

Attitudes and normative beliefs predicted participants' intentions to exceed the posted speed limit explaining 61% of the variance. The role of attitudes and perceived social pressure in predicting speeding intentions has been consistently reported across a number of studies (e.g., Parker et al., 1992). The present study then went on to extend previous TPB work within the driver behaviour domain which has, until now, relied upon self-report measures of speeding or the use of driving simulators. Whilst previous work (Conner et al., 2007; Elliott et al., 2007) has demonstrated the utility of using objective measures of behaviour such as those collected on driving simulators, external factors common to driving in the real world are likely to influence an individual's speeding behaviour. In order to address this issue, speed data collected over a period of 28 days using an instrumented vehicle, provided a measure of participants' general speeding behaviour on a range of differing roads and environments. Despite the failure to test an extended TPB model, to our knowledge, this study remains the only truly prospective test of the intention-behaviour relationship using objective and ecologically valid assessed speeding behaviour.

Intentions were found to reliably predict participants' propensity to speed explaining 11% of the variance. Analysis conducted by Elliott et al. (2003) suggested that intentions and PBC accounted for 32% of the variance in self-reported behaviour after controlling for demographic variables. Similarly, Elliot et al. (2007) examined speeding behaviour on a driving simulator and found that the measures of intention and PBC explained between 31% and 39% of the variance. The present analysis would therefore suggest that the TPB model is more successful in predicting self-reported speeding behaviour or behaviour measured in a simulator where the external influences on speeding behaviour are minimal and controlled. Findings here are in line with Armitage and Conner (2001) who noted a marked difference between studies employing self-report and objectively assessed behaviour. Nevertheless, although the present model predicted only 11% of the variance in speeding behaviour, the intention-behaviour relationship ($r = 0.31$) is still considered to equate to a medium effect size (Cohen, 1992).

The findings for PBC are less usual. PBC did not have an effect on either intentions or behaviour. In previous studies PBC has been found to successfully predict self-reported compliance with the speed limit (Elliott et al., 2003; Elliott et al., 2007) and self-reported speeding (Letirand and Delhomme, 2005). Similarly, studies employing objective measures of behaviour have also demonstrated the influence of PBC. Conner et al. (2007) noted that PBC directly predicted speeding behaviour measured using a driving simulator. This may suggest therefore that the measures utilised within the current study failed to tap the PBC construct.

It is worth noting, however, that four other studies also report similar findings to the current study. Within these, PBC failed to predict self-reported speeding behaviour (De Pelsmacker and Janssens, 2007), speeding behaviour measured on a simulator (Elliott et al., 2007), speeding behaviour using on-road speed camera assessments (Conner et al., 2007) and speeding behaviour logged using an instrumented vehicle (Warner and Åberg, 2006). In the latter study, self-reported speeding replaced measures of intention. Although PBC predicted self-report speeding, it did not predict logged speeding (except through its contribution to self-reported speeding). Since PBC is believed to represent a proxy of actual control (Ajzen, 1991), Warner and Åberg (2006) argue therefore that the experienced drivers took account of their actual control when reporting their previous speeding behaviour. The lack of external pressures (such as time pressure or risk of being caught by the police) within the simulated environment was discussed as a potential explanation by Elliott et al. (2007). Since the current study found similar results using real-world speeding behaviour however, Elliott et al.'s (2007) explanation does not seem to apply. Alternatively, De Pelsmacker and Janssens (2007) argued simply that because an individual is always able to control their speed in traffic, PBC has little influence over behaviour[7]. Results of the current analysis might be seen to support this, suggesting that speeding is to a large extent under an individual's volitional control. However, given the mixed evidence across self-report and objectively assessed speeding behaviour studies, the influence of PBC upon speeding behaviour remains unclear and would seem to warrant further investigation using real-world data.

One of the important analyses reported in relation to interventions was the analysis of the beliefs which distinguish those who intend to engage in speeding from those who do not. The vast majority of beliefs and evaluations assessed significantly distinguished intenders from non-intenders. This would suggest that the survey was generally successful in identifying the key beliefs that distinguish intenders from non-intenders. It also indicates that the vast majority of these beliefs could legitimately form the focus of interventions.

4.2 The impact of ISA on cognitions relating to speeding

4.2.1 Introduction

Previous studies of intervening ISA systems and the behavioural results presented within this report have demonstrated the potential of ISA systems in reducing mean speeds, 85th percentile speeds and variability in the speed distribution. However, changes in speeding behaviour have also been noted with systems which exert no control over the vehicle, which might imply that the observed behavioural changes are caused by underlying changes in cognitions. Yet, despite the wealth of literature documenting the behavioural impact of ISA systems, few studies have examined the effect of ISA upon cognitions relating to speeding, concentrating instead on drivers' attitudes towards the actual ISA system.

Those studies which have probed drivers' attitudes towards speeding have tended to employ basic measures of attitudes and the available reports provide only a brief synopsis of the changes in opinion. In the Belgian ISA trial (reported in Olsson, 2004), for example, drivers were more likely to believe that the speed limits in 30 mph areas were too low following experience with a haptic throttle ISA system (23% before, 36% during, 41% after). Drivers were also less likely to believe that speeding saved time following experience with the system. However, the responses are rather limited and do not allow tests of statistical significance.

Nevertheless it seems reasonable to suppose that experience with an ISA system may prompt a change in drivers' cognitions. As discussed, the TPB argues that speed choice depends on psychological factors such as beliefs, attitudes and perceived control. If experience with ISA modified attitudes towards speeding, this should contribute to a lasting change in behaviour. Ajzen (2005) argues that changes in the attitudes, subjective norms and perceived behavioural control should produce changes in intentions, which in turn should lead to changes in behaviour (given adequate control over a behaviour). In order to change these constructs Ajzen (2005)

[7] However it should be noted that although this study examined constructs within the TPB it failed to test the influence of variables within the conceptual framework of the TPB

emphasises that the underlying behavioural, normative and control beliefs should be targeted for change or new salient beliefs designed to produce positive change should be introduced. Typically, persuasive messages would be used to change or introduce beliefs; however, experience with ISA could indirectly achieve the former. For example, evidence suggests that drivers' speed choice is related to the behavioural belief that speeding saves journey time. Since ISA trials have tended to demonstrate that complying with the speed limit does not necessarily increase journey time (e.g. Comte and Carsten, 1999), actual experience with an ISA system may serve to correct drivers' beliefs relating to the perceived benefits of speeding, producing positive attitude change. Indeed, Fujii, Gärling, and Kitamura (2001) found that drivers tended to have negative beliefs about public transport but following experience of using public transport, these beliefs were modified in a positive direction.

In terms of control, individuals are more likely to perform a behaviour when it is easy rather than difficult to perform. An individual's perceived control is influenced by the extent of the opportunity to perform a behaviour and the availability of resources to help them in the performance of this behaviour. An individual's perception of control is assumed to be the product of the individual's evaluation of factors likely to facilitate/inhibit the performance of a behaviour and the frequency of their occurrence (control beliefs). These control beliefs can be both internal (information, skills, emotions) and external (opportunities, barriers) in their nature. In their examination of control beliefs relating to speeding, Elliott et al. (2005) noted that clearly-signed speed limits were perceived to facilitate speed limit compliance such that drivers who were more likely to believe this expressed stronger intentions to comply with the speed limit. Thus, providing drivers with continual speed limit information via an ISA system could potentially raise an individual's perceived behavioural control. Elsewhere, Bandura (1986) suggests that self-efficacy beliefs comprise of four principal sources of information. These sources are enactive mastery experience, that is, the experience from performing similar tasks; vicarious experiences; verbal persuasion; and physiological and affective states. Bandura (1982) suggests that previous performance accomplishments are the most powerful source of self-efficacy such that successful performance tends to raise efficacy expectations and failures tend to lower it. Hence, driving with an ISA system that imposed control over the vehicle speed could increase PBC by providing an opportunity to engage in speed limit compliance with relative ease and repeated success.

Alternatively, if we are to believe that speeding is partially under the control of automatic processes (Elliott, Armitage, and Baughan, 2003), ISA may provide a useful tool in establishing new habits. Whilst there is no doubt that speeding is, to a large extent, a deliberate behaviour rationalised by drivers, the automatic processes that may also govern this behaviour would suggest that speeding is somewhat resistant to behavioural change. Typical information- based interventions would be unsuccessful in changing habituated behaviour since they rely upon the individual's ability to control their behaviour, placing considerable demand on motivational resources and relying ultimately on a desire to change (Verplanken and Wood, 2006). When tackling established habits, Ouellette and Wood (1998) argue therefore that the most effective behavioural change strategies are those that "impede performance of established behaviour while facilitating formation of new behaviours into habits" (p.70). Since an intervening ISA system imposes speed limit compliance, prolonged experience with this system may provide a stable context in which an individual can form new associations in memory between their actions and environment.

To date, only one study has used specific psychological theory to monitor changes in cognitions as a result of experience with an ISA system. As part of the Borlänge field trials, Warner (2006) collected measures of drivers' attitudes, PBC, and subjective norm with respect to speeding before (March 2001) and during activation of the warning ISA system (December, 2001 and

June, 2004). Comparisons of median values suggested that, a year after activation, drivers found it slightly more acceptable to exceed the speed limit and harder to comply with the speed limits. However, the difference was non-significant and in 2004, compared to December 2001, drivers held significantly less favourable attitudes towards speeding and perceived that they had significantly more control over complying with the speed limit. Although beliefs were not significantly different to those expressed before the activation of the system, median values were lower than those previously reported. Self-reported speeding however did not decline over time, suggesting that the small changes in cognitions observed were not sufficient to produce a change in intentions and behaviour. Whilst the results provide only modest evidence for the impact of ISA on cognitions, the results are based on a limited sample size (n = 27). Furthermore, since the ISA system was purely informative, more substantial changes in cognitions may be observed following experience with an intervening ISA system since these systems strongly encourage speed limit compliance and make compliance much easier, thus providing the best opportunity to challenge drivers' inaccurate beliefs.

It is possible to argue therefore that long-term experience with an intervening but overridable ISA system may result in a change in both cognitions and behaviour. Given that, by nature, the ISA system designed in this trial offers restricted opportunities to speed, it may seem redundant to evaluate the potential of this system in changing cognitions. However, since the implementation path of ISA is undetermined, it is of interest to evaluate the potential of the short-term use of ISA as a tool for reducing speeding behaviour. Restricting young and learner participants during their novice years could, for example, help establish habituated pro-safety behaviours.

4.2.2 Results

4.2.2.1 Impact of ISA on key predictors of speeding intentions and behaviour

In order to determine whether the key predictors of speeding intentions and behaviour changed following experience with the ISA system a set of comparative regressions were conducted (see appendix D for full details).

Comparisons of the regression models suggested that the significant predictors of intentions, namely attitude and normative beliefs, remained consistent over time. Beta weightings across the models were remarkably similar suggesting that experience with the ISA system did not alter the factors that determine intentions to exceed the speed limit. Intentions expressed prior to the activation of ISA were not predictive of speeding behaviour under ISA control, or speeding behaviour measured following a return to unsupported driving. Intentions measured following experience with the ISA system however, were found to successfully predict subsequent unrestricted speeding behaviour. Here intentions predicted 18% of the variance in participants' propensity to exceed the speed limit. Prediction of speeding behaviour during Phase 3 was somewhat improved compared to Phase 1 speeding suggesting that experience of taking part in the trial and using the ISA system may have forced participants to consider their speeding behaviour and cognitions more accurately.

4.2.2.2 Impact of the ISA intervention on speeding behaviour and the individual TPB constructs

Speeding scenario

In order to examine changes in behaviour and cognitions as a result of the ISA intervention comparisons were made across the mean ratings of each individual construct at each time point (Table 27 and Table 28).

Intentions to speed were relatively weak and comparisons over time suggest that intentions weakened further as a result of experience with the ISA system. Given the intervening nature of the system, past behaviour scores are as expected. Drivers' self-reported propensity to exceed the speed decreased during Phase 2. There was little change over time in terms of the remaining TPB constructs.

Comparisons across the groups indicated that, compared to females, male participants' consistently upheld cognitions that were more in favour of speeding. Whilst female participants expressed less favourable attitudes towards speeding, perceived greater social pressure not to speed and rated speeding as less morally acceptable than male participants, males expressed a greater self-identity as a safe driver than females. Differences between old and young participants were less apparent and inconsistent. In general however, compared to younger participants, older participants appeared to express beliefs that were less favourable towards to speeding.

Table 27: Descriptives for behaviour and TPB constructs (intention, attitude, PBC, behavioural beliefs and control beliefs) by time by sex by age

			Behaviour			Intention			Attitude			PBC			Behavioural Beliefs			Control Beliefs		
Phase	Sex	Age	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	42.32	12.63	18	-0.61	1.06	14	-0.41	0.46	13	5.52	0.45	14	-1.47	1.29	14	-2.58	3.26	14
		old	33.64	13.07	25	-0.89	1.36	24	-0.50	1.06	24	5.69	0.80	24	-1.49	2.30	24	-3.73	3.08	24
		Total	**37.27**	**13.45**	**43**	**-0.79**	**1.25**	**38**	**-0.47**	**0.89**	**37**	**5.62**	**0.69**	**38**	**-1.48**	**1.97**	**38**	**-3.31**	**3.15**	**38**
	Female	young	29.55	9.70	17	-1.15	0.93	16	-0.88	0.88	16	5.34	1.20	16	-2.57	1.25	16	-4.97	4.60	16
		old	27.19	11.95	18	-0.96	1.36	14	-0.97	1.06	14	5.46	0.78	14	-2.27	1.15	14	-5.27	3.76	14
		Total	**28.33**	**10.82**	**35**	**-1.06**	**1.13**	**30**	**-0.92**	**0.95**	**30**	**5.40**	**1.01**	**30**	**-2.43**	**1.19**	**30**	**-5.11**	**4.16**	**30**
	Total	young	36.12	12.88	35	-0.90	1.01	30	-0.67	0.75	29	5.42	0.92	30	-2.06	1.37	30	-3.85	4.14	30
		old	30.94	12.88	43	-0.91	1.34	38	-0.67	1.07	38	5.60	0.79	38	-1.78	1.98	38	-4.30	3.38	38
		Total	**33.26**	**13.06**	**78**	**-0.91**	**1.20**	**68**	**-0.67**	**0.94**	**67**	**5.52**	**0.85**	**68**	**-1.90**	**1.73**	**68**	**-4.10**	**3.71**	**68**
Time 2	Male	young	32.95	10.55	18	-0.50	0.87	14	-0.46	0.68	13	5.63	0.74	14	-1.19	1.47	14	-2.10	5.34	14
		old	27.43	11.84	25	-1.22	1.22	24	-0.63	0.87	24	5.69	1.14	24	-1.40	2.02	24	-3.90	3.13	24
		Total	**29.74**	**11.52**	**43**	**-0.96**	**1.15**	**38**	**-0.57**	**0.80**	**37**	**5.67**	**1.00**	**38**	**-1.32**	**1.82**	**38**	**-3.24**	**4.11**	**38**
	Female	young	24.94	8.16	17	-1.26	1.07	16	-0.78	0.98	16	5.51	1.06	16	-1.95	1.12	16	-3.92	3.76	16
		old	24.99	9.85	18	-1.58	1.16	14	-1.22	1.30	14	5.28	0.77	14	-2.60	1.79	14	-4.60	4.50	14
		Total	**24.97**	**8.94**	**35**	**-1.41**	**1.11**	**30**	**-0.99**	**1.14**	**30**	**5.41**	**0.93**	**30**	**-2.26**	**1.48**	**30**	**-4.23**	**4.06**	**30**
	Total	young	29.06	10.17	35	-0.91	1.04	30	-0.64	0.86	29	5.57	0.91	30	-1.60	1.33	30	-3.07	4.58	30
		old	26.41	10.99	43	-1.36	1.19	38	-0.85	1.07	38	5.54	1.03	38	-1.84	2.00	38	-4.16	3.65	38
		Total	**27.60**	**10.65**	**78**	**-1.16**	**1.14**	**68**	**-0.76**	**0.98**	**67**	**5.55**	**0.97**	**68**	**-1.74**	**1.73**	**68**	**-3.68**	**4.09**	**68**
Time 3	Male	young	38.82	11.84	18	-0.78	1.30	14	-0.52	0.76	13	5.42	0.76	14	-1.15	1.79	14	-1.89	4.01	14
		old	34.47	14.63	25	-1.21	1.28	24	-0.63	0.99	24	5.49	1.27	24	-1.19	2.42	24	-3.47	4.57	24
		Total	**36.29**	**13.56**	**43**	**-1.05**	**1.29**	**38**	**-0.59**	**0.90**	**37**	**5.46**	**1.10**	**38**	**-1.17**	**2.18**	**38**	**-2.89**	**4.39**	**38**
	Female	young	33.22	12.20	17	-1.38	1.17	16	-0.83	1.03	16	5.76	1.12	16	-1.75	1.24	16	-3.05	3.80	16
		old	25.54	9.53	18	-1.75	0.95	14	-1.25	1.31	14	5.27	0.78	14	-2.59	1.53	14	-5.85	4.81	14
		Total	**29.27**	**11.43**	**35**	**-1.55**	**1.07**	**30**	**-1.03**	**1.17**	**30**	**5.53**	**0.99**	**30**	**-2.15**	**1.42**	**30**	**-4.36**	**4.45**	**30**
	Total	young	36.10	12.18	35	-1.10	1.25	30	-0.69	0.92	29	5.60	0.97	30	-1.47	1.53	30	-2.51	3.88	30
		old	30.73	13.38	43	-1.41	1.19	38	-0.86	1.14	38	5.41	1.11	38	-1.71	2.22	38	-4.35	4.74	38
		Total	**33.14**	**13.05**	**78**	**-1.27**	**1.21**	**68**	**-0.79**	**1.04**	**67**	**5.49**	**1.04**	**68**	**-1.60**	**1.93**	**68**	**-3.54**	**4.45**	**68**

Table 28: Descriptives for behaviour and TPB constructs (normative beliefs, moral norm, anticipated regret, past behaviour, self-identity and perceived susceptibility) by time by sex by age

			Normative Beliefs			Moral Norm			Anticipated Regret			Past Behaviour			Self Identity			Perceived Suscept.		
Phase	Sex	Age	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	3.48	3.78	14	5.24	0.74	14	0.04	0.90	14	4.70	1.13	14	6.00	0.88	14	1.93	0.93	14
		old	5.61	6.91	24	4.97	1.51	24	-0.01	1.74	24	4.43	1.75	24	6.00	1.22	24	2.01	1.73	24
		Total	**4.83**	**5.98**	**38**	**5.07**	**1.28**	**38**	**0.01**	**1.48**	**38**	**4.53**	**1.54**	**38**	**6.00**	**1.09**	**38**	**1.98**	**1.47**	**38**
	Female	young	5.98	5.55	16	5.48	1.05	16	-0.44	1.42	16	4.45	1.32	16	5.88	1.02	16	1.85	1.47	16
		old	4.80	4.29	14	5.85	1.13	14	0.46	1.74	14	3.95	1.48	14	5.64	1.15	14	2.60	1.62	14
		Total	**5.42**	**4.96**	**30**	**5.65**	**1.09**	**30**	**-0.02**	**1.62**	**30**	**4.21**	**1.40**	**30**	**5.77**	**1.07**	**30**	**2.20**	**1.56**	**30**
	Total	young	4.81	4.90	30	5.37	0.92	30	-0.22	1.21	30	4.57	1.22	30	5.93	0.94	30	1.89	1.22	30
		old	5.31	6.03	38	5.29	1.44	38	0.16	1.74	38	4.25	1.65	38	5.87	1.19	38	2.22	1.69	38
		Total	**5.09**	**5.52**	**68**	**5.32**	**1.23**	**68**	**0.00**	**1.53**	**68**	**4.39**	**1.48**	**68**	**5.90**	**1.08**	**68**	**2.08**	**1.50**	**68**
Time 2	Male	young	2.84	3.58	14	4.95	0.90	14	0.12	1.01	14	3.95	1.25	14	5.43	1.50	14	1.69	0.94	14
		old	4.43	6.89	24	5.05	1.41	24	-0.08	1.62	24	3.37	1.66	24	5.96	1.16	24	1.76	1.68	24
		Total	**3.84**	**5.89**	**38**	**5.01**	**1.23**	**38**	**0.00**	**1.41**	**38**	**3.58**	**1.53**	**38**	**5.76**	**1.30**	**38**	**1.74**	**1.43**	**38**
	Female	young	3.05	4.55	16	5.19	1.07	16	-0.27	1.42	16	3.89	1.19	16	5.69	0.79	16	1.48	1.31	16
		old	5.06	5.84	14	5.98	1.04	14	0.62	1.83	14	2.92	1.15	14	5.79	0.97	14	2.62	1.65	14
		Total	**3.99**	**5.20**	**30**	**5.56**	**1.12**	**30**	**0.14**	**1.66**	**30**	**3.43**	**1.25**	**30**	**5.73**	**0.87**	**30**	**2.01**	**1.56**	**30**
	Total	young	2.95	4.06	30	5.08	0.99	30	-0.09	1.24	30	3.92	1.20	30	5.57	1.17	30	1.58	1.14	30
		old	4.66	6.45	38	5.39	1.35	38	0.18	1.71	38	3.20	1.49	38	5.89	1.09	38	2.08	1.70	38
		Total	**3.91**	**5.55**	**68**	**5.25**	**1.21**	**68**	**0.06**	**1.51**	**68**	**3.52**	**1.41**	**68**	**5.75**	**1.12**	**68**	**1.86**	**1.49**	**68**
Time 3	Male	young	2.97	5.96	14	5.14	1.16	14	-0.36	0.96	14	4.19	1.23	14	6.07	0.73	14	1.88	1.12	14
		old	5.49	7.40	24	4.90	1.57	24	0.07	1.61	24	3.69	1.64	24	5.88	1.45	24	1.38	2.23	24
		Total	**4.56**	**6.93**	**38**	**4.99**	**1.42**	**38**	**-0.09**	**1.41**	**38**	**3.87**	**1.51**	**38**	**5.95**	**1.23**	**38**	**1.56**	**1.90**	**38**
	Female	young	3.98	5.75	16	5.21	1.06	16	-0.51	1.58	16	4.28	1.21	16	5.88	0.89	16	1.50	1.12	16
		old	5.64	5.77	14	6.05	0.86	14	0.57	1.72	14	3.19	1.32	14	5.79	0.80	14	3.05	2.11	14
		Total	**4.76**	**5.72**	**30**	**5.60**	**1.04**	**30**	**-0.01**	**1.71**	**30**	**3.77**	**1.36**	**30**	**5.83**	**0.83**	**30**	**2.22**	**1.81**	**30**
	Total	young	3.51	5.77	30	5.18	1.09	30	-0.44	1.31	30	4.24	1.20	30	5.97	0.81	30	1.68	1.12	30
		old	5.55	6.76	38	5.32	1.45	38	0.25	1.65	38	3.50	1.53	38	5.84	1.24	38	1.99	2.31	38
		Total	**4.65**	**6.38**	**68**	**5.26**	**1.30**	**68**	**-0.05**	**1.54**	**68**	**3.83**	**1.43**	**68**	**5.90**	**1.07**	**68**	**1.85**	**1.87**	**68**

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on the individual TPB constructs[8]. Results are reported in Table 29. Given the large number of tests, only significant main effects or interactions[9] are reported.

Table 29: Results of ANOVA for TPB constructs (speeding scenario)

TPB Construct	Sig	Description
Main Effect of Time		
Percentage of distance travelled speeding	***	Speeding behaviour measured at time 2 was significantly lower that recorded at time 1 or time 3. During the activation of ISA participants' speeding behaviour was significantly reduced (F(1.89, 139.98) = 16.41, p < .001).
Intention	**	Ratings measured at time 3 were significantly lower than those measured at time 1. Following experience with ISA, participants expressed significantly weaker intentions to exceed the speed limit (F(1.88, 120.34) = 6.24, p < .01).
Past behaviour	***	Ratings at time 1 were significantly higher than those reported at time 2 and time 3. Following experience with ISA, participants reported that they engaged in significantly less speeding (F(2,128) = 11.62, p < .001).
Main Effect of Gender		
Attitude	*	Compared to male participants, female participants held significantly less favourable attitudes towards speeding (F(1,63) = 4.36, p < .05).
Moral norm	*	Compared to male participants, female participants expressed significantly stronger moral norms not to speed (F(1,64) = 4.59, p < .05).
Main Effect of Age Group		
Past behaviour	*	Compared to older participants, young participants' reports of past speeding behaviour were significantly higher (F(1,64) = 5.51, p < .05).

Disengage scenario

Changes in cognitions relating to disengaging the ISA system were also examined. Comparisons were made across the mean ratings of each individual construct at each time point (Table 31).

Although intention scores remained negative, suggesting that the desire to override the system was weak, the mean trend suggested that experience with the system increased participants' intentions to disengage the system. Attitudes towards disengaging the system however did not differ over time. Following experience with ISA, participants appeared to report feeling in greater control of their ability to disengage the system. This is perhaps a reflection of the participants' realisation of the ease with which they could override the system. Since participants were not instructed on the functionality of the system during Phase 1 they may have believed that overriding the system would be difficult and cumbersome. The mean trends also suggest that, following experience with ISA, participants were less likely to consider overriding the system morally unacceptable and less likely to anticipate regretting overriding the system. Nevertheless

[8] For all ANOVAs discussed in the report, Bonferroni correction was used in order to control the familywise error rate.
[9] Note higher order (3-,4-way) interactions are omitted throughout analysis due to the difficulty in attributing meaningful explanations to these effects and lack of any consistent pattern.

participants perceived that disengaging the system increased their susceptibility to an accident (although differences across time were minimal).

Comparisons across the groups suggested that compared to their counterparts, female participants and older participants tended to express weaker intentions to override the system, less favourable attitudes towards disengaging, stronger social pressure not to disengage the ISA system, perceive greater susceptibility to accident and anticipate stronger feelings of regret if they did disengage the system.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on the individual TPB constructs. Results are reported in Table 30. Given the large number of tests, only significant main effects or interactions are reported.

Table 30: Results of ANOVA for TPB constructs (disengage scenario)

TPB Construct	Sig	Description
Main Effect of Time		
PBC	***	Ratings at time 2 and time 3 were significantly higher than those at time 1. Following experience with ISA, participants felt they were in significantly greater control of their ability to disengage the system ($F(1.74,111.52) = 21.06$, $p < .001$).
Moral norm	**	Ratings at time 2 and time 3 were significantly lower than those reported at time 1. Following experience with ISA, participants were significantly less likely to consider overriding the system morally unacceptable ($F(1.58, 101.50) = 6.60$, $p < .01$).
Anticipated regret	***	Ratings at time 2 and time 3 were significantly lower than those reported at time 1. Following experience with the ISA system participants were significantly less likely to anticipate regretting overriding the system ($F(1.75, 112.01) = 14.10$, $p < .001$).
Main Effect of Age Group		
Attitudes	*	Younger participants' attitudes towards disengaging the system were significantly more favourable than those expressed by older participants ($F(1,64) = 6.25$, $p < .05$).

Table 31: Descriptives for TPB constructs (disengage scenario) time by sex by age

Phase	Sex	Age	Intention			Attitude			PBC			Behavioural Beliefs			Control Beliefs			Normative Pressure			Moral Norm			Anticipated Regret			Perceived Suscept.		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	-1.12	1.10	14	0.33	0.75	14	5.64	0.67	14	0.49	1.47	14	-4.61	4.54	14	-0.14	5.01	14	5.79	1.05	14	1.07	0.98	14	1.21	1.71	14
		old	-2.04	0.86	24	-0.15	1.20	24	5.90	0.96	24	0.89	1.90	24	-5.10	5.08	24	3.12	6.84	24	4.79	2.23	24	0.88	2.04	24	0.17	1.52	24
		Total	-1.70	1.04	38	0.03	1.07	38	5.81	0.87	38	0.74	1.75	38	-4.92	4.83	38	1.92	6.36	38	5.16	1.92	38	0.95	1.72	38	0.55	1.66	38
	Female	young	-1.96	1.19	16	0.30	1.30	16	5.25	1.24	16	1.30	2.62	16	-8.07	6.31	16	3.23	5.23	16	5.25	1.13	16	0.88	1.57	16	0.75	2.49	16
		old	-2.02	0.87	14	-0.59	1.06	14	5.36	1.04	14	0.70	2.74	14	-7.99	5.87	14	3.10	5.55	14	5.29	1.20	14	1.32	1.40	14	0.86	2.07	14
		Total	-1.99	1.03	30	-0.12	1.25	30	5.30	1.13	30	1.02	2.65	30	-8.03	6.00	30	3.17	5.29	30	5.27	1.14	30	1.08	1.48	30	0.80	2.27	30
	Total	young	-1.57	1.20	30	0.31	1.06	30	5.43	1.01	30	0.92	2.17	30	-6.46	5.74	30	1.65	5.32	30	5.50	1.11	30	0.97	1.31	30	0.97	2.14	30
		old	-2.04	0.85	38	-0.31	1.16	38	5.70	1.01	38	0.82	2.21	38	-6.16	5.49	38	3.11	6.32	38	4.97	1.91	38	1.04	1.82	38	0.42	1.75	38
		Total	-1.83	1.04	68	-0.03	1.15	68	5.58	1.02	68	0.86	2.18	68	-6.29	5.56	68	2.47	5.90	68	5.21	1.62	68	1.01	1.61	68	0.66	1.94	68
Time 2	Male	young	-0.90	1.60	14	0.60	0.98	14	6.21	0.73	14	1.30	1.65	14	-3.82	4.55	14	-0.70	6.28	14	4.50	1.51	14	0.07	1.47	14	0.57	1.87	14
		old	-1.44	1.37	24	0.10	1.11	24	6.53	0.85	24	0.92	1.70	24	-5.05	7.41	24	-0.07	7.22	24	3.88	2.17	24	-0.08	2.31	24	0.29	2.03	24
		Total	-1.25	1.46	38	0.29	1.08	38	6.41	0.81	38	1.06	1.67	38	-4.60	6.46	38	-0.30	6.81	38	4.11	1.96	38	-0.03	2.02	38	0.39	1.95	38
	Female	young	-1.50	0.93	16	0.23	1.27	16	6.03	1.24	16	1.64	2.16	16	-2.72	5.41	16	-0.19	4.68	16	4.44	1.36	16	-0.19	1.41	16	0.25	1.73	16
		old	-1.79	1.16	14	-0.39	1.19	14	6.25	0.72	14	0.98	2.72	14	-6.71	7.35	14	3.13	6.27	14	5.36	1.28	14	0.61	1.64	14	0.29	1.44	14
		Total	-1.63	1.04	30	-0.06	1.25	30	6.13	1.02	30	1.33	2.42	30	-4.58	6.59	30	1.36	5.63	30	4.87	1.38	30	0.18	1.55	30	27.00	1.57	30
	Total	young	-1.22	1.30	30	0.40	1.14	30	6.12	1.02	30	1.48	1.91	30	-3.23	4.97	30	-0.43	5.39	30	4.47	1.41	30	-0.07	1.42	30	0.40	1.77	30
		old	-1.57	1.29	38	-0.08	1.15	38	6.43	0.81	38	0.94	2.10	38	-5.66	7.33	38	1.11	6.97	38	4.42	2.01	38	0.17	2.09	38	0.29	1.81	38
		Total	-1.42	1.30	68	0.13	1.16	68	6.29	0.91	68	1.18	2.02	68	-4.59	6.47	68	0.43	6.33	68	4.44	1.76	68	0.07	1.82	68	0.34	1.78	68
Time 3	Male	young	-1.02	1.55	14	0.30	1.26	14	6.19	0.89	14	2.03	2.62	14	-3.68	6.80	14	-2.04	7.59	14	4.21	1.58	14	-0.57	1.57	14	0.64	1.69	14
		old	-1.46	1.64	24	-0.04	1.18	24	6.19	1.19	24	1.16	2.07	24	-4.81	6.08	24	2.23	6.45	24	4.29	2.35	24	-0.08	2.27	24	0.08	2.46	24
		Total	-1.30	1.60	38	0.09	1.21	38	6.19	1.08	38	1.48	2.29	38	-4.39	6.29	38	0.65	7.10	38	4.26	2.08	38	-0.26	2.03	38	0.29	2.20	38
	Female	young	-1.44	1.20	16	0.04	1.15	16	6.52	0.59	16	1.63	2.87	16	-4.34	6.21	16	0.76	4.02	16	4.06	1.34	16	-0.25	1.56	16	0.56	1.63	16
		old	-1.86	1.08	14	-0.58	1.40	14	6.32	0.78	14	0.73	3.38	14	-6.55	8.58	14	3.27	6.85	14	5.21	1.67	14	0.79	1.59	14	0.71	1.07	14
		Total	-1.63	1.15	30	-0.25	1.29	30	6.43	0.68	30	1.21	3.10	30	-5.37	7.36	30	1.93	5.57	30	4.60	1.59	30	0.23	1.63	30	0.63	1.38	30
	Total	young	-1.24	1.37	30	0.16	1.19	30	6.37	0.75	30	1.82	2.72	30	-4.03	6.39	30	-0.55	6.02	30	4.13	1.43	30	-0.40	1.54	30	0.60	1.63	30
		old	-1.61	1.46	38	-0.24	1.28	38	6.24	1.05	38	1.00	2.59	38	-5.45	7.04	38	2.61	6.52	38	4.63	2.15	38	0.24	2.07	38	0.32	2.06	38
		Total	-1.45	1.42	68	-0.06	1.25	68	6.29	0.93	68	1.36	2.66	68	-4.82	6.75	68	1.22	6.46	68	4.41	1.87	68	-0.04	1.87	68	0.44	1.88	68

4.2.2.3 Examination of changes in individual beliefs (speeding scenario)

Analysis also sought to determine any significant effects of the ISA intervention on the individual belief and evaluation components. Given the large number of items included only significant main effects and interactions are reported.

Behavioural beliefs

In order to examine changes in beliefs as a result of the ISA intervention, comparisons were made across the mean ratings of each behavioural belief at each time point. Descriptives for the beliefs are shown in Table 33. Comparisons across the group suggested that, compared to male participants, female participants expressed stronger beliefs relating to the likelihood of negative consequences arising from speeding (e.g. risk causing an accident) and weaker beliefs relating to the likelihood of positive consequences arising from speeding (e.g. save time, make me feel good). Again, differences across the age groups were less pronounced and consistent. Here, compared to younger participants, older participants were more likely to believe that speeding would reduce journey times (e.g. save time, get me to my destination more quickly). Comparisons over time suggested that beliefs (whether pro or anti speeding) weakened following experience with the ISA system.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on individual behavioural beliefs. Results are reported in Table 32. Given the large number of tests, only significant main effects or interactions are reported.

Table 32: Results of ANOVA for behavioural beliefs

Behavioural Belief	Sig	Description
Main Effect of Time		
Speeding would get me to my destination more quickly	**	Ratings at time 2 were significantly lower than those reported at time 1. Following experience with ISA, participants were significantly less likely to believe that speeding would get them to their destination more quickly ($F(1.79, 114.70) = 5.37$, $p < .01$).
Speeding would make me feel good	*	Ratings at time 2 were significantly higher than those reported at time 1. Following experience with the ISA system, participants were more likely to believe that speeding would make them feel good ($F(2,128) = 4.66$, $p < .05$).
Main Effect of Gender		
Speeding would risk causing an accident	*	Female participants were significantly more likely than male participants to believe that speeding would risk causing an accident ($F(1,64) = 4.62$, $p < .05$).
Speeding would get me stopped by the police	*	Female participants were significantly more likely than males to believe that speeding would get them stopped by the police ($F(1,64) = 4.98$, $p < .05$).
Speeding would get me prosecuted and fined	***	Female participants were significantly more likely than male participants to believe that speeding would lead to prosecution and fine ($F(1,64) = 17.66$, $p < .001$).
Main Effect of Age Group		
Speeding would make me feel anxious	*	Older participants were significantly more likely than younger participants to believe that speeding would make them feel anxious ($F(1,64) = 5.10$, $p < .05$).

Table 33: Behavioural beliefs relating to exceeding the speed limit by time by gender by age

Phase	Sex	Age	get me to my destination more quickly			risk causing an accident			irritate other drivers			enable me to make rapid progress			get me stopped by police			save time			get me prosecuted and fined			make me feel good			make me feel anxious		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	0.71	1.12	14	1.19	0.82	14	-0.55	1.04	14	0.40	0.81	14	0.93	1.55	14	0.29	1.03	14	1.31	1.24	14	-0.83	0.84	14	0.17	1.16	14
		old	0.90	1.21	24	0.90	1.24	24	-0.03	1.36	24	0.65	1.01	24	1.43	1.40	24	0.85	1.07	24	1.69	1.39	24	-1.39	1.18	24	0.65	1.43	24
		Total	0.83	1.16	38	1.01	1.10	38	-0.22	1.26	38	0.56	0.94	38	1.25	1.46	38	0.64	1.08	38	1.55	1.33	38	-1.18	1.09	38	0.47	1.34	38
	Female	young	0.23	1.72	16	1.46	0.93	16	-0.04	1.37	16	-0.02	1.57	16	2.50	0.74	16	0.10	1.59	16	2.42	0.77	16	-1.40	1.16	16	0.21	1.33	16
		old	1.42	1.16	14	1.49	1.06	14	-0.17	0.98	14	0.96	0.81	14	2.14	1.21	14	1.10	1.06	14	2.36	0.73	14	-1.35	1.60	14	0.96	1.23	14
		Total	0.78	1.58	30	1.47	0.98	30	-0.10	1.18	30	0.44	1.35	30	2.33	0.99	30	0.57	1.43	30	2.39	0.74	30	-1.37	1.36	30	0.56	1.32	30
	Total	young	0.46	1.47	30	1.33	0.88	30	-0.28	1.23	30	0.18	1.27	30	1.77	1.41	30	0.19	1.34	30	1.90	1.15	30	-1.13	1.05	30	0.19	1.23	30
		old	1.09	1.20	38	1.12	1.20	38	-0.08	1.22	38	0.77	0.94	38	1.69	1.36	38	0.94	1.06	38	1.94	1.22	38	-1.37	1.33	38	0.77	1.35	38
		Total	0.81	1.35	68	1.21	1.07	68	-0.17	1.22	68	0.51	1.13	68	1.73	1.38	68	0.61	1.24	68	1.92	1.18	68	-1.27	1.21	68	0.51	1.32	68
Time 2	Male	young	0.29	0.90	14	0.76	0.84	14	-0.45	0.88	14	0.48	0.78	14	1.24	1.10	14	0.57	0.83	14	1.24	1.28	14	-0.48	0.95	14	0.21	1.30	14
		old	0.57	1.14	24	0.92	1.08	24	-0.31	1.34	24	0.53	0.83	24	1.15	1.47	24	0.58	0.92	24	1.33	1.22	24	-0.97	1.07	24	0.19	1.42	24
		Total	0.46	1.06	38	0.86	0.99	38	-0.36	1.18	38	0.51	0.80	38	1.18	1.33	38	0.58	0.88	38	1.30	1.23	38	-0.79	1.04	38	0.20	1.36	38
	Female	young	0.06	1.44	16	1.17	0.91	16	-0.90	0.84	16	-0.15	1.22	16	2.13	1.23	16	0.02	1.21	16	2.33	0.91	16	-1.06	0.92	16	-0.19	1.15	16
		old	0.50	1.48	14	1.52	0.96	14	-0.57	1.16	14	0.64	1.45	14	2.50	0.79	14	0.62	1.19	14	2.57	0.74	14	-1.33	1.40	14	1.19	1.25	14
		Total	0.27	1.45	30	1.33	0.93	30	-0.74	1.00	30	0.22	1.37	30	2.30	1.05	30	0.30	1.22	30	2.44	0.83	30	-1.19	1.15	30	0.46	1.37	30
	Total	young	0.17	1.21	30	0.98	0.89	30	-0.69	0.88	30	0.14	1.07	30	1.71	1.23	30	0.28	1.07	30	1.82	1.22	30	-0.79	0.96	30	0.00	1.22	30
		old	0.54	1.26	38	1.14	1.07	38	-0.40	1.27	38	0.57	1.08	38	1.65	1.41	38	0.60	1.01	38	1.79	1.22	38	-1.11	1.19	38	0.56	1.43	38
		Total	0.38	1.24	68	1.07	0.99	68	-0.53	1.11	68	0.38	1.09	68	1.68	1.33	68	0.46	1.04	68	1.80	1.21	68	-0.97	1.10	68	0.31	1.36	68
Time 3	Male	young	0.26	1.39	14	0.74	1.26	14	-0.60	1.45	14	0.17	1.21	14	0.81	1.59	14	0.14	1.15	14	1.12	1.11	14	-0.50	1.13	14	0.05	1.27	14
		old	0.49	1.42	24	0.82	1.36	24	-0.15	1.32	24	0.46	1.40	24	1.14	1.71	24	0.44	1.23	24	1.24	1.67	24	-0.99	1.12	24	0.35	1.51	24
		Total	0.40	1.40	38	0.79	1.31	38	-0.32	1.36	38	0.35	1.32	38	1.02	1.65	38	0.33	1.19	38	1.19	1.47	38	-0.81	1.14	38	0.24	1.41	38
	Female	young	0.08	1.57	16	1.06	0.99	16	-0.83	1.11	16	0.23	1.38	16	2.10	1.11	16	0.44	1.61	16	2.46	1.01	16	-0.81	1.12	16	-0.15	1.41	16
		old	0.67	1.27	14	1.69	0.99	14	-0.05	1.42	14	0.48	1.29	14	2.36	0.93	14	0.43	1.28	14	2.31	0.87	14	-1.50	1.39	14	1.12	1.53	14
		Total	0.36	1.44	30	1.36	1.02	30	-0.47	1.30	30	0.34	1.32	30	2.22	1.02	30	0.43	1.44	30	2.39	0.93	30	-1.13	1.28	30	0.44	1.58	30
	Total	young	0.17	1.46	30	0.91	1.11	30	-0.72	1.26	30	0.20	1.28	30	1.50	1.48	30	0.30	1.40	30	1.83	1.24	30	-0.67	1.12	30	-0.06	1.33	30
		old	0.55	1.35	38	1.14	1.30	38	-0.11	1.34	38	0.46	1.34	38	1.59	1.57	38	0.43	1.23	38	1.63	1.51	38	-1.18	1.24	38	0.63	1.54	38
		Total	0.38	1.41	68	1.04	1.22	68	-0.38	1.33	68	0.35	1.31	68	1.55	1.52	68	0.38	1.30	68	1.72	1.39	68	-0.95	1.20	68	0.33	1.48	68

Outcome evaluations

Descriptives for the outcome evaluations are shown in Table 35. Comparisons across the groups indicated that, compared to male participants, female participants were less positive in their evaluation of the benefits associated with speeding (e.g. save time, feel good) and more negative in their evaluation of the drawbacks associated with speeding. Differences between the ages were again less apparent. Changes over time were relatively inconsistent.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on individual outcome evaluations. Results are presented in Table 34. Given the large number of tests, only significant main effects or interactions are reported.

Table 34: Results of ANOVA for outcome evaluations

Outcome Evaluation	Sig	Description
Main Effect of Time		
Speeding would irritate other drivers	**	Ratings at time 2 were significantly higher than those reported at time 1. Following experience with the ISA system, participants viewed the outcome of irritating other drivers significantly less negatively than they had prior to experience with ISA ($F(1,128) = 4.84$, $p < .01$).
Main Effect of Gender		
Speeding would risk causing an accident	**	Compared to male participants, female participants rated the outcome of being involved in an accident significantly more negatively ($F(1,64) = 9.29$, $p < .01$).
Main Effect of Age Group		
Speeding would risk causing an accident	*	Older participants rated the outcome of causing an accident significantly more negatively than younger participants ($F(1,64) = 4.08$, $p < .05$).
Interactions		
Speeding would get me to my destination more quickly	*	Time by age interaction ($F(1.69, 108.39) = 4.57$, $p < .05$). Following experience with the system younger participants' evaluation of getting to their destination more quickly was significantly more positive

Table 35: Outcome evaluations relating to exceeding the speed limit by time by gender by age

Phase	Sex	Age	get me to my destination more quickly			risk causing an accident			irritate other drivers			enable me to make rapid progress			get me stopped by police			save time			get me prosecuted and fined			make me feel good			make me feel anxious		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	0.71	1.12	14	1.19	0.82	14	-0.55	1.04	14	0.40	0.81	14	0.93	1.55	14	0.29	1.03	14	1.31	1.24	14	-0.83	0.84	14	0.17	1.16	14
		old	0.90	1.21	24	0.90	1.24	24	-0.03	1.36	24	0.65	1.01	24	1.43	1.40	24	0.85	1.07	24	1.69	1.39	24	-1.39	1.18	24	0.65	1.43	24
		Total	0.83	1.16	38	1.01	1.10	38	-0.22	1.26	38	0.56	0.94	38	1.25	1.46	38	0.64	1.08	38	1.55	1.33	38	-1.18	1.09	38	0.47	1.34	38
	Female	young	0.23	1.72	16	1.46	0.93	16	-0.04	1.37	16	-0.02	1.57	16	2.50	0.74	16	0.10	1.59	16	2.42	0.77	16	-1.40	1.16	16	0.21	1.33	16
		old	1.42	1.16	14	1.49	1.06	14	-0.17	0.98	14	0.96	0.81	14	2.14	1.21	14	1.10	1.06	14	2.36	0.73	14	-1.35	1.60	14	0.96	1.23	14
		Total	0.78	1.58	30	1.47	0.98	30	-0.10	1.18	30	0.44	1.35	30	2.33	0.99	30	0.57	1.43	30	2.39	0.74	30	-1.37	1.36	30	0.56	1.32	30
	Total	young	0.46	1.47	30	1.33	0.88	30	-0.28	1.23	30	0.18	1.27	30	1.77	1.41	30	0.19	1.34	30	1.90	1.15	30	-1.13	1.05	30	0.19	1.23	30
		old	1.09	1.20	38	1.12	1.20	38	-0.08	1.22	38	0.77	0.94	38	1.69	1.36	38	0.94	1.06	38	1.94	1.22	38	-1.37	1.33	38	0.77	1.35	38
		Total	0.81	1.35	68	1.21	1.07	68	-0.17	1.22	68	0.51	1.13	68	1.73	1.38	68	0.61	1.24	68	1.92	1.18	68	-1.27	1.21	68	0.51	1.32	68
Time 2	Male	young	0.29	0.90	14	0.76	0.84	14	-0.45	0.88	14	0.48	0.78	14	1.24	1.10	14	0.57	0.83	14	1.24	1.28	14	-0.48	0.95	14	0.21	1.30	14
		old	0.57	1.14	24	0.92	1.08	24	-0.31	1.34	24	0.53	0.83	24	1.15	1.47	24	0.58	0.92	24	1.33	1.22	24	-0.97	1.07	24	0.19	1.42	24
		Total	0.46	1.06	38	0.86	0.99	38	-0.36	1.18	38	0.51	0.80	38	1.18	1.33	38	0.58	0.88	38	1.30	1.23	38	-0.79	1.04	38	0.20	1.36	38
	Female	young	0.06	1.44	16	1.17	0.91	16	-0.90	0.84	16	-0.15	1.22	16	2.13	1.23	16	0.02	1.21	16	2.33	0.91	16	-1.06	0.92	16	-0.19	1.15	16
		old	0.50	1.48	14	1.52	0.96	14	-0.57	1.16	14	0.64	1.45	14	2.50	0.79	14	0.62	1.19	14	2.57	0.74	14	-1.33	1.40	14	1.19	1.25	14
		Total	0.27	1.45	30	1.33	0.93	30	-0.74	1.00	30	0.22	1.37	30	2.30	1.05	30	0.30	1.22	30	2.44	0.83	30	-1.19	1.15	30	0.46	1.37	30
	Total	young	0.17	1.21	30	0.98	0.89	30	-0.69	0.88	30	0.14	1.07	30	1.71	1.23	30	0.28	1.07	30	1.82	1.22	30	-0.79	0.96	30	0.00	1.22	30
		old	0.54	1.26	38	1.14	1.07	38	-0.40	1.27	38	0.57	1.08	38	1.65	1.41	38	0.60	1.01	38	1.79	1.22	38	-1.11	1.19	38	0.56	1.43	38
		Total	0.38	1.24	68	1.07	0.99	68	-0.53	1.11	68	0.38	1.09	68	1.68	1.33	68	0.46	1.04	68	1.80	1.21	68	-0.97	1.10	68	0.31	1.36	68
Time 3	Male	young	0.26	1.39	14	0.74	1.26	14	-0.60	1.45	14	0.17	1.21	14	0.81	1.59	14	0.14	1.15	14	1.12	1.11	14	-0.50	1.13	14	0.05	1.27	14
		old	0.49	1.42	24	0.82	1.36	24	-0.15	1.32	24	0.46	1.40	24	1.14	1.71	24	0.44	1.23	24	1.24	1.67	24	-0.99	1.12	24	0.35	1.51	24
		Total	0.40	1.40	38	0.79	1.31	38	-0.32	1.36	38	0.35	1.32	38	1.02	1.65	38	0.33	1.19	38	1.19	1.47	38	-0.81	1.14	38	0.24	1.41	38
	Female	young	0.08	1.57	16	1.06	0.99	16	-0.83	1.11	16	0.23	1.38	16	2.10	1.11	16	0.44	1.61	16	2.46	1.01	16	-0.81	1.12	16	-0.15	1.41	16
		old	0.67	1.27	14	1.69	0.99	14	-0.05	1.42	14	0.48	1.29	14	2.36	0.93	14	0.43	1.28	14	2.31	0.87	14	-1.50	1.39	14	1.12	1.53	14
		Total	0.36	1.44	30	1.36	1.02	30	-0.47	1.30	30	0.34	1.32	30	2.22	1.02	30	0.43	1.44	30	2.39	0.93	30	-1.13	1.28	30	0.44	1.58	30
	Total	young	0.17	1.46	30	0.91	1.11	30	-0.72	1.26	30	0.20	1.28	30	1.50	1.48	30	0.30	1.40	30	1.83	1.24	30	-0.67	1.12	30	-0.06	1.33	30
		old	0.55	1.35	38	1.14	1.30	38	-0.11	1.34	38	0.46	1.34	38	1.59	1.57	38	0.43	1.23	38	1.63	1.51	38	-1.18	1.24	38	0.63	1.54	38
		Total	0.38	1.41	68	1.04	1.22	68	-0.38	1.33	68	0.35	1.31	68	1.55	1.52	68	0.38	1.30	68	1.72	1.39	68	-0.95	1.20	68	0.33	1.48	68

Normative beliefs

Descriptives for the beliefs are shown in Table 36. Comparisons across the groups suggested that in general female participants perceived greater social pressure not to speed than male participants. Compared to female participants however, male participants were more likely to believe that their family or spouse/partner would disapprove of their speeding. Differences between older and younger participants were again less apparent and inconsistent. Comparisons over time suggested that following immediate experience with ISA, perceived social pressure not to speed decreased. However, ratings began to rise again following a return to unsupported driving.

Table 36: Normative beliefs relating to exceeding the speed limit by time by gender by age

Phase	Sex	Age	police			other road users			family			friends			spouse/partner		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	1.88	1.07	14	0.07	0.93	14	0.62	0.85	14	-0.14	0.95	14	0.77	1.17	13
		old	2.13	0.80	24	0.06	1.57	24	1.06	1.32	24	0.17	1.57	24	1.31	1.53	24
		Total	**2.04**	**0.90**	**38**	**0.06**	**1.35**	**38**	**0.89**	**1.18**	**38**	**0.05**	**1.37**	**38**	**1.12**	**1.42**	**37**
	Female	young	2.56	0.76	16	0.29	1.29	16	0.79	1.34	16	-0.02	1.14	16	0.89	1.46	15
		old	2.40	0.76	14	0.13	0.63	14	0.83	1.20	14	0.39	1.02	14	0.37	1.32	14
		Total	**2.49**	**0.75**	**30**	**0.22**	**1.02**	**30**	**0.81**	**1.25**	**30**	**0.17**	**1.08**	**30**	**0.64**	**1.40**	**29**
	Total	young	2.24	0.96	30	0.19	1.12	30	0.71	1.12	30	-0.08	1.04	30	0.83	1.31	28
		old	2.23	0.79	38	0.08	1.29	38	0.97	1.27	38	0.25	1.38	38	0.96	1.51	38
		Total	**2.24**	**0.86**	**68**	**0.13**	**1.21**	**68**	**0.86**	**1.20**	**68**	**0.11**	**1.24**	**68**	**0.91**	**1.42**	**66**
Time 2	Male	young	1.33	1.30	14	0.10	0.96	14	0.67	0.96	14	0.07	0.68	14	0.69	1.08	13
		old	1.97	0.89	24	-0.15	1.33	24	0.85	1.51	24	0.01	1.44	24	0.92	1.55	24
		Total	**1.74**	**1.09**	**38**	**-0.06**	**1.20**	**38**	**0.78**	**1.32**	**38**	**0.04**	**1.21**	**38**	**0.84**	**1.39**	**37**
	Female	young	1.65	1.17	16	-0.29	1.00	16	0.50	1.00	16	-0.04	0.79	16	0.76	1.47	15
		old	2.33	0.92	14	-0.19	0.88	14	0.74	1.53	14	0.40	1.70	14	0.43	1.75	14
		Total	**1.97**	**1.10**	**30**	**-0.24**	**0.93**	**30**	**0.61**	**1.25**	**30**	**0.17**	**1.29**	**30**	**0.60**	**1.59**	**29**
	Total	young	1.50	1.22	30	-0.11	0.98	30	0.58	0.97	30	0.01	0.73	30	0.73	1.28	28
		old	2.11	0.91	38	-0.17	1.17	38	0.81	1.50	38	0.16	1.53	38	0.74	1.62	38
		Total	**1.84**	**1.09**	**68**	**-0.14**	**1.09**	**68**	**0.71**	**1.29**	**68**	**0.09**	**1.24**	**68**	**0.73**	**1.47**	**66**
Time 3	Male	young	1.45	1.01	14	-0.21	1.31	14	0.48	1.51	14	0.05	1.33	14	0.41	1.66	13
		old	2.08	1.00	24	0.29	1.19	24	1.00	1.59	24	0.19	1.53	24	1.08	1.76	24
		Total	**1.85**	**1.04**	**38**	**0.11**	**1.24**	**38**	**0.81**	**1.56**	**38**	**0.14**	**1.44**	**38**	**0.85**	**1.73**	**37**
	Female	young	2.13	1.33	16	-0.40	1.21	16	0.69	1.20	16	0.23	1.00	16	0.82	1.53	15
		old	2.57	0.65	14	0.50	1.11	14	0.62	1.42	14	0.48	1.47	14	0.31	1.60	14
		Total	**2.33**	**1.07**	**30**	**0.02**	**1.23**	**30**	**0.66**	**1.28**	**30**	**0.34**	**1.22**	**30**	**0.57**	**1.56**	**29**
	Total	young	1.81	1.22	30	-0.31	1.24	30	0.59	1.34	30	0.14	1.15	30	0.63	1.57	28
		old	2.26	0.91	38	0.37	1.15	38	0.86	1.52	38	0.30	1.49	38	0.80	1.73	38
		Total	**2.06**	**1.07**	**68**	**0.07**	**1.23**	**68**	**0.74**	**1.44**	**68**	**0.23**	**1.34**	**68**	**0.73**	**1.65**	**66**

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on individual normative beliefs. Given the large number of tests, only significant main effects or interactions are reported. Results are reported in Table 37.

Table 37: Results of ANOVA for normative beliefs

Normative Belief	Sig	Description
Main Effect of Time		
The police would disapprove of my speeding	**	Ratings at time 2 were significantly lower than those reported at time 1. Following experience with the system, participants were significantly less likely to believe that the police would disapprove of their speeding ($F(2,128) = 5.06$, $p < .01$).
Main Effect of Gender		
The police would disapprove of my speeding	*	Compared to male participants, female participants were significantly more likely to believe that the police would disapprove of speeding ($F(1,64) = 6.02$, $p < .05$).
Main Effect of Age Group		
The police would disapprove of my speeding	*	Compared to younger participants, older participants were significantly more likely to believe that the police would disapprove of speeding ($F(1,64) = 4.78$, $p < .05$).

Motivation to comply

In order to examine changes in beliefs as a result of the ISA intervention, comparisons were made across the mean motivation to comply ratings at each time point. Descriptives for the motivation to comply ratings are shown in Table 38. Comparisons across the genders suggested that, compared to female participants, male participants expressed a stronger motivation to comply with other road users, their family and their spouse/partner. In general, older participants expressed a stronger motivation to comply with the salient referents than younger participants. Comparisons over time suggested that participants' motivation to comply with the stated referents was weaker following immediate experience with ISA but strengthened again following a return to unsupported driving.

Table 38: Motivation to comply relating to exceeding the speed limit by time by gender by age

Phase	Sex	Age	police			other road users			family			friends			spouse/partner		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	5.50	1.22	14	4.00	1.84	14	5.07	1.64	14	3.79	1.63	14	5.08	1.71	13
		old	5.46	1.32	24	4.54	1.64	24	5.58	0.97	24	4.08	1.91	24	5.75	1.26	24
		Total	**5.47**	**1.27**	**38**	**4.34**	**1.71**	**38**	**5.39**	**1.26**	**38**	**3.97**	**1.79**	**38**	**5.51**	**1.45**	**37**
	Female	young	5.81	0.98	16	4.50	1.59	16	4.63	1.96	16	3.94	1.57	16	5.20	1.74	15
		old	5.46	1.66	13	4.00	1.92	14	5.07	1.14	14	4.29	1.33	14	4.36	1.50	14
		Total	**5.66**	**1.32**	**29**	**4.27**	**1.74**	**30**	**4.83**	**1.62**	**30**	**4.10**	**1.45**	**30**	**4.79**	**1.66**	**29**
	Total	young	5.67	1.09	30	4.27	1.70	30	4.83	1.80	30	3.87	1.57	30	5.14	1.69	28
		old	5.46	1.43	37	4.34	1.74	38	5.39	1.05	38	4.16	1.70	38	5.24	1.50	38
		Total	**5.55**	**1.28**	**67**	**4.31**	**1.71**	**68**	**5.15**	**1.45**	**68**	**4.03**	**1.64**	**68**	**5.20**	**1.57**	**66**
Time 2	Male	young	4.93	1.27	14	4.00	1.36	14	4.71	1.33	14	3.93	1.38	14	5.46	1.33	13
		old	5.33	1.49	24	4.21	1.50	24	5.50	1.10	24	3.83	1.71	24	5.33	1.58	24
		Total	**5.18**	**1.41**	**38**	**4.13**	**1.44**	**38**	**5.21**	**1.23**	**38**	**3.87**	**1.58**	**38**	**5.38**	**1.48**	**37**
	Female	young	5.69	1.35	16	3.38	1.59	16	4.63	1.50	16	3.94	0.93	16	4.80	1.47	15
		old	5.69	1.03	13	3.14	1.23	14	4.43	1.28	14	4.07	1.94	14	4.29	1.64	14
		Total	**5.69**	**1.20**	**29**	**3.27**	**1.41**	**30**	**4.53**	**1.38**	**30**	**4.00**	**1.46**	**30**	**4.55**	**1.55**	**29**
	Total	young	5.33	1.35	30	3.67	1.49	30	4.67	1.40	30	3.93	1.14	30	5.11	1.42	28
		old	5.46	1.35	37	3.82	1.49	38	5.11	1.27	38	3.92	1.78	38	4.95	1.66	38
		Total	**5.40**	**1.34**	**67**	**3.75**	**1.48**	**68**	**4.91**	**1.34**	**68**	**3.93**	**1.52**	**68**	**5.02**	**1.55**	**66**
Time 3	Male	young	5.43	1.02	14	4.00	1.62	14	4.79	1.85	14	4.07	1.73	14	5.15	1.82	13
		old	5.42	1.44	24	4.38	1.47	24	5.42	1.32	24	4.33	1.52	24	5.63	1.17	24
		Total	**5.42**	**1.29**	**38**	**4.24**	**1.51**	**38**	**5.18**	**1.54**	**38**	**4.24**	**1.58**	**38**	**5.46**	**1.43**	**37**
	Female	young	5.75	1.34	16	3.56	1.59	16	4.25	1.57	16	4.00	1.15	16	4.80	1.42	15
		old	5.69	1.11	13	3.86	1.56	14	4.21	1.76	14	4.50	1.51	14	4.64	1.45	14
		Total	**5.72**	**1.22**	**29**	**3.70**	**1.56**	**30**	**4.23**	**1.63**	**30**	**4.23**	**1.33**	**30**	**4.72**	**1.41**	**29**
	Total	young	5.60	1.19	30	3.77	1.59	30	4.50	1.70	30	4.03	1.43	30	4.96	1.60	28
		old	5.51	1.33	37	4.18	1.50	38	4.97	1.59	38	4.39	1.50	38	5.26	1.35	38
		Total	**5.55**	**1.26**	**67**	**4.00**	**1.55**	**68**	**4.76**	**1.64**	**68**	**4.24**	**1.47**	**68**	**5.14**	**1.46**	**66**

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on motivation to comply ratings. Given the large number of tests, only significant main effects or interactions are reported in Table 39.

Table 39: Results of ANOVA for motivation to comply

Motivation to Comply	Sig	Description
Main Effect of Time		
Other road users	*	Ratings at time 2 were significantly lower than those reported at time 1. Following experience with ISA, participants were significantly less motivated to comply with other roads users ($F(2,128) = 3.29$, $p < .05$).
Main Effect of Gender		
Family	*	Compared to males, females were significantly less motivated to comply with their family ($F(1,64) = 4.89$, $p < .05$).
Spouse/partner	*	Compared to males, females were significantly less motivated to comply with their spouse/partner ($F(1,64) = 4.82$, $p < .05$).

Control beliefs

Descriptives for the control belief ratings are shown in Table 41. Comparisons across the groups suggested that, compared to their counterparts, female participants and older participants were more likely to believe that the stated control factors would inhibit speeding. Changes over time appeared minimal.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on control belief ratings. Results are presented in Table 40. Given the large number of tests, only significant main effects or interactions are reported.

Table 40: Results of ANOVA for control beliefs

Control Beliefs	Sig	Description
Main Effect of Time		
In a hurry	*	Post hoc pairwise comparisons did not indicate any significant differences between time points. The mean trend however suggested that, following experience with ISA, participants were less likely to believe that being in a hurry would facilitate speeding ($F(1.80, 115.21) = 3.72$, $p < .05$).
In heavy traffic	***	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Following experience with ISA participants were significantly less likely to believe that driving in heavy traffic would inhibit speeding ($F(2,128) = 9.34$, $p < .001$).
Main Effect of Gender		
At night-time	*	Compared to female participants, male participants were significantly more likely to believe that driving at night-time would facilitate speeding ($F(1,64) = 4.35$, $p < .05$).
On wet surfaces	**	Compared to female participants, male participants were significantly less likely to believe driving on wet surfaces would inhibit their speeding behaviour ($F(1,64) = 10.95$, $p < .01$).
In a bad mood	*	Compared to male participants, female participants were significantly more likely to believe that driving in a bad mood would inhibit speeding ($F(1,64) = 4.83$, $p < .05$).
Main Effect of Age Group		
At night-time	*	Compared to older participants, younger participants were significantly less likely to believe that driving at night-time would inhibit speeding ($F(1,64) = 6.29$, $p < .05$).
On wet surfaces	*	Compared to older participants, younger participants were significantly less likely to believe driving on wet surfaces would inhibit their speeding behaviour ($F(1,64) = 6.13$, $p < .05$).

Table 41: Control beliefs relating to exceeding the speed limit by time by gender by age

			night-time			wet surfaces			in a hurry			good mood			heavy traffic			bad mood			passenger		
Phase	Sex	Age	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	0.24	1.30	14	-1.43	0.94	14	0.86	1.04	14	-0.62	0.86	14	-1.71	0.79	14	0.36	1.14	14	-0.88	0.77	14
		old	-0.72	1.30	24	-1.93	0.77	24	1.01	1.18	24	-0.38	1.06	24	-2.04	0.92	24	-0.13	0.77	24	-0.76	0.80	24
		Total	**-0.37**	**1.37**	**38**	**-1.75**	**0.86**	**38**	**0.96**	**1.12**	**38**	**-0.46**	**0.99**	**38**	**-1.92**	**0.88**	**38**	**0.05**	**0.94**	**38**	**-0.81**	**0.78**	**38**
	Female	young	-0.65	1.60	16	-2.15	0.81	16	0.42	1.35	16	-0.50	0.99	16	-2.10	0.80	16	-0.50	1.10	16	-0.83	1.07	16
		old	-0.92	1.25	14	-2.38	0.71	14	0.73	1.30	14	-0.39	1.19	14	-2.15	0.67	14	-0.43	0.80	14	-1.25	1.09	14
		Total	**-0.77**	**1.43**	**30**	**-2.26**	**0.76**	**30**	**0.56**	**1.31**	**30**	**-0.45**	**1.07**	**30**	**-2.13**	**0.73**	**30**	**-0.47**	**0.95**	**30**	**-1.03**	**1.08**	**30**
	Total	young	-0.23	1.51	30	-1.81	0.93	30	0.62	1.22	30	-0.56	0.92	30	-1.92	0.81	30	-0.10	1.18	30	-0.86	0.93	30
		old	-0.79	1.27	38	-2.10	0.77	38	0.91	1.22	38	-0.38	1.10	38	-2.08	0.83	38	-0.24	0.79	38	-0.94	0.93	38
		Total	**-0.55**	**1.40**	**68**	**-1.97**	**0.85**	**68**	**0.78**	**1.22**	**68**	**-0.46**	**1.02**	**68**	**-2.01**	**0.82**	**68**	**-0.18**	**0.97**	**68**	**-0.90**	**0.92**	**68**
Time 2	Male	young	0.50	1.29	14	-1.15	0.99	14	0.62	1.27	14	-0.26	1.10	14	-1.50	0.78	14	0.12	1.22	14	-0.60	0.89	14
		old	-0.54	1.03	24	-1.79	0.82	24	0.65	1.14	24	-0.46	0.99	24	-1.78	1.08	24	-0.07	0.91	24	-0.97	0.90	24
		Total	**-0.16**	**1.22**	**38**	**-1.56**	**0.92**	**38**	**0.64**	**1.17**	**38**	**-0.39**	**1.02**	**38**	**-1.68**	**0.98**	**38**	**0.00**	**1.02**	**38**	**-0.83**	**0.90**	**38**
	Female	young	-0.38	1.39	16	-1.88	0.71	16	0.31	1.18	16	-0.15	0.89	16	-1.60	0.98	16	-0.42	1.02	16	-0.79	0.62	16
		old	-0.50	1.77	14	-2.17	0.66	14	0.24	1.32	14	-0.48	1.34	14	-1.74	1.01	14	-0.60	1.10	14	-1.10	1.16	14
		Total	**-0.43**	**1.55**	**30**	**-2.01**	**0.69**	**30**	**0.28**	**1.22**	**30**	**-0.30**	**1.12**	**30**	**-1.67**	**0.98**	**30**	**-0.50**	**1.04**	**30**	**-0.93**	**0.91**	**30**
	Total	young	0.03	1.40	30	-1.54	0.91	30	0.46	1.21	30	-0.20	0.98	30	-1.56	0.88	30	-0.17	1.13	30	-0.70	0.75	30
		old	-0.53	1.33	38	-1.93	0.78	38	0.50	1.21	38	-0.46	1.11	38	-1.76	1.05	38	-0.26	1.00	38	-1.02	0.99	38
		Total	**-0.28**	**1.38**	**68**	**-1.76**	**0.85**	**68**	**0.48**	**1.20**	**68**	**-0.35**	**1.06**	**68**	**-1.67**	**0.97**	**68**	**-0.22**	**1.05**	**68**	**-0.88**	**0.90**	**68**
Time 3	Male	young	0.69	1.11	14	-1.55	0.65	14	0.60	1.12	14	-0.12	0.97	14	-1.31	0.89	14	0.02	1.11	14	-0.60	0.89	14
		old	-0.63	1.16	24	-1.57	0.83	24	0.68	1.37	24	-0.22	1.29	24	-1.64	1.05	24	-0.18	1.11	24	-0.92	0.93	24
		Total	**-0.14**	**1.30**	**38**	**-1.56**	**0.76**	**38**	**0.65**	**1.27**	**38**	**-0.18**	**1.17**	**38**	**-1.52**	**0.99**	**38**	**-0.11**	**1.10**	**38**	**-0.80**	**0.92**	**38**
	Female	young	-0.50	1.03	16	-1.67	0.83	16	0.73	1.19	16	-0.13	0.65	16	-1.33	0.89	16	-0.02	0.93	16	-0.83	0.83	16
		old	-1.17	1.79	14	-2.33	0.54	14	0.02	1.49	14	-0.45	1.10	14	-1.81	1.00	14	-0.64	1.14	14	-1.33	1.25	14
		Total	**-0.81**	**1.45**	**30**	**-1.98**	**0.77**	**30**	**0.40**	**1.36**	**30**	**-0.28**	**0.89**	**30**	**-1.56**	**0.96**	**30**	**-0.31**	**1.06**	**30**	**-1.07**	**1.06**	**30**
	Total	young	0.06	1.21	30	-1.61	0.74	30	0.67	1.14	30	-0.12	0.80	30	-1.32	0.87	30	0.00	1.00	30	-0.72	0.85	30
		old	-0.82	1.43	38	-1.85	0.82	38	0.44	1.43	38	-0.31	1.21	38	-1.70	1.02	38	-0.35	1.13	38	-1.07	1.06	38
		Total	**-0.44**	**1.40**	**68**	**-1.75**	**0.79**	**68**	**0.54**	**1.31**	**68**	**-0.23**	**1.05**	**68**	**-1.53**	**0.97**	**68**	**-0.20**	**1.08**	**68**	**-0.92**	**0.98**	**68**

Frequency

Descriptives for the frequency ratings are shown in Table 43. Comparisons across the groups suggested that in general females reported driving in the conditions more frequently than males. Differences were minimal, however. In general, younger participants also reported driving in the conditions more frequently than older participants. Changes over time in the frequency with which participants drove in these conditions were mixed.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on frequency ratings. Results are presented in Table 42. Given the large number of tests, only significant main effects or interactions are reported.

Table 42: Results of ANOVA for frequency

Frequency	Sig	Description
Main Effect of Time		
At night-time	**	Ratings at time 2 and time 3 were significantly lower than those at time 1. Following experience with the system and the removal of the system, participants were significantly less likely to have driven at night-time ($F(2,128) = 4.98$, $p < .01$).
On wet surfaces	*	Post hoc pairwise comparisons did not reveal any significant differences across time points but the mean trend suggests that participants were less likely to have driven on wet surfaces following experience with the ISA system ($F(2,128) = 3.39$, $p < .05$).
In a hurry	***	Ratings at time 3 were significantly higher than those reported at time 1. Following the removal of the system, participants were more likely to have driven when in a hurry ($F(2,128) = 7.06$, $p < .001$).
With a passenger	*	Ratings at time 2 were significantly lower than those reported at time 3. Participants were significantly less likely to have driven with a passenger when driving with ISA ($F(2,128) = 4.02$, $p < .05$).
Main Effect of Gender		
With a passenger	*	Compared to male participants, female participants were significantly more likely to drive with a passenger ($F(1,64) = 4.20$, $p < .05$).
Main Effect of Age Group		
In a hurry	*	Compared to older participants, younger participants were significantly more likely to drive when in a hurry ($F(1,64) = 4.18$, $p < .05$).

Table 43: Frequency ratings relating to exceeding the speed limit by time by gender by age

Phase	Sex	Age	night-time			wet surfaces			in a hurry			good mood			heavy traffic			bad mood			passenger		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	5.52	0.88	14	5.52	0.88	14	3.55	1.07	14	4.45	0.84	14	5.05	0.65	14	3.40	0.84	14	5.05	1.07	14
		old	5.56	0.98	24	5.56	0.98	24	3.35	0.93	24	4.25	0.60	24	5.24	0.84	24	3.39	0.84	24	5.01	0.99	24
		Total	**5.54**	**0.93**	**38**	**5.54**	**0.93**	**38**	**3.42**	**0.98**	**38**	**4.32**	**0.70**	**38**	**5.17**	**0.77**	**38**	**3.39**	**0.83**	**38**	**5.03**	**1.00**	**38**
	Female	young	5.96	0.71	16	5.96	0.71	16	3.77	0.87	16	4.48	1.01	16	5.56	0.76	16	3.40	0.76	16	5.75	1.06	16
		old	5.49	0.88	14	5.49	0.88	14	3.81	1.03	14	4.21	0.89	14	5.40	0.82	14	3.26	0.82	14	5.76	0.76	14
		Total	**5.74**	**0.81**	**30**	**5.74**	**0.81**	**30**	**3.79**	**0.93**	**30**	**4.36**	**0.95**	**30**	**5.49**	**0.78**	**30**	**3.33**	**0.78**	**30**	**5.76**	**0.92**	**30**
	Total	young	5.76	0.81	30	5.76	0.81	30	3.67	0.95	30	4.47	0.92	30	5.32	0.75	30	3.40	0.78	30	5.42	1.11	30
		old	5.53	0.93	38	5.53	0.93	38	3.52	0.98	38	4.24	0.71	38	5.30	0.83	38	3.34	0.83	38	5.29	0.97	38
		Total	**5.63**	**0.88**	**68**	**5.63**	**0.88**	**68**	**3.58**	**0.97**	**68**	**4.34**	**0.81**	**68**	**5.31**	**0.79**	**68**	**3.37**	**0.80**	**68**	**5.35**	**1.03**	**68**
Time 2	Male	young	5.17	1.08	14	5.17	1.08	14	4.40	0.89	14	4.62	1.07	14	5.29	0.95	14	3.21	0.90	14	4.64	1.14	14
		old	5.38	0.92	24	5.38	0.92	24	3.36	0.84	24	4.06	0.57	24	5.35	1.00	24	3.46	0.94	24	5.02	1.21	24
		Total	**5.30**	**0.97**	**38**	**5.30**	**0.97**	**38**	**3.75**	**0.99**	**38**	**4.26**	**0.82**	**38**	**5.32**	**0.97**	**38**	**3.37**	**0.92**	**38**	**4.88**	**1.18**	**38**
	Female	young	5.56	1.07	16	5.56	1.07	16	4.08	1.08	16	4.38	0.82	16	5.42	0.91	16	3.63	0.57	16	5.18	0.91	16
		old	5.40	0.91	14	5.40	0.91	14	3.62	1.54	14	4.31	0.86	14	5.40	0.82	14	3.43	0.80	14	5.43	1.26	14
		Total	**5.49**	**0.99**	**30**	**5.49**	**0.99**	**30**	**3.87**	**1.31**	**30**	**4.34**	**0.82**	**30**	**5.41**	**0.85**	**30**	**3.53**	**0.68**	**30**	**5.29**	**1.08**	**30**
	Total	young	5.38	1.07	30	5.38	1.07	30	4.23	0.99	30	4.49	0.93	30	5.36	0.91	30	3.43	0.76	30	4.93	1.04	30
		old	5.39	0.90	38	5.39	0.90	38	3.46	1.13	38	4.15	0.69	38	5.37	0.92	38	3.45	0.88	38	5.17	1.23	38
		Total	**5.38**	**0.97**	**68**	**5.38**	**0.97**	**68**	**3.80**	**1.13**	**68**	**4.30**	**0.82**	**68**	**5.36**	**0.91**	**68**	**3.44**	**0.82**	**68**	**5.06**	**1.15**	**68**
Time 3	Male	young	5.29	0.91	14	5.29	0.91	14	4.24	0.86	14	4.86	0.94	14	5.33	1.00	14	3.38	0.79	14	4.76	1.19	14
		old	5.38	1.11	24	5.38	1.11	24	3.89	1.04	24	4.13	1.05	24	5.35	1.12	24	3.72	1.08	24	5.14	1.18	24
		Total	**5.34**	**1.03**	**38**	**5.34**	**1.03**	**38**	**4.02**	**0.98**	**38**	**4.39**	**1.06**	**38**	**5.34**	**1.06**	**38**	**3.60**	**0.99**	**38**	**5.00**	**1.18**	**38**
	Female	young	5.25	1.16	16	5.25	1.16	16	4.42	0.92	16	4.29	0.81	16	5.58	0.98	16	3.77	0.38	16	4.96	1.48	16
		old	5.64	0.90	14	5.64	0.90	14	3.88	1.32	14	4.33	0.97	14	5.69	0.93	14	3.14	1.20	14	5.45	1.11	14
		Total	**5.43**	**1.05**	**30**	**5.43**	**1.05**	**30**	**4.17**	**1.14**	**30**	**4.31**	**0.87**	**30**	**5.63**	**0.94**	**30**	**3.48**	**0.90**	**30**	**5.19**	**1.32**	**30**
	Total	young	5.27	1.03	30	5.27	1.03	30	4.33	0.88	30	4.56	0.90	30	5.47	0.98	30	3.59	0.63	30	4.87	1.33	30
		old	5.47	1.04	38	5.47	1.04	38	3.89	1.14	38	4.20	1.01	38	5.47	1.06	38	3.51	1.15	38	5.25	1.15	38
		Total	**5.38**	**1.03**	**68**	**5.38**	**1.03**	**68**	**4.08**	**1.05**	**68**	**4.36**	**0.97**	**68**	**5.47**	**1.01**	**68**	**3.54**	**0.95**	**68**	**5.08**	**1.24**	**68**

4.2.2.4 Examination of changes in individual beliefs (disengage scenario)

Behavioural beliefs

Comparisons over time (see Table 45) suggested that following experience with the system drivers' beliefs (whether positive or negative) tended to weaken. Comparisons across the groups were generally inconsistent.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on behavioural belief ratings. Results are presented in Table 44. Given the large number of tests, only significant main effects or interactions are reported.

Table 44: Results of ANOVA for behavioural beliefs

Behavioural Belief	Sig	Description
Main Effect of Time		
Would make me feel relieved	**	Ratings at time 2 were significantly higher than ratings at time 1. Following experience with ISA drivers were significantly more likely to believe that disengaging the system would provide some relief ($F(1.68,107.78) = 5.35$, $p < .01$).
Would make me feel good	*	Post hoc pairwise comparisons did not reveal any significant differences between time points but the mean trend suggests that following experience with ISA, participants were significantly more likely to believe that disengaging the system would make them feel good ($F(2,128) = 3.20$, $p < .05$).
Would make me feel anxious	*	Ratings at time 2 were significantly lower than ratings at time 1. Following experience with ISA, participants were significantly less likely to believe that disengaging the system would make them feel anxious ($F(1.96,125.38) = 3.75$, $p < .05$).
Main Effect of Age Group		
Would make me feel relieved	**	Compared to younger participants, older participants were significantly less likely to believe that disengaging the system would make them feel relieved ($F(1,64) = 7.71$, $p < .01$).
Would make me feel good	*	Compared to younger participants, older participants were significantly less likely to believe that disengaging the system would make them feel good ($F(1,64) = 4.85$, $p < .05$).

Table 45: Behavioural beliefs relating to disengaging the system by time by gender by age

Phase	Sex	Age	get me to my destination more quickly			risk causing an accident			reduce pressure from other drivers			enable me to make rapid progress			make me feel relieved			regain control of car			save time			allow me to keep up with traffic			make me feel good			make me feel anxious		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	0.86	1.29	14	-0.93	1.38	14	0.79	1.85	14	0.43	1.28	14	-0.64	1.28	14	0.36	1.34	14	-0.29	1.14	14	1.21	1.12	14	-0.29	1.49	14	0.21	1.67	14
		old	0.67	1.61	24	-0.38	1.50	24	1.42	1.53	24	1.04	1.08	24	-0.50	1.79	24	0.50	1.87	24	0.42	1.47	24	1.08	1.38	24	-1.08	1.44	24	-0.42	1.98	24
		Total	**0.74**	**1.48**	**38**	**-0.58**	**1.46**	**38**	**1.18**	**1.66**	**38**	**0.82**	**1.18**	**38**	**-0.55**	**1.61**	**38**	**0.45**	**1.67**	**38**	**0.16**	**1.39**	**38**	**1.13**	**1.28**	**38**	**-0.79**	**1.49**	**38**	**-0.18**	**1.87**	**38**
	Female	young	0.44	1.90	16	-0.50	1.51	16	1.13	1.67	16	0.56	1.63	16	-0.38	1.93	16	0.50	1.79	16	0.00	1.83	16	1.31	1.45	16	-0.81	1.87	16	-0.38	1.82	16
		old	0.86	1.66	14	-0.21	1.12	14	1.36	1.69	14	1.00	1.80	14	-1.00	1.88	14	0.07	1.77	14	0.21	1.53	14	0.79	1.63	14	-0.93	1.54	14	0.14	1.70	14
		Total	**0.63**	**1.77**	**30**	**-0.37**	**1.33**	**30**	**1.23**	**1.65**	**30**	**0.77**	**1.70**	**30**	**-0.67**	**1.90**	**30**	**0.30**	**1.76**	**30**	**0.10**	**1.67**	**30**	**1.07**	**1.53**	**30**	**-0.87**	**1.70**	**30**	**-0.13**	**1.76**	**30**
	Total	young	0.63	1.63	30	-0.70	1.44	30	0.97	1.73	30	0.50	1.46	30	-0.50	1.63	30	0.43	1.57	30	-0.13	1.53	30	1.27	1.28	30	-0.57	1.70	30	-0.10	1.75	30
		old	0.74	1.61	38	-0.32	1.36	38	1.39	1.57	38	1.03	1.37	38	-0.68	1.82	38	0.34	1.82	38	0.34	1.48	38	0.97	1.46	38	-1.03	1.46	38	-0.21	1.88	38
		Total	**0.69**	**1.60**	**68**	**-0.49**	**1.40**	**68**	**1.21**	**1.64**	**68**	**0.79**	**1.42**	**68**	**-0.60**	**1.73**	**68**	**0.38**	**1.70**	**68**	**0.13**	**1.51**	**68**	**1.10**	**1.38**	**68**	**-0.82**	**1.57**	**68**	**-0.16**	**1.81**	**68**
Time 2	Male	young	1.14	1.10	14	-0.93	1.54	14	1.36	1.22	14	0.36	1.34	14	0.79	1.31	14	0.29	1.94	14	0.50	1.29	14	1.57	0.85	14	0.36	1.60	14	-0.50	1.45	14
		old	-0.04	1.88	24	-0.58	1.74	24	0.58	2.04	24	0.00	1.87	24	-0.50	1.79	24	0.71	1.68	24	-0.17	1.69	24	0.67	1.81	24	-0.88	1.85	24	-0.88	1.70	24
		Total	**0.39**	**1.72**	**38**	**-0.71**	**1.66**	**38**	**0.87**	**1.80**	**38**	**0.13**	**1.68**	**38**	**-0.03**	**1.73**	**38**	**0.55**	**1.77**	**38**	**0.08**	**1.57**	**38**	**1.00**	**1.58**	**38**	**-0.42**	**1.84**	**38**	**-0.74**	**1.61**	**38**
	Female	young	0.06	2.02	16	-0.25	1.57	16	1.63	1.02	16	0.50	1.26	16	0.63	1.54	16	-0.13	1.75	16	-0.31	1.74	16	1.25	1.13	16	-0.50	1.75	16	-0.81	1.76	16
		old	0.93	1.82	14	-0.21	1.42	14	1.21	1.19	14	0.93	1.33	14	-0.64	2.17	14	-0.07	1.77	14	0.43	1.91	14	1.14	1.23	14	-0.93	1.77	14	-0.50	1.65	14
		Total	**0.47**	**1.94**	**30**	**-0.23**	**1.48**	**30**	**1.43**	**1.10**	**30**	**0.70**	**1.29**	**30**	**0.03**	**1.94**	**30**	**-0.10**	**1.73**	**30**	**0.03**	**1.83**	**30**	**1.20**	**1.16**	**30**	**-0.70**	**1.74**	**30**	**-0.67**	**1.69**	**30**
	Total	young	0.57	1.72	30	-0.57	1.57	30	1.50	1.11	30	0.43	1.28	30	0.70	1.42	30	0.07	1.82	30	0.07	1.57	30	1.40	1.00	30	-0.10	1.71	30	-0.67	1.60	30
		old	0.32	1.89	38	-0.45	1.62	38	0.82	1.78	38	0.34	1.73	38	-0.55	1.91	38	0.42	1.73	38	0.05	1.77	38	0.84	1.62	38	-0.89	1.80	38	-0.74	1.67	38
		Total	**0.43**	**1.81**	**68**	**-0.50**	**1.59**	**68**	**1.12**	**1.55**	**68**	**0.38**	**1.54**	**68**	**0.00**	**1.81**	**68**	**0.26**	**1.77**	**68**	**0.06**	**1.67**	**68**	**1.09**	**1.40**	**68**	**-0.54**	**1.79**	**68**	**-0.71**	**1.63**	**68**
Time 3	Male	young	1.14	1.35	14	-0.71	1.90	14	1.36	1.50	14	0.64	1.65	14	0.86	1.61	14	0.36	1.74	14	0.21	1.58	14	1.57	0.65	14	0.64	1.82	14	-0.71	1.54	14
		old	0.00	1.84	24	-0.92	1.79	24	0.58	1.95	24	0.04	1.63	24	-0.58	1.74	24	0.33	1.83	24	-0.29	1.68	24	0.75	1.57	24	-0.46	1.53	24	-0.42	1.86	24
		Total	**0.42**	**1.75**	**38**	**-0.84**	**1.81**	**38**	**0.87**	**1.82**	**38**	**0.26**	**1.64**	**38**	**-0.05**	**1.82**	**38**	**0.34**	**1.77**	**38**	**-0.11**	**1.64**	**38**	**1.05**	**1.35**	**38**	**-0.05**	**1.71**	**38**	**-0.53**	**1.74**	**38**
	Female	young	0.25	2.02	16	-0.31	1.45	16	1.31	1.58	16	0.94	1.53	16	0.38	1.86	16	-0.69	2.18	16	0.19	1.91	16	1.44	1.15	16	-0.13	1.59	16	-1.06	1.69	16
		old	0.29	1.94	14	-0.50	1.45	14	1.29	1.94	14	0.36	1.69	14	-1.14	2.11	14	-0.14	2.18	14	-0.43	1.91	14	0.57	2.31	14	-1.00	2.25	14	-0.36	2.02	14
		Total	**0.27**	**1.95**	**30**	**-0.40**	**1.43**	**30**	**1.30**	**1.73**	**30**	**0.67**	**1.60**	**30**	**-0.33**	**2.09**	**30**	**-0.43**	**2.16**	**30**	**-0.10**	**1.90**	**30**	**1.03**	**1.81**	**30**	**-0.53**	**1.94**	**30**	**-0.73**	**1.86**	**30**
	Total	young	0.67	1.77	30	-0.50	1.66	30	1.33	1.52	30	0.80	1.56	30	0.60	1.73	30	-0.20	2.02	30	0.20	1.73	30	1.50	0.94	30	0.23	1.72	30	-0.90	1.60	30
		old	0.11	1.86	38	-0.76	1.67	38	0.84	1.95	38	0.16	1.64	38	-0.79	1.88	38	0.16	1.95	38	-0.34	1.74	38	0.68	1.85	38	-0.66	1.82	38	-0.39	1.90	38
		Total	**0.35**	**1.83**	**68**	**-0.65**	**1.66**	**68**	**1.06**	**1.78**	**68**	**0.44**	**1.62**	**68**	**-0.18**	**1.93**	**68**	**0.00**	**1.98**	**68**	**-0.10**	**1.75**	**68**	**1.04**	**1.56**	**68**	**-0.26**	**1.82**	**68**	**-0.62**	**1.78**	**68**

Outcome evaluations

Where outcome evaluations were repeated, the results are as for the speeding scenario. Table 47 suggests that differences over time suggested the majority of outcomes were evaluated more positively following experience with the system. Differences across the groups were again inconsistent.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on the individual outcome evaluations. Results are presented in Table 46. Given the large number of tests, only significant main effects or interactions are reported.

Table 46: Results of ANOVA for outcome evaluations

Outcome Evaluation	Sig	Description
Main Effect of Time		
Would reduce pressure from other traffic	*	Ratings at time 3 were significantly higher than those reported at time 1. Following experience with ISA, participants evaluated the outcome of reducing pressure from other traffic significantly more positively than they had prior to any experience with ISA (F(1.82,116.750 = 4.11, p < .05).

Table 47: Outcome evaluations relating to disengaging the system by time by gender by age

			get me to my destination more quickly			risk causing an accident			reduce pressure from other drivers			enable me to make rapid progress			make me feel relieved			regain control of car			save time			allow me to keep up with traffic			make me feel good			make me feel anxious		
Phase	Sex	Age	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	1.52	0.82	14	-2.95	0.12	14	1.00	0.88	14	1.12	0.53	14	1.43	1.40	14	1.43	0.94	14	1.52	0.72	14	0.64	1.60	14	1.62	1.11	14	-2.05	0.99	14
		old	1.42	1.37	24	-2.94	0.13	24	0.96	1.37	24	1.10	1.53	24	1.17	1.69	24	0.71	1.49	24	1.44	1.37	24	0.88	1.15	24	1.33	1.70	24	-2.31	0.98	24
		Total	**1.46**	**1.19**	**38**	**-2.95**	**0.12**	**38**	**0.97**	**1.20**	**38**	**1.11**	**1.25**	**38**	**1.26**	**1.57**	**38**	**0.97**	**1.35**	**38**	**1.47**	**1.17**	**38**	**0.79**	**1.32**	**38**	**1.44**	**1.50**	**38**	**-2.21**	**0.97**	**38**
	Female	young	0.88	1.26	16	-2.98	0.08	16	0.88	1.54	16	1.02	1.38	16	0.81	1.68	16	1.13	1.71	16	1.01	1.47	16	0.75	1.39	16	0.85	2.07	16	-2.35	0.77	16
		old	1.30	0.94	14	-2.98	0.09	14	1.57	1.28	14	1.14	1.15	14	1.43	1.28	14	1.36	1.39	14	1.51	1.08	14	1.14	1.51	14	1.11	1.57	14	-2.40	0.69	14
		Total	**1.07**	**1.12**	**30**	**-2.98**	**0.08**	**30**	**1.20**	**1.45**	**30**	**1.08**	**1.26**	**30**	**1.10**	**1.52**	**30**	**1.23**	**1.55**	**30**	**1.24**	**1.31**	**30**	**0.93**	**1.44**	**30**	**0.97**	**1.83**	**30**	**-2.38**	**0.73**	**30**
	Total	young	1.18	1.11	30	-2.97	0.10	30	0.93	1.26	30	1.07	1.06	30	1.10	1.56	30	1.27	1.39	30	1.25	1.19	30	0.70	1.47	30	1.21	1.71	30	-2.21	0.88	30
		old	1.37	1.22	38	-2.96	0.11	38	1.18	1.35	38	1.11	1.38	38	1.26	1.54	38	0.95	1.47	38	1.47	1.26	38	0.97	1.28	38	1.25	1.64	38	-2.35	0.87	38
		Total	**1.29**	**1.17**	**68**	**-2.96**	**0.11**	**68**	**1.07**	**1.31**	**68**	**1.09**	**1.24**	**68**	**1.19**	**1.54**	**68**	**1.09**	**1.43**	**68**	**1.37**	**1.23**	**68**	**0.85**	**1.36**	**68**	**1.23**	**1.66**	**68**	**-2.29**	**0.87**	**68**
Time 2	Male	young	1.40	0.69	14	-2.69	0.44	14	1.21	1.05	14	1.50	0.96	14	1.79	0.80	14	1.71	0.99	14	1.69	0.81	14	0.93	1.33	14	1.86	1.04	14	-1.81	1.08	14
		old	1.17	1.20	24	-2.96	0.15	24	1.79	1.22	24	1.17	1.24	24	1.46	1.56	24	1.08	1.38	24	1.31	1.15	24	1.08	1.35	24	1.32	1.48	24	-2.17	1.07	24
		Total	**1.25**	**1.04**	**38**	**-2.86**	**0.32**	**38**	**1.58**	**1.18**	**38**	**1.29**	**1.14**	**38**	**1.58**	**1.33**	**38**	**1.32**	**1.28**	**38**	**1.45**	**1.04**	**38**	**1.03**	**1.33**	**38**	**1.52**	**1.35**	**38**	**-2.04**	**1.08**	**38**
	Female	young	1.00	1.34	16	-3.00	0.00	16	1.25	1.73	16	0.67	1.48	16	1.38	1.36	16	0.88	1.54	16	1.06	1.49	16	0.81	1.11	16	1.17	2.14	16	-2.21	0.90	16
		old	1.26	1.19	14	-2.95	0.18	14	1.64	1.60	14	0.93	1.54	14	1.50	1.79	14	0.86	1.56	14	1.24	1.68	14	0.79	1.63	14	0.71	1.84	14	-2.40	0.88	14
		Total	**1.12**	**1.26**	**30**	**-2.98**	**0.12**	**30**	**1.43**	**1.65**	**30**	**0.79**	**1.49**	**30**	**1.43**	**1.55**	**30**	**0.87**	**1.53**	**30**	**1.14**	**1.55**	**30**	**0.80**	**1.35**	**30**	**0.96**	**1.99**	**30**	**-2.30**	**0.88**	**30**
	Total	young	1.19	1.09	30	-2.86	0.34	30	1.23	1.43	30	1.06	1.31	30	1.57	1.14	30	1.27	1.36	30	1.36	1.24	30	0.87	1.20	30	1.49	1.73	30	-2.02	0.99	30
		old	1.20	1.18	38	-2.96	0.16	38	1.74	1.35	38	1.08	1.34	38	1.47	1.62	38	1.00	1.43	38	1.28	1.35	38	0.97	1.44	38	1.10	1.63	38	-2.25	1.00	38
		Total	**1.20**	**1.13**	**68**	**-2.91**	**0.26**	**68**	**1.51**	**1.40**	**68**	**1.07**	**1.32**	**68**	**1.51**	**1.42**	**68**	**1.12**	**1.40**	**68**	**1.31**	**1.29**	**68**	**0.93**	**1.33**	**68**	**1.27**	**1.67**	**68**	**-2.15**	**1.00**	**68**
Time 3	Male	young	1.80	1.03	14	-2.69	0.51	14	1.57	1.02	14	1.60	1.01	14	1.79	1.31	14	1.43	1.34	14	1.83	0.98	14	1.50	1.34	14	2.07	0.78	14	-1.90	1.22	14
		old	1.11	1.28	24	-2.94	0.21	24	1.88	1.48	24	1.10	1.47	24	1.33	1.83	24	1.38	1.44	24	1.17	1.54	24	0.88	1.80	24	1.33	1.69	24	-2.13	1.18	24
		Total	**1.36**	**1.23**	**38**	**-2.85**	**0.37**	**38**	**1.76**	**1.32**	**38**	**1.28**	**1.33**	**38**	**1.50**	**1.66**	**38**	**1.39**	**1.39**	**38**	**1.41**	**1.38**	**38**	**1.11**	**1.66**	**38**	**1.61**	**1.46**	**38**	**-2.04**	**1.18**	**38**
	Female	young	1.56	1.52	16	-2.98	0.08	16	1.56	1.67	16	1.31	1.57	16	1.63	1.54	16	1.69	1.35	16	1.44	1.62	16	1.06	1.18	16	1.40	1.87	16	-2.21	0.75	16
		old	1.17	1.69	14	-2.95	0.12	14	1.43	1.70	14	1.07	1.91	14	1.50	1.79	14	1.21	1.42	14	1.36	1.69	14	1.29	1.49	14	1.14	1.83	14	-2.64	0.59	14
		Total	**1.38**	**1.59**	**30**	**-2.97**	**0.10**	**30**	**1.50**	**1.66**	**30**	**1.20**	**1.71**	**30**	**1.57**	**1.63**	**30**	**1.47**	**1.38**	**30**	**1.40**	**1.62**	**30**	**1.17**	**1.32**	**30**	**1.28**	**1.83**	**30**	**-2.41**	**0.70**	**30**
	Total	young	1.67	1.30	30	-2.84	0.38	30	1.57	1.38	30	1.44	1.33	30	1.70	1.42	30	1.57	1.33	30	1.62	1.35	30	1.27	1.26	30	1.71	1.48	30	-2.07	0.99	30
		old	1.13	1.42	38	-2.95	0.18	38	1.71	1.56	38	1.09	1.62	38	1.39	1.79	38	1.32	1.42	38	1.24	1.57	38	1.03	1.68	38	1.26	1.72	38	-2.32	1.03	38
		Total	**1.37**	**1.39**	**68**	**-2.90**	**0.29**	**68**	**1.65**	**1.47**	**68**	**1.25**	**1.50**	**68**	**1.53**	**1.63**	**68**	**1.43**	**1.37**	**68**	**1.41**	**1.48**	**68**	**1.13**	**1.51**	**68**	**1.46**	**1.63**	**68**	**-2.21**	**1.01**	**68**

Normative pressure

Comparisons across Table 48 suggest that normative pressure from friends, family and partners not to disengage the system decreased when ISA was activated, whilst perceived pressure from the police and other road users increased. In general female drivers and older drivers perceived greater pressure not to disengage the system.

Table 48: Normative beliefs relating to disengaging the system

Phase	Sex	Age	police			other road users			family			friends			spouse/partner		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	0.43	1.83	14	-1.07	1.64	14	0.21	1.37	14	-1.07	1.54	14	0.15	1.63	13
		old	0.54	1.77	24	-0.50	1.50	24	0.92	1.59	24	0.46	1.67	24	1.00	1.53	24
		Total	**0.50**	**1.77**	**38**	**-0.71**	**1.56**	**38**	**0.66**	**1.53**	**38**	**-0.11**	**1.77**	**38**	**0.70**	**1.60**	**37**
	Female	young	0.63	1.63	16	-0.06	1.39	16	0.81	1.33	16	0.56	1.26	16	1.13	1.06	15
		old	1.29	1.54	14	-0.14	1.66	14	0.71	1.27	14	0.64	1.15	14	0.93	1.38	14
		Total	**0.93**	**1.60**	**30**	**-0.10**	**1.49**	**30**	**0.77**	**1.28**	**30**	**0.60**	**1.19**	**30**	**1.03**	**1.21**	**29**
	Total	young	0.53	1.70	30	-0.53	1.57	30	0.53	1.36	30	-0.20	1.61	30	0.68	1.42	28
		old	0.82	1.71	38	-0.37	1.55	38	0.84	1.46	38	0.53	1.48	38	0.97	1.46	38
		Total	**0.69**	**1.70**	**68**	**-0.44**	**1.55**	**68**	**0.71**	**1.41**	**68**	**0.21**	**1.57**	**68**	**0.85**	**1.44**	**66**
Time 2	Male	young	0.93	1.33	14	-1.07	1.54	14	-0.21	1.72	14	-0.50	1.45	14	-0.23	1.74	13
		old	0.38	2.00	24	-0.58	1.44	24	-0.17	1.61	24	-0.33	1.52	24	-0.08	1.69	24
		Total	**0.58**	**1.78**	**38**	**-0.76**	**1.48**	**38**	**-0.18**	**1.63**	**38**	**-0.39**	**1.48**	**38**	**-0.14**	**1.69**	**37**
	Female	young	0.69	1.78	16	-1.31	1.30	16	-0.06	1.61	16	-0.44	1.21	16	0.07	1.58	15
		old	1.07	1.98	14	0.00	1.57	14	0.43	1.50	14	0.43	1.65	14	0.29	1.77	14
		Total	**0.87**	**1.85**	**30**	**-0.70**	**1.56**	**30**	**0.17**	**1.56**	**30**	**-0.03**	**1.47**	**30**	**0.17**	**1.65**	**29**
	Total	young	0.80	1.56	30	-1.20	1.40	30	-0.13	1.63	30	-0.47	1.31	30	-0.07	1.63	28
		old	0.63	1.99	38	-0.37	1.50	38	0.05	1.58	38	-0.05	1.59	38	0.05	1.71	38
		Total	**0.71**	**1.80**	**68**	**-0.74**	**1.50**	**68**	**-0.03**	**1.59**	**68**	**-0.24**	**1.48**	**68**	**0.00**	**1.66**	**66**
Time 3	Male	young	-0.14	2.25	14	-1.43	1.28	14	-0.43	1.83	14	-0.64	1.55	14	-0.23	1.96	13
		old	0.88	1.30	24	0.00	1.35	24	0.29	1.40	24	-0.08	1.32	24	0.46	1.47	24
		Total	**0.50**	**1.75**	**38**	**-0.53**	**1.48**	**38**	**0.03**	**1.59**	**38**	**-0.29**	**1.41**	**38**	**0.22**	**1.67**	**37**
	Female	young	0.38	1.09	16	-0.81	1.33	16	0.13	1.09	16	0.13	1.09	16	0.40	1.06	15
		old	1.36	1.39	14	-0.21	1.58	14	0.43	1.79	14	0.36	1.82	14	0.21	2.01	14
		Total	**0.83**	**1.32**	**30**	**-0.53**	**1.46**	**30**	**0.27**	**1.44**	**30**	**0.23**	**1.45**	**30**	**0.31**	**1.56**	**29**
	Total	young	0.13	1.72	30	-1.10	1.32	30	-0.13	1.48	30	-0.23	1.36	30	0.11	1.55	28
		old	1.05	1.33	38	-0.08	1.42	38	0.34	1.53	38	0.08	1.51	38	0.37	1.67	38
		Total	**0.65**	**1.57**	**68**	**-0.53**	**1.46**	**68**	**0.13**	**1.52**	**68**	**-0.06**	**1.44**	**68**	**0.26**	**1.61**	**66**

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on normative beliefs. Results are presented in Table 49. Given the large number of tests, only significant main effects or interactions are reported. Drivers' motivations to comply with the selected referents are as discussed earlier regarding the speeding scenario (see section 4.2.2.3).

Table 49: Results of ANOVA for normative beliefs

Normative beliefs	Sig	Description
Main Effect of Time		
My family would disapprove of my disengaging the system	**	Ratings at time 2 and time 3 were significantly lower than those reported at time 1. Following experience with ISA participants were significantly less likely to believe that their family would disapprove of them disengaging the system ($F(1.97,125.76) = 5.82$, $p < .01$).
My partner/spouse would disapprove of my disengaging the system	**	Ratings at time 2 and time 3 were significantly lower than those reported at time 1. Following experience with ISA, participants were significantly less likely to believe that their spouse or partner would disapprove of them disengaging the system ($F(1.78, 110.23) = 7.17$, $p < .01$).
Main Effect of Gender		
My friends would disapprove of my disengaging the system	*	Compared to male participants, female participants were significantly more likely to believe that their friends would disapprove of them disengaging the system ($F(1,64) = 6.20$, $p < .05$).
Main Effect of Age Group		
Other road users would disapprove of my disengaging the system	*	Compared to older participants, younger participants were significantly less likely to believe that other road users would disapprove of their overriding the system ($F(1,64) = 5.87$, $p < .05$).
My friends would disapprove of my disengaging the system	*	Compared to younger participants, older participants were significantly more likely to believe that their friends would disapprove of them overriding the system ($F(1,64) = 4.93$, $p < .05$).

Control beliefs

Table 51 indicates that being in a hurry facilitated drivers' propensity to disengage the system. Across the road categories, drivers seemed most likely to disengage the system on a motorway. Compared to their counterparts, female drivers and older drivers were more likely to believe that the control factors inhibited disengaging the system.

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on control beliefs. Results are presented in Table 50. Given the large number of tests, only significant main effects or interactions are reported.

Table 50: Results of ANOVA for control beliefs

Control beliefs	Sig	Description
Main Effect of Age Group		
In a hurry	*	Compared to older participants, younger participants were more likely to believe that being in a hurry would facilitate disengaging the system ($F(1,64) = 4.04$, $p < .05$).
At night-time	*	Compared to older participants, younger participants were significantly less likely to believe driving at night-time would inhibit disengaging the system ($F(1,64) = 5.27$, $p < .05$).

Table 51: Control beliefs relating to disengaging the system

Phase	Sex	Age	motorway			30mph road			40mph road			in a hurry			heavy traffic			night-time			wet surfaces			passenger		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	Male	young	0.50	1.16	14	-1.21	1.37	14	-0.93	1.00	14	0.79	0.80	14	-1.79	1.19	14	-0.21	1.48	14	-1.64	0.84	14	-1.21	0.97	14
		old	-0.17	1.49	24	-1.42	1.41	24	-1.04	1.43	24	0.29	1.49	24	-1.46	1.35	24	-0.88	1.30	24	-1.46	1.10	24	-1.00	1.06	24
		Total	0.08	1.40	38	-1.34	1.38	38	-1.00	1.27	38	0.47	1.29	38	-1.58	1.29	38	-0.63	1.38	38	-1.53	1.01	38	-1.08	1.02	38
	Female	young	-0.38	1.89	16	-1.94	1.24	16	-1.56	1.46	16	0.50	1.26	16	-1.69	1.40	16	-1.47	0.99	15	-1.81	1.11	16	-1.75	1.13	16
		old	-1.00	1.47	14	-1.07	1.59	14	-1.07	1.54	14	0.29	1.90	14	-2.14	1.10	14	-1.79	1.19	14	-2.07	1.07	14	-1.36	1.28	14
		Total	-0.67	1.71	30	-1.53	1.46	30	-1.33	1.49	30	0.40	1.57	30	-1.90	1.27	30	-1.62	1.08	29	-1.93	1.08	30	-1.57	1.19	30
	Total	young	0.03	1.63	30	-1.60	1.33	30	-1.27	1.28	30	0.63	1.07	30	-1.73	1.28	30	-0.86	1.38	29	-1.73	0.98	30	-1.50	1.07	30
		old	-0.47	1.52	38	-1.29	1.47	38	-1.05	1.45	38	0.29	1.63	38	-1.71	1.29	38	-1.21	1.32	38	-1.68	1.12	38	-1.13	1.14	38
		Total	-0.25	1.58	68	-1.43	1.41	68	-1.15	1.37	68	0.44	1.41	68	-1.72	1.28	68	-1.06	1.35	67	-1.71	1.05	68	-1.29	1.12	68
Time 2	Male	young	0.29	1.98	14	-1.43	1.34	14	-0.57	1.65	14	1.21	0.89	14	-2.00	0.88	14	0.00	1.57	14	-1.57	0.94	14	-1.07	1.00	14
		old	0.04	2.05	24	-1.04	1.71	24	-1.21	1.67	24	0.25	1.87	24	-1.71	1.43	24	-1.04	1.63	24	-1.67	1.58	24	-0.96	1.60	24
		Total	0.13	2.00	38	-1.18	1.57	38	-0.97	1.67	38	0.61	1.64	38	-1.82	1.25	38	-0.66	1.66	38	-1.63	1.36	38	-1.00	1.39	38
	Female	young	0.13	2.31	16	-0.56	1.86	16	0.19	1.47	16	0.88	1.82	16	-1.19	1.60	16	-0.33	1.54	15	-1.69	1.20	16	-0.88	1.09	16
		old	-0.71	2.02	14	-1.43	2.06	14	-1.07	1.86	14	0.36	2.24	14	-1.57	1.22	14	-0.93	1.98	14	-2.21	1.25	14	-1.57	1.45	14
		Total	-0.27	2.18	30	-0.97	1.97	30	-0.40	1.75	30	0.63	2.01	30	-1.37	1.43	30	-0.62	1.76	29	-1.93	1.23	30	-1.20	1.30	30
	Total	young	0.20	2.12	30	-0.97	1.67	30	-0.17	1.58	30	1.03	1.45	30	-1.57	1.36	30	-0.17	1.54	29	-1.63	1.07	30	-0.97	1.03	30
		old	-0.24	2.05	38	-1.18	1.83	38	-1.16	1.72	38	0.29	1.99	38	-1.66	1.34	38	-1.00	1.74	38	-1.87	1.47	38	-1.18	1.56	38
		Total	-0.04	2.08	68	-1.09	1.75	68	-0.72	1.72	68	0.62	1.80	68	-1.62	1.34	68	-0.64	1.69	67	-1.76	1.31	68	-1.09	1.35	68
Time 3	Male	young	0.86	1.83	14	-1.43	1.50	14	-0.71	1.86	14	1.07	1.14	14	-1.57	1.74	14	0.00	1.66	14	-1.86	1.03	14	-0.64	1.34	14
		old	0.04	1.78	24	-0.83	1.66	24	-1.00	1.35	24	0.25	1.59	24	-1.46	1.44	24	-1.08	1.32	24	-1.25	1.51	24	-1.21	1.25	24
		Total	0.34	1.82	38	-1.05	1.61	38	-0.89	1.54	38	0.55	1.48	38	-1.50	1.54	38	-0.68	1.53	38	-1.47	1.37	38	-1.00	1.29	38
	Female	young	0.56	2.13	16	-1.13	2.03	16	-0.56	1.82	16	1.00	1.79	16	-1.50	1.71	16	-0.80	1.74	15	-2.19	1.05	16	-0.94	1.12	16
		old	-0.57	1.74	14	-0.93	1.90	14	-1.07	1.77	14	0.07	2.30	14	-1.64	1.28	14	-0.93	1.90	14	-1.86	1.35	14	-1.29	1.59	14
		Total	0.03	2.01	30	-1.03	1.94	30	-0.80	1.79	30	0.57	2.06	30	-1.57	1.50	30	-0.86	1.79	29	-2.03	1.19	30	-1.10	1.35	30
	Total	young	0.70	1.97	30	-1.27	1.78	30	-0.63	1.81	30	1.03	1.50	30	-1.53	1.70	30	-0.41	1.72	29	-2.03	1.03	30	-0.80	1.21	30
		old	-0.18	1.77	38	-0.87	1.73	38	-1.03	1.50	38	0.18	1.86	38	-1.53	1.37	38	-1.03	1.53	38	-1.47	1.47	38	-1.24	1.36	38
		Total	0.21	1.90	68	-1.04	1.75	68	-0.85	1.64	68	0.56	1.75	68	-1.53	1.51	68	-0.76	1.63	67	-1.72	1.31	68	-1.04	1.31	68

Frequency

Where beliefs are repeated, changes in frequency ratings are as before for the speeding scenario (see section 4.2.2.3). Differences across time points and groups were inconsistent (Table 53).

A series of mixed design 3 x 2 x 2 ANOVAs (time x gender x age) were carried out to assess the impact of the ISA intervention on frequency ratings. Results are presented in Table 52. Given the large number of tests, only significant main effects or interactions are reported.

Table 52: Results of ANOVA for frequency

Frequency	Sig	Description
Main Effect of Gender		
On an urban road	*	Compared to male participants, female participants were more likely to drive on urban roads ($F(1,64) = 6.43$, $p < .05$).
Main Effect of Age Group		
On a motorway	*	Compared to younger participants, older participants were less likely to drive on a motorway ($F(1,64) = 5.47$, $p < .05$).

Table 53: Frequency ratings relating to disengaging the system

Phase	Sex	Age	motorway			30mph road			40mph road			in a hurry			heavy traffic			night-time			wet surfaces			passenger		
			M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N	M	SD	N
Time 1	**Male**	young	6.00	1.04	14	6.54	0.66	13	6.36	0.74	14	3.55	1.07	14	5.05	0.65	14	5.52	0.88	14	5.52	0.88	14	5.05	1.07	14
		old	5.29	1.43	24	6.38	0.77	24	5.96	1.23	24	3.35	0.93	24	5.24	0.84	24	5.56	0.98	24	5.56	0.98	24	5.01	0.99	24
		Total	**5.55**	**1.33**	**38**	**6.43**	**0.73**	**37**	**6.11**	**1.09**	**38**	**3.42**	**0.98**	**38**	**5.17**	**0.77**	**38**	**5.54**	**0.93**	**38**	**5.54**	**0.93**	**38**	**5.03**	**1.00**	**38**
	Female	young	5.81	1.11	16	6.81	0.40	16	6.50	0.73	16	3.77	0.87	16	5.56	0.76	16	5.96	0.71	16	5.96	0.71	16	5.75	1.06	16
		old	4.86	1.56	14	6.36	1.39	14	6.64	0.63	14	3.81	1.03	14	5.40	0.82	14	5.49	0.88	14	5.49	0.88	14	5.76	0.76	14
		Total	**5.37**	**1.40**	**30**	**6.60**	**1.00**	**30**	**6.57**	**0.68**	**30**	**3.79**	**0.93**	**30**	**5.49**	**0.78**	**30**	**5.74**	**0.81**	**30**	**5.74**	**0.81**	**30**	**5.76**	**0.92**	**30**
	Total	young	5.90	1.06	30	6.69	0.54	29	6.43	0.73	30	3.67	0.95	30	5.32	0.75	30	5.76	0.81	30	5.76	0.81	30	5.42	1.11	30
		old	5.13	1.47	38	6.37	1.02	38	6.21	1.09	38	3.52	0.98	38	5.30	0.83	38	5.53	0.93	38	5.53	0.93	38	5.29	0.97	38
		Total	**5.47**	**1.35**	**68**	**6.51**	**0.86**	**67**	**6.31**	**0.95**	**68**	**3.58**	**0.97**	**68**	**5.31**	**0.79**	**68**	**5.63**	**0.88**	**68**	**5.63**	**0.88**	**68**	**5.35**	**1.03**	**68**
Time 2	**Male**	young	5.21	1.48	14	6.08	1.12	13	5.50	1.45	14	4.40	0.89	14	5.29	0.95	14	5.17	1.08	14	5.17	1.08	14	4.64	1.14	14
		old	5.21	1.32	24	6.29	1.04	24	6.04	1.23	24	3.36	0.84	24	5.35	1.00	24	5.38	0.92	24	5.38	0.92	24	5.02	1.21	24
		Total	**5.21**	**1.36**	**38**	**6.22**	**1.06**	**37**	**5.84**	**1.33**	**38**	**3.75**	**0.99**	**38**	**5.32**	**0.97**	**38**	**5.30**	**0.97**	**38**	**5.30**	**0.97**	**38**	**4.88**	**1.18**	**38**
	Female	young	5.56	1.46	16	6.38	1.02	16	6.13	1.09	16	4.08	1.08	16	5.42	0.91	16	5.56	1.07	16	5.56	1.07	16	5.18	0.91	16
		old	4.50	1.83	14	6.71	0.83	14	6.71	0.83	14	3.62	1.54	14	5.40	0.82	14	5.40	0.91	14	5.40	0.91	14	5.43	1.26	14
		Total	**5.07**	**1.70**	**30**	**6.53**	**0.94**	**30**	**6.40**	**1.00**	**30**	**3.87**	**1.31**	**30**	**5.41**	**0.85**	**30**	**5.49**	**0.99**	**30**	**5.49**	**0.99**	**30**	**5.29**	**1.08**	**30**
	Total	young	5.40	1.45	30	6.24	1.06	29	5.83	1.29	30	4.23	0.99	30	5.36	0.91	30	5.38	1.07	30	5.38	1.07	30	4.93	1.04	30
		old	4.95	1.54	38	6.45	0.98	38	6.29	1.14	38	3.46	1.13	38	5.37	0.92	38	5.39	0.90	38	5.39	0.90	38	5.17	1.23	38
		Total	**5.15**	**1.51**	**68**	**6.36**	**1.01**	**67**	**6.09**	**1.22**	**68**	**3.80**	**1.13**	**68**	**5.36**	**0.91**	**68**	**5.38**	**0.97**	**68**	**5.38**	**0.97**	**68**	**5.06**	**1.15**	**68**
Time 3	**Male**	young	5.43	1.70	14	6.15	0.99	13	5.79	1.25	14	4.24	0.86	14	5.33	1.00	14	5.29	0.91	14	5.29	0.91	14	4.76	1.19	14
		old	5.29	1.20	24	6.04	1.16	24	6.00	1.10	24	3.89	1.04	24	5.35	1.12	24	5.38	1.11	24	5.38	1.11	24	5.14	1.18	24
		Total	**5.34**	**1.38**	**38**	**6.08**	**1.09**	**37**	**5.92**	**1.15**	**38**	**4.02**	**0.98**	**38**	**5.34**	**1.06**	**38**	**5.34**	**1.03**	**38**	**5.34**	**1.03**	**38**	**5.00**	**1.18**	**38**
	Female	young	5.94	1.00	16	6.50	0.97	16	6.19	0.91	16	4.42	0.92	16	5.58	0.98	16	5.25	1.16	16	5.25	1.16	16	4.96	1.48	16
		old	4.71	1.27	14	6.36	0.84	14	6.29	0.83	14	3.88	1.32	14	5.69	0.93	14	5.64	0.90	14	5.64	0.90	14	5.45	1.11	14
		Total	**5.37**	**1.27**	**30**	**6.43**	**0.90**	**30**	**6.23**	**0.86**	**30**	**4.17**	**1.14**	**30**	**5.63**	**0.94**	**30**	**5.43**	**1.05**	**30**	**5.43**	**1.05**	**30**	**5.19**	**1.32**	**30**
	Total	young	5.70	1.37	30	6.34	0.97	29	6.00	1.08	30	4.33	0.88	30	5.47	0.98	30	5.27	1.03	30	5.27	1.03	30	4.87	1.33	30
		old	5.08	1.24	38	6.16	1.05	38	6.11	1.01	38	3.89	1.14	38	5.47	1.06	38	5.47	1.04	38	5.47	1.04	38	5.25	1.15	38
		Total	**5.35**	**1.32**	**68**	**6.24**	**1.02**	**67**	**6.06**	**1.03**	**68**	**4.08**	**1.05**	**68**	**5.47**	**1.01**	**68**	**5.38**	**1.03**	**68**	**5.38**	**1.03**	**68**	**5.08**	**1.24**	**68**

4.2.3 Discussion

Current research across several countries has demonstrated the enormous capability of ISA in reducing mean speeds and the speed distribution. Whilst attempts have been made to track attitudinal changes as result of such technological interventions, few have applied specific psychological theory to monitor changes in cognitions. Using the TPB within the ISA UK project addressed this issue.

Analysis sought to determine the impact of long-term experience with ISA upon the individual TPB constructs. Whilst results demonstrated little significant impact upon the constructs of the TPB, intentions were reported to significantly weaken following long-term experience with the ISA system. Following experience with the ISA system participants expressed significantly weaker intentions to exceed the speed limit. Examination of beliefs also provided encouraging results and suggested that following experience with the ISA system participants were significantly less likely to believe that speeding would get them to their destination more quickly and less likely to believe being in a hurry would facilitate speeding. Although participants still remained in agreement with these beliefs, the results tend to indicate that ISA went some way towards showing the participants that speeding does not necessarily reduce journey times. This is especially important since research has shown that behavioural beliefs relating to "arriving quicker" and control beliefs relating to "being late/in a rush" (Elliott, et al., 2005) reliably predict intentions to speed and intentions to comply with the speed limit.

Although the participants expressed positive intentions to alter their behaviour and demonstrated positive changes in their beliefs this failed to translate into behavioural change. Whilst speeding behaviour was shown to drop significantly during the ISA activation period, levels of speeding returned to those previously observed following the removal of the system. Results would therefore suggest that, whilst active, ISA was effective in reducing behaviour. However without the support of the system, participants were less likely to comply with the speed limit.

Moreover, if speeding is under the partial influence of habit, as some have argued (Elliott et al., 2003), the results would suggest that although ISA may have been successful in blocking habitual behaviour when activated, it was unsuccessful in establishing new compliant habits. Ouellette and Wood (1998) maintain that any intervention designed to change habitual behaviour should ensure an immediate positive response. Whilst reinforcement was not required to promote repetition (since the nature of the ISA system enforces repetition) the results might suggest that it does seem important in determining whether this new, enforced behaviour can then proceed relatively automatically. Outcomes of the new behaviour must be judged more favourably than the alternatives and it is the behavioural outcomes of efficiency, profitability and convenience that motivate change (Verplanken and Wood, 2006). Even if we are not to believe that speeding is under the control of habit, this argument could provide a potential explanation for the findings. Since the positive outcomes associated with complying with the speed limits are by nature never directly experienced (a reduction in accident risk, avoidance of prosecution or fines, reduced anxiety etc) it seems reasonable to suppose that exceeding the speed limit with its immediate perceived reinforcements (feeling good, saving time etc) is often judged as the more favourable outcome. Within the present analysis examination of the behavioural beliefs suggested that 'feeling good' was not only the strongest correlate with speeding intentions and behaviour but that this belief strengthened following experience with ISA system. As discussed, Warner (2006) also noted that the belief "makes me arrive quicker" predicted drivers' intentions to exceed the speed limit on urban and rural roads. Given research relating to the powerful influence of positive affect (Lawton, Parker, Manstead, and Stradling, 1997) and the common misconception that speeding decreases journey time, establishing speed limit compliance with less obvious favourable outcomes presents a difficult problem. The results may also suggest that, without the support of the ISA system, participants were more vulnerable to non-motivational pressures associated with driving such as pressure from traffic etc. Nevertheless, the results are important in that they demonstrate a significant change in intentions and possibly suggest that experience with ISA prompts a consideration that behavioural change may be necessary.

Changes in cognitions relating to the disengage scenario were less positive. Following experience with ISA, participants felt in significantly greater control of their ability to disengage the system (perhaps because of the realisation of the relative ease with which the system could be overridden). Participants were also significantly less likely to view overriding the system as morally unacceptable.

It is important to note however that although the ISA intervention failed to elicit a sustained behaviour change, the behavioural analysis presented in Table 8 in Section 3.5 suggested there was no indication of a negative carry over effect; speeding behaviour remained stable and did not become more prolific. Examination of the significant time-based interactions showed no discernable pattern, suggesting that the impact of ISA upon behaviour and cognitions did not alter according to a driver's age or gender.

Although it was not the main focus of the research to determine any general between-participant differences, several significant differences in beliefs were identified. Differences between male and female participants were the most pronounced. Compared to male participants, female participants were significantly less likely to speed and expressed significantly less favourable attitudes towards exceeding the speed limit. Closer investigation of participants' behavioural beliefs suggested that female participants were significantly more likely to believe that speeding would risk causing an accident, being stopped by the police and being prosecuted and fined than male participants. Unsurprisingly, therefore, female participants perceived significantly more pressure from the police not to speed. Male participants, however, perceived significantly more pressure from their partners and family. Analysis relating to the control beliefs suggested that male participants viewed control factors such as driving at night-time as significantly less inhibiting than female participants. Similar differences were noted between young and older participants. Although differences were much less frequent, compared to older participants, younger participants were more likely to engage in speeding and tended to express beliefs that were much more favourable towards speeding. Findings here are in line previous research (Parker, Manstead, Stradling, and Reason, 1992; Parker, Manstead, Stradling, Reason, and Baxter, 1992) and provide information that is useful for more traditional speeding campaigns.

4.3 Attitudes towards ISA: the impact of experience

4.3.1 Introduction

The successful implementation of ISA will ultimately depend upon the public acceptance. The last decade has seen a notable shift in opinion amongst UK drivers with a significant proportion of drivers supporting the implementation of ISA technologies. Despite such favourable findings, Carsten (2002, p 7) points out however, that these attitudes may not be "deeply held". Given the intervening feature of an ISA system, the implementation of such a safety measure could raise considerable opposition. Experience has shown however, that sceptical views regarding the benefits of many safety systems, including seat belts and traffic calming, change with the debate around legislation or with experience of actual deployment. Reassuringly, research in Europe has also demonstrated that experience with ISA increases drivers' acceptance (Almqvist and Nygård, 1997; Persson, Towliat, Almqvist, Risser and Magdeburg, 1993) and it is drivers' perceptions of the secondary benefits associated with ISA that are likely to account for this increased acceptance. In several studies, for example, drivers reported that ISA had increased their perceived safety (Biding and Lind, 2002), attention to the driving task (Almqvist and Nygård, 1997) and driving style (Besseling and van Boxtel, 2001). Moreover, whilst opponents often express concerns that this type of technology threatens the driver's control, previous field trials would tend to suggest that neither passive nor intrusive ISA systems significantly limit the driver's perceived freedom (Besseling and van Boxtel, 2001; Lahrmann, Madsen and Boroch, 2001). However, whilst it is encouraging to note that familiarity with ISA breeds acceptance, previous long-term ISA field trials have taken place outside of the UK. In response to this, the ISA UK project provided the first evaluation of the long-term impact of ISA on UK drivers' attitudes towards the system and the workload associated with driving an ISA vehicle.

Despite positive shifts in attitudes amongst ISA test drivers, some drivers remain resistant to the concept. In Tilburg, for example, an overwhelming 62% of drivers still evaluated driving with ISA less positively than driving without ISA (Besseling and van Boxtel, 2001). It becomes important therefore to identify which individuals are least likely to adopt ISA and where drivers consider its use most appropriate.

Drivers' attitudes towards current speed limits provide some indication of the likely resistance to ISA. Lahrmann, Madsen and Boroch (2001) noted that almost all Danish ISA test drivers would prefer speed limits to increase, particularly on highways and motorways. Similarly, in the SARTRE 3 study, 43% of U.K drivers reported they would prefer increased speed limits on motorways and 21% would prefer increases on main roads (Cauzard, 2004). Swedish drivers agreed that 30km/h and 50km/h speed limits should be adhered to (Biding & Lind, 2002) and Tilburg drivers believed that it was most important to keep to the speed limit on 50km/h, 70km/h and 90km/h roads and least important on the 110km/h roads (Besseling & van Boxtel, 2001). Unsurprising therefore, Biding and Lind's (2002) comparison across four Swedish cities found that 80% of drivers believed that ISA was most justifiable in 30km/h areas. On 50km/h roads in urban and residential areas and higher speed limit roads however, the proportions drop. Almqvist and Nygård (1997) also noted that drivers were less positive about ISA's use in rural areas than urban areas. Differences here were explained because drivers had no experience of ISA on a rural road or expected speed to be regulated in urban areas but this could reflect a general resistance to ISA control on higher speed limited roads. As a whole, the results tend to imply that acceptability of ISA is highest for slower urban and residential roads. This seems sensible given the increased number of potential hazards and the fewer opportunities to speed in these areas; however results from the Tilburg drivers experience provide some contradictory evidence. Here, Besseling and van Boxtel (2001) reported that although drivers did not perceive a difference in appreciation of ISA on 30km/h and 50km/h (in fact 60% found driving on these roads positive), appreciation was highest for the 80km/h roads. However, anecdotal evidence has suggested that a high number of speed cameras on these roads may account for drivers' responses. Nevertheless, road context is clearly an important factor. Várhelyi and Mäkinen (2001) also suggest that drivers also accept the need for an ISA system in certain critical situations such as slippery roads, at pavement defects, in poor visibility, in built-up areas, at pedestrian crossings. Similar findings were also observed in the large-scale Swedish trials (Biding & Lind, 2002) where drivers considered ISA quite or very justified during the daytime in urban areas, in poor weather conditions and when road works were present. Since environmental factors seem likely to influence drivers' acceptability of ISA it becomes important to examine those contexts where drivers perceived safety and frustration is at its greatest.

To date, few studies have systematically examined individual differences related to the acceptance of ISA. In a comparison of drivers and non-drivers of the Umeå trial, Garvill, Marell and Westin (2003) examined factors influencing drivers' decision to install an ISA system.

Groups differed with respect to age, perceived moral obligation to keep to speed limits, perceived correlation between speed and risk, perceived difficulty in keeping within the speed limits and number of reported speed violations. Jamson (2002) examined differential use of a voluntary ISA system. Although a simulator study found no differences between drivers, an on-road study suggested that drivers who admitted to speeding were less likely to engage the system and thus demonstrated least acceptance. Taken together these studies suggest that those who need the system the most are the least likely to use it. Since psychological and demographic factors appear to moderate acceptance, an aim of this project was to determine any systematic differences in terms of drivers' acceptability of and attitudes towards ISA with respect to age, gender and intention to speed.

4.3.2 Design

In order to determine changes in acceptability, attitudes towards the ISA system and workload experienced when driving with ISA, questionnaires were administered at four time points:

- Time 1: at initial vehicle handover,
- Time 2: following one month of ISA control,
- Time 3: following four months of ISA control, and
- Time 4: following a one-month return to non-ISA-controlled driving.

Administering measures according to this timetable allowed comparisons between drivers' expectations of the system and any relevant changes in attitudes, acceptability and workload following early and prolonged experience with the ISA system.

Measures of subjective workload were specifically taken following a prearranged observation drive which took place according to the time points listed above. The primary purpose of this drive within the ISA UK study was to examine any differences in driving behaviours using the Wiener Fahrprobe technique[10]. Conducting these drives provided the opportunity to monitor subjective workload experienced when completing a fixed route.

4.3.3 Measures

4.3.3.1 Acceptability

Driver acceptance of the ISA system was measured using an acceptability scale of advanced transport telematics developed by Van der Laan et al. (1997). The simple scale provided a direct measure of attitudes towards systems. Nine items measured participant's views of ISA allowing system evaluation across the dimensions of usefulness and satisfaction. Administration of the questionnaire at four time points allowed the calculation of an end score for each participant on the two dimensions of "usefulness" (e.g., useful-useless, scored +2 to –2) and "satisfaction" (e.g., pleasant-unpleasant, scored +2 to –2). A practical system evaluation was gauged by the usefulness score, whilst satisfaction scores reflected the system's pleasantness. High scores reflected positive appraisals of the system's usefulness and high satisfaction with the system. In a

[10] Here drivers are accompanied by two observers who register a wide variety of driver behaviour, either positive or negative, across different road geometry layouts such as links and junctions. Analysis of collected data is simple, and requires a total count of the number of negative behaviours including: unsafe merging/gap acceptance at junctions; incorrect lane changes; ignores other road users e.g. by not adapting their speed; unsafe overtaking manoeuvres; adoption of short headways. In addition, the total number of conflicts with other traffic is also collected.

comparison of six studies high scale reliability was found (Van der Laan et al., 1997). De Waard, Van der Hurst and Brookhuis (1999) have since utilised the scale.

Table 54: Reliability scores for acceptability measures

Measure	Time 1	Time 2	Time 3	Time 4
Usefulness	0.78	0.83	0.85	0.91
Satisfaction	0.87	0.92	0.91	0.93

4.3.3.2 Driver Behaviour Questionnaire

Self-reported driving violations and errors were assessed using the shortened 24-item version of the Driver Behaviour Questionnaire (Parker et al., 1995). This instrument measured the frequency with which individuals committed various types of errors and violations when driving, identifying three distinct types of aberrant driving behaviours; errors, lapses and violations. Participants were presented with 24 aberrant driving behaviours and asked to rate how often they have committed these (0 = never, 1 = hardly ever, 2 = occasionally, 3 = quite often, 4 = frequently, 5 = nearly all the time). In a comparison between the 50-item and 24-item scale, good internal consistency has been found for each of the three subscales (Cronbach's α coefficients 0.84 for the errors, 0.80 for the violations, and 0.72 for lapses). The three factors first identified in Reason, Manstead, Stradling, Baxter and Campbell (1990) were confirmed. Test-retest correlations also demonstrated reliability over time (time 1 and time 2 correlations were 0.69 for error scale, 0.81 for the violation scale and 0.75 for the lapse scale).

Eight items measured **errors** (e.g., 'Attempt to overtake someone that you hadn't noticed to be taking a right turn', never-nearly all the time; scored 0 to +5). High scores reflected a greater propensity to perform the behaviour. Eight items measured **lapses** (e.g., 'Attempt to drive away from traffic lights in third gear', never-nearly all the time; scored 0 to +5). High scores reflected a greater propensity to perform the behaviour. Eight items measured **violations** (e.g., 'Disregard the speed limits late at night or early in the morning', never-nearly all the time; scored 0 to +5). High scores reflected a greater propensity to perform the behaviour. Reliability scores for the DBQ measures were generally good, as shown in Table 55.

Table 55: Reliability scores for DBQ measures

Measure	Time 1	Time 2	Time 3	Time 4
Lapse	0.68	0.61	0.69	0.74
Error	0.76	0.74	0.69	0.87
Violation	0.74	0.69	0.66	0.67

4.3.3.3 NASA-RTLX

The NASA-RTLX (Byers, Bittner and Hill, 1989) provided a measure of subjective workload. This tool involved formalising the driver's own judgement about the workload s/he experienced based on the assumption that workload is influenced by mental demand, physical demand, temporal demand, performance, frustration level and effort. Drivers placed a line on a bipolar scale (low-high) indicating their experience of each attribute. The score was simply taken as the length (in mm) from the left scale anchor. A high score here represented a strong experience of each attribute (e.g. drivers experienced a high level of frustration when driving). Nygren (1991) supports the scale's potential as a general prediction model for experienced workload. Within the driving domain the NASA-RTLX has assessed workload in tests of an intelligent speed adaptation system (Comte, 2000). Reliability scores for the NASA-RTLX measures were generally good, as shown in Table 56.

Table 56: Reliability scores for NASA-RTLX measures

Measure	Time 1	Time 2	Time 3	Time 4
NASA-RTLX	0.67	0.71	0.52	0.54

4.3.3.4 General attitudinal items

Items included within the questionnaire sought to determine the impact of ISA upon the experience of driving and examine differences between drivers' expectations of the system and their subsequent experience.

Given research pertaining to the influence of drivers' perceived safety and frustration on system acceptance, several items sought to determine on which roads and in which traffic scenarios drivers experienced increased or indeed decreased frustration and risk (as compared to unsupported driving).

Over the years, opponents of ISA have expressed concerns regarding drivers' ability to overtake when speed limited and the potential negative behavioural adaptations such as close following. In response to this, a number of items were included to evaluate drivers' experiences of these behaviours.

It has also been suggested that providing drivers with speed limit information and controlling their speed to the posted speed limit may affect drivers' concentration on the driving task and the manner in which they drive. A number of items were therefore included to determine any differences in drivers' attention when driving with ISA. Since the cost of ISA may prove an obstacle to any national roll out of ISA, items also investigated drivers' willingness to install and pay for an intervening ISA system.

4.3.4 Results

Given the large number of items included within the questionnaires only summaries for each item at each time point are provided. Higher order (3-way & 4-way) interactions are not presented given the difficulty in attributing meaningful explanations to these effects and the lack of any consistent patterns across analyses.

4.3.4.1 Driver Behaviour Questionnaire

The Driver Behaviour Questionnaire (Parker et al., 1995) measured the frequency with which individuals committed various types of errors and violations when driving, identifying three distinct types of aberrant driving behaviours; errors, lapses and violations. Figure 82 suggests that participants' tendency to suffer errors, lapses and violations decreased following experience with ISA. A series of mixed design 4 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were performed to identify significant differences in participants' propensity to engage in aberrant driving behaviours before, during and after their experience of ISA. The results are shown in Table 57.

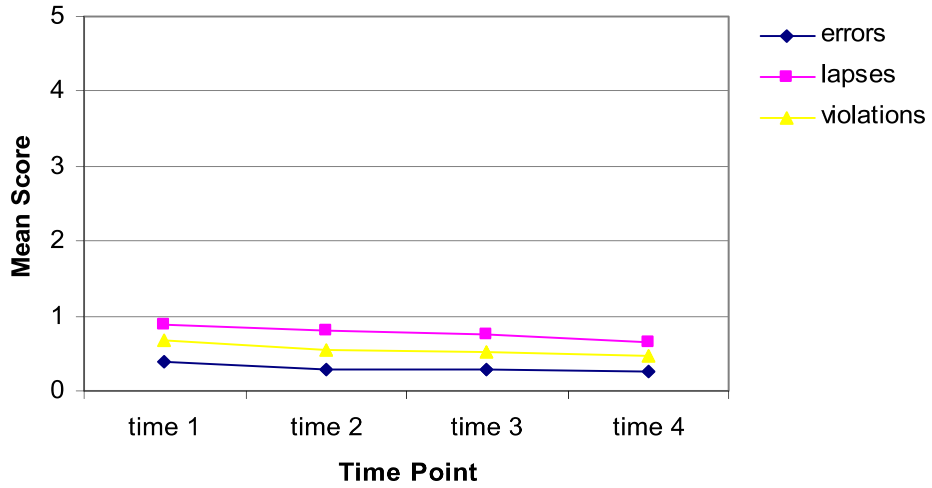


Figure 82: Mean error, lapse and violation score on DBQ over time

Table 57: Results of ANOVA for DBQ scores

DBQ	Sig	Description
Main Effect of Time		
Error	*	Post hoc pairwise comparisons did not reveal any significant differences between time points however the mean trend suggests that participants' propensity to suffer errors significantly declined following experience with ISA (F (2.92, 163.23) = 3.36, p < .05).
Lapse	**	Ratings at time 4 were significantly lower than those reported at time 1. Participants' propensity to suffer lapses significantly declined following experience with ISA beyond the removal of the system (F(2.95,165.39) = 4.38, p < .01).
Violation	***	Ratings at time 3 and time 4 were significantly lower than those reported at time 1. Participants' propensity to commit violations significantly declined following experience with ISA beyond the removal of the system (F(2.99,167.40) = 6.45, p< .001).
Main Effect of Gender		
Lapse	*	Females suffered significantly more lapses than males (F(1,56) = 5.54, p < .05).

4.3.4.2 Acceptability

As stated earlier, driver acceptance of the ISA system was measured using an acceptability scale of advanced transport telematics developed by Van de Laan et al. (1997). Figure 83 illustrates participants' mean *usefulness* and *satisfaction* ratings for each time point at which they were assessed. The mean trend suggests that even though initial experience with the system reduced participants' satisfaction with and appreciation of the usefulness of ISA, this increased with prolonged experience and continued to rise even when the system was removed.

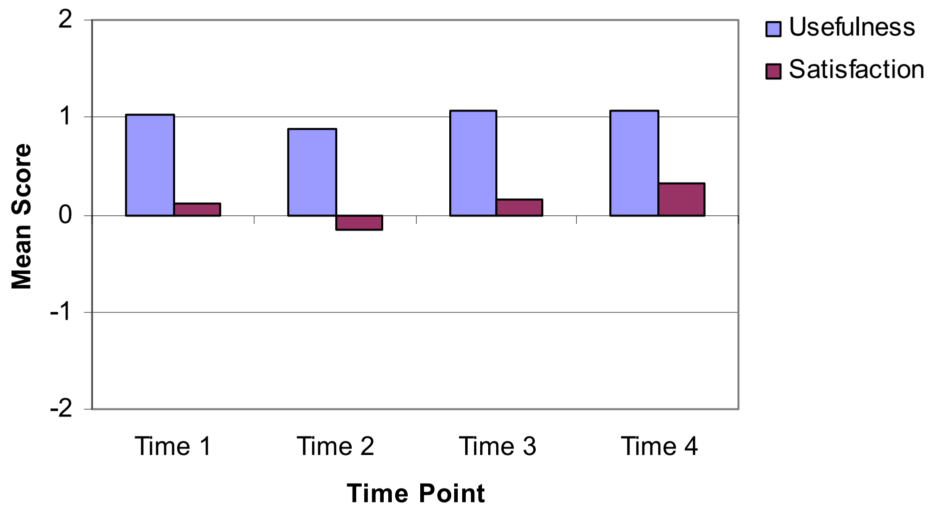


Figure 83: Acceptability ratings for the dimensions of "usefulness" and "satisfaction" over time

A series of mixed design 4 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out. The results are shown in Table 58.

Table 58: Results of ANOVA for acceptability scores

Acceptability	Sig	Description
Main Effect of Time		
Satisfaction	*	Ratings were significantly higher at time 4 compared to time 2. The general trend suggests that satisfaction with ISA dipped following early exposure to the system, but this rose steadily and significantly with prolonged exposure, beyond the removal of ISA support ($F(2.46, 132.87) = 3.79$, $p < .05$).
Main Effect of Gender		
Usefulness	*	Compared to male participants, female participants rated the ISA system as significantly more useful ($F(1,54) = 5.28$, $p < .05$).
Main Effect of Intention Group		
Usefulness	**	Compared to non-intenders, intenders rated the ISA system as significantly less useful ($F(1,54) = 6.17$, $p < .01$).
Satisfaction	**	Compared to non-intenders, intenders rated the ISA system as significantly less satisfying ($F(1,54) = 6.17$, $p < .01$).

4.3.4.3 Subjective mental workload

Subjective mental workload was measured using the NASA-RTLX (Byers et al., 1989). Comparisons across the means (Figure 84) suggest that the mental demand, physical demand and effort associated with driving declined when ISA support was provided. Whilst participants' performance showed marginal improvements under the support of ISA, frustration and time pressure were also seen to increase.

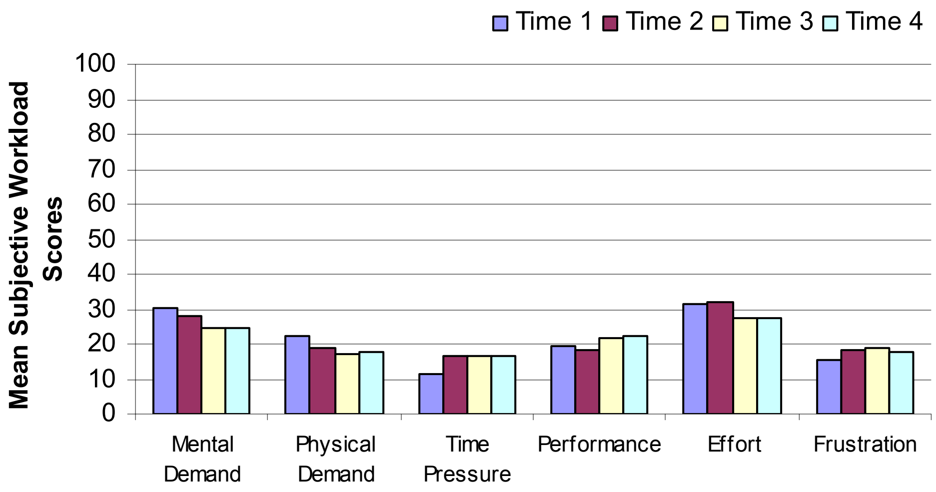


Figure 84: Individual workload dimension scores over time

A series of mixed design 4 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out to assess the impact of the ISA intervention on workload. Given the large number of tests, only significant main effects or interactions are reported. The results are presented in Table 59.

Table 59: Results of ANOVA for NASA-RTLX scores

Acceptability	Sig	Description
Main Effect of Time		
Physical demand	*	Ratings were significantly lower at time 3 and time 4 compared to time 1. Driving was rated as significantly less physically demanding following prolonged experience with ISA and the removal of the system ($F(3,201) = 4.46$, $p < .05$).
Time pressure	**	Ratings at time 2 were significantly higher than those expressed at time 1. Following early experience with ISA, participants experienced significantly greater time pressure. The mean trend would also suggest that participants continued to feel under increased time pressure beyond the removal of the system ($F(3,201) = 4.72$, $p < .01$).
Main Effect of Intention Group		
Frustration	*	Compared to non-intenders, intenders experienced considerably more frustration ($F(1,67) = 5.84$, $p < .05$).

4.3.4.4 General attitudes towards ISA

A number of items were included to monitor changes in participants' attitudes towards the system and their experience of driving with ISA compared to unsupported driving. Given the large number of items included only significant main effects and interactions are reported.

Perceived risk

Figure 85 compares participants' expectations and perceptions of the risk involved in driving with ISA following early and prolonged experience with the system compared to driving with an unsupported vehicle. The results suggest that, compared to unsupported driving, participants felt at increased risk under ISA control when overtaking, driving on a motorway and in fast moving traffic. This increased perceived risk surpassed their expectations and seemed typical to those situations which afforded the greatest opportunity for speeding. For all other driving conditions, participants tended to feel at less risk when driving with ISA compared to driving in a normal vehicle. Although participants' perceptions of the reduction in risk across scenarios was not as great as expected, ratings remained negative and would tend to suggest that in the majority of conditions participants considered driving with ISA safer than driving in an unsupported car.

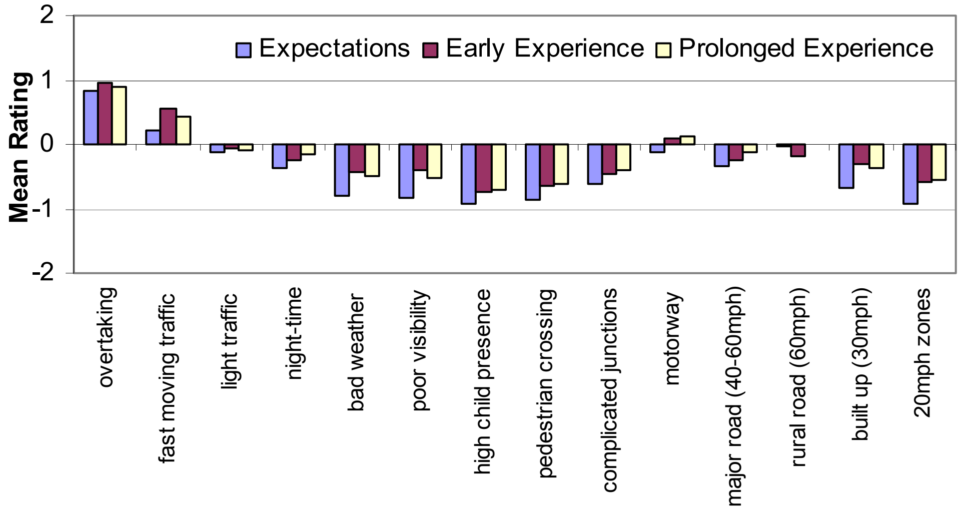


Figure 85: Compared to unsupported driving, how has driving with ISA affected your perceived risk in the following situations? (scored -2 to 2; decreased-increased)

A series of mixed design 3 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out to assess the impact of the ISA intervention on risk perceptions. Given the large number of tests, only significant main effects or interactions are reported (see Table 60).

Table 60: Results of ANOVA for perceived risk ratings

Perceived risk when…	Sig	Description
Main Effect of Time		
Driving with ISA in fast moving traffic	*	Post hoc pairwise comparisons did not reveal any differences between time points but the mean trend suggests that, following experience with ISA, participants perceived the increase in risk when driving with ISA in fast moving traffic as significantly greater than they had expected ($F(1.90,122.00) = 3.24$, $p < .05$).

Perceived risk when…	Sig	Description
Main Effect of Time		
Driving with ISA in bad weather conditions	**	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Although participants believed that ISA had decreased the risk of driving in bad weather, the reduction in risk perceived following experience with the system was significantly less than participants had originally expected ($F(1.98,118.53) = 6.14$, $p < .01$).
Driving with ISA in poor visibility conditions	**	Ratings at time 2 were significantly higher than those at time 1. Although participants believed that ISA had decreased the risk of driving in poor visibility conditions, the reduction in risk perceived following early experience with the system was significantly less than participants had anticipated ($F(2,120) = 5.87$, $p < .01$).
Driving with ISA in 30 mph zones	**	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Although participants believed that ISA had decreased the risk of driving in 30 mph zones, the reduction in risk perceived following experience with the system was significantly less than participants had expected ($F(2,120) = 6.42$, $p < .01$).
Driving with ISA in 20 mph zones	**	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Although participants believed that ISA decreased the risk of driving in 20 mph zones, the perceived reduction in risk expressed following experience with the system was significantly less than participants had anticipated ($F(2,120) = 5.21$, $p < .01$).
Main Effect of Gender		
Driving with ISA in light traffic	*	Compared to female participants, male participants expressed a significantly stronger belief that driving with ISA in light traffic increased risk ($F(1,60) = 4.84$, $p < .05$).
Main Effect of Age Group		
Driving with ISA in bad weather conditions	*	Compared to older participants, young participants expressed a significantly stronger belief that driving with ISA in bad weather conditions reduced risk ($F(1,04) = 5.88$, $p < .05$).
Driving with ISA in poor visibility conditions	*	Compared to older participants, young participants expressed a significantly stronger belief that driving with ISA in poor visibility conditions with ISA reduced risk ($F(1,60) = 6.91$, $p < .05$).
Driving with ISA in 20 mph zones	***	Compared to older participants, young participants expressed a significantly stronger belief that driving with ISA in 20 mph zones reduced risk ($F(1,60) = 11.96$, $p < .001$).
Main Effect of Intention Group		
Driving with ISA on motorways	*	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA on motorways increased risk ($F(1,60) = 4.41$, $p < .05$).
Driving with ISA on major roads outside built-up areas	*	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA on major roads outside built-up areas increased risk ($F(1,60) = 4.05$, $p < .05$).

Perceived frustration

Although the NASA-RTLX did not highlight a significant difference in frustration levels when driving with ISA, the mean trend did suggest that participants experienced some increase in frustration whilst speed restricted (see Figure 84). In order to examine those specific situations where frustration was most prevalent, a number of items compared participants' expectations and perceptions of the frustration involved in driving with ISA compared to unsupported driving.

Figure 86 highlights that participants expected and generally went on to feel increased frustration when driving with ISA whilst overtaking, driving in fast moving traffic, in light traffic, at night time, on motorways, major roads outside built up areas and on rural roads. Frustration again seemed specific to those situations which afforded the greatest opportunity to speed. In the remaining scenarios participants believed that ISA reduced frustration. In general, frustration levels began to subside following prolonged experience with the ISA system. Moreover, although the actual frustration experienced was greater than that expected, scores still remained negative for the majority of scenarios suggesting driving ISA was, on whole, less frustrating than driving in an unsupported vehicle.

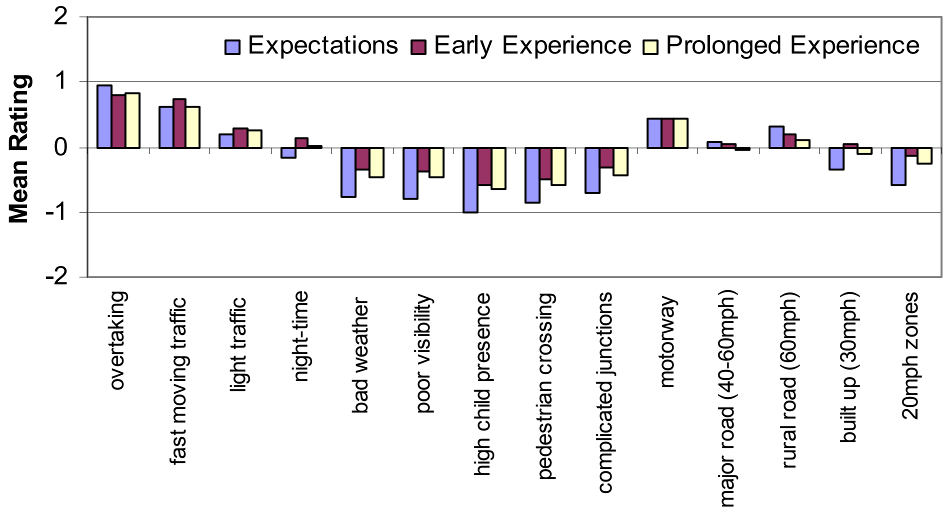


Figure 86: Compared to unsupported driving, how has driving with ISA affected your level of frustration in the following situations? (scored -2 to 2; decreased-increased)

A series of mixed design 3 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out to assess the impact of the ISA intervention on perceived frustration. Results are presented in Table 61. Given the large number of tests, only significant main effects or interactions are reported.

Table 61: Results of ANOVA for frustration ratings

Frustration when…	Sig	Description
Main Effect of Time		
Driving with ISA at night-time	*	Post hoc pairwise comparisons did not reveal any significant differences between time points but the mean trend suggests that following early experience with ISA, participants' frustration when driving at night-time was greater than they had expected (F (2,122) = 3.11, p < .05).

Frustration when…	Sig	Description
Main Effect of Time		
Driving with ISA in bad weather	**	Ratings at time 2 were significantly higher than those reported at time 1. Although participants agreed that ISA reduced the degree of frustration experienced when driving in bad weather conditions, the decrease experienced during their early experience was significantly less than they had expected ($F(2,122) = 6.00$, $p < .01$).
Driving with ISA in poor visibility conditions	***	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Although participants agreed that ISA reduced the degree of frustration experienced when driving in poor visibility conditions, the decrease experienced following early and long-term exposure to ISA was significantly less than they had expected ($F(2,122) = 7.51$, $p < .001$).
Driving with ISA near areas with a high child presence.	***	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Although participants agreed that ISA had reduced the degree of frustration experienced when driving near areas with a high child presence, the decrease experienced following early and long-term exposure to ISA was significantly less than they had expected ($F(2,122) = 7.10$, $p < .001$).
Driving with ISA near a pedestrian crossing	**	Ratings at time 2 were significantly higher than those reported at time 1. Although participants agreed ISA reduced frustration when driving near pedestrian crossings, the decrease experienced following early exposure to ISA was significantly less than they had expected ($F(2,122) = 5.47$, $p < .01$).
Driving with ISA at complicated junctions	*	Ratings at 2 were significantly higher than those reported at time 1. Although participants agreed that ISA reduced the degree of frustration experienced when driving with ISA at complicated junctions, the decrease experienced following early exposure to ISA was significantly less than they had expected ($F(2,122) = 4.71$, $p < .05$).
Driving with ISA in on 30 mph roads	*	Ratings at time 2 were significantly higher than those reported at time 1. During their early experience of ISA, participants experienced significantly more frustration when driving with ISA on 30 mph roads than they had expected ($F(2,122) = 3.81$, $p < .05$).
Driving with ISA in 20 mph zones	*	Ratings at time 2 were significantly higher than those at time 1. During their early experience of ISA, participants experienced significantly more frustration when driving with ISA in 20 mph zones than they had expected ($F(1.78,108.60) = 4.93$, $p < .05$).
Main Effect of Age Group		
Driving with ISA on a motorway	*	Compared to older participants, young participants expressed a significantly stronger belief that driving with ISA on a motorway increased frustration ($F(1,61) = 6.25$, $p < .05$).
Main Effect of Intention Group		
Overtaking with ISA	*	Compared to non-intenders, intenders expressed a significantly stronger belief that overtaking with ISA increased frustration ($F(1,61) = 6.93$, $p < .05$).
Driving with ISA in fast moving traffic.	***	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA in fast moving traffic increased frustration ($F(1,61) = 15.20$, $p < .001$).

Frustration when…	Sig	Description
Main Effect of Intention Group		
Driving with ISA in light traffic	***	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA in light traffic increased frustration ($F(1,61) = 14.002$, $p < .001$).
Driving with ISA at night-time	***	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA at night-time increased frustration ($F(1,61) = 11.24$, $p < .001$).
Driving with ISA on a motorway	***	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA on a motorway increased frustration ($F(1,61) = 13.49$, $p < .001$).
Driving with ISA on major roads outside a built up area	***	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA on major roads outside built up areas increased frustration ($F(1,61) = 15.67$, $p < .001$).
Driving with ISA on 60 mph rural roads	**	Compared to non-intenders, intenders expressed a significantly stronger belief that that driving with ISA on 60 mph rural roads increased frustration ($F(1,61) = 7.33$, $p < .01$).
Driving with ISA in on 30 mph roads	*	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA on 30 mph roads increased frustration ($F(1,61) = 6.88$, $p < .05$).
Driving with ISA in 20 mph zones	**	Compared to non-intenders, intenders expressed a significantly stronger belief that driving with ISA in 20 mph zones increased frustration ($F(1,61) = 9.29$, $p < .01$).
Interactions		
Overtaking with ISA	*	Time by gender interaction ($F(2,122) = 4.35$, $p < .05$). Following experience with the ISA system, male participants perceived less frustration when overtaking with ISA than they had expected, whereas female participants showed no change in opinion.
Driving with ISA in poor visibility conditions	*	Gender by age interaction ($F(1,61) = 6.23$, $p < .05$). Compared to older male participants, young male participants reported a significantly greater reduction in frustration when driving with ISA in poor visibility conditions.
Driving with ISA in 30 mph zones	*	Gender by intention interaction ($F(1,61) = 6.88$, $p < .05$). Female intenders experienced significantly greater increase in frustration when driving with ISA on 30 mph roads than female non-intenders.
Driving with ISA in 20 mph zones	*	Gender by intention interaction ($F(1,61) = 5.08$, $p < .05$). Female intenders perceived a considerably greater increase in frustration when driving in 20 mph zones.

The driving task

Figure 87 highlights that participants' anticipation of conflicts, attention to other roads users and pedestrians increased whilst driving with ISA compared to unsupported driving. Perhaps, unsurprisingly, participants' awareness of speed limits also increased when driving with ISA. Although participants reported a decreased tendency to accelerate when driving with ISA, participants also noted an increased tendency to brake. Compared to unsupported driving, participants' tendency to check their speedometer also increased. Despite this however, the general trends suggest that ISA allowed the participants to develop more effective driving styles and search strategies when driving with the ISA system.

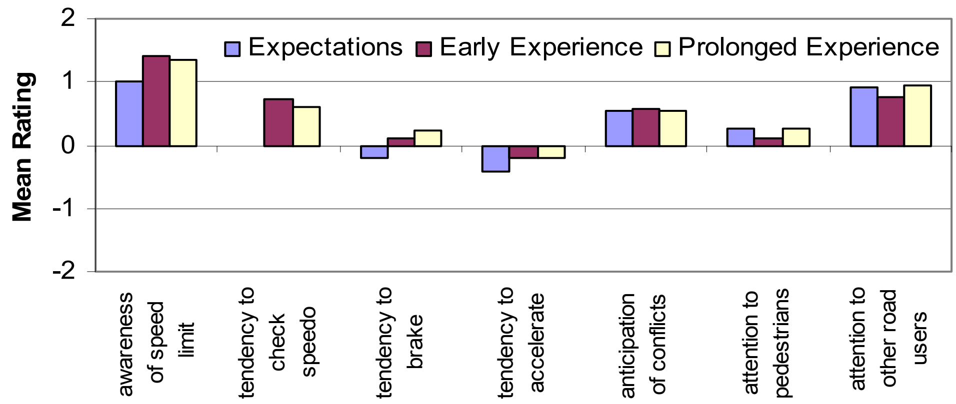


Figure 87: Compared to unsupported driving, how has ISA affected the following aspects of driving? (scored -2 to 2; decreased-increased)

A series of mixed design 3 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out to assess the impact of the ISA intervention on various aspects of driving. Given the large number of tests, only significant main effects or interactions are reported. The results are presented in Table 62.

Table 62: Results of ANOVA for effect of ISA on driving task (1)

Effect of ISA on…	Sig	Description
Main Effect of Time		
Awareness of the speed limit	**	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. The increase in awareness following experience with the system was significantly greater than participants had anticipated ($F(1.74,102.38) = 5.40$, $p < .01$).
Tendency to check the speedometer	***	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Participants believed that ISA significantly increased their tendency to check the speedometer beyond their expectations ($F(2,122) = 12.12$, $p < .001$).
Tendency to brake	*	Post hoc pairwise comparisons did not reveal any significant differences between time points but the mean trend suggests that, following experience with ISA, participants believed that ISA had increased their tendency to brake significantly more than they had anticipated ($F(2,122) = 3.44$, $p < .05$).
Main Effect of Gender		
Tendency to check the speedometer	*	Compared to male participants, female participants expressed a significantly stronger belief that ISA had increased their tendency to check the speedometer ($F(1, 61) = 6.94$, $p < .05$).
Tendency to brake	**	Compared to male participants, female participants expressed a significantly stronger belief that ISA had increased their tendency to brake ($F(1,61) = 7.27$, $p < .01$).
Anticipation of potential conflicts	**	Compared to male participants, female participants expressed a significantly stronger belief that ISA had increased their anticipation of potential conflicts ($F(1,61) = 10.75$, $p < .01$).

Effect of ISA on…	Sig	Description
Interactions		
Tendency to check the speedometer	*	Gender by intention group interaction (*F*(1,610 = 5.48, p < .05). Female intenders were significantly more likely to have increased their tendency to check their speedometer than male intenders.
Tendency to check the speedometer	*	Age by intention group (*F*(1,61) = 4.49, p < .05). Younger non-intenders showed a greater propensity to check their speedometer.

Figure 88 highlights that, compared to unsupported driving, participants perceived that journey times increased whilst driving with ISA. As expected, participants found that driving with ISA made it easier to keep to the speed limits. However, the enjoyment and comfort of driving seemed to decrease when driving with the ISA system. Although participants expressed a weak belief that ISA would decrease the risk of an accident, early experience with ISA appeared to make participants feel at increased risk. Participants also felt under increased pressure from other drivers when driving with ISA activated.

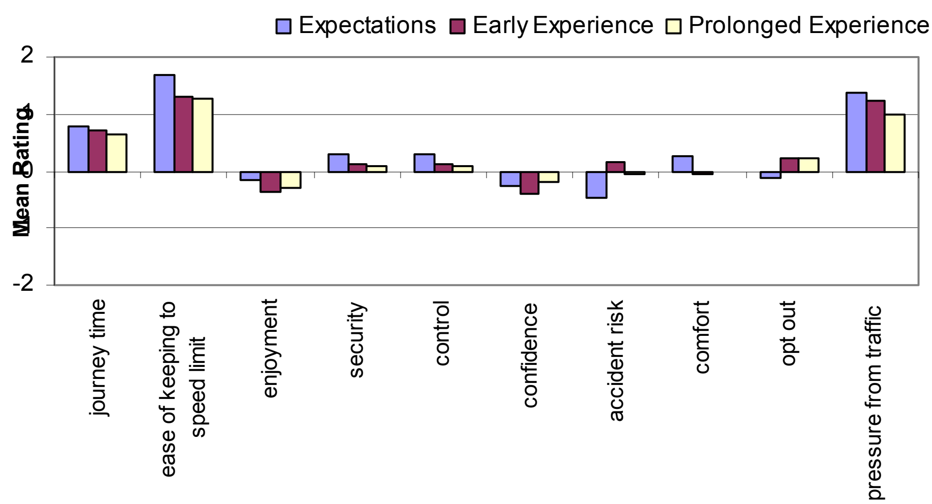


Figure 88: Compared to unsupported driving, how has ISA affected the following? (-2 to 2; decreased-increased)

A series of mixed design 3 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out to assess the impact of the ISA intervention on the driving experience. The results are presented in Table 63. Given the large number of tests, only significant main effects or interactions are reported.

Table 63: Results of ANOVA for effect of ISA on driving task (2)

Effect of ISA on…	Sig	Description
Main Effect of Time		
Ease of keeping within the speed limit	**	Ratings at time 2 and time 3 were significantly lower than those reported at time 1. Although participants anticipated that ISA would make it easier to comply with the speed limits, this was not as easy as they had anticipated ($F(2,120) = 5.38$, $p < .01$).
Comfort of driving	*	Post hoc pairwise comparisons did not indicate any significant differences between time points. Comparisons of the means suggested that participants had anticipated that ISA would increase the comfort of driving however, following early experience with ISA, they were less likely to believe this. Following prolonged experience with ISA this belief began to strengthen again ($F(1.88,115.02) = 4.05$, $p < .05$).
Risk of becoming accident involved	**	Ratings at time 2 and time 3 were significantly higher than those reported at time 1. Although participants had expected that ISA would lower the risk of them becoming accident involved they were significantly less likely to believe this following experience with the system ($F(2,122) = 6.03$, $p < .01$).
Pressure from other road users	**	Time 3 ratings were significantly lower than those reported at time 1. Although participants had expected pressure from other roads users when driving with ISA, this perceived pressure significantly decreased as experience with the system increased ($F(2,122) = 5.62$, $p < .01$).
Participants' tendency to disengage the system	*	Ratings at time 2 were significantly higher than those reported at time 1. Although they had not expected it to, pressure from other road users significantly increased participants' tendency to opt out and override the system ($F(2,122) = 3.84$, $p < .05$).
Main Effect of Intention Group		
Ease of keeping within the speed limit	**	Compared to non-intenders, intenders expressed a significantly weaker belief that ISA made it easier keep to the speed limit ($F(1,60) = 8.54$, $p < .01$).
Enjoyment of driving	*	Compared to non-intenders, intenders expressed a significantly stronger belief that ISA had decreased the enjoyment of driving ($F(1,61) = 6.63$, $p < .05$).
Comfort of driving	**	Compared to non-intenders, intenders expressed a significantly stronger belief that ISA had decreased the comfort of driving ($F(1,61) = 7.26$, $p < .01$).
Confidence	*	Compared to non-intenders, intenders felt significantly more apprehensive when driving with ISA ($F(1,61) = 6.55$, $p < .05$).
Risk of becoming accident involved	*	Compared to non-intenders, intenders expressed a significantly stronger belief that ISA had increased the risk of becoming accident involved ($F(1,61) = 5.35$, $p < .05$).
Tendency to disengage the system	**	Compared to non-intenders, intenders expressed a significantly stronger belief that greater pressure from other road users increased their tendency to disengage the system ($F(1,59) = 7.19$, $p < .01$).

Effect of ISA on…	Sig	Description
Interactions		
Risk of becoming accident involved	*	Time by age group interaction ($F(2,122) = 4.40$, $p < .05$). Younger participants' ratings did not differ significantly over time. Following prolonged experience with the ISA system, older participants felt ISA had increased the risk of becoming accident involved significantly more than they had expected.

As can be seen in Figure 89, participants disagreed that ISA had made them less vigilant or reduced their adopted following distances. Participants did believe however, that ISA created difficulties when overtaking and prevented the opportunity to accelerate out of danger. However these beliefs weakened following prolonged experience with the system.

Figure 89: To what extent do you agree with the following criticisms of ISA? (scored -2 to 2; disagree-agree)

A series of mixed design 3 x 2 x 2 x 2 ANOVAs (time x gender x age x intention group) were carried out to assess the impact of the ISA intervention on the participants' opinions relating to common criticisms of the ISA system. Results are presented in Table 64. Given the large number of tests, only significant main effects or interactions are reported.

Table 64: Results of ANOVA for effects on driving task (3)

	Sig	Description
Main Effect of Intention Group		
ISA created difficulties when overtaking	*	Compared to non-intenders, intenders expressed a significantly stronger belief that ISA created difficulties when overtaking ($F(1,61) = 5.43$, $p < .05$).
ISA prevented acceleration out of danger	*	Compared to non-intenders, intenders expressed a significantly stronger belief that ISA prevented acceleration out of danger ($F(1,61) = 5.06$, $p < .05$).

Willingness to pay

Participants[11] were asked whether they would be willing to have an ISA system installed in their vehicle and how much they were willing to pay. Fifty-four percent of participants would be willing to have ISA installed in their vehicles if its use was voluntary. Participants' willingness to pay for the system ranged from paying nothing to £500. On average participants would be willing to pay £111.[12] Of the 49 participants who responded, 29% were not willing to pay for ISA, 14% would pay up to £50, 29% stated a cost between £51-100, 18% would pay between £101-250 and 10% would pay up to £500. Sixty-two percent of participants approved of the compulsory fitting of ISA to all new vehicles and 56% agreed to mandatory introduction of ISA for *all* participants.

Table 65 to Table 67 explore differences in opinion amongst the selected groups. Although results indicated that non-intenders were more willing to have an ISA system installed on their vehicle, just under half of intenders were also willing to have ISA installed. Comparisons across the genders suggested that female participants were more willing to have ISA installed, particularly female non-intenders. Although age differences were less apparent amongst the non-intenders, young intenders showed a greater reluctance to have ISA installed than older intenders (Table 65).

Table 65: Would you have ISA installed on your vehicle if its use was voluntary? (yes/no, %)

Gender	Age Group	Non-intenders		Intenders	
		Yes	No	Yes	No
Male	Young	60	40	29	71
	Old	50	50	55	45
	Total	**54**	**46**	**44**	**56**
Female	Young	67	33	40	60
	Old	100	0	50	50
	Total	**80**	**20**	**45**	**55**
Total	Young	64	36	33	67
	Old	67	33	53	47
	Total	**65**	**35**	**45**	**55**

Non-intenders showed stronger support for the compulsory fitting of ISA to all new vehicles. Intenders were again somewhat divided in their opinion. Differences across the age groups and genders were minimal but young female participants expressed the most resistance to the compulsory fitting of ISA to new vehicles (Table 66).

[11] It should be noted that responses here relate to only the final three field trials, as these questions were added later to the questionnaire pack.
[12] Participants were asked to state how much they were willing to pay for voluntary ISA; they were not presented with price brackets.

Table 66: Would you approve of the compulsory fitting of ISA to new vehicles? (yes/no, %)

Gender	Age Group	Non-intenders		Intenders	
		Yes	No	Yes	No
Male	Young	80	20	44	56
	Old	75	25	50	50
	Total	**77**	**23**	**47**	**53**
Female	Young	67	33	40	60
	Old	75	25	57	43
	Total	**70**	**30**	**50**	**50**
Total	Young	73	27	43	57
	Old	75	25	53	47
	Total	**74**	**26**	**48**	**52**

Non-intenders were again in strong support of the mandatory introduction of ISA for all participants whilst intenders remained split in their opinion. Differences across the genders and age groups were minimal amongst intenders but within the non-intenders older participants and male participants demonstrated greatest support for the mandatory introduction of ISA for all participants (Table 67).

Table 67: Would you approve of the mandatory introduction of ISA for all participants (i.e. its use would be enforced by law)? (yes/no, %)

Gender	Age Group	Non-intenders		Intenders	
		Yes	No	Yes	No
Male	Young	80	20	43	57
	Old	88	13	45	55
	Total	**85**	**15**	**44**	**56**
Female	Young	33	67	40	60
	Old	75	25	50	50
	Total	**50**	**50**	**45**	**55**
Total	Young	55	45	42	58
	Old	83	17	47	53
	Total	**70**	**30**	**45**	**55**

Participants who disagreed with the mandatory introduction of ISA for all participants tended to approve of targeting ISA at specific high risk groups. Sixty one approved of the mandatory introduction for novice participants, 87% for the introduction for speed offenders and 48% for the introduction for professional participants.

4.3.5 Discussion

Despite the overwhelming evidence that variants of ISA greatly reduce speeding behaviour and the finding that experience with an intervening ISA can serve to reduce intentions to speed, it is important to understand drivers' initial expectations of an ISA system and the effect that long-term experience with such a system can have on these opinions. Optimising public confidence and acceptance of ISA essentially relies upon offering a reliable system which successfully balances the trade off between maximum gains and minimal irritation. Given the difference between attitudes based on expectations and those based on experience (Levelt, 1997), analysis within this project also attempted to determine the effect of long-term experience with ISA on drivers acceptance of and attitudes towards the system.

4.3.5.1 Acceptability

Standardised acceptability measures suggested that despite an initial dip in acceptance following early experience with the ISA system, participants' satisfaction with the system steadily rose beyond the removal of system. Although usefulness scores did not change significantly, again the general trend suggested that following a slight dip with initial ISA use, ratings of usefulness increased with prolonged experience and remained at a high level following the removal of the system. Findings here are in line with European research which demonstrated acceptance increases with experience (Almqvist and Nygård, 1997; Persson et al., 1993).

4.3.5.2 Subjective mental workload

Mental workload evaluations indicated that reported physical demand significantly decreased over time. Reported time pressure significantly increased perhaps suggesting that participants felt that ISA imposed greater difficulty in reaching destinations in time than driving in an unsupported vehicle. Despite a failure to find any significant change over time, the measures also tended to indicate that following prolonged experience with ISA reported mental demand and effort declined, whilst driving performance improved. In general, the measures suggested that ISA eased the workload associated with driving.

4.3.5.3 Perceived risk and frustration

Participants were generally accurate in predicting when ISA would increase or decrease frustration and risk. The actual level of frustration of feeling of risk perceived following experience with the system was, however, often significantly greater than they had expected. Increased frustration experienced and perceived risk seemed specific to those situations which afforded the greatest opportunity to speed. Participants reported feeling under increased frustration and at increased risk when driving with ISA on motorways, in fast moving or light traffic and when overtaking. This supports previous ISA research across Europe which notes a general resistance to ISA control on higher speed limited roads and greater acceptance of ISA for slower urban and residential roads (e.g. Biding and Lind, 2002). For those situations where hazards or accident risk was at its greatest (e.g. bad weather conditions, poor visibility, high child presence, pedestrian crossing), ISA served to reduce participants' frustration and perceived risk. Whilst the perceptions of the reduction in risk of frustration were not as great as expected, ratings remained negative suggesting that, in the majority of conditions, participants considered driving with ISA safer than driving in an unsupported vehicle. Since participants appeared to appreciate the benefit of speed control in these safety critical conditions, developing a variable or dynamic ISA system that identifies certain locations and conditions in the network or weather, may provide a persuasive factor to increase public acceptance. Little research has examined drivers' experience of dynamic systems but as discussed, both Várhelyi and Mäkinen (2001) and Biding and Lind (2002) note drivers' desire for support in these safety critical situations. Since Várhelyi and Mäkinen (2001) suggest that acceptance of ISA is optimal if the system improves drivers' perceived safety, current results provide encouraging support for the development of a dynamic ISA. These system features may also provide more emotionally laden arguments for implementing ISA (e.g. lowering speed limits outside schools) which may prove particularly influential with certain driver groups such as parents.

4.3.5.4 The driving task

Participants' anticipation of conflicts, attention to other roads users, pedestrians and other aspects of the driving task (e.g. scanning) increased whilst driving with ISA compared to unsupported driving. Participants' awareness of speed limits also significantly increased when driving with ISA. Although this is perhaps unsurprising given the nature of the system, participants' awareness rose significantly beyond their expectations. Unfortunately, whilst participants reported a decreased tendency to accelerate when driving with ISA (though not as reduced as expected), participants also noted an increased tendency to brake. Participants were significantly more likely to brake following prolonged experience with the system than they originally anticipated. Worryingly this might highlight a negative behavioural adaptation to ISA. This could however reflect participants' braking response to inaccurately placed speed limit signs or may be the participants reporting that system itself brakes more than they would in normal driving situations. If so, development of a more reliable speed limit map should counteract this increased tendency to brake. Compared to unsupported driving, participants' tendency to check their speedometer also increased significantly more than expected following experience with the system. This could again reflect a response to the false and inaccurately placed speed limits such that participants had to check for any disparity between the posted speed limit and ISA speed limit. Again development of a reliable map would reduce participants need to check their speedometer. This tendency began to decline following prolonged use however, suggesting that, with experience, participants adapted to the functionality of the ISA system. Overall, the general trends suggest that ISA allowed the participants to develop more effective driving styles and search strategies when driving with the ISA system. Results here again support previous research that has documented an improvement in attention to the driving task (Almqvist and Nygård, 1997) and driving style (Besseling and van Boxtel, 2001).

Compared to unsupported driving, participants perceived that journey times increased whilst driving with ISA. As expected, participants found that driving with ISA made it easier to keep to the speed limits compared to driving in a normal car. Despite this, keeping to the speed limit during early and prolonged use of the system was not as easy as they had expected. Although differences over time were non-significant, enjoyment decreased slightly when driving with ISA compared to unsupported driving and participants felt in less control and less secure following experience with the system. The comfort of driving also significantly decreased over time such that driving with ISA during early use was significantly less comfortable than participants had expected. Whilst participants did not anticipate that ISA would increase the risk of an accident they were significantly more inclined to believe this having gained some early experience of driving with the system. Changes in opinion here may be due to the inappropriate or sometime severe braking activated by the ISA system. However, since the mean trend suggested that this belief began to weaken following prolonged experience, participants appear again to have adapted to the functionality of the system. Participants also felt under increased pressure from other drivers when driving with ISA activated. As experience with the system grew, however, this perceived pressure significantly declined. Surprisingly, despite this decline in perceived pressure, participants' propensity to override the system increased. Although participants had not expected to override the system (perhaps because they had not realised the ease at which the system could be disabled or the need to need to override the system when encountering inaccurately placed speed limits) they were significantly more inclined to disengage the system during their early experience. The lack of change in overriding behaviour from early to prolonged experience of the system however suggests that although divers continued to fight the system this did not increase as experience progressed.

Although experience with the ISA tended to increase participants' acceptance of the system, some opinions were more resistant to change. Following long-term experience with ISA, participants continued to believe that ISA created difficulties when overtaking and prevented acceleration out of danger, despite the overridable nature of the ISA system. These are often issues singled out by opponents of mandatory systems which have until recently remained untested. Current research within the ISA UK project has attempted to assess the impact of a mandatory system on drivers' overtaking decisions on rural roads (Jamson, Chorlton, Jamson, Horrobin and Carsten, 2007). A rural road with a number of 2+1 road sections was modelled to allow participants the opportunity to make a protected overtaking manoeuvre. Analysis indicated that when driving with a mandatory ISA system, participants made fewer overtaking manoeuvres, were more likely to have to abandon an overtaking (presumably due to running out of road), spent longer in critical hatched area and following a successful overtaking manoeuvre cut back into the lane more sharply and with a smaller distance to the front of the lead vehicle. However, whilst ISA did create difficulties when overtaking, this seems to be a function of drivers' poor judgement and reliance on exceeding the speed limit to complete a successful overtaking manoeuvre, rather than the system per se. Thus with experience drivers may learn to complete overtaking manoeuvres within the legal speed limit or to reject overtaking opportunities that require excess speed.

4.3.5.5 Willingness to pay

The cost of ISA to the driver may prove a major obstacle to any roll out. The majority of ISA related studies have therefore sought to determine how much drivers are willing to pay to have an ISA system installed. Results of the current study provide encouraging support for the implementation of ISA within the UK. Just over half of the participants were willing to have ISA installed in their vehicle if its use were voluntary and nearly 60% of participants approved of the mandatory introduction of voluntary ISA for all participants. Although 29% of drivers were not willing to pay for ISA, 28% stated that they would pay between £51-100 and 10% were willing to pay up to £500.

For those that disagreed with the mandatory introduction of ISA for all drivers, 61% approved of the mandatory introduction of ISA for novice drivers, 87% for introduction for speed offenders and 48% for the introduction of ISA for professional drivers. Results are again similar to those reported in previous ISA trials. Lahrmann et al. (2001) found that 19 out 20 drivers believed ISA could be used as a measure for selected groups and persistent speed offenders, novice, young, company and commercial drivers have been suggested by drivers as justifiable target groups for ISA (Biding and Lind, 2002). Given that nearly half of the participants within this present study approved of the ISA concept as long as it is not imposed on them, introducing ISA primarily for these risk groups might provide a smoother pathway to the implementation of ISA for all drivers.

When considering the results of the present study however, it is important to remember that results relate to experience with an intervening (although overridable) system. Drivers' acceptance of ISA is undoubtedly dependent on the nature of the ISA system. Biding and Lind (2002) found that fifty percent of drivers using an informative system were willing to pay for to keep the system in their vehicle. However, this dropped to 34% for those who had a warning system installed and between 29-4% for those with an active gas pedal installed. Similarly, the level of functionality of an ISA system can influence acceptability. Marchau, Heijden and Molin's (2005) survey of the general public indicated that respondents were not willing to pay more than 150 Euros (£102 approx) extra for ISA alone but when ISA was combined with additional functionality such as cruise control a slightly higher net cost was acceptable. Considering responses noted earlier, these studies would suggest that the attractiveness of ISA largely relates to its functionality in terms of the level of control it exerts on differing road types and the additional systems incorporated. Since drivers are more motivated to buy a system for other features such as cruise control, it is perhaps worthwhile combining ISA so that drivers can choose whether to use this feature. Evidence has confirmed that experience increases acceptance of ISA, thus a multi-functional platform could provide an ideal opportunity for drivers to try this technology. Similarly, whilst a mandatory system offers the greatest safety potential, acceptance of this level of control is likely to be weaker. It is therefore recommended that any future research should examine the long-term impact of ISA systems with different functional variations.

4.3.5.6 Individual differences

Little research has examined individual differences in terms of the drivers' acceptance of ISA. In order to address this issue, the project examined the influence of demographic and social cognition factors on the long-term acceptability of ISA.

The lack of any consistent effects over time or interactions with time suggested that any changes in attitudes or acceptance as a result of long-term experience with ISA were universal and did not depend upon either age, gender or participants' intention to speed. Examination of between driver differences however indicated that age, gender and intention to speed moderated acceptance in general. Analysis consistently demonstrated that individuals exhibiting stronger intentions to speed expressed significantly stronger beliefs that driving with ISA increased risk and evoked frustration. Those intending to speed were significantly stronger in their belief that ISA had decreased both the comfort and enjoyment of driving and expressed a significantly stronger belief that ISA increased the risk of becoming accident involved. Items relating to willingness to pay also highlighted that intenders were less likely to approve of the compulsory fitting of ISA to all new vehicle or the mandatory introduction of ISA for all drivers. Since previous research and analysis in section 4.1 has clearly demonstrated the relationship between intention to speed and observed speeding behaviour, the results provide strong evidence that those who are in most need of ISA are those least likely to accept it. Indeed, standardised measures of acceptability differentiated amongst high and low intenders, indicating that those most likely to engage in speeding expressed greater dissatisfaction with the system and saw less value in its use. Behavioural data presented in Section 3.8.3 (Figure 63) and Section 3.8.5 (Figure 75 and Figure 76) also demonstrated that intenders showed a greater propensity to speed and override the ISA system.

Comparisons across the age groups suggested that, compared to older participants, younger participants were significantly more likely to perceive a greater reduction in risk when driving with ISA in bad weather, in poor visibility conditions and on 20 mph roads. This perhaps suggests that older participants consider themselves adequately experienced and equipped to deal with these conditions. Younger participants, however, appeared to attach more value to the technological support of ISA in situations where they are perhaps less adept at driving to the conditions. Younger participants may therefore prove more receptive to campaigns emphasising the benefits of ISA in safety critical situations. Whilst this provides useful information for targeted campaigns, the behavioural evidence presented in Section 3.8.2 (Figure 53) and Section 3.8.5 (Figure 75 and Figure 76) indicated that younger participants exhibit a greater propensity to engage in speeding and override the system. Results here might suggest that younger drivers remain resistant to the concept of ISA in normal driving situations but show some degree of acceptance of ISA in more problematic driving conditions.

Significant differences across the genders were less prominent. Female participants tended to feel at greater risk when driving in light traffic than male participants whereas males reported significantly more frustration than females when driving on motorways. Despite any consistent differences within the attitudinal data however, behavioural data reported in Section 3.8.1 (Figure 43) and Section 3.8.5 (Figure 75 and Figure 76) clearly demonstrates that male participants engage in more speeding behaviour than female participants and exhibit a greater propensity to override the system. Since male participants demonstrate a greater resistance to complying with the speed limit, gender remains an important issue.

5. CONCLUSIONS AND IMPLICATIONS

5.1 System operation

The overridable intervening ISA installed for these trials was designed to appear to the drivers as though it were original equipment. No major problems were identified with the HMI: the use of auditory confirmation of changes in speed limit was evidently useful and helped to ensure that drivers did not fixate on the ISA display. The throttle system also seems to have been fine in terms of usability with the vibration feature helping to ensure that drivers did not "over-demand" throttle. Overall, the ISA system operated for 93.5% of desired days, which is considered highly satisfactory for a prototype retrofitted system. Speed limit information was generally conveyed reliably in the vehicles, with any errors more likely to result from speed sign position problems in the maps than from incorrect positioning. This was helped by setting a high threshold on positioning certainty before the system acquired speed limit. A high quality map with accurate positioning of changes in speed limits is an essential ingredient for real-world ISA. A production ISA could no doubt improve on the prototype positioning system used here. Roads could be linked logically in the map, so ensuring that ISA would not allow the vehicle to "jump" illogically from one road to another, for example from a motorway to an overhead bridge. In addition GPS technology is continually improving, while in the future Galileo will provide an even higher level of service in positioning.

In the trials, participants seemed to have adapted their reference to chosen speed between trial phases. During Phase 1 and 3 when the ISA system was turned off, participants were observed to obey the speed limits with reference to speedometer reading. During Phase 2, participants were observed to rely on the ISA system (i.e. throttle cut-off) instead of the speedometer reading. This has implications because, in accordance with current vehicle standards, the speedometer read low but the ISA system used true speed. The obvious solution is for the speedometer regulations to be changed so that they read accurately. In addition, the ISA system implemented here did not restrict vehicle speed to posted speed limits (i.e. the speed limits provided by the digital maps) with absolute precision. The throttle control permitted vehicle speed to go somewhat over the speed limit, due to hysteresis in the ISA system response to driver throttle demand. If drivers relied on the system to keep them within the speed limit, they might actually be above the limit. This would need to be considered in setting standards for real-world ISA.

5.2 Behavioural changes

The ISA system was observed to have a distinctive effect in terms of transforming the speed distribution across all speed zones except the 60 mph zones. Speeds over the speed limit and in particular very high exceeding of the limit was curtailed. On the 60 mph roads, speeding behaviour was already rare in the pre period (the first month), so it is not surprising that there was little change with ISA. The lack of speeding in these roads is presumably due to traffic and road geometry conditions, and is in line with national data. When ISA was switched on, a large proportion of the speed distribution initially spread over the speed limit was shifted to around or below the speed limit. Analysis of various statistics related to speed (mean, 85th percentile, etc.) revealed a 'V' shape across trial phases, i.e. the statistic went down from Phase 1 to Phase 2, then up from Phase 2 to Phase 3. This pattern is especially prominent with respect to high percentiles of the speed distribution, which are strong indicators of speeding behaviour. ISA not only diminished excessive speeding, but also led to a reduction in speed variation as well as in jerk occurrence with positive implications for road accident reduction.

The use of an overridable ISA system also provides an opportunity to demonstrate potential resistance from the driving population against its implementation, based on true behaviour instead of opinion. ISA was overridden the most on motorways, followed by built-up areas (20 and 30 mph zones). Urban environments are where drivers are most likely to encounter conflicts with vulnerable road users such as pedestrians and cyclists than in the rest of speed zones. Thus there is some tendency for ISA to be overridden on roads where it is perhaps needed most. In term of sub-groups within the driving population, male drivers and young drivers overrode the system more than their counterparts regardless of speed zones. Given that these two groups of drivers also drove faster and had a higher percentage of distance travelled over the speed limit than their counterparts, there is a pronounced tendency for ISA to be overridden by those drivers who in safety terms stand to benefit most from using it. It was also found that speed intenders overrode the system more frequently than non-intenders on motorways, and that private motorists were more likely to override in built-up areas while fleet drivers more frequently overrode on motorways. These findings indicate the need for efficient incentives and safety education to encourage system use.

5.3 Attitudinal changes

Unfortunately evidence of multi-collinearity made it impossible to test an extended model of the TPB. Nevertheless, the present analysis found support for the use of the TPB in predicting intentions and behaviour with regard to exceeding the speed limit. Although PBC did not independently predict speeding behaviour an intention-behaviour relationship of .37 was observed, which suggests that focussing on changing the antecedents of intentions may produce observable changes in speeding behaviour. Analysis of individual beliefs also successfully identified a number of beliefs amenable to change which distinguished those who intend to exceed the speed limit and those who do not.

Findings relating to the impact of ISA suggested that an overridable intervening ISA significantly reduced the percentage of distance travelled whilst exceeding the speed limit. However, although when active ISA served to significantly reduce speeding behaviour, failure to elicit a sustained change in behaviour when the system was removed suggested that the ISA intervention was unable to establish a new compliant habit. Despite this, there was encouraging evidence that the implementation of ISA could serve to change participants' intentions to speed.

The successful implementation of ISA will ultimately rely upon the attitude of the general public. The current analysis found promising support for the finding that long-term experience with an ISA system increases acceptability. Despite an initial dip in acceptability, the rating of the ISA system in terms of usefulness and satisfaction, improved over time. Participants tended to feel at increased risk and more frustrated in those situations (e.g. on a motorway, in fast moving and light traffic) which afforded the greatest opportunity to speed. Overtaking was also raised as a concern. Nevertheless, in the majority of driving situations, participants did feel that risk was reduced when driving with ISA compared to unsupported driving and experienced less frustration. Similarly participants believed that attention to the speed limits and to potential hazards (e.g. other road users, pedestrians) and conflicts had increased. ISA seems to have raised participants' perceived safety and encouraged participants to develop more effective driving styles. Support for the implementation of ISA was also reasonably strong, with 56% of participants approving of compulsory fitting of ISA to all new vehicles. The project extended previous research in its examination of influence of age, gender and intention to speed. Intention to speed was the most consistent moderator of acceptability such that those expressing strong intentions to speed demonstrated the most resistance to ISA. Given that the evidence would suggest that the voluntary implementation of ISA may fail to target those who are most in need of the system, implementation of an ISA system may have more potential if high risk groups such this are specifically targeted.

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APPENDIX A: PARTICIPANTS' AGREEMENT

Agreement between the University of Leeds and Participants in the Trial of Intelligent Speed Adaptation for the ISA-UK Project

I, as a participant in the trial, agree with the following terms:

I understand that the University of Leeds is providing the following:

1. The use of an ISA car for six months. After the six months, the participant will have to return the car and the keys. The vehicle remains the property of Arval Key fleets (the lease company).

2. Road tax on the vehicle.

3. Comprehensive insurance **for the named driver**. No other person is allowed to drive the car. This insurance covers personal and **occasional** business use of the car (except where special arrangements have been made). It does not cover use of the car for hire.

4. A roadside recovery service (provided through the leasing company ARVAL Key Fleets).

5. A contact telephone numbers, so that participants, can notify us of any problems with the vehicle or the ISA equipment. **The number is: 0113 343 1771**

6. The cost of servicing of the car, if required.

The University of Leeds agrees to the following:

7. All data collected automatically will be stored without name and address information on the participants.

8. No reports will be issued containing information which allows participants in the trial to be identified.

9. Data will not be supplied by the University to any third parties outside the project in any way which links that data to any individual participant.

10. Participants will be protected from intrusion by the press and media to the best of our ability.

My specific commitments are as follows:

11. I am responsible for providing:
    (a) Petrol

(b) Basic day-to-day maintenance of the car, i.e. maintain tyre pressure, top up oil and windscreen fluid.

12. I will comply with the terms of the insurance policy.

13. I will unscrew the radio aerial when taking the car through a carwash.

14. I will ensure that occupants of the car do not smoke.

15. I am responsible for paying any parking charges, parking tickets, fixed penalty tickets that occur as a result of my actions.

16. I agree to take reasonable care of the vehicle and lock it whenever left unattended.

17. I agree not to tamper with any of the equipment installed in the car.

18. I will not install any additional electronic equipment in the car. This includes hands-free mobile phones.

19. I will not place any additional carpet or mats in the front foot well on the driver's side of the vehicle.

20. If the car accumulates enough miles to require a service, I will take it into the local Skoda dealer in Leeds. The dealer is **D.M. Keith Ltd**, Thwaite Gate, Hunslett Low Road, Leeds LS10 1DY (tel. 0113 277 1777). Their Service Manager is aware of the ISA trial.

21. I agree not to drive the car outside England, Scotland and Wales.

22. I will notify the University of any plans to take the car outside the Leeds metropolitan area for more than three days at a time.

23. I understand that I am responsible for any insurance excess that may be incurred while the car is in my care.

24. I agree to the collection of data from the car and I understand that this means that the University will be able to record vehicle location at all times.

25. While the ISA system is operational, I agree to keep the ISA system engaged to the fullest extent possible and I understand that the car may be withdrawn if I do not do so.

26. I will provide access to the car by members of the ISA team in order to reconfigure the car from non-ISA to ISA and vice versa, and in order to download data from the car. This access will be at the end of the first, fifth and sixth months of my use of the car and will take place at the University. The last occasion (at six months) will be the one on which I return the car to the possession of the University.

27. I agree to attend the one special event, involving all the trial participants.

28. I agree to participate in four accompanied drives, in which I will drive the car along a specified route with by two staff members of the University as passengers. Each drive will take approximately one and a half hours and will be arranged by the University for times and dates that are mutually convenient.

29. I agree to the indefinite use of the data supplied by myself and obtained from the car by the University, its partners in the project (MIRA Ltd and NAVTEQ Professional Services) and the project sponsor (The Department for Transport) with the proviso that this data will not be stored in any electronic database that contains my personal contact information such as name, address or phone number(s).

30. I will notify the University if the ISA features are not working properly.

31. I will notify the University of any changes in my personal circumstances such as change of address or change in phone number(s).

32. I will notify the University of any changes in the status of my driving licence such as the incurrence of fixed penalty points or driving convictions.

33. I will notify the University immediately if there is any accident involving the car, or if the car is damaged or stolen (this is to be done on the phone number listed on item 5).

34. I agree not to contact the press or the broadcast media concerning the ISA trial or my role in it and to refer any approaches by the press or broadcast media to the University.

35. I understand that the University reserves the right to terminate this agreement at any time.

Participant (name in capitals) ____

Participant (signed) _______________________________ Date _________________

Witness (signed) ________________________________ Date _________________

APPENDIX B: ANOVA RESULTS FOR KEY STATISTICS OF THE SPEED DISTRIBUTION

Table B1: ANOVA results for mean speeds between gender groups

Gender group	Speed zone	Mean			Univariate ANOVA			Post-hoc t-tests		
		Phase 1	Phase 2	Phase 3	*F* statistic	significance	Effect size	PH1 vs PH2	PH1 vs PH3	PH2 vs PH3
Male	20	19.46	18.39	18.76	F(2,89) = 1.19	0.308	0.03	×	×	×
	30	27.09	26.41	27.34	F(2,130) = 3.65	0.029*	0.05	×	×	*
	40	34.97	34.22	35.19	F(2,130) = 1.65	0.196	0.02	×	×	×
	50	44.31	43.71	44.58	F(2,127) = 1.07	0.345	0.02	×	×	×
	60	46.20	45.83	46.03	F(2,130) = 0.12	0.891	0.00	×	×	×
	70	68.82	65.30	67.61	F(2,128) = 4.86	0.009**	0.07	**	X	*
Female	20	18.49	18.69	20.00	F(2,74) = 0.33	0.719	0.01	×	×	×
	30	26.21	25.44	26.43	F(2,101) = 3.12	0.048*	0.06	×	×	*
	40	34.25	33.66	34.46	F(2,101) = 1.57	0.213	0.03	×	×	×
	50	41.88	41.51	42.33	F(2,99) = 1.05	0.353	0.02	×	×	×
	60	46.30	45.95	46.28	F(2,101) = 0.07	0.929	0.00	×	×	×
	70	63.73	61.95	63.85	F(2,100) = 0.62	0.539	0.01	×	×	×

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B2: ANOVA results for the 85th percentile speeds between gender groups

Gender group	Speed zone	Mean			Univariate ANOVA			Post-hoc t-tests		
		Phase 1	Phase 2	Phase 3	*F* statistic	significance	Effect size		PH2	PH3
Male	20	25.42	23.12	24.78	F(2,89) = 4.35	0.016*	0.09	PH1	**	×
								PH2		×
	30	35.05	32.49	35.13	F(2,130) = 19.2	< 0.0005**	0.23	PH1	**	×
								PH2		**
	40	43.99	41.64	43.87	F(2,130) = 8.75	< 0.0005**	0.12	PH1	**	×
								PH2		**
	50	54.03	51.85	54.13	F(2,127) = 4.62	0.012*	0.07	PH1	*	×
								PH2		*
	60	56.85	56.16	56.58	F(2,130) = 0.50	0.608	0.01	PH1	×	×
								PH2		×
	70	79.75	74.99	77.81	F(2,128) = 5.55	0.005**	0.08	PH1	**	×
								PH2		*
Female	20	24.39	24.17	26.17	F(2,74) = 0.88	0.419	0.02	PH1	×	×
								PH2		×
	30	34.24	31.75	34.37	F(2,101) = 19.9	< 0.0005**	0.28	PH1	**	×
								PH2		**
	40	42.77	41.03	43.00	F(2,101) = 4.36	0.015*	0.08	PH1	*	×
								PH2		*
	50	51.65	49.99	51.82	F(2,99) = 6.59	0.002**	0.12	PH1	**	×
								PH2		**
	60	55.63	55.14	55.38	F(2,101) = 0.04	0.958	0.00	PH1	×	×
								PH2		×
	70	74.45	71.64	75.04	F(2,100) = 3.39	0.047*	0.05	PH1	×	×
								PH2		*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B3: ANOVA results for percentage of distance travelled over speed limit between gender groups

Gender group	Speed zone	Mean Phase 1	Mean Phase 2	Mean Phase 3	Univariate ANOVA: *F* statistic	Significance	Effect size	Post-hoc t-tests: PH1 vs PH2	PH1 vs PH3	PH2 vs PH3
Male	20	48.88	44.78	52.46	F(2,42)= 1.59	0.216	0.070	×	×	×
	30	41.74	36.82	41.34	F(2,86)= 10.8	< 0.0005**	0.201	**	×	**
	40	31.31	25.70	30.23	F(2,86)= 8.16	0.001**	0.160	**	×	**
	50	32.27	29.72	33.23	F(2,80)= 1.28	0.285	0.031	×	×	×
	60	7.90	7.00	9.35	F(2,86)= 1.31	0.274	0.030	×	×	×
	70	38.99	27.27	39.46	F(2,82)= 8.76	< 0.0005**	0.176	**	×	**
Female	20	36.55	39.66	40.15	F(2,36)= 0.25	0.777	0.014	×	×	×
	30	36.71	32.67	36.14	F(2,68)= 9.42	< 0.0005**	0.217	**	×	**
	40	24.73	21.53	26.29	F(2,68)= 5.38	0.007**	0.137	*	×	**
	50	22.18	17.01	22.98	F(2,64)= 3.49	0.036*	0.098	×	×	**
	60	5.45	4.02	5.35	F(2,68)= 1.82	0.169	0.051	×	×	×
	70	21.85	21.10	25.05	F(2,66)= 0.53	0.589	0.016	×	×	×

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B4: ANOVA results for mean speeds between age groups

<table>
<tr><th rowspan="2">Age group</th><th rowspan="2">Speed zone</th><th rowspan="2">Phase 1</th><th rowspan="2">Phase 2</th><th rowspan="2">Phase 3</th><th colspan="6">Univariate ANOVA</th></tr>
<tr><th>F statistic</th><th>significance</th><th>Effect size</th><th colspan="3">Post-hoc t-tests</th></tr>
<tr><td rowspan="18">Young</td><td rowspan="3">20</td><td rowspan="3">18.20</td><td rowspan="3">17.91</td><td rowspan="3">18.34</td><td rowspan="3">F(2,72) = 0.27</td><td rowspan="3">0.761</td><td rowspan="3">0.01</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">30</td><td rowspan="3">26.76</td><td rowspan="3">26.00</td><td rowspan="3">27.28</td><td rowspan="3">F(2,106) = 4.17</td><td rowspan="3">0.018*</td><td rowspan="3">0.07</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>*</td><td>X</td></tr>
<tr><td>PH2</td><td></td><td>*</td></tr>
<tr><td rowspan="3">40</td><td rowspan="3">35.58</td><td rowspan="3">34.37</td><td rowspan="3">35.64</td><td rowspan="3">F(2,106) = 3.59</td><td rowspan="3">0.031*</td><td rowspan="3">0.06</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>X</td><td>X</td></tr>
<tr><td>PH2</td><td></td><td>*</td></tr>
<tr><td rowspan="3">50</td><td rowspan="3">44.50</td><td rowspan="3">43.30</td><td rowspan="3">44.54</td><td rowspan="3">F(2,103) = 3.36</td><td rowspan="3">0.049*</td><td rowspan="3">0.04</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>*</td><td>X</td></tr>
<tr><td>PH2</td><td></td><td>X</td></tr>
<tr><td rowspan="3">60</td><td rowspan="3">46.78</td><td rowspan="3">46.06</td><td rowspan="3">46.61</td><td rowspan="3">F(2,106) = 0.59</td><td rowspan="3">0.557</td><td rowspan="3">0.01</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">70</td><td rowspan="3">70.37</td><td rowspan="3">65.46</td><td rowspan="3">68.87</td><td rowspan="3">F(2,103) = 5.97</td><td rowspan="3">0.004**</td><td rowspan="3">0.10</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>**</td><td>X</td></tr>
<tr><td>PH2</td><td></td><td>*</td></tr>
<tr><td rowspan="18">Old</td><td rowspan="3">20</td><td rowspan="3">20.03</td><td rowspan="3">19.19</td><td rowspan="3">20.22</td><td rowspan="3">F(2,91) = 1.26</td><td rowspan="3">0.288</td><td rowspan="3">0.03</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">30</td><td rowspan="3">26.66</td><td rowspan="3">25.95</td><td rowspan="3">26.74</td><td rowspan="3">F(2,125) = 2.76</td><td rowspan="3">0.067</td><td rowspan="3">0.04</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">40</td><td rowspan="3">33.93</td><td rowspan="3">33.62</td><td rowspan="3">34.29</td><td rowspan="3">F(2,125) = 0.73</td><td rowspan="3">0.483</td><td rowspan="3">0.01</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">50</td><td rowspan="3">41.70</td><td rowspan="3">42.05</td><td rowspan="3">42.61</td><td rowspan="3">F(2,123) = 0.21</td><td rowspan="3">0.808</td><td rowspan="3">0.00</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">60</td><td rowspan="3">45.91</td><td rowspan="3">45.78</td><td rowspan="3">45.92</td><td rowspan="3">F(2,125) = 0.01</td><td rowspan="3">0.991</td><td rowspan="3">0.00</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">70</td><td rowspan="3">65.04</td><td rowspan="3">63.06</td><td rowspan="3">64.61</td><td rowspan="3">F(2,125) = 1.37</td><td rowspan="3">0.258</td><td rowspan="3">0.02</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
</table>

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B5: ANOVA results for the 85th percentile speeds between age groups

Age group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA *F* statistic	Univariate ANOVA significance	Univariate ANOVA Effect size	Post-hoc t-tests		
Young									PH2	PH3
	20	24.06	23.18	24.28	F(2,72) = 1.16	0.320	0.03	PH1	✗	✗
								PH2		✗
									PH2	PH3
	30	35.39	32.54	35.74	F(2,106) = 19.9	< 0.0005**	0.27	PH1	**	✗
								PH2		**
									PH2	PH3
	40	45.38	41.96	45.00	F(2,106) = 13.6	< 0.0005**	0.20	PH1	**	✗
								PH2		**
									PH2	PH3
	50	54.55	51.48	54.50	F(2,103) = 9.32	< 0.0005**	0.15	PH1	**	✗
								PH2		**
									PH2	PH3
	60	57.08	55.75	56.58	F(2,106) = 1.32	0.273	0.02	PH1	✗	✗
								PH2		✗
									PH2	PH3
	70	83.00	76.42	80.15	F(2,103) = 7.70	0.001**	0.13	PH1	**	✗
								PH2		*
Old									PH2	PH3
	20	26.03	23.77	26.46	F(2,91) = 4.63	0.012*	0.09	PH1	*	✗
								PH2		*
									PH2	PH3
	30	34.22	31.90	34.22	F(2,125) = 19.0	< 0.0005**	0.23	PH1	**	✗
								PH2		**
									PH2	PH3
	40	41.95	40.85	42.37	F(2,125) = 3.21	0.044*	0.05	PH1	✗	✗
								PH2		*
									PH2	PH3
	50	51.15	50.47	51.75	F(2,123) = 1.51	0.224	0.02	PH1	✗	✗
								PH2		✗
									PH2	PH3
	60	55.73	55.58	55.70	F(2,125) = 0.01	0.994	0.00	PH1	✗	✗
								PH2		✗
									PH2	PH3
	70	74.77	71.86	74.59	F(2,125) = 3.40	0.037*	0.05	PH1	*	✗
								PH2		✗

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. ✗ denotes the difference is not significant

Table B6: ANOVA results for percentage of distance travelled over speed limit between age groups

<table>
<tr><th rowspan="2">Age group</th><th rowspan="2">Speed zone</th><th rowspan="2">Phase 1</th><th rowspan="2">Phase 2</th><th rowspan="2">Phase 3</th><th colspan="6">Univariate ANOVA</th></tr>
<tr><th>F statistic</th><th>significance</th><th>Effect size</th><th colspan="3">Post-hoc t-tests</th></tr>
<tr><td rowspan="18">Young</td><td rowspan="3">20</td><td rowspan="3">46.45</td><td rowspan="3">42.92</td><td rowspan="3">45.34</td><td rowspan="3">F(2,30)= 0.24</td><td rowspan="3">0.787</td><td rowspan="3">0.016</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">30</td><td rowspan="3">40.32</td><td rowspan="3">34.95</td><td rowspan="3">38.48</td><td rowspan="3">F(2,70)= 16.02</td><td rowspan="3">< 0.0005**</td><td rowspan="3">0.314</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>**</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>**</td></tr>
<tr><td rowspan="3">40</td><td rowspan="3">31.74</td><td rowspan="3">25.52</td><td rowspan="3">31.38</td><td rowspan="3">F(2,70)= 11.10</td><td rowspan="3">< 0.0005**</td><td rowspan="3">0.241</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>**</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>**</td></tr>
<tr><td rowspan="3">50</td><td rowspan="3">35.25</td><td rowspan="3">28.83</td><td rowspan="3">35.28</td><td rowspan="3">F(2,64)= 3.84</td><td rowspan="3">0.027*</td><td rowspan="3">0.107</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>*</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>*</td></tr>
<tr><td rowspan="3">60</td><td rowspan="3">8.57</td><td rowspan="3">7.50</td><td rowspan="3">10.28</td><td rowspan="3">F(2,70)= 1.41</td><td rowspan="3">0.251</td><td rowspan="3">0.039</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">70</td><td rowspan="3">35.70</td><td rowspan="3">27.38</td><td rowspan="3">40.74</td><td rowspan="3">F(2,64)= 6.27</td><td rowspan="3">0.003**</td><td rowspan="3">0.164</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>*</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>**</td></tr>
<tr><td rowspan="18">Old</td><td rowspan="3">20</td><td rowspan="3">41.06</td><td rowspan="3">42.08</td><td rowspan="3">47.66</td><td rowspan="3">F(2,48)= 1.22</td><td rowspan="3">0.305</td><td rowspan="3">0.048</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">30</td><td rowspan="3">38.83</td><td rowspan="3">35.01</td><td rowspan="3">39.50</td><td rowspan="3">F(2,84)= 8.20</td><td rowspan="3">0.001**</td><td rowspan="3">0.163</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>**</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>**</td></tr>
<tr><td rowspan="3">40</td><td rowspan="3">25.60</td><td rowspan="3">22.46</td><td rowspan="3">26.06</td><td rowspan="3">F(2,84)= 3.53</td><td rowspan="3">0.034*</td><td rowspan="3">0.077</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>*</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>**</td></tr>
<tr><td rowspan="3">50</td><td rowspan="3">21.75</td><td rowspan="3">20.20</td><td rowspan="3">23.33</td><td rowspan="3">F(2,80)= 1.13</td><td rowspan="3">0.328</td><td rowspan="3">0.027</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">60</td><td rowspan="3">5.35</td><td rowspan="3">4.16</td><td rowspan="3">5.32</td><td rowspan="3">F(2,84)= 1.24</td><td rowspan="3">0.295</td><td rowspan="3">0.029</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
<tr><td rowspan="3">70</td><td rowspan="3">27.96</td><td rowspan="3">22.31</td><td rowspan="3">27.08</td><td rowspan="3">F(2,84)= 1.49</td><td rowspan="3">0.231</td><td rowspan="3">0.034</td><td></td><td>PH2</td><td>PH3</td></tr>
<tr><td>PH1</td><td>×</td><td>×</td></tr>
<tr><td>PH2</td><td></td><td>×</td></tr>
</table>

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B7: ANOVA results for mean speeds between intention groups

Intention group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA			Post-hoc t-tests		
					F statistic	significance	Effect size	PH1 / PH2	PH1 / PH3	PH2 / PH3
Intender	20	18.55	17.35	17.93	F(2,84) = 1.17	0.314	0.03	×	×	×
	30	27.05	26.17	27.11	F(2,122) = 4.66	0.011*	0.07	*	×	*
	40	34.70	33.97	34.96	F(2,122) = 1.61	0.204	0.03	×	×	×
	50	43.49	43.16	43.88	F(2,118) = 0.49	0.615	0.01	×	×	×
	60	46.17	46.00	46.41	F(2,122) = 0.15	0.864	0.00	×	×	×
	70	69.65	65.41	67.16	F(2,119) = 5.49	0.005**	0.08	**	×	×
Non-intender	20	19.84	19.54	20.38	F(2,73) = 0.55	0.580	0.01	×	×	×
	30	26.28	25.76	26.77	F(2,109) = 2.24	0.112	0.04	×	×	×
	40	34.58	33.94	34.76	F(2,109) = 1.23	0.295	0.02	×	×	×
	50	42.59	42.26	43.20	F(2,108) = 1.39	0.254	0.03	×	×	×
	60	46.34	45.79	45.93	F(2,108) = 0.07	0.933	0.00	×	×	×
	70	62.98	62.44	65.35	F(2,109) = 2.04	0.136	0.04	×	×	*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B8: ANOVA results for the 85th speeds distribution between intention groups

Intention group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA			Post-hoc t-tests		
					F statistic	significance	Effect size	PH1 vs PH2	PH1 vs PH3	PH2 vs PH3
Intender	20	24.81	22.24	24.35	F(2,84) = 5.21	0.007**	0.11	**	×	*
	30	35.10	32.09	34.95	F(2,122) = 31.9	< 0.0005**	0.34	**	×	**
	40	43.46	41.10	43.55	F(2,122) = 10.5	< 0.0005**	0.15	**	×	**
	50	53.53	51.85	53.68	F(2,118) = 3.15	0.047*	0.05	*	×	×
	60	56.74	56.18	56.95	F(2,122) = 0.64	0.528	0.01	×	×	×
	70	81.18	75.08	77.77	F(2,119) = 7.94	0.001**	0.12	**	×	×
Non-intender	20	25.46	24.57	26.09	F(2,73) = 1.15	0.321	0.03	×	×	×
	30	34.19	32.22	34.65	F(2,109) = 10.2	< 0.0005**	0.16	**	×	**
	40	43.43	41.58	43.40	F(2,109) = 3.40	0.037*	0.06	*	×	*
	50	51.97	50.20	52.49	F(2,108) = 7.09	0.001**	0.12	**	×	**
	60	55.75	55.20	55.17	F(2,108) = 0.10	0.903	0.00	×	×	×
	70	72.77	72.17	75.77	F(2,109) = 3.13	0.048*	0.05	×	×	*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B9: ANOVA results for percentage of distance travelled over speed limit between intention groups

Intention group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA			Post-hoc t-tests		
					F statistic	Significance	Effect size	PH1–PH2	PH1–PH3	PH2–PH3
Intender	20	50.10	43.74	46.89	F(2,40) = 0.85	0.436	0.041	✗	✗	✗
	30	40.17	36.07	39.46	F(2,82) = 7.90	0.001**	0.162	**	✗	**
	40	29.19	24.69	29.63	F(2,82) = 8.11	0.001**	0.165	**	✗	**
	50	31.73	28.52	33.60	F(2,74) = 2.17	0.121	0.055	✗	✗	*
	60	7.92	6.47	9.74	F(2,82) = 2.54	0.085	0.058	✗	✗	*
	70	40.92	30.07	38.06	F(2,76) = 4.11	0.020*	0.098	**	✗	✗
Non-intender	20	38.93	39.75	44.60	F(2,34) = 1.10	0.345	0.061	✗	✗	✗
	30	38.76	33.74	38.56	F(2,72) = 12.6	< 0.0005**	0.259	**	✗	**
	40	27.49	22.91	27.21	F(2,72) = 4.84	0.011*	0.118	**	✗	**
	50	23.59	19.32	23.44	F(2,70) = 2.34	0.104	0.063	✗	✗	*
	60	5.72	4.79	5.29	F(2,70) = 0.47	0.627	0.013	✗	✗	✗
	70	21.20	18.66	27.70	F(2,72) = 3.95	0.024*	0.099	✗	✗	*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. ✗ denotes the difference is not significant

Table B10: ANOVA results for mean speeds between types of driver

Intention group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA					
					F statistic	Significance	Effect size	Post-hoc t-tests		
Private motorists									PH2	PH3
	20	20.53	20.33	21.30	F(2,74)= 0.38	0.685	0.01	PH1	×	×
								PH2		×
									PH2	PH3
	30	27.06	26.39	27.25	F(2,115)= 1.75	0.178	0.03	PH1	×	×
								PH2		×
									PH2	PH3
	40	34.95	34.19	35.16	F(2,115)= 1.52	0.223	0.03	PH1	×	×
								PH2		×
									PH2	PH3
	50	43.49	43.06	43.48	F(2,112)= 0.57	0.568	0.01	PH1	×	×
								PH2		×
									PH2	PH3
	60	47.08	46.44	46.57	F(2,115)= 0.05	0.948	0.00	PH1	×	×
								PH2		×
									PH2	PH3
	70	66.70	63.19	64.71	F(2,114)= 2.88	0.060	0.05	PH1	*	×
								PH2		×
Fleet drivers									PH2	PH3
	20	18.19	17.08	17.66	F(2,83)= 1.31	0.274	0.03	PH1	×	×
								PH2		×
									PH2	PH3
	30	26.42	25.55	26.68	F(2,116)= 7.86	0.001**	0.12	PH1	**	×
								PH2		**
									PH2	PH3
	40	34.35	33.66	34.52	F(2,116)= 1.61	0.204	0.03	PH1	×	×
								PH2		×
									PH2	PH3
	50	42.74	42.17	43.56	F(2,114)= 1.17	0.313	0.02	PH1	×	×
								PH2		×
									PH2	PH3
	60	44.95	44.76	45.35	F(2,115)= 0.28	0.753	0.00	PH1	×	×
								PH2		×
									PH2	PH3
	70	67.60	65.17	68.75	F(2,114)= 3.26	0.042*	0.05	PH1	×	×
								PH2		*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B11: ANOVA results for the 85th percentile speeds between types of driver

Intention group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA					
					F statistic	significance	Effect size	Post-hoc t-tests		
Private motorists	20	26.44	25.57	27.51	F(2,74) = 1.08	0.343	0.03		PH2	PH3
								PH1	×	×
								PH2		×
	30	35.04	32.72	35.23	F(2,115) = 10.2	< 0.0005**	0.15		PH2	PH3
								PH1	**	×
								PH2		**
	40	43.28	41.28	43.66	F(2,115) = 8.05	0.001**	0.12		PH2	PH3
								PH1	**	×
								PH2		**
	50	53.29	51.15	52.88	F(2,112) = 4.23	0.017*	0.07		PH2	PH3
								PH1	*	×
								PH2		×
	60	57.04	56.04	56.10	F(2,115) = 0.35	0.706	0.01		PH2	PH3
								PH1	×	×
								PH2		×
	70	76.29	72.36	74.77	F(2,114) = 3.09	0.047*	0.05		PH2	PH3
								PH1	*	×
								PH2		*
Fleet drivers	20	24.14	21.82	23.62	F(2,83) = 5.39	0.006**	0.12		PH2	PH3
								PH1	**	×
								PH2		*
	30	34.41	31.59	34.44	F(2,116) = 39.8	< 0.0005**	0.41		PH2	PH3
								PH1	**	×
								PH2		**
	40	43.60	41.42	43.27	F(2,116) = 4.45	0.014*	0.07		PH2	PH3
								PH1	*	×
								PH2		*
	50	52.43	50.76	53.25	F(2,114) = 4.22	0.017*	0.07		PH2	PH3
								PH1	*	×
								PH2		*
	60	55.03	54.85	55.78	F(2,115) = 0.58	0.562	0.01		PH2	PH3
								PH1	×	×
								PH2		×
	70	79.91	75.53	79.95	F(2,114) = 5.86	0.004**	0.09		PH2	PH3
								PH1	**	×
								PH2		*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

Table B12: ANOVA results for percentage of distance travelled over speed limit between types of driver

Intention group	Speed zone	Phase 1	Phase 2	Phase 3	Univariate ANOVA					
					F statistic	significance	Effect size	Post-hoc t-tests		
Private motorists									PH2	PH3
	20	48.31	43.26	47.41	F(2,28)= 0.46	0.639	0.032	PH1	×	×
								PH2		×
									PH2	PH3
	30	40.82	36.73	40.99	F(2,76)= 8.19	0.001**	0.177	PH1	**	×
								PH2		**
									PH2	PH3
	40	29.05	24.23	28.62	F(2,76)= 5.84	0.004**	0.133	PH1	**	×
								PH2		**
									PH2	PH3
	50	26.75	20.91	25.91	F(2,70)= 3.75	0.028*	0.097	PH1	*	×
								PH2		**
									PH2	PH3
	60	6.98	5.42	7.02	F(2,76)= 1.64	0.200	0.041	PH1	×	×
								PH2		×
									PH2	PH3
	70	26.87	21.91	29.48	F(2,74)= 1.94	0.151	0.050	PH1	×	×
								PH2		×
Fleet drivers									PH2	PH3
	20	42.84	41.04	44.85	F(2,46)= 0.45	0.643	0.019	PH1	×	×
								PH2		×
									PH2	PH3
	30	38.23	33.27	37.13	F(2,78)= 12.41	< 0.0005**	0.241	PH1	**	×
								PH2		**
									PH2	PH3
	40	27.76	23.49	28.37	F(2,78)= 6.92	0.002**	0.151	PH1	**	×
								PH2		**
									PH2	PH3
	50	28.74	27.02	31.26	F(2,74)= 1.59	0.210	0.041	PH1	×	×
								PH2		×
									PH2	PH3
	60	6.82	5.97	8.35	F(2,76)= 1.29	0.283	0.033	PH1	×	×
								PH2		×
									PH2	PH3
	70	35.77	27.12	36.55	F(2,74)= 4.56	0.014*	0.110	PH1	**	×
								PH2		*

Note:
1. * denotes the difference is significant at the 0.05 level
2. ** denotes the difference is significant at the 0.01 level
3. × denotes the difference is not significant

APPENDIX C: KEY BELIEFS DISTINGUISHING INTENDERS FROM NON-INTENDERS

In order to examine any systematic differences in those participants who intend to exceed the speed limit and those who do not, statistical comparisons were made across behavioural beliefs, outcome evaluations, normative beliefs, motivations to comply, control beliefs and power. Due to missing data, the number of responses varies slightly across the analysis.

Behavioural beliefs

Significant differences were noted for a number of the multiplicative measures of behavioural beliefs by outcome evaluations. However, given it is often difficult to attribute meaningful understanding to these measures, it is often considered more useful to explore the differences across the individual variables (Table 68, top panel).

Intenders and non-intenders differed on the majority of behavioural beliefs. The two groups differed most notably on the belief that exceeding the speed limit would risk causing an accident. Although both believed that speeding would risk causing an accident (M > 0), intenders were significantly less likely to believe this than non-intenders ($F(1,76) = 27.47$, $p < .001$). Whilst both groups were unlikely to believe that exceeding the speed limit would make them feel good, intenders were significantly less likely to believe this than non-intenders ($F(1,76) = 27.11$, $p < .001$). Similarly, intenders were significantly less likely to believe that exceeding the speed limit would make them feel anxious ($F(1,76) = 16.72$, $p < .01$) than non-intenders. Non-intenders believed that exceeding the speed limit would irritate other participants whereas intenders did not ($F(1,76) = 13.92$, $p < .001$). The groups also differed on beliefs relating to perceived journey time. Intenders were significantly more likely to believe that exceeding the speed limit would allow them to save time ($F(1,76) = 11.64$, $p < .001$), make rapid progress ($F(1,76) = 9.10$, $p < .01$) and get them to their destination more quickly ($F(1,76) = 4.27$, $p < .05$) than non-intenders. Both groups were in relatively strong agreement that exceeding the speed limit was against the law and would risk being stopped by the police and prosecuted and fined. Although intenders were less likely to believe that speeding would result in prosecution ($F(1,76) = 7.31$, $p < .01$) than non-intenders, differences relating to the criminality of speeding were less pronounced and suggest that the benefits of speeding (saving time, emotive reactions) account for the difference in participants' motivations to speed rather than the potential dis-benefits such as monetary fines and endorsements.

Both intenders and non-intenders negatively evaluated the outcomes of negative behavioural beliefs. However, where the groups differed, intenders were significantly less negative in their evaluation of the outcomes. Intenders and non-intenders differed most significantly in their evaluation of feeling anxious. Whilst both groups negatively evaluated feeling anxious, intenders were significantly less negative in their evaluation ($F(1,76) = 10.44$, $p < .01$). Conversely intenders were significantly more positive in their evaluation of feeling good ($F(1,76) = 4.63$, $p < .05$). Although neither group rated irritating participants positively, intenders were significantly less negative in their evaluations than non-intenders ($F(1,76) = 8.60$, $p < .01$). Both groups positively evaluated saving time ($F(1,76) = 6.59$, $p < .05$), making rapid progress ($F(1,76) = 5.98$, $p < .05$) and getting to their destination more quickly ($F(1,76) = 6.05$, $p < .05$) positively, however intenders were significantly more positive in their evaluation than non-intenders. Intenders also evaluated breaking the law less negatively than non-intenders ($F(1,76) = 8.29$, $p < .01$). Intenders and non-intenders did not differ significantly in their evaluation of the outcome of being stopped by the police or prosecuted and fined or being involved in an accident.

Since beliefs provide useful targets for intervention, correlations between the individual beliefs, intentions and behaviour were calculated in order to identify the most influential beliefs. The belief that speeding would make participants feel good was the strongest correlate with intention ($r = 0.62$) and behaviour ($r = 0.37$). A strong negative correlation was also found between participants' belief that speeding would risk causing an accident and intentions ($r = -0.53$) or behaviour ($r = -0.35$). Beliefs relating to being stopped by the police did not correlate with either intentions or behaviour.

Normative pressure

Significant differences were noted for all the multiplicative measures of normative pressure by motivation to comply. Again however, it is more useful to examine the differences across the individual measures (Table 68, middle panel).

Examination of participants' normative beliefs suggested that intenders and non-intenders differed most significantly in their belief that their spouse/partner would disapprove of their speeding behaviour. Whilst both believed that their partner would disapprove of their speeding, this belief was significantly weaker for intenders ($F(1,74) = 28.48$, $p < .001$). Similarly, whilst both groups believed that their family ($F(1,76) = 20.50$, $p < .001$) and the police ($F(1,76) = 4.64$, $p < .05$) would disapprove, intenders expressed a weaker endorsement of this belief. However, although non-intenders were likely to believe that their friends ($F(1,76) = 21.44$, $p < .001$) and other road users ($F(1,76) = 12.83$, $p < .001$) would also disapprove of the speeding, intenders did not.

The police were the most influential group for both the intenders and non-intenders. Motivation to comply with the police however highlighted one of the strongest differences across intenders and non-intenders. Both groups expressed strong motivation to comply with this referent group but the motivation was significantly stronger for non-intenders than intenders ($F(1,76) = 9.34$, $p < .01$). Participants' motivation to comply with their family ($F(1,76) = 9.95$, $p < .01$) and spouse/partner ($F(1,74) = 8.06$, $p < .01$) was also significantly stronger amongst non-intenders than intenders.

Correlations suggested that intention to speed seemed to be significantly associated with a lack of belief that the salient references would disapprove of their speeding. Similarly, those who intended to speed demonstrated a significantly weaker motivation to comply with their family ($r = -0.39$), the police ($r = -0.32$) and their spouse/partner ($r = -0.31$). A weak motivation to comply with their family ($r = -0.25$) and their spouse/partner ($r = -0.24$) also provided significant correlates with actual speeding behaviour.

Table 68: Differences between those intending and not intending to exceed the speed limit for behavioural beliefs (BB), outcome evaluations (OE), belief x evaluation (BE), normative pressure (NB), motivation to comply (MC), normative pressure x motivation to comply (NBMC), frequency (F), control belief (CB), control belief x frequency (CBF) and correlation with behavioural intention (BI) and behaviour (B)

	BB					BI	B	OE					BI	B	BE					BI	B
	non intenders		intenders			correlation		non intenders		intenders			correlation		non intenders		intenders			correlation	
Exceeding the speed would…	M	SD	M	SD		r	r		SD	M	SD		r	r	M	SD	M	SD		r	r
get me to my destination more quickly	0.48	1.69	1.12	0.97	*	0.25*	-0.13	0.89	1.53	1.57	0.80	*	0.37***	0.08	1.56	3.15	2.08	2.11		0.17	-0.11
risk causing an accident	1.79	0.93	0.69	0.92	***	-0.53***	-0.35**	-2.95	0.18	-2.96	0.11		0.04	0.04	-5.32	2.81	-2.08	2.75	***	0.53***	0.35**
irritate other drivers	0.45	1.46	-0.57	0.88	***	-0.44***	-0.18	-2.55	0.68	-2.02	0.87	**	0.37***	0.15	-1.26	4.12	1.19	1.79	***	0.42***	0.19
enable me to make rapid progress	0.10	1.34	0.85	0.80	**	0.31**	-0.09	0.68	1.55	1.36	0.82	*	0.38***	0.02	0.96	2.50	1.51	1.92		0.11	-0.19
get me stopped by the police	2.04	1.34	1.43	1.37		-0.20	-0.15	-2.67	1.12	-2.86	0.28		-0.20	-0.05	-6.00	3.97	-4.25	4.03		0.18	0.13
save time	0.16	1.49	1.11	0.92	***	0.36***	-0.06	0.97	1.45	1.67	0.92	*	0.37***	0.05	1.23	2.97	2.20	2.30		0.22	-0.11
get me prosecuted and fined	2.29	0.94	1.58	1.32	**	-0.30**	-0.20	-2.74	1.03	-2.92	0.21		-0.19	-0.02	-6.40	3.66	-4.74	3.91		0.19	0.16
make me feel good	-1.88	1.00	-0.63	1.11	***	0.62***	0.37***	0.76	2.09	1.58	1.19	*	0.36***	0.05	-1.04	5.37	-0.72	2.39		0.01	0.12
make me feel anxious	0.94	1.51	0.02	1.27	**	-0.45***	-0.27*	-2.59	0.55	-1.98	1.04	**	0.29**	0.12	-2.62	4.32	0.27	3.04	***	0.48**	0.28*

	NB					BI	B	MC					BI	B	NBMC					BI	B
	non intenders		intenders			correlation		non intenders		intenders			correlation		non intenders		intenders			correlation	
Salient referents	M	SD	M	SD		r	r	M	SD	M	SD		r	r	M	SD	M	SD		r	r
police	2.45	0.91	2.03	0.78	*	-0.26*	-0.15	5.95	1.49	5.03	1.17	**	-0.32**	-0.11	14.66	7.06	10.04	4.47	***	-0.37***	-0.15
other road users	0.65	1.35	-0.28	0.90	***	-0.38***	-0.04	4.16	2.02	4.28	1.40		-0.03	0.00	3.99	6.86	-1.17	4.61	***	-0.40***	-0.02
family	1.54	1.16	0.38	1.10	***	-0.46***	-0.16	5.63	1.34	4.60	1.53	**	-0.39***	-0.25*	9.52	7.76	2.02	5.09	***	-0.55***	-0.19
friends	0.70	1.23	-0.48	1.01	***	-0.52***	-0.08	3.89	1.81	3.78	1.58		0.03	-0.07	3.68	6.32	-1.63	4.95	***	-0.46***	0.03
spouse/partner	1.68	1.29	0.19	1.15	***	-0.51***	-0.27*	5.68	1.60	4.68	1.47	**	-0.31**	-0.24*	10.57	8.81	1.13	5.81	***	-0.57***	-0.30**

	F					BI	B	CB					BI	B	CBF					BI	B
	non intenders		intenders			correlation		non intenders		intenders			correlation		non intenders		intenders			correlation	
Control beliefs	M	SD	M	SD		r	r	M	SD	M	SD		r	r	M	SD	M	SD		r	r
night time	5.69	0.91	5.36	0.93		-0.16	0.03	-1.04	1.46	-0.10	1.21	**	0.39***	0.33**	-5.87	8.79	-0.05	6.22	***	0.41***	0.35**
wet surfaces	5.77	0.95	5.44	0.80		-0.20	-0.08	-2.31	0.68	-1.66	0.89	***	0.36***	0.26*	-13.53	4.73	-8.86	4.96	***	0.42***	0.30**
in a hurry	3.19	1.12	3.85	0.93	**	0.44***	0.10	-0.03	1.49	1.33	0.90	***	0.59***	0.24*	0.53	4.63	5.45	3.68	***	0.60***	0.23*
good mood	4.57	1.08	4.29	0.68		-0.16	-0.16	-1.14	1.09	0.06	0.73	***	0.66***	0.12	-5.91	6.31	0.39	3.17	***	0.65***	0.16
heavy traffic	5.36	0.81	5.23	0.74		0.00	-0.12	-2.36	0.58	-1.64	0.99	***	0.51***	0.13	-12.68	3.87	-8.41	5.42	***	0.47***	0.15
bad mood	3.20	0.90	3.40	0.77		0.14	0.06	-0.54	1.30	0.01	0.84	*	0.38***	0.25*	-1.46	3.63	0.15	2.83	*	0.35***	0.25*
passenger	5.46	1.15	5.23	0.87		-0.14	-0.23*	-1.37	1.08	-0.59	0.71	***	0.50***	0.33**	-7.44	6.59	-2.95	3.49	***	0.50***	0.38***

Note: * p < 0.05, ** p <0.01 ***, p <0.00

Control beliefs

Significant differences were noted for all the multiplicative measures of control beliefs by power. However, greater insight is gained when comparisons are made between the individual measures (Table 68, bottom panel).

Both intenders and non-intenders seemed equally likely to drive in the situations highlighted by the control factors. Only one significant difference was noted such that intenders were significantly more likely to drive in a hurry compared to non-intenders ($F(1,76) = 7.85$, $p < .01$).

On the whole the majority of control factors were seen to inhibit participants' propensity to exceed the speed limit. Despite this however intenders evaluated driving at night time ($F(1,76) = 9.81$, $p < .01$), on wet surfaces ($F(1,76) = 12.93$, $p < .001$), in heavy traffic ($F(1,76) = 15.22$, $p < .001$) and with a passenger ($F(1,76) = 14.28$, $p < .001$) as less inhibiting than non-intenders. Moreover, where non-intenders believed driving in a hurry ($F(1,76) = 23.87$, $p < .001$), in a bad mood ($F(1,76) = 4.99$, $p < .05$) or in a good mood ($F(1,76) = 32.96$, $p < .001$) would inhibit their speeding behaviour, intenders believed these factors would facilitate speeding.

Significant correlations suggested that the beliefs "driving in a good mood" ($r = 0.66$) or a "in a hurry" ($r = 0.59$) were the strongest correlates with intention to speed. Participants who believed that driving in a good mood or in a hurry would facilitate speeding were significantly more likely to intend to speed than those who did not. Comparisons across the strongest correlates with behaviour suggested that participants who believed driving at night-time ($r = 0.33$) or with a passenger ($r = 0.33$) would facilitate speeding were significantly more likely to engage in speeding behaviour than those who did not.

APPENDIX D: IMPACT OF ISA ON THE KEY PREDICTORS OF SPEEDING INTENTIONS AND BEHAVIOUR

In order to determine whether the key predictors of speeding intentions and behaviour changed following experience with the ISA system a set of comparative regressions were conducted.

Comparisons across the correlations in Table 69 suggest that attitude and normative beliefs provide significant correlates with **intentions** at each time point. Whilst PBC was found to significantly correlate with intentions at time 1, it did not at time 2 (immediately following ISA intervention) or time 3 (following a return to unsupported driving).

Table 69: Correlation for intentions at time 1, time 2 and time 3

Time 1 Cognitions	1.	2.	3.	4.
1. Intention	-	0.77	0.40	-0.60
2. Attitude		-	0.48	-0.64
3. PBC			-	-0.40
4. NB X MC				-

N=78 Note: r > 0.22, p<0.05
r > 0.29, p <0.01
r > 0.36, p<0.001

Time 2 Cognitions	1.	2.	3.	4.
1. Intention	-	0.72	0.10	-0.57
2. Attitude		-	0.18	-0.60
3. PBC			-	-0.12
4. NB X MC				-

N = 71 Note: r > 0.23, p<0.05
r > 0.30, p <0.01
r > 0.38, p<0.001

Time 3 Cognitions	1.	2.	3.	4.
1. Intention	-	0.73	0.19	-0.56
2. Attitude		-	0.24	-0.59
3. PBC			-	-0.23
4. NB X MC				-

N = 70 Note: r > 0.23, p<0.05
r > 0.30, p <0.01
r > 0.38, p<0.001

A set of regressions was carried out to assess the key predictors of intention at each time point. The regression conducted in section 4.1.3.1 is included for comparison. As can be seen in Table 70, cognitions measured at time 2, following experience with the ISA system, explained 55.6% of the variance in driver intentions to exceed the speed limit (R^2 = 0.56, F (3,70) = 27.90, p < .001). Both attitude (β = 0.60, p < .001) and normative beliefs (β = -0.22, p < .05) provided significant and independent predictors of intentions. Similarly, cognitions measured at time 3 following a return to unsupported driving accounted for 56.0% of the variance in participants' intentions to exceed the speed limit (R^2 = 0.56, F (3,69) = 28.03, p < .001). Here, only attitude (β = 0.62, p < .001) proved a significant and independent predictor of intentions. However the influence of normative beliefs approached significance (β = -0.20, p = .056). Beta weightings are remarkably similar across all three time points suggesting the influence of the variables was consistent across time points. Attitude provided the strongest and most consistent predictor of intentions. Normative beliefs also proved an independent predictor of intentions. PBC was not found to influence participants' intentions to exceed the speed limit before or after the ISA intervention. Despite the ISA intervention the key predictors of intentions remained consistent.

Table 70: Regression analysis for intentions at time 1, time 2 and time 3

Time 1 Cognitions Predictor	R^2	F	β
1			
Attitude	0.61	38.48	0.64***
PBC			0.01
Normative beliefs			-0.19*

Time 2 Cognitions Predictor	R^2	F	β
1			
Attitude	0.56	27.9	0.60***
PBC			-0.04
Normative beliefs			-0.22*

Time 3 Cognitions Predictor	R^2	F	β
1			
Attitude	0.56	28.03	0.62***
PBC			-0.01
Normative beliefs			-0.2

Note: * p < 0.05, ** p <0.01 ***, p <0.001

In terms of predicting **behaviour**, only prospective tests of the intention-behaviour relationship are included in the analysis. Comparisons across the correlations in Table 71 suggest that intentions measured at time 1 provided a significant correlate with phase 1 and phase 2 behaviour. Intentions did not correlate with behaviour measured during phase 3 (following a return to unsupported driving). Table 72 suggests that intentions measured at time 2 provided at significant correlate with behaviour measured during phase 3. PBC measured at both times points failed to correlate with any measures of behaviour.

Table 71: Correlation for behaviour at time 1, time 2 and time 3 (time 1 cognitions)

Time 1 Cognitions and Phase 1 Behaviour	1.	2.	3.
1. Intention	-	0.41	0.30
2. PBC		-	0.00
3. Behaviour			-

N=77 Note: r > 0.22, p<0.05; r > 0.28, p <0.01; r > 0.36, p<0.001

Time 1 Cognitions and Phase 2 Behaviour	1.	2.	3.
1. Intention	-	0.40	0.24
2. PBC		-	-0.03
3. Behaviour			-

N = 78 Note: r > 0.22, p<0.05; r > 0.28, p <0.01; r > 0.36, p<0.001

Time 1 Cognitions and Phase 3 Behaviour	1.	2.	3.
1. Intention	-	0.08	0.42
2. PBC		-	0.07
3. Behaviour			-

N = 73 Note: r > 0.23, p<0.05; r > 0.30, p <0.01; r > 0.37, p<0.001

Table 72: Correlation for behaviour at time 1, time 2 and time 3 (time 2 cognitions)

Time 2 Cognitions and Phase 3 Behaviour	1.	2.	3.
1. Intention	-	0.40	0.15
2. PBC		-	0.00
3. Behaviour			-

N = 78 Note: r > 0.22, p<0.05; r > 0.28, p <0.01; r > 0.36, p<0.001

A set of regressions were employed to examine the key predictors of behaviour during each phase of the trial. Although cognitions measured prior to experience with the ISA system (time 1 cognitions) were found to be predictive of subsequent speeding behaviour (see Table 73), these cognitions did not predict speeding behaviour when ISA was active (Phase 2 behaviour) (R^2 = 0.08, F (2,75) = 3.06, p = .053) or speeding behaviour following a return to unsupported driving (R^2 = 0.03, F (2,75) = 1.04, p = .360) (Phase 3 behaviour).

Table 73: Regression analysis for behaviour at time 1, time 2 and time 3 (time 1 cognitions)

Time 1 Cognitions and Phase 1 Behaviour — Predictor	R^2	F	β
1			
Intention	0.11	4.59	0.37**
PBC			-0.15

Time 1 Cognitions and Phase 2 Behaviour — Predictor	R^2	F	β
1			
Intention	0.08	3.06	0.30*
PBC			-0.15

Time 1 Cognitions and Phase 3 Behaviour — Predictor	R^2	F	β
1			
Intention	0.03	1.04	0.18
PBC			-0.07

Note: * p < 0.05, ** p <0.01 ***, p <0.001

Cognitions measured following experience with ISA (time 2 cognitions) were predictive of subsequent speeding behaviour (R^2 = 0.18, F (2,70) = 7.61, p < .001) (see Table 74). Here, only intention (β = 0.42, p < .001) proved a significant and independent predictor of participants' propensity to exceed the speed limit.

Table 74: Regression analysis for behaviour at time 3 (time 2 cognitions)

Time 2 Cognitions and Phase 3 Behaviour			
Predictor	R^2	F	β
1			
Intention	0.18	7.61	0.42***
PBC			0.03

Note: * p < 0.05, ** p <0.01 ***, p <0.001

PBC was not found to influence participants' speeding behaviour before or after the ISA intervention. In those situations where ISA was unavailable, intentions were found to reliably predict behaviour explaining between 11.0% and 17.9% of the variance in participants' propensity to exceed the speed limit.