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Lancashire ISA

Final Report

The effect of Advisory ISA on drivers' choice of speed and attitudes to speeding

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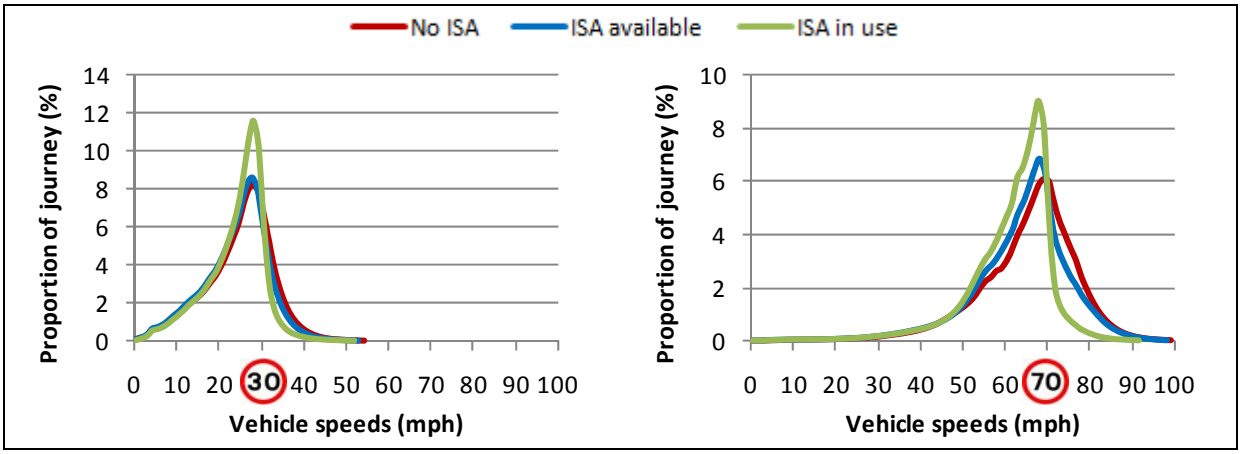
Highlights of major results

- When drivers chose to use advisory ISA, speeding was reduced by 30% on 30 mph roads and by 56% on 70 mph roads.
- Overall, being able to use the system (but not necessarily having it active) reduced speeding on 30 mph roads by 18% and on 70 mph roads by 31%.
- For drivers aged 25 and below, active use of advisory ISA resulted in a reduction in speeding of 22% on 30 mph roads and 37% on 70 mph roads.
- For drivers with less than three years of experience, active use of advisory ISA was associated with a 25% reduction in speeding on 30 mph roads and a 48% reduction in speeding on 70 mph roads.
- The effect of system availability on 85th percentile speed was observable but relatively small. This indicates that much of the speeding that was curtailed by the system was in a range that was relatively close to the speed limit.
- Two-thirds of the car drivers who took part in this trial would consider buying advisory ISA.
- On average, the car drivers were willing to pay around £100 for an advisory ISA system.

Executive summary

Intelligent Speed Adaptation (ISA) is a driver support system which provides speed limit information into the vehicle. The ISA system trialled in this project consisted of an off-the-shelf satellite navigation system with the added functionality of displaying speed limits covering Lancashire, Blackpool, and Blackburn with Darwen, and of warning the driver visually and auditorily upon vehicle speed exceeding the speed limit. Participants were recruited from the general public and local fleets. The equipment was provided to the participants free of charge. The trial lasted 9 months for each participant. ISA was disabled during the first two months to provide a baseline and then was enabled for the remaining seven months. Vehicle speeds were recorded at 1 Hz. The trial collected over 2.8 million miles of driving data contributed by 402 participants.

When ISA was in use, the speed distribution was reshaped in comparison with the standard bell shape observed from the baseline period. As a result, ISA reduced the mean and 85th percentile speeds, and more prominently, the amount of speeding.



The effectiveness varied among roads with different speed limits. On 30 mph roads, the reduction from the advisory ISA was 2% in mean speeds, 5% in 85th percentile speeds, and 30% in speeding. On 70 mph roads, the effect of advisory ISA was even more prominent, which resulted in a 4% cut in mean speeds, a 6% cut in 85th percentile speeds, and a 56% cut in speeding. The effectiveness of ISA was jeopardised when it was only used intermittently (i.e. ISA available but not used). However the effect of advisory ISA in curtailing speeding was still pronounced.

	No ISA → ISA available						No ISA → ISA in use					
	Speed limit						Speed limit					
	20	30	40	50	60	70	20	30	40	50	60	70
Mean speed	-1%	**-3%**	**-2%**	**-2%**	**-1%**	**-2%**	-1%	**-2%**	**-3%**	**-2%**	-1%	**-4%**
85th speed	0%	**-2%**	**-2%**	**-1%**	**-1%**	**-2%**	-3%	**-5%**	**-4%**	**-3%**	**-2%**	**-6%**
Speeding	**-6%**	**-18%**	**-23%**	**-24%**	**-16%**	**-31%**	-7%	**-30%**	**-40%**	**-44%**	**-21%**	**-56%**

Note: Numbers in **BOLD** denote statistical significance at the 0.05 level while **BOLD** denotes significance at the 0.01 level.

The effect of ISA also varied to some extent among different driver groups. In terms of cutting down excessive speeds, the effect was greater for drivers aged below 25 and for drivers with less than 3 years experience, in comparison with their counterparts. However, these drivers were also more resistant to speed limit compliance than their counterparts. Drivers' density of exposure to traffic played a role when it came to reduction in speeding; those with an annual mileage over the 10,000 mark showed somewhat stronger resistance to speed limit compliance. Gender did not appear to influence the effectiveness of advisory ISA.

Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of age and experience

			Speed limit					
			20	30	40	50	60	70
Age	85th	< 25 yrs	-3%	-8%	**-7%**	**-5%**	**-5%**	**-5%**
		25-59 yrs	-3%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
		>= 60 yrs	0%	**-5%**	**-3%**	**-2%**	-1%	**-6%**
	Speeding	< 25 yrs	-2%	**-22%**	**-46%**	**-40%**	**-41%**	**-37%**
		25-59 yrs	**-11%**	**-31%**	**-41%**	**-47%**	-15%	**-56%**
		>= 60 yrs	-11%	**-39%**	**-47%**	**-56%**	-38%	**-69%**
experience	85th	< 3 yrs	1%	**-7%**	**-6%**	-3%	-3%	**-6%**
		> 3 yrs	-2%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
	Speeding	< 3 yrs	11%	**-25%**	**-47%**	-38%	**-35%**	**-48%**
		> 3 yrs	**-12%**	**-32%**	**-41%**	**-47%**	-21%	**-56%**

Note: Numbers in **BOLD** denote statistical significance at the 0.05 level while **BOLD** denotes significance at the 0.01 level.

Voluntary usage of the ISA system in the trial offers an insight into the patterns of system adoption. Two noticeable trends were revealed. Firstly, usage of the system diminished along with a decrease in speed limit regardless of driver characteristics. One potential reason for this would be that travelling on roads with a lower speed limit is typically associated with shorter trips when the participants might be less prone to spending time in setting the system up before driving off. However drivers most likely to encounter vulnerable road users on roads with a lower speed limit, and hence it appeared that ISA was used the least where it was needed the most. Secondly, there was a tendency for participants who would benefit from ISA the most to use ISA the least; e.g. drivers with strong intention to speed, younger drivers and novice drivers.

Based on subjective data, drivers' attitudes towards exceeding the speed limit and towards ISA remained fairly stable throughout the trial period. However, participants felt that ISA reduced their anxiety. The willingness to pay value remained similar before and after the trial at around £100. Two-thirds of drivers who took part in this trial would consider buying advisory ISA.

1 Introduction

Speed is a universal road safety problem, and the relationship between speed and accident severity has been well documented. Speed management has been a major focus of attention in Lancashire's road safety strategy; one of the aims in its road safety strategy's action plan is to identify appropriate new technology for improving road safety. Intelligent Speed Adaptation (ISA) brings the speed limit into the vehicle to make the driver aware of the prevailing speed limit and to discourage the driver from speeding. There are different variants of ISA. The one adopted for this project was an advisory ISA system which provides speed limit information to the driver but does not intervene in the vehicle's throttle control. The primary objective of this project was to deploy advisory ISA for Lancashire drivers based on a cost-effective platform. A user trial was organised to validate the effectiveness of the advisory ISA system. This report addresses the results of the evaluation based on recorded vehicle data and on a set of subjective data collected from the participants.

The next chapter explains the methodology of the user trial, followed by an overview of the vehicle data. Chapter 4 presents an analysis of the effectiveness of advisory ISA on car drivers' behaviour at an overall level, followed by analyses on the influence of driver characteristics in Chapter 5. System usage by the car drivers is then examined in Chapter 6, and the subjective (questionnaire) data in Chapter 7. The analysis of ISA for the bus fleet is covered in Chapter 8, followed by discussion and recommendations.

2 Methodology

2.1 In-vehicle system

The hardware consisted of a nomadic satellite navigation system, and a communication module (supplied by Mobile Devices Ltd), as shown in Figure 1, with an extra layer of speed limit information and warning functionality (developed by Smart Car Technologies Pty Ltd). There were two modes of visual display of the speed limit information as shown in Figure 2. The display mode was user selectable. Figure 3 illustrates a typical installation of the ISA system.

Figure 1: The system display and communication module

Figure 2: Visual display of the ISA system

Figure 3: In-vehicle set up

The ISA system conveyed information to the user visually and auditorily, as depicted in Table 1. The system compared vehicle speed (obtained via GPS) against the onboard speed limit database. As soon as speeding is established, warning would be given (i.e. no tolerance threshold). The auditory warning would repeat every second until the vehicle speed has been brought down below the speed limit.

Table 1: Communication interface of the ISA unit

Event	Auditory display	Visual display
3 second before change of speed limit	Double drums	
Vehicle speed > SL	One beep	
Vehicle speed >= SL + 5 mph	Triple beeps	

The onboard speed limit database (created by Photarc Surveys Ltd) covered all public roads within the boundaries of the three highway authorities — Lancashire, Blackpool, and Blackburn with Darwen — as shown in Figure 4.

Figure 4: Survey boundary

Participants were recruited from the general public via advertisements in newspapers and on radio, as well as from local fleets (e.g. local authorities, health services, companies, colleges etc) through fleet managers. There were 1065 responses. Of these, 483 drivers were selected for hardware to be installed onto their own vehicles (installation carried out by Base Systems Ltd). The power source to the satellite navigation display was hardwired to the vehicle. The installation costs were absorbed by the project. Upon project completion, participants were offered the option of keeping the satellite navigation unit free of charge. Further updates on software, map, and the speed limit database were offered by the hardware supplier on a subscription basis.

The ISA system had two-way communication capabilities with the data centre via the GSM network. Software, map, and speed limit updates were delivered wirelessly to each ISA unit. Vehicle speeds were recorded at 1Hz and transmitted back to the data centre periodically.

The trial lasted 9 months for each participant, although for project management purposes the entire trial had staggered starts and ends across the fleet. ISA functionality was disabled for the first two months, serving as baseline (Phase 1). At the end of the baseline period, ISA functionality was switched on remotely and stayed on for the remaining 7 months (Phase 2). Participants were notified in advance of the switch-on.

All participants signed an agreement before the trial commenced to acknowledge data collection activities.

2.2 Questionnaires

In addition to the speed data, participants were also invited to complete four questionnaires over the course of the trial. The questionnaire was designed to monitor changes in beliefs and acceptability regarding advisory ISA. The questionnaire was administered at established time points throughout the trial as shown in Figure 5. The following sections provide an overview of the constructs and items included in the questionnaire.

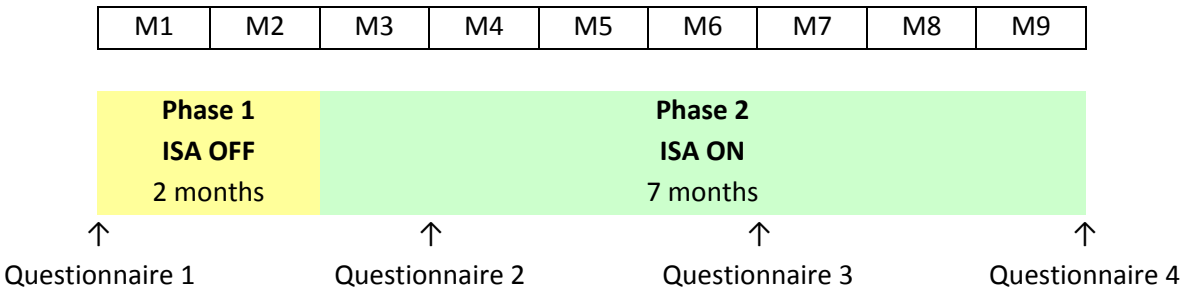


Figure 5: Schedule of questionnaire administration

2.2.1 Driver cognition

The questionnaire included items that allowed the tracking of changes in drivers' cognitions relating to speeding, as a result of using advisory ISA. Research indicates that speed choice depends on

psychological factors such as beliefs and attitudes (e.g. Conner et al., 2007; and Elliott et al., 2007). If it is found that using ISA modifies cognitions relating to speeding, then any observed changes in speeding behaviour may have the potential to be more durable.

The Theory of Planned Behaviour (TPB: Ajzen, 1985) is a social cognition model that can be used to describe the psychological determinants of speeding behaviour. The model proposes that intentions and perceived behavioural control (PBC) are the determinants of behaviour. Intentions relate to an individual's readiness to perform a given behaviour whilst PBC describes that individuals' perception of the ease or difficulty of performing the behaviour (Ajzen, 1991). It is suggested that PBC indirectly (via intentions) and directly influences behaviour and that, in turn, intentions are influenced by three factors (attitudes, subjective norms, and PBC), as shown in Figure 6.

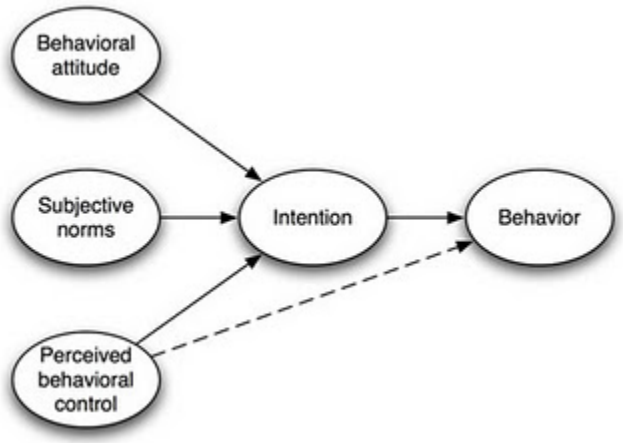


Figure 6: The TPB model (Ajzen, 1985)

Attitude towards the behaviour reflects an individual's overall evaluation of the behaviour. Subjective norm refers to the perceived social pressure to engage or not engage in the behaviour Again PBC reflects the perceived ease or difficulty of undertaking a given behaviour.

Ajzen (2005) argues that changes in attitudes, subjective norms and perceived behavioural control should produce changes in intentions, which in turn should lead to changes in behaviour. In order to change these global constructs, Ajzen (2005) 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. ISA could indirectly change these beliefs (for a fuller discussion, see Chorlton and Connor, in press).

2.2.2 Acceptability of ISA

Unified Theory of Acceptance and Use of Technology

Several theoretical models exist that purport to facilitate the understanding how different factors contribute to the acceptance of technologies. The model employed in this research was based on the Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. (2003). The authors propose that the model presents a complete picture of the acceptance process by merging eight previously used models all of which had their origins in psychology, sociology and

communications. Each of those models uses a variety of independent variables, and the unified model was created based on the conceptual and empirical similarities across these eight models. It is argued that the UTAUT model should now serve as a benchmark for the factors impacting the acceptance of information technologies (e.g. Davis, 1989; Chau, 2001; Venkatesh & Davis, 2000).

The UTAUT model contains five direct determinants of behavioural intention and use behaviour:
(1) performance expectancy, which is "the degree to which an individual believes that using the system will help him or her to attain gains in job performance"
(2) effort expectancy, which is "the degree of ease associated with the use of the system"
(3) social influence, which is "the degree to which an individual perceives that important others believe he or she should use the new system"
(4) facilitating conditions, which is "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" and
(5) behavioural intention, which is "the person's subjective probability that he or she will perform the behaviour in question"

The model has been able to account for 70% of the variance in the intention to use a technology, which is considered a measure improvement over any of the original models where the maximum was around 40 per cent (Venkatesh et al., 2003).

For the present research, the 22 instrument items were selected from eight different user acceptance models. These items can be classified into eight constructs in the UTAUT model:

i. Performance Expectancy (PE)
ii. Effort Expectancy (EE)
iii. Attitude toward Using Technology (AT)
iv. Social Influence (SI)
v. Facilitating Conditions (FC)
vi. Self-Efficacy (SE)
vii. Anxiety (AX)
viii. Behavioural Intention to Use the System (BI)

Van der Laan acceptance scale

This is a nine-item scale loading onto the two factors of satisfaction and usefulness. In previous studies of ISA, the scale has been sensitive to differences in opinion regarding specific aspects of vehicle technologies, as well as to differences of opinion among different driver groups and over time (Van der Laan et al., 1997).

2.2.3 Affordability

Acceptance of ISA may be mediated by willingness to pay (which in turn can be influenced by socio-economic status). We included a standardised affordability questionnaire, consisting of six items. The van Westendorp Price Sensitivity Meter (van Westendorp, 1976) was developed to examine patterns of price-consciousness. It uses an indirect approach rather than directly asking "How much would you pay for this product?" (which can be unreliable). The van Westendorp approach is to "surround the market price" by asking four price-value relational questions:

i. At what price would you consider this product to be a bargain – a great value for the money?
ii. At what price would it start to get expensive, but still worth considering?
iii. At what price would it be so cheap that quality is doubted?
iv. At what price is it so expensive that it would not be considered at all?

In some studies (Morsink et al., 2006; Marchau et al., 2010) willingness to pay for an ISA system was found to be a good predictor of acceptability. The analysis is used to understand the total market price sensitivity and ideal price ranges for the product.

2.2.4 Driving behaviour and habits

Participants were asked to complete the Driver Behaviour Questionnaire, originally developed over twenty years ago (Reason, Manstead, Stradling, Baxter, and Campbell, 1990). It consists of items describing a variety of errors and violations commonly performed while driving and respondents had to indicate how often each occurred to them during the last year. The DBQ has been a tremendously popular tool: almost 200 English-written studies have used it. A meta analysis (de Winter and Dodou, 2010) showed that errors and violations are about equally strong predictors of self-reported accidents and that age correlated negatively with violations and errors. The twenty-eight item version was included in this questionnaire.

2.2.5 Personality

Personality was measured using the Sensation Seeking scale. Sensation Seeking is a personality trait believed to have a biological basis that expresses as a need for physiological arousal, novel experience, and a willingness to take social, physical, and financial risks to obtain such arousal (Zuckerman, 1994). A forty-item scale is traditionally used. However in order to reduce the amount of time participants had to spend completing the questionnaire we used a shortened (4-item) version developed and validated by Stephenson et al. (2003).

Conscientiousness, another dimension of personality has been shown to correlate with accident involvement (Arthur and Graziano, 1996). Individuals who rate themselves as more self-disciplined, responsible, reliable, and dependable are less likely to be involved in driving accidents than those who rate themselves lower on these attributes. The ten-item scale of Conscientiousness was included in the personality section of the questionnaire.

2.2.6 System usability and effects

Items relating to Ease of Use were included, along with specific acceptability items regarding the hazard warning function. Ten items relating to system effects were also developed to cover e.g. comfort and enjoyment of the driving task. Social acceptability was also probed here.

2.2.7 Additional items

Further items thought important to evaluate were included:

- Attention to objects in the external environment
- Trust in the system
- Distraction cause by the system

3 Overview of data

3.1 Vehicle data

This trial collected over 2.8 million miles of driving data. Some data do not have a valid speed limit recorded, as shown in Table 2, which is primarily attributable to vehicle being driven out of the survey boundary. Table 3 provides a breakdown of accumulated mileage across different speed limit zones for the car and bus fleets respectively. For the car fleet, the vast majority of data were recorded on 30 and 70 mph roads. For the bus fleet, 30 mph roads dominate the data set. Data collected from 10 and 15 mph roads are minimal and did not warrant inclusion in the analysis.

Table 2: Quantity of vehicle data collected in the project

	No. of records	%	Miles	%
With a valid speed limit attached	345,255,880	75%	2,169,606	76%
No speed limit attached	114,871,062	25%	698,995	24%
	460,126,942		2,868,600	

Table 3: Breakdown of accumulated mileage by speed limits and vehicle type

Speed limit	Car fleet	%	Bus fleet	%
10	8	0%	0	0%
15	106	0%	7	0%
20	26,516	1%	442	1%
30	789,323	37%	15,111	49%
40	201,617	9%	4,942	16%
50	149,091	7%	2,651	9%
60	239,535	11%	3,627	12%
70	732,824	34%	3,806	12%
	2,139,019	100%	**30,586**	100%

3.2 Sample size

Some drivers of the car fleet chose to withdraw from the trial or did not have a working device. The final sample included for analysis contains driving data contributed by 402 participants, as shown in Table 4. Of the 19 buses equipped with the Advisory ISA system, 4 were not regularly used during the trial period. Hence, data recorded on 15 buses were used in the analysis.

Table 5 depicts a breakdown of system exposure, which refers to Phase 2 data only; i.e. when the ISA functionality was provided. This shows that a large proportion of speed data were recorded when the screen was not turned on. Similar patterns of system exposure were observed from the bus fleet, as shown in Table 6.

Table 4: Breakdown of sample size of the car fleet

Data element	Number of participants
Phase 1 and 2	393
Phase 1 only	4
Phase 2 only	5
	402

Table 5: Breakdown of system exposure of the car fleet

Proportion of distance driven with screen off	No of participants
up to 10%	3
10% - 20%	16
20% - 30%	20
30% - 40%	11
40% - 50%	19
50% - 60%	21
60% - 70%	39
70% - 80%	36
80% - 90%	69
Over 90%	164

Table 6: Breakdown of system exposure of the bus fleet

Proportion of distance driven with screen off	No of units
up to 50%	1
50% - 60%	1
60% - 70%	3
70% - 80%	2
80% - 90%	3
Over 90%	5

Due to the low system usage, the analysis of the vehicle data has examined the effectiveness of advisory ISA in terms of two data categories:

- *ISA available*: this refers to the data collected throughout Phase 2 of the trial, with the implication that ISA might be used only intermittently.
- *ISA in use*: this refers to the data recorded in Phase 2 when the participants chose to receive speed limit information.

3.3 Questionnaire data

Of the total sample of drivers, 131 completed the questionnaires at all four time points. The distribution across age and gender is shown in Table 7.

Table 7: Characteristics of respondents who responded at all four time points

	Male	Female
<25 yrs	1%	1%
25-59 yrs	48%	29%
>=60 years	12%	9%

4 Car drivers' choice of speeds

Figure 7 shows the speed distributions of the car fleet on 20 to 70 mph roads respectively. The speed distribution of 'ISA available' generally shows a fairly similar shape to the 'No ISA' condition across different speed limit zones, except for the 70 mph roads. When the drivers chose to receive ISA information (i.e. 'ISA in use'), the speed distribution was more dramatically reshaped, which suggests that advisory ISA can be effective in curtailing speeding. The effect of advisory ISA is especially prominent on 70 mph roads, even when the system was only used intermittently (i.e. the 'ISA available curve'). On 60 mph roads, the effect of ISA was minimal, which is predominantly because most drivers would not be able to remain a speed near the limit for a prolonged period due to geometric characteristics of rural single-carriageway roads.

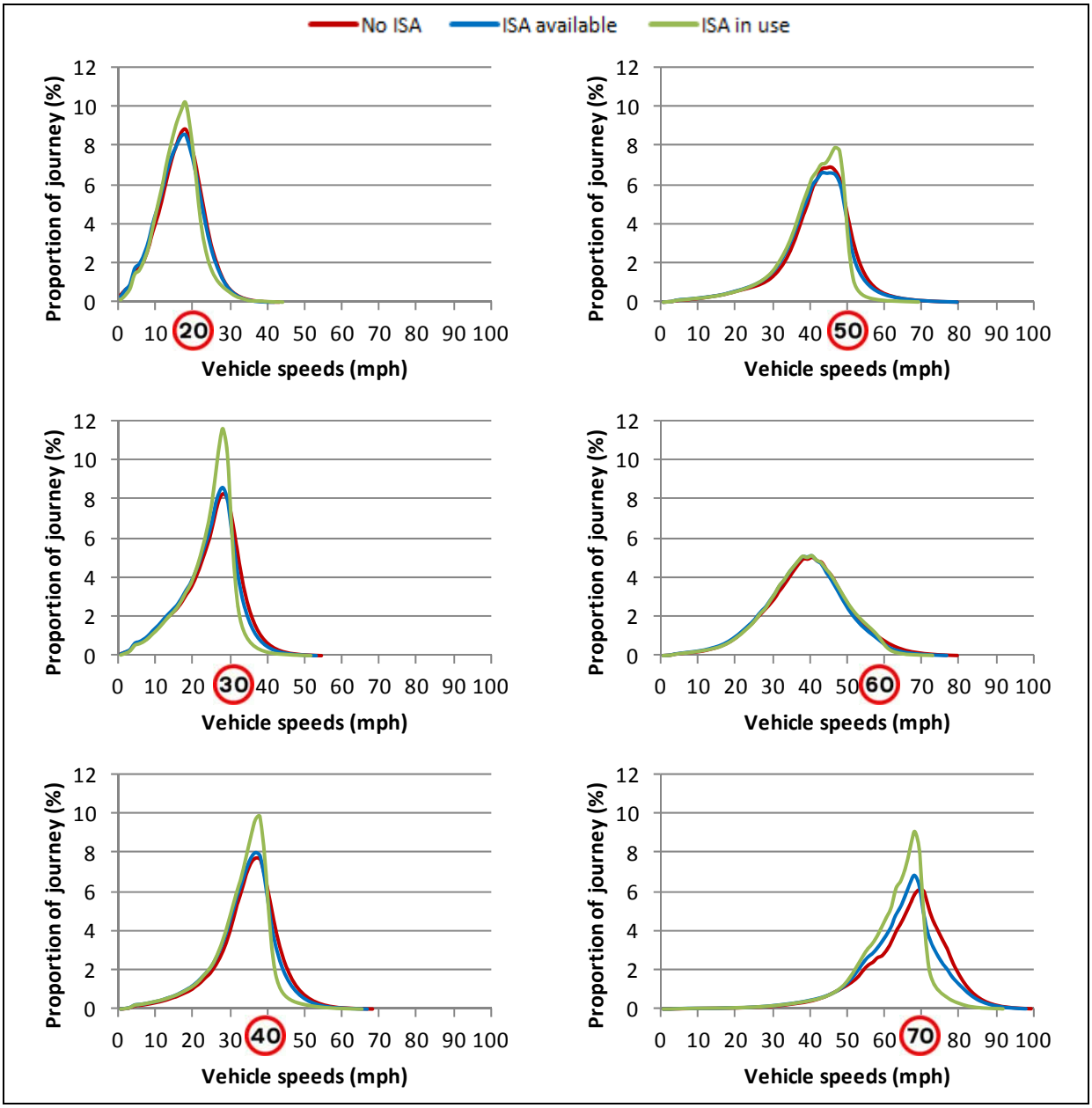


Figure 7: Speed distributions of the car fleet

Figure 8 shows the mean and 85th percentile speeds across speed limit zones, which also suggests that vehicle speeds were brought down when advisory ISA was provided. While the effect of advisory ISA in reducing mean and 85th percentile speeds seems fairly moderate, Figure 9 demonstrates a more prominent effect of advisory ISA in terms of reduction in the proportion of distance driven over speed limits.

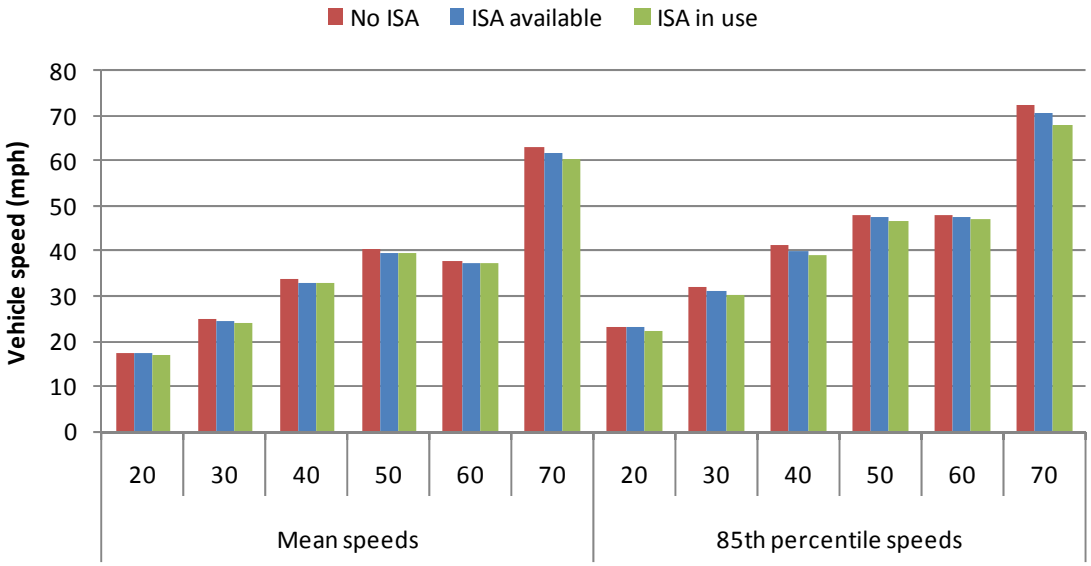


Figure 8: Mean and 85th percentile speeds of the car fleet across speed limit zones

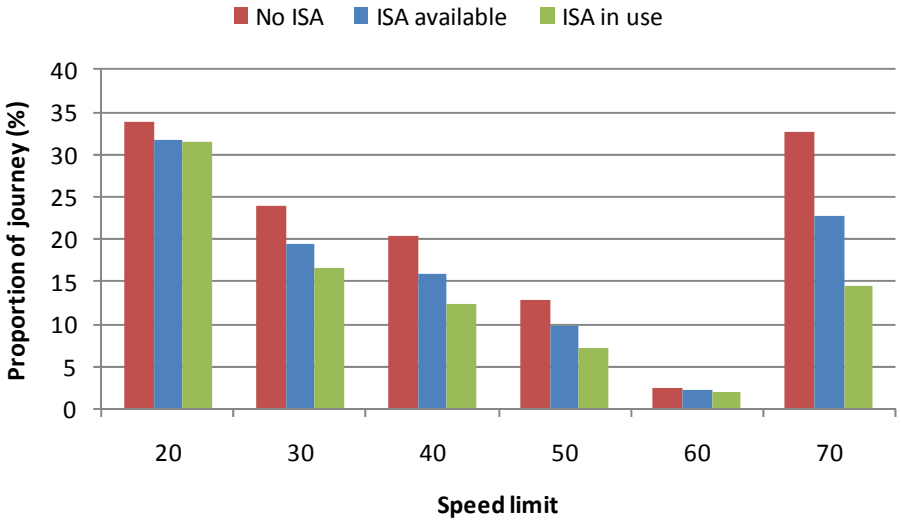


Figure 9: Proportion of distance travelled of the car fleet over speed limits

Table 8 depicts the reduction in speeds and the proportion of distance travelled over speed limit when ISA was in use, across different speed limit zones. Numbers in **BOLD** denote statistical significance at the 0.05 level while **BOLD** denotes significance at the 0.01 level. The reduction in speeds is effective across the majority of speed limit zones, but not of great magnitude. The 85th percentile speeds demonstrate a larger reduction than mean speeds, which indicates that advisory ISA was effective in reducing excessive speeds. The reduction in proportion of speeding

demonstrates a fairly large effect. On 30 mph roads, there was a 30% reduction. The effect was much more prominent on 70 mph roads, which showed a 56% reduction. This again indicates the effectiveness of advisory ISA in curtailing the high end of the speed distribution; i.e. ISA reshapes the speed distribution more than just shifting the distribution towards lower speeds. The effectiveness of advisory ISA was jeopardised when system usage decreased. However, even when ISA was only used intermittently over time, its effect in tackling speeding was still prominent, as shown in Table 9, with an 18% and a 31% reduction in speeding on 30 and 70 mph roads respectively. The raw speed data can be found in Appendix 1.

Table 8: Reduction in speeds and speeding of the car fleet from 'No ISA' to 'ISA in use'

	Speed limit					
	20	30	40	50	60	70
Mean	-1%	**-2%**	**-3%**	**-2%**	-1%	**-4%**
85th	-3%	**-5%**	**-4%**	**-3%**	**-2%**	**-6%**
Speeding	-7%	**-30%**	**-40%**	**-44%**	**-21%**	**-56%**

Table 9: Reduction in speeds and speeding of the car fleet from 'No ISA' to 'ISA available'

	Speed limit					
	20	30	40	50	60	70
Mean	-1%	**-3%**	**-2%**	**-2%**	**-1%**	**-2%**
85th	0%	**-2%**	**-2%**	**-1%**	**-1%**	**-2%**
Speeding	**-6%**	**-18%**	**-23%**	**-24%**	**-16%**	**-31%**

5 The influence of car driver characteristics

5.1 Gender

Gender did not appear to influence the pattern of the effectiveness of advisory ISA to a great extent. As shown in Table 10, the difference between the two groups of drivers is very small for all speed limit zones. ISA appeared to be marginally more effective for female drivers in speed reduction on 70 mph roads. Female drivers also appeared to be marginally more willing to comply with speed limits when ISA was used. The raw speed data and speed distributions can be found in Appendix 2.

Table 10: Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of gender

		Speed limit					
		20	30	40	50	60	70
Mean	Male	0%	**-1%**	**-2%**	**-2%**	0%	**-3%**
	female	-1%	**-2%**	**-4%**	**-2%**	**-2%**	**-6%**
85th	Male	-3%	**-5%**	**-5%**	**-4%**	-2%	**-5%**
	female	-3%	**-5%**	**-4%**	**-3%**	**-2%**	**-7%**
Speeding	Male	-6%	**-29%**	**-38%**	**-42%**	-21%	**-55%**
	female	-8%	**-31%**	**-42%**	**-46%**	-21%	**-57%**

5.2 Age

Table 11 shows that advisory ISA was less effective in speed reduction for drivers over 60 years old than for their counterparts. This is primarily due to the baseline speeds for the over 60 year old group being lower. However, advisory ISA worked better for these drivers when it comes to reduction in speeding. On this measure, the young drivers, aged 25 and below, showed stronger resistance to speed limit compliance even when advisory ISA was in use. The raw speed data and speed distributions can be found in Appendix 3.

Table 11: Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of age (3 bands)

		Speed limit					
		20	30	40	50	60	70
Mean	< 25 yrs	1%	-5%	-3%	-2%	**-5%**	-3%
	25-59 yrs	-1%	**-2%**	**-3%**	**-3%**	-1%	**-4%**
	>= 60 yrs	5%	0%	**-2%**	-1%	1%	-4%
85^{th}	< 25 yrs	-3%	-8%	**-7%**	**-5%**	**-5%**	**-5%**
	25-59 yrs	-3%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
	>= 60 yrs	0%	**-5%**	**-3%**	**-2%**	-1%	**-6%**
Speeding	< 25 yrs	-2%	**-22%**	**-46%**	**-40%**	**-41%**	**-37%**
	25-59 yrs	**-11%**	**-31%**	**-41%**	**-47%**	-15%	**-56%**
	>= 60 yrs	-11%	**-39%**	**-47%**	**-56%**	-38%	**-69%**

Table 12 breaks the younger driver group further down to less than 19 years old and over. The less than 19 years old group seemed to benefit from advisory ISA more than other age groups in terms of speed reduction. However, the sample size for this group of drivers is extremely small (3-5 drivers depending on speed limit zones) and in turn the robustness of the results is very likely to suffer from lack of reliability. The raw speed data and speed distributions can be found in Appendix 4.

Table 12: Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of age (4 bands)

		Speed limit					
		20	30	40	50	60	70
Mean	<= 19 yrs	-7%	-13%	**4%**	0%	-11%	-5%
	20-24 yrs	4%	-3%	**-5%**	-2%	-4%	-2%
	25-59 yrs	-1%	**-2%**	**-3%**	**-3%**	-1%	**-4%**
	>= 60 yrs	5%	0%	**-2%**	-1%	1%	-4%
85th	<= 19 yrs	-2%	-16%	-4%	**-5%**	-8%	-8%
	20-24 yrs	-3%	-5%	**-8%**	-5%	-5%	**-4%**
	25-59 yrs	-3%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
	>= 60 yrs	0%	**-5%**	**-3%**	**-2%**	-1%	**-6%**
Speeding	<= 19 yrs	-45%	-13%	-36%	**-81%**	—	-60%
	20-24 yrs	13%	**-24%**	**-49%**	-35%	**-41%**	**-32%**
	25-59 yrs	**-11%**	**-31%**	**-41%**	**-47%**	-15%	**-56%**
	>= 60 yrs	-11%	**-39%**	**-47%**	**-56%**	-38%	**-69%**

5.3 Experience

With respect to driving experience, defined as the number of years since passing the test, advisory ISA was more effective for the novice group in reduction of high speeds (i.e. the 85th percentile speeds), but they were also more resistant to speed limit compliance in general, even when advisory ISA was in use, as shown in Table 13. The raw speed data and speed distributions can be found in Appendix 5.

Table 13: Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of experience (2 bands)

		Speed limit					
		20	30	40	50	60	70
Mean	< 3 yrs	2%	-4%	**-3%**	-1%	**-4%**	-3%
	> 3 yrs	0%	-2%	**-3%**	-3%	**-1%**	-4%
85th	< 3 yrs	1%	**-7%**	**-6%**	-3%	-3%	**-6%**
	> 3 yrs	-2%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
Speeding	< 3 yrs	11%	**-25%**	**-47%**	-38%	**-35%**	**-48%**
	> 3 yrs	**-12%**	**-32%**	**-41%**	**-47%**	-21%	**-56%**

Table 14 breaks the novice driver group further down to holding a licence for less than a year and over. The contrast between the two groups is similar to the comparison between drivers who are

less than 19 years old and 20-24 years old; i.e. advisory ISA had a stronger effect on speed reduction for the least experienced drivers. However the sample size for this group is small (5-11 drivers depending on speed limit zones) and the robustness of the results again suffers from variability within the small sample. The raw speed data and speed distributions can be found in Appendix 6.

Table 14: Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of experience (3 bands)

		Speed limit					
		20	30	40	50	60	70
Mean	< 1 yr	-8%	-6%	0%	2%	-7%	**-6%**
	1-3 yrs	10%	-3%	**-6%**	-3%	-3%	-1%
	> 3yrs	0%	**-2%**	**-3%**	**-3%**	-1%	**-4%**
85th	< 1 yr	-9%	-10%	-4%	-1%	-4%	**-10%**
	1-3 yrs	9%	**-6%**	**-8%**	-5%	-2%	-3%
	> 3yrs	-2%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
Speeding	< 1 yr	-41%	-22%	-35%	-41%	-17%	**-61%**
	1-3 yrs	73%	**-27%**	**-55%**	-37%	**-36%**	**-39%**
	> 3yrs	**-12%**	**-32%**	**-41%**	**-47%**	-21%	**-56%**

5.4 Annual mileage

When the data was split on density of exposure to traffic, defined as the mileage driven each year, there was little difference between the two groups in speed reduction as shown in Table 15. However, higher mileage drivers were more resistant to speed compliance than their counterparts, with the only exception being on 30 mph roads. This suggests that higher mileage drivers were more conscious about crash avoidance on 30 mph roads where the potential conflicts with vulnerable road users such as pedestrians and cyclists are in particular high, and demonstrated a slightly stronger willingness to comply with the speed limit. The raw speed data and speed distributions can be found in Appendix 7.

Table 15: Reduction in speeds and speeding from 'No ISA' to 'ISA in use' in terms of annual mileage

		Speed limit					
		20	30	40	50	60	70
Mean	<= 10000	0%	**-2%**	**-4%**	**-3%**	0%	**-4%**
	> 10000	3%	**-2%**	**-2%**	**-4%**	**-3%**	**-3%**
85th	<= 10000	-3%	**-5%**	**-5%**	**-4%**	-1%	**-5%**
	> 10000	1%	**-5%**	**-4%**	**-4%**	**-4%**	**-6%**
Speeding	<= 10000	**-15%**	**-31%**	**-47%**	**-52%**	-22%	**-59%**
	> 10000	1%	**-34%**	**-33%**	**-35%**	-24%	**-47%**

6 System usage by the car drivers

The analysis results presented in previous sections suggest that advisory ISA is effective when it is used. This highlights the benefit of encouraging usage. As identified in Section 3.2, there was a large proportion of data from Phase 2 recorded when the device was not in use. One of the fields in the vehicle data file distinguishes system status among different conditions, as explained in Table 16. The primary reason for non-usage was the screen not being turned on, which suggests that the driver simply did not intend to use advisory ISA.

Table 16: Definitions of system status

System status	Definition	Implication of driver's behaviour
The screen was not turned on	There was no communication between the advisory ISA system and the driver. The data were still logged as usual (e.g. vehicle speeds and associated speed limits etc), but the ISA system was not able to convey the speed limit information to the driver.	The driver had no intention to use advisory ISA. The choice of speed was not influenced by ISA.
The screen was turned on but the driver did not log-in	The log-in screen resided and a reminder would be given every 30 seconds. Auditory warning upon speeding would also be given, but not visually.	It is difficult to interpret the driver's intention. The amount of data recorded under this condition was very limited but noisy.
System was in use	The driver would be using either display modes. Speed limit information was conveyed to the driver via the screen. Warning upon speeding was given visually and auditorily.	The driver chose to make use of advisory ISA. The choice of speed could be influenced by ISA.

There is a moderate but statistically significant association between the amount of speeding in Phase 1 and the proportion of distance driven with the screen turned off in Phase 2 ($r = 0.18$, $p < 0.001$). This pattern can be observed by the upward trend in general revealed in the following two figures. Figure 10 suggests that non-usage of ISA increased with a higher tendency to speed during the baseline period, while Figure 11 shows that participants who chose to use ISA less frequently were those who chose to speed more frequently during the baseline period.

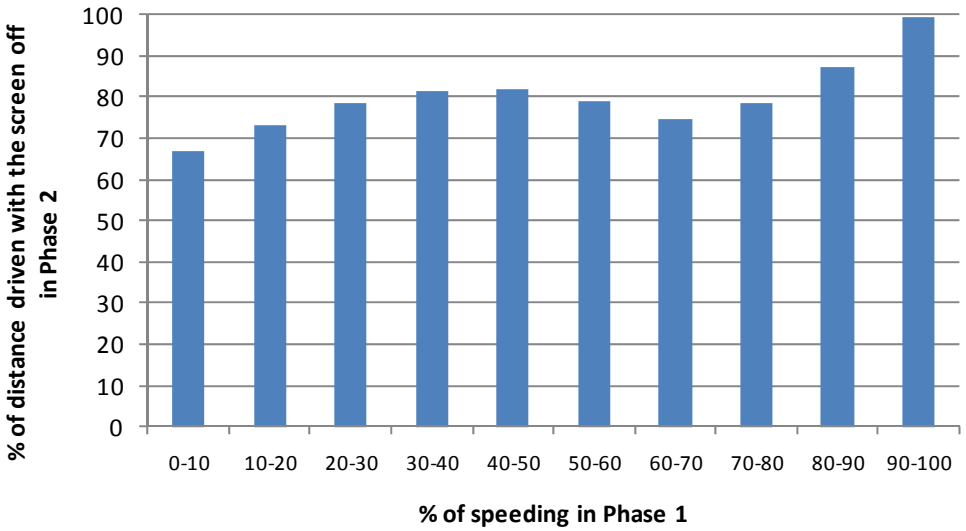


Figure 10: Comparison of ISA adoption among speeding tendency classification

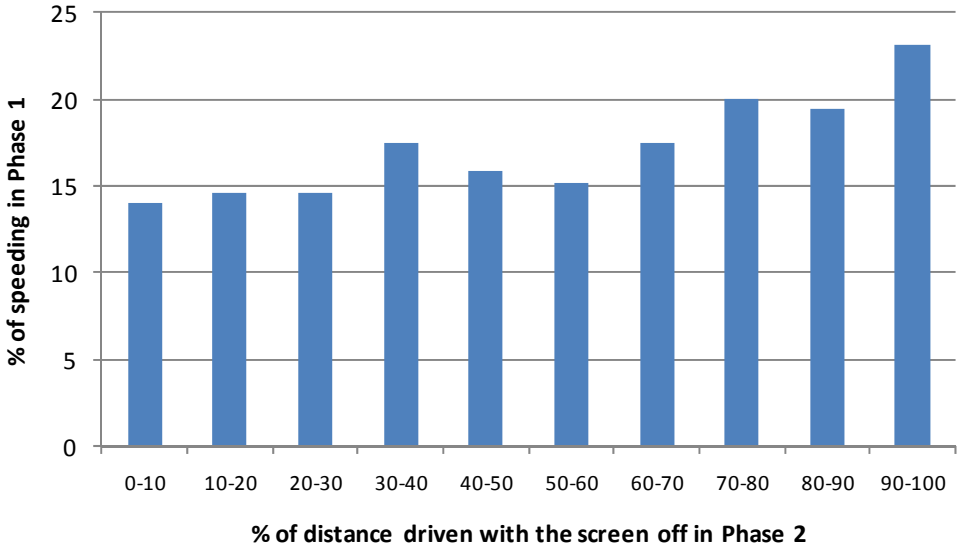


Figure 11: Comparison of speeding tendency among system usage classification

Table 17 shows that the association pattern observed at the overall level remained when the data were broken down to individual speed limit zones. It also suggests that speeding tendency and 85th percentile speeds generally provide a stronger association with non-usage than the mean speeds. This is because ISA reshaped the speed distribution and curtailed excessive speeds. The data from 20 mph zones did not show strong evidence of association. This is mostly due to a combination of the association pattern being less stabilised as a result of the smaller data range and the sample size. With respect to the 60 mph zones, the mean speeds showed a more prominent effect because ISA did not reshape the speed distribution as much as in the other zones; i.e. the shape of the distribution remained fairly similar to the standard bell shape when ISA was turned on.

Table 17: Association between non-usage of ISA and choice of speed during the baseline

The association between non-usage of ISA with	Speed limit					
	20	30	40	50	60	70
% speeding in baseline	0.06	**0.26**	**0.26**	**0.19**	0.10	**0.23**
85th percentile speeds in baseline	0.12	**0.28**	**0.27**	**0.18**	0.10	**0.26**
mean speeds in baseline	0.06	**0.21**	**0.20**	**0.12**	**0.11**	**0.21**

Note: numbers shown in the table are correlation coefficients

Table 18 compares non-use of ISA by driver characteristics. Female drivers, surprisingly, had a higher proportion of non-usage than male drivers, which is perhaps due to female drivers are more prone to commence short trips such as shop runs and school runs. Non-usage decreased with an increase in age and experience. Since the analysis results presented in Section 5.2 and 5.3 show that younger and less experienced drivers were also more resistant to speed limit compliance than their counterparts, it seems that those who would benefit more from ISA would also less likely to use ISA. Annual mileage did not appear to influence the usage. Table 18 also suggests a clear trend regardless of driver characteristics that the willingness to use the system decreased along with a decrease in the speed limit.

Table 18: Percentage of distance travelled when the display was off

		Speed limit					
		20	30	40	50	60	70
Gender*	Male	80%	77%	71%	69%	68%	64%
	Female	85%	82%	78%	75%	75%	73%
Age*	< 25 yrs	93%	92%	90%	87%	87%	83%
	25-59 yrs	80%	77%	72%	70%	69%	65%
	>= 60 yrs	79%	75%	67%	63%	62%	58%
Experience*	< 3 yrs	90%	89%	86%	83%	83%	76%
	> 3 yrs	80%	77%	71%	69%	68%	64%
Annual mileage	< 10000 miles	81%	78%	73%	70%	69%	65%
	> 10000 miles	80%	77%	73%	73%	72%	66%

Note: *denotes that the between group differences were significant at least at the 0.05 level.

7 Car drivers: questionnaire data

A number of measures of speeding behaviour have been presented in Section 4. For the purposes of comparison with the TPB measures, and to enable us to establish a link between cognition and behaviour, the % of distance travelled exceeding the speed limit was computed across all road types, for Time 1 (Phase 1) and at an aggregate level for Times 2 to 4 (Phase 2). Additionally, the Phase 2 data were further disaggregated into two datasets. The first contained the speeding data where ISA was known to not be in use (i.e. not connected) and the second where ISA was available to the driver.

7.1 Driver cognition

The items included from the TPB model were collapsed to form the constructs shown in Table 19. Reliability analyses were conducted for items within a construct and in general were found to be acceptable. A series of ANOVAs were undertaken to assess how the availability of ISA impacted on the TPB constructs.

The analysis reveals drivers' intention (motivation) to keep to the speed limit reduced over the period of the trial. Intentions were significantly lower in Time 4, where drivers had had several months' exposure to ISA, compared to those reported in Time 1 and during their early exposure. This appears a little at odds with the behavioural data that was reported in Section 4. With respect to the means for both instrumental and affective attitudes, participants were overall disposed to positive attitudes towards keeping to the speeding limit (i.e. the scores are closer to 5 than to 1, although as in the case of intentions, this declined over the course of the trial, with attitudes in Time 4 being slightly less positive. The extent to which drivers felt social pressure (injunctive and descriptive norms) to keep to the speed limit increased over the trial period. It should be noted that all these results are only marginally significant (with effect sizes <0.1) and that the only TPB item that increased to a greater extent was that of self-efficacy. This item asked drivers to evaluate their confidence in being able to keep to the speed limit. It appears that the ISA system increased this perception, by the end of trial and this may therefore explain the speed reductions observed.

It can be seen in Table 20 that during Phase 2 (Times 2 to 4) the percentage of distance driven over the speed limit reduced, compared to Time 1. Post hoc tests revealed that drivers spent less time travelling over the speed limit regardless of whether the ISA system was active or not. However, it can be seen that the largest reductions were obtained when the ISA display was active. This implies that drivers were perhaps conscious of the presence of the ISA even though it was not active and it acted as a reminder to reduce their speed.

Table 19: Statistical testing of the TPB items (attitudes to speeding)

TPB Construct	Mean				Repeated measures ANOVA	Post hoc t-tests			
	T 1	T2	T 3	T 4					
Intention	4.46	4.24	4.37	3.84	F(3,318)= 3.6, p<.05		T2	T3	T4
						T1	×	×	*
						T2		×	×
						T3			×
Instrumental attitude	3.84	3.63	3.84	3.51	F(3,321)= 3.76, p<.05		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			*
Affective attitude	3.58	3.45	3.51	3.30	F(3,321)= 3.31, p<.05		T2	T3	T4
						T1	×	×	*
						T2		×	×
						T3			×
Injunctive norms	3.67	3.57	3.56	3.93	F(3,189)= 2.89, p<.05		T2	T3	T4
						T1	×	×	×
						T2		×	*
						T3			*
Descriptive norms	3.27	3.32	3.53	3.45	F(3,171)= 0.71, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Control beliefs	2.85	3.00	2.80	2.79	F(3,318)= 0.64, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Perceived control	3.09	3.61	3.50	3.74	F(3,321)= 2.35, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Self efficacy	3.14	3.62	3.64	4.01	F(3,321)= 5.31, p<.001		T2	T3	T4
						T1	×	×	***
						T2		×	×
						T3			×
Moral norm	3.33	3.05	3.52	3.35	F(3,321)= 1.57, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Anticipated regret	2.96	2.72	3.28	2.99	F(3,321)= 2.01, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Self identity	4.30	4.02	4.05	4.22	F(3,321)= 1.35, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×

× not significant

*p< .05;

*** p< .001

Table 20: Statistical testing of speeding behaviour

Mean (distance spent speeding)			Repeated measures ANOVA
Time 1	Times2-4 (ISA not on)	Times2-4 (ISA on)	
27.49	23.06	14.17	F(2,160)= 93.47, p<.000

7.2 Acceptability of ISA

7.2.1 Unified Theory of Acceptance and Use of Technology

The mean scores are shown in Table 21 for each of the four time points (1=low acceptability of ISA and 5= high acceptability)

Table 21: UTAUT items used in the questionnaire

Scales / Items	Mean			
	T1	T2	T3	T4
Performance Expectancy (PE)				
PE1: The advisory ISA system will be effective in reducing my speed	3.02	2.56	2.66	2.63
PE2: I will drive more safely with the advisory ISA system	2.82	3.04	2.97	2.92
PE3: Using the advisory ISA system will improve my driving performance	2.82	2.42	2.47	2.44
PE4: I will find the advisory ISA system useful when I drive	2.30	1.93	2.11	2.01
PE5: Using the advisory ISA system will make it easier to drive	1.81	1.66	1.69	1.70
Effort Expectancy (EE)				
EE1: Learning to operate the advisory ISA system will be easy for me	4.18	3.83	3.89	3.76
EE2: I will find the advisory ISA system easy to use	4.24	4.17	4.39	4.28
Attitude toward Using Technology (AT)				
AT1: Driving with the advisory ISA system will be fun	4.18	4.15	4.27	4.27
AT2: Using the ISA system will be frustrating	4.00	3.79	4.00	3.94
AT3: If ISA was an optional feature on a new car I would be willing to pay extra for it	4.38	4.27	4.40	4.40
AT4: The advisory ISA system will be satisfying to use	4.15	3.87	4.01	4.00
AT5: Using the advisory ISA system is a good idea	3.63	3.35	3.51	3.54
Social Influence (SI)				
SI1: My employer will support my use of the advisory ISA system	3.18	3.09	3.09	3.02
SI2: People who are important to me think that I should use the advisory ISA system	4.56	3.96	3.90	3.12
Facilitating Conditions (FC)				
FC1: I have the knowledge necessary to use the advisory ISA system	4.55	3.93	3.88	3.11
FC2: Someone is available for assistance with system difficulties	3.80	3.31	3.46	3.18
Self-Efficacy (SE)				
SE1: I will be able to drive using the system if there is no one around to tell me what to do as I go	3.50	3.14	3.30	3.12
Anxiety (AX)				
AX1: I feel apprehensive about using the advisory ISA system	4.06	3.57	3.69	3.58
AX2: I hesitate to use the advisory ISA system for fear of making mistakes I cannot correct	3.40	2.94	3.02	3.03
AX3: The advisory ISA system will be an invasion of my personal freedom	3.65	3.37	3.50	3.57
Behavioural Intention to Use the System (BI)				
BI1: I intend to use the advisory ISA system	2.07	2.02	2.18	2.11
BI2: I plan to use the advisory ISA system	3.12	2.66	2.98	2.96

Statistical testing was performed in order to establish if acceptability of the advisory ISA changed over time (see Table 22). The reader should bear in mind that those scores elicited in Time 1 were

done so prior to the driver having experienced advisory ISA and so are influenced by any preconceptions – even though drivers were provided with written information regarding how the system would function. Therefore the data at Times 2 to 4 are the most relevant here, although for the sake of completeness the data analysis has included scores from Time 1 as well. Changes in scores in Times 2, 3 and 4 would suggest that exposure to ISA influences acceptability.

Table 22: Statistical analysis of the UTAUT items over time

UTAUT Construct	Mean				Repeated measures ANOVA	Post hoc t-tests			
	T 1	T2	T 3	T 4					
Performance Expectancy	3.95	3.60	3.87	3.87	F(3,321)= 1.6, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Effort Expectancy	4.09	4.09	4.33	4.40	F(3,321)= 1.04, ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Attitude Toward Using Technology	3.49	3.20	3.17	3.19	F(3,321)= 2.15,ns		T2	T3	T4
						T1	×	×	×
						T2		×	×
						T3			×
Social Influence	3.62	3.33	3.42	3.29	F(3,120)= 3.36, p<.05		T2	T3	T4
						T1	×	×	*
						T2		×	×
						T3			×
Facilitating Conditions	4.42	3.84	3.79	4.22	F(3,321)= 6.03, p<.001		T2	T3	T4
						T1	***	***	×
						T2		×	×
						T3			*
Self-Efficacy	3.65	3.09	4.04	3.21	F(3,321)= 3.18, p<.05		T2	T3	T4
						T1	×	×	×
						T2		*	×
						T3			×
Anxiety	3.706	2.016	2.296	1.954	F(3,321)= 11.02, p<.001		T2	T3	T4
						T1	***	***	***
						T2		×	×
						T3			×
Behavioural Intention	4.64	4.09	3.90	2.93	F(3,321)= 10.82, p<.001		T2	T3	T4
						T1		**	**
						T2		×	**
						T3			**

Looking at only those results which show a consistent and highly significant pattern over time, it can be seen that scores on the Facilitating Conditions construct (meaning that users have the necessary resources such as expertise, knowledge and money to adopt ISA) decrease over time. This implies that in the first few months of using ISA (Time 2&3) the drivers felt that they encountered difficulties that they could not resolve themselves. By the end of the trial (Time 4) their scores reverted to the baseline, as either their knowledge had improved or the technical problems had subsided.

Acceptability scores relating to the construct of Anxiety decrease over time, indicating less acceptability. Drivers' pre-ISA anxiety increases and this higher level of anxiety was maintained throughout the ISA-on phase. With regards to Behavioural Intention (intention to use ISA) drivers report a high level of acceptability at the start of the trial (Time 1). This decreases as the trial progresses. If we assume that acceptability scores are at their most "accurate" at Time 4 (i.e. when initial preconceptions have been replaced by evidence-based opinion) we can then start to build up a picture of the relationship between the acceptability constructs. Table 23 provides a summary of a Spearman correlation analysis to test the relationships among the UTAUT constructs in Time 4.

Table 23: Spearman correlations between UTAUT constructs (Time 4)

UTAUT Construct		Effort Expectancy	Attitude	Social Influence	Facilitating Conditions	Self-Efficacy	Anxiety	Behavioural Intention
Performance Expectancy	Coeff	0.269	0.795	0.439	0.058	0.158	-0.457	0.542
	Sig.	0.002	0.000	0.000	0.512	0.071	0.000	0.000
	N	131	131	78	131	131	131	131
Effort Expectancy	Coeff		0.241	0.387	0.194	0.224	-0.354	0.204
	Sig.		0.005	0.000	0.027	0.010	0.000	0.020
	N		131	78	131	131	131	131
Attitude	Coeff			0.396	-0.029	0.172	-0.438	0.598
	Sig.			0.000	0.738	0.049	0.000	0.000
	N			78	131	131	131	131
Social Influence	Coeff				0.103	-0.011	-0.286	0.429
	Sig.				0.367	0.921	0.011	0.000
	N				78	78	78	78
Facilitating Conditions	Coeff					0.168	-0.195	-0.022
	Sig.					0.055	0.026	0.799
	N					131	131	131
Self-Efficacy	Coeff						-0.201	0.384
	Sig.						0.021	0.000
	N						131	131
Anxiety	Coeff							-0.329
	Sig.							0.000
	N							131

There are numerous significant correlations between the constructs, indicating they may be measuring the same underlying acceptability. As the UTAUT was developed in the field of user interaction with Information Technology, it is appropriate to discover if the same factors apply in this different domain of driver support systems. Therefore a Principal Components Analysis (PCA) was carried out to assess the validity of the scale. Reliability analysis was conducted for the scales using Cronbach's Alpha. As summarized in Table 24, several of the scales that represent the UTAUT constructs appear to have a good degree of reliability since each computed statistic is above .70. Unfortunately, it appears that the Social Influence and Facilitating Conditions are consistently low.

Table 24: Reliability analysis for the UTAUT items

UTAUT Construct	Number of Items	Cronbach's Alpha			
		T1	T2	T3	T4
Performance Expectancy	5	0.84	0.88	0.91	0.90
Effort Expectancy	2	0.87	0.76	0.83	0.91
Attitude Toward Using Technology	4	0.71	0.41	0.51	0.49
Social Influence	2	0.43	0.51	0.35	0.44
Facilitating Conditions	2	0.56	0.57	0.49	0.55
Self-Efficacy	1	n/a	n/a	n/a	n/a
Anxiety	3	0.66	0.71	0.74	0.72
Behavioural Intention	2	0.94	0.98	0.97	0.97

The factor loading matrix with varimax rotation is shown in Table 25. In sum, four factors were extracted and they explained 71% of the total variance. Low communalities (i.e. low influence of the factors) were found for SI1, FC2 & SE1, so they were removed from the PCA. The last row of the table lists the variance explained by each factor. Each item has obviously larger loading on its corresponding factor, indicating that these items could effectively reflect the factors and that the factors have good discriminant validity.

Table 25: PCA factor loadings for UTAUT items

Items	Factor Matrix			
	Factor 1 Attitude	**Factor 2 Ease of use**	**Factor 3 Intention**	**Factor 4 Anxiety**
AT1: Driving with the advisory ISA system will be fun	0.78	0.05	0.33	0.08
AT2: Using the ISA system will be frustrating	-0.57	-0.02	-0.04	-0.24
AT3: If ISA was an optional feature on a new car I would be willing to pay extra for it	0.56	-0.17	0.19	0.24
AT5: Using the advisory ISA system is a good idea	0.64	0.44	0.11	-0.13
PE1: The advisory ISA system will be effective in reducing my speed	0.76	0.17	-0.18	-0.03
SI2: People who are important to me think that I should use the advisory ISA system	0.52	0.17	0.18	-0.19
PE2:I will drive more safely with the advisory ISA system	0.76	0.07	0.31	-0.02
PE3: Using the advisory ISA system will improve my driving performance	0.84	0.17	0.21	-0.09
PE4: I will find the advisory ISA system useful when I drive	0.80	0.16	0.28	-0.14
AT4: The advisory ISA system will be satisfying to use	0.71	0.15	0.46	-0.14
PE5: Using the advisory ISA system will make it easier to drive	0.80	-0.06	0.21	-0.13
EE1: Learning to operate the advisory ISA system will be easy for me	0.10	0.96	0.08	-0.11
EE2: I will find the advisory ISA system easy to use	0.11	0.91	0.13	0.03
FC1: I have the knowledge necessary to use the advisory ISA system	0.09	0.77	-0.03	-0.33
BI1: I intend to use the advisory ISA system	0.33	0.08	0.89	-0.09
BI2: I plan to use the advisory ISA system	0.34	0.09	0.89	-0.16
AX1: I feel apprehensive about using the advisory ISA system	-0.18	-0.02	-0.22	0.82
AX2: I hesitate to use the advisory ISA system for fear of making mistakes I cannot correct	-0.09	-0.18	-0.08	0.82
AX3: The advisory ISA system will be an invasion of my personal freedom	-0.43	-0.23	0.09	-0.57
% variance explained	33%	15%	12%	11%

In order to then establish if any of the acceptability factors could predict drivers' propensity to use the ISA system in Phase 2, the factor scores were correlated with the distance driven with the system on. The results, shown in Table 26, indicate that two of the factors can predict use. The easier drivers find the ISA system to use the more likely they activated it; in converse where they felt anxious about using it they were more likely not to activate it. Measures of personality (sensation seeking and conscientiousness) did not correlate with ISA use.

Table 26: Correlations between acceptability factors and ISA use

	Acceptability factor			
	Attitude	**Ease of use**	**Intention**	**Anxiety**
Distance driven with ISA on	0.09	0.41**	0.10	-0.39**

**p<.01

7.2.2 Van der Laan acceptance scale

The two sub-scales of satisfying and usefulness were computed, across the four Time points. No statistically significant difference was found across time, so drivers' opinions did not change. It can be seen in Figure 12 that, while drivers viewed the ISA as useful (with a positive score), they were less inclined to view ISA as satisfying, with scores closer to neutral.

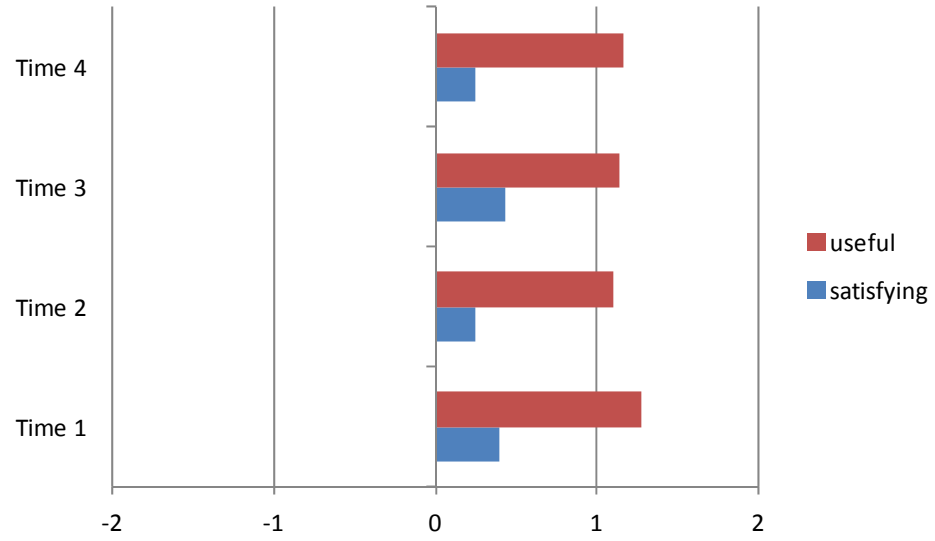


Figure 12 Van der Laan acceptability scale results

7.3 Affordability

Measured at two time points (Time 1 and Time 4), willingness to pay for the ISA system was gauged both prior to and after use. The cumulative percentage of respondents willing to purchase ISA at increasing prices is shown in Figure 13. For ease of interpretation, the "Indifference Price Point" (IPP) is indicated, via the arrows. The IPP is the point at which the number of respondents who consider

the product a bargain is equal to the number of respondents who consider it to be getting expensive, but still worth considering. In this study, prior to use, the IPP is just over £100, decreasing only slightly after use.

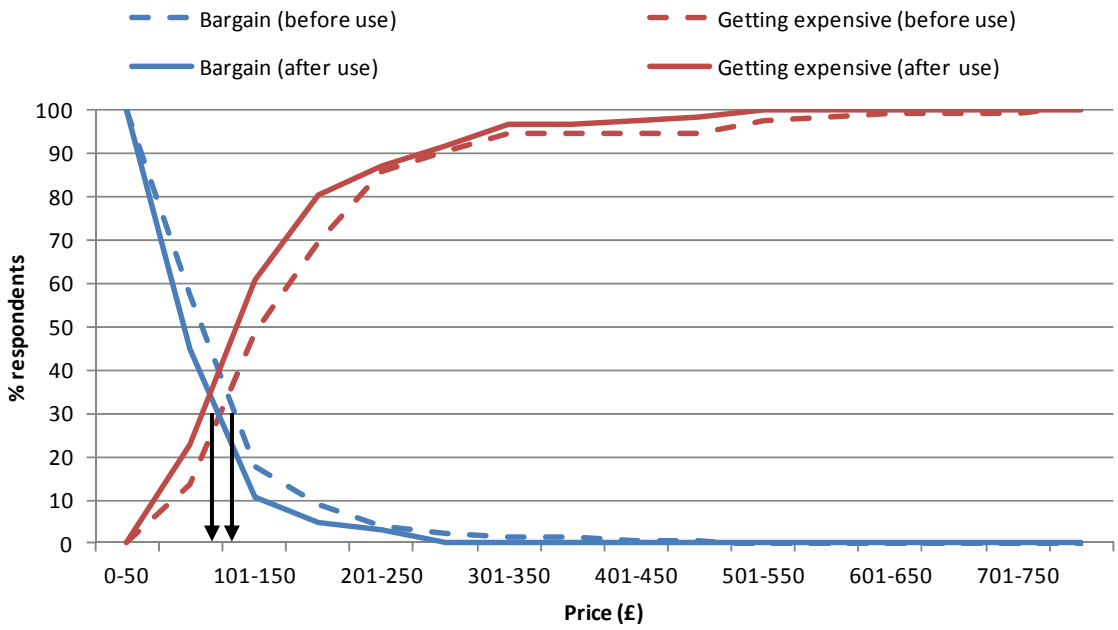


Figure 13 Price sensitivity towards advisory ISA

7.4 Driving behaviour and habits

Means for each of the four constructs in the Driver Behaviour Questionnaire are shown in Table 27. None of the constructs changed with exposure to ISA.

Table 27: DBQ constructs over time

DBQ construct	Time 1	Time 2	Time 3	Time 4
Lapses	1.98	1.95	1.94	1.89
Aggressive violations	1.75	1.83	1.74	1.69
Errors	1.67	1.64	1.66	1.61
Ordinary violations	1.96	1.93	1.87	1.82

7.5 System usability and effects

At Time 4, drivers were asked to rate the ISA for its usability (see Figure 14). Overall, drivers responded positively to the items. Only one negatively worded item was included (the auditory warning was irritating) and this showed a high level of agreement.

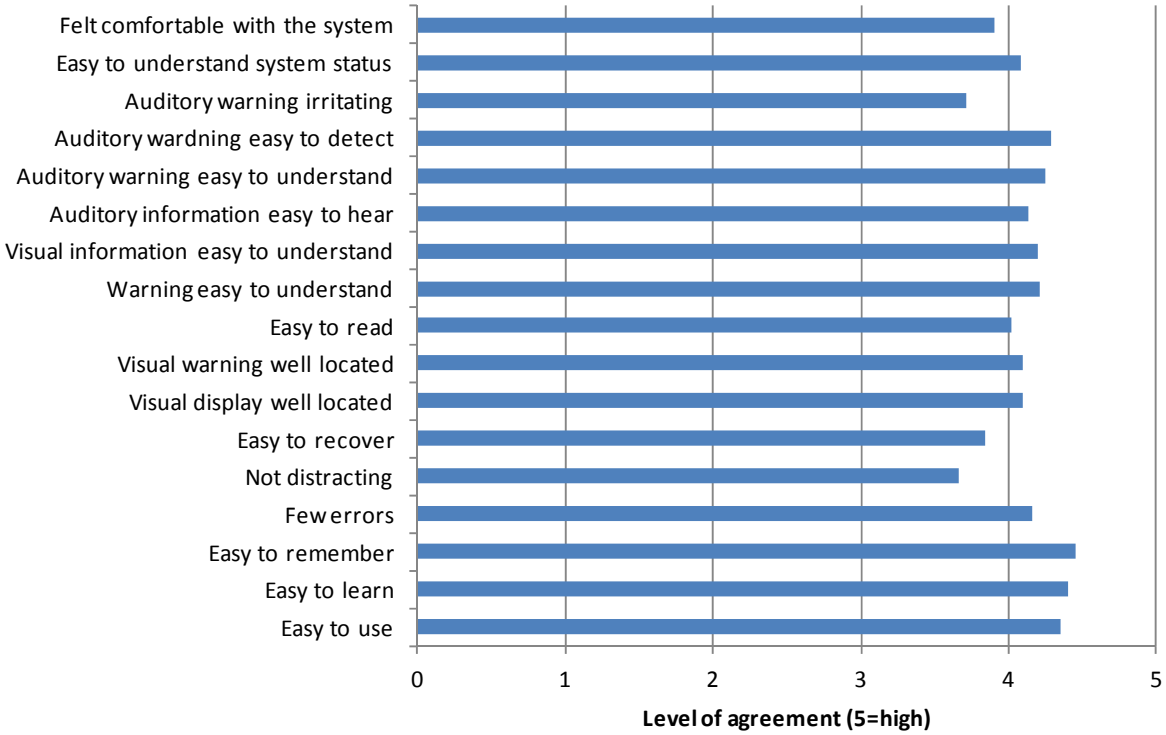


Figure 14: Ease of use

When asked to indicate how advisory ISA had affected key components of the driving task, participants tended to report an increase in their attentiveness in traffic, following distances, tendency to obey speed limits and their ability to avoid near misses. Decreases in their probability of being fined were also generally reported (see Figure 15).

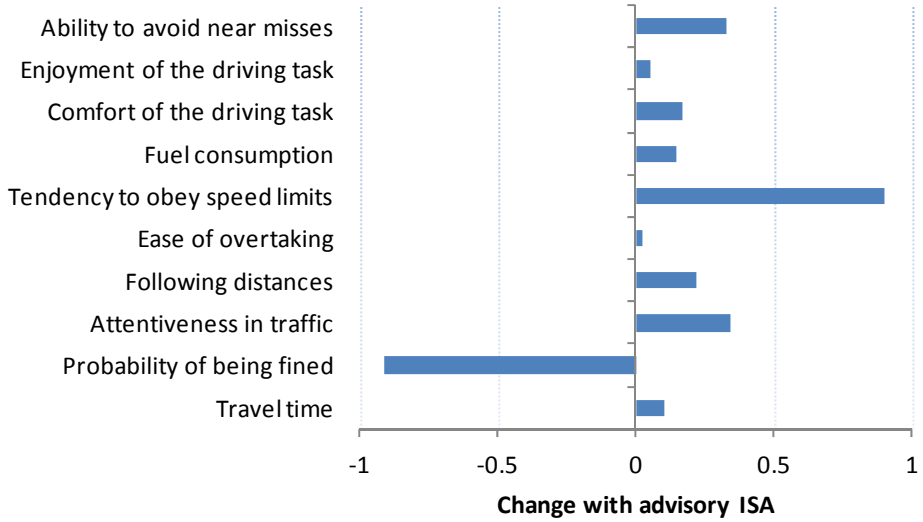


Figure 15: System effects

In reply to the question "Should advisory ISA be fitted to all new vehicles", 61% responded positively; 49% approved its mandatory introduction for all drivers. Among those who responded negatively to the latter question, the proportion who believed that the mandatory introduction of advisory ISA should apply to the following groups were:

Novice drivers – 72%
Young drivers – 80%
Elderly drivers – 38%
Professional drivers – 20%
Speed offenders – 86%

Sixty-four percent of drivers who took part in this trial would purchase a vehicle with advisory ISA installed.

7.6 Attention to the external environment

Respondents were asked to indicate the attention they pay to objects and events in the external environment. They responded on a scale from Low (1) to High (5) and the results were compared across time points. From Table 28, it can be seen that there were no changes reported in the presence of ISA in any of the four scenarios.

Table 28 Statistical testing of items relating to attention to external objects

During your everyday driving how would you rate your attention to the following?									
	Mean				Repeated measures ANOVA	Post hoc t-tests			
	T 1	T2	T 3	T 4					
other road users	4.16	4.36	4.46	4.45	F(3,321)= 1.36, ns		T2	T3	T4
						T1	×	×	×
						T2	×	×	×
						T3	×	×	×
speed limit signs	3.95	4.08	4.19	4.21	F(3,321)= 0.93, ns		T2	T3	T4
						T1	×	×	×
						T2	×	×	×
						T3	×	×	×
to pedestrians	4.55	4.29	4.35	4.49	F(3,321)= 1.19, ns		T2	T3	T4
						T1	×	×	×
						T2	×	×	×
						T3	×	×	×
to potential hazards (e.g. sharp bends in the road)	4.51	4.36	4.30	4.27	F(3,321)= 0.81, ns		T2	T3	T4
						T1	×	×	×
						T2	×	×	×
						T3	×	×	×
						T3	×	×	×
						T1	×	×	×
						T2	×	×	×
						T3	×	×	×

8 Bus fleet

8.1 Vehicle data

Figure 16 shows the speed distributions of the bus fleet on 20 to 70 mph roads respectively. The speed distributions are generally rather noisy due to the relatively small amount of data collected during the trial. The lack of smoothness of the speed distributions is especially apparent for higher speed limits (for buses, e.g. 40 mph onwards). However, it is still evident that advisory ISA influenced the bus drivers' choice of speed.

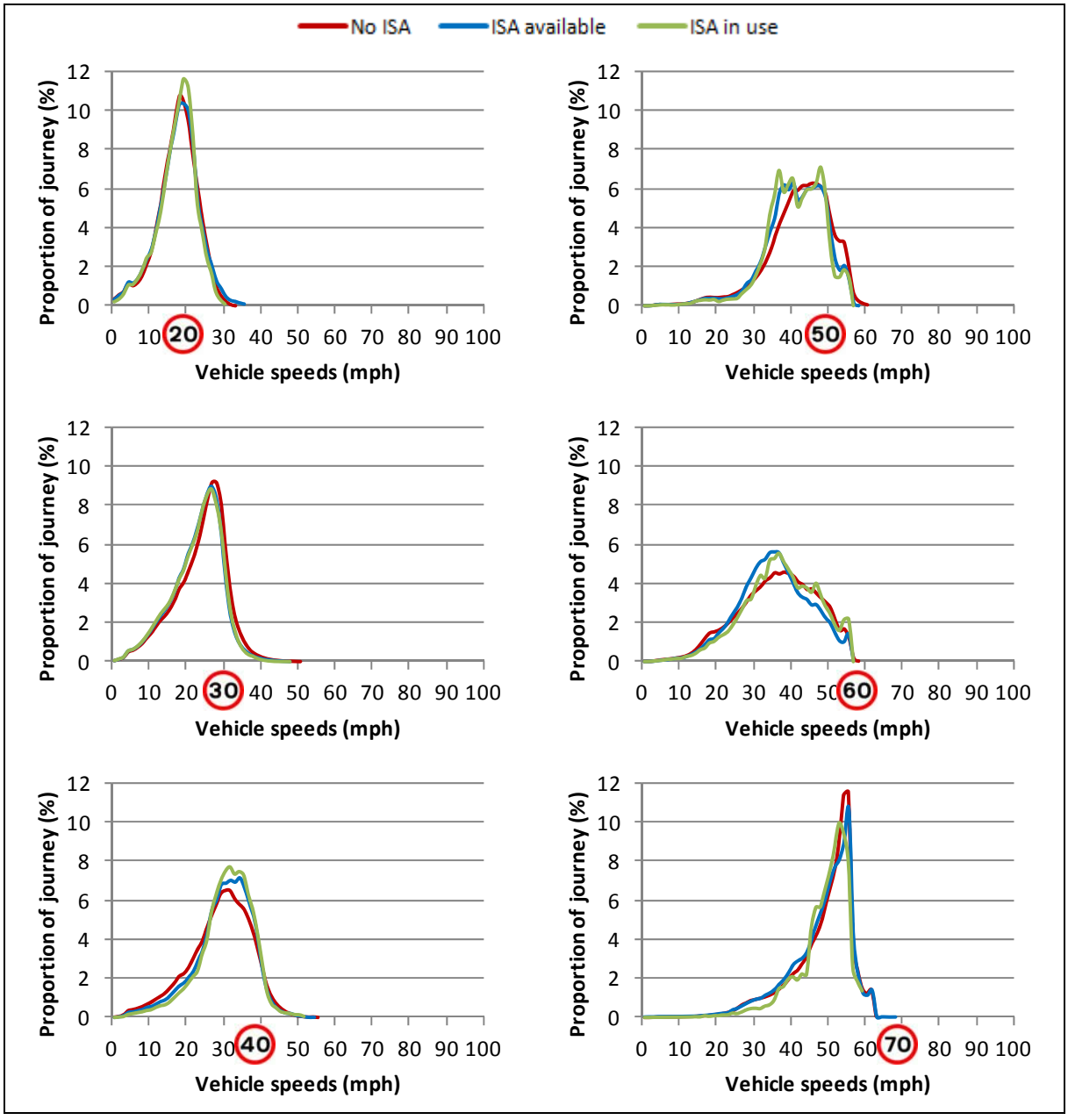


Figure 16: Speed distributions of the bus fleet

Figure 17 shows the mean and 85th percentile speeds across speed limit zones, which also suggests that vehicle speeds were brought down when advisory ISA was provided, except for higher speed limit zones where the data patterns suffer from the lack of data. While the effect of advisory ISA in reducing mean and 85th percentile speeds seems fairly moderate, Figure 18 demonstrates a more pronounced effect of advisory ISA in terms of reduction in the proportion of distance driven over speed limits.

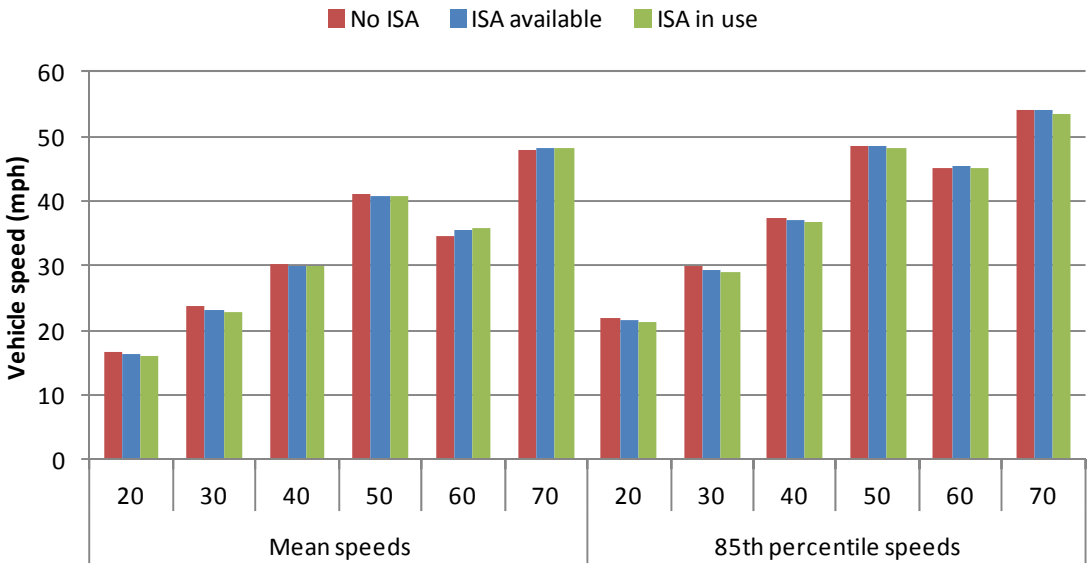


Figure 17: Mean and 85th percentile speeds of the bus fleet across speed limit zones

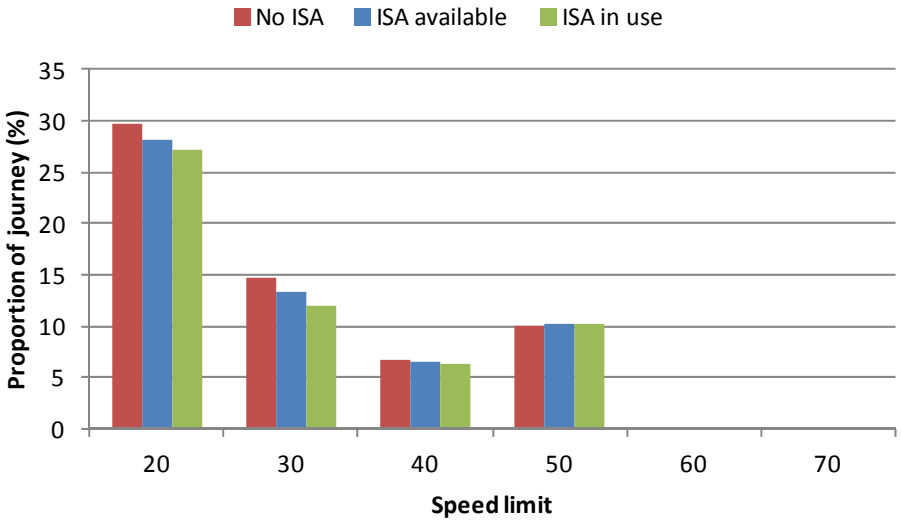


Figure 18: Proportion of distance travelled by the bus fleet over the speed limit

Table 29 depicts the reduction in speeds and the proportion of distance travelled over speed limit of the bus fleet when ISA was in use, across different speed limit zones. Numbers in **BOLD** denote statistical significance at the 0.05 level. It is worth noting that the absence of statistical significance among the test results is primarily attributable to the small sample size. The reduction in speeds is more effective for lower speed limit zones. The reduction in proportion of speeding demonstrates a fairly large effect. On 30 mph roads, there was a 19% reduction. The effectiveness of advisory ISA was jeopardised when system usage decreased. However, even when ISA was only used intermittently over time, its effect in tackling speeding was still encouraging, as shown in Table 30, with a 9% reduction in speeding on 30 mph roads. The raw speed data can be found in Appendix 8.

Table 29: Reduction in speeds and speeding of the bus fleet from 'No ISA' to 'ISA in use'

	Speed limit					
	20	30	40	50	60	70
Mean	-4%	-4%	-1%	-1%	3%	0%
85th	-3%	-4%	-1%	-1%	2%	-1%
Speeding	-8%	**-19%**	-7%	2%	—	—

Table 30: Reduction in speeds and speeding of the bus fleet from 'No ISA' to 'ISA available'

	Speed limit					
	20	30	40	50	60	70
Mean	-3%	-2%	-1%	0%	2%	1%
85th	-1%	**-2%**	-1%	0%	1%	0%
Speeding	-5%	-9%	-2%	3%	—	—

8.2 Questionnaire data

The bus drivers' questionnaire was considerably shorter than that for the car drivers, with only measures of acceptability (van der Laan) and driver behaviour (DBQ). In addition the questionnaire was administered only at three time points (Times 1, 2 and 4).

The bus drivers indicated a shift towards negative acceptability as the trial progressed (see Figure 19). They were neutral towards ISA at the beginning of the trial, but their scores on both the useful and satisfying dimensions of the scale tended towards the negative end of the scale both in Time 2 and after longer exposure in Time 4.

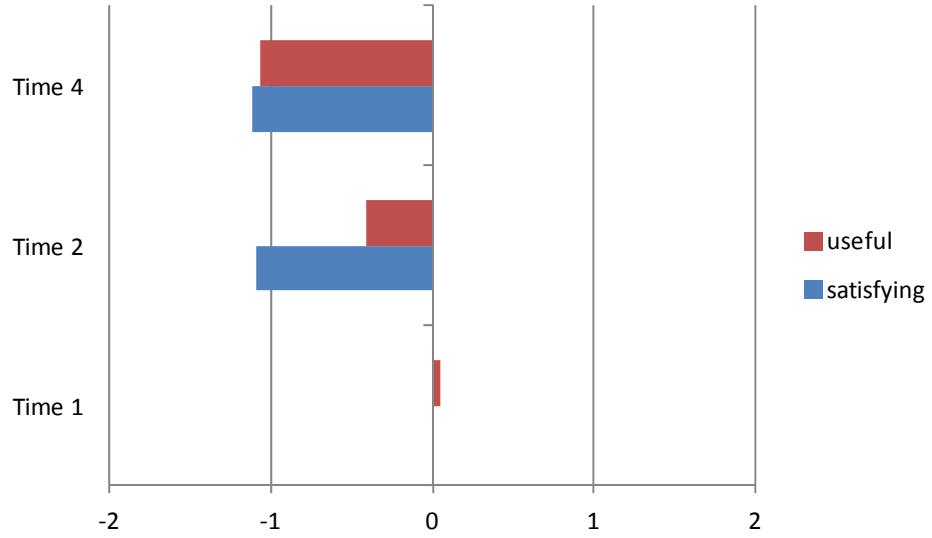


Figure 19: Acceptability of the ISA system by bus drivers

As with the car drivers, there were no significant changes in self-reported driver behaviour and habits after exposure to the ISA system (see Table 31).

Table 31: DBQ constructs over time

DBQ construct	Time 1	Time 2	Time 3	Time 4
Lapses	1.45	1.39	1.84	1.81
Aggressive violations	1.34	1.56	1.72	1.68
Errors	1.45	1.71	1.34	1.47
Ordinary violations	1.62	1.43	1.88	1.62

9 Discussion and recommendations

9.1 The effectiveness of advisory ISA

The results from this trial suggest that advisory ISA can be a useful speed management tool. When ISA was in use, the speed distribution was reshaped in comparison with the standard bell shape observed from the baseline period. As a result, ISA when used reduced the mean and 85th percentile speeds, and more particularly the amount of speeding. The effectiveness varied among roads with different speed limits. On 30 mph roads, mostly urban streets with a mixture of vulnerable road users, advisory ISA resulted in a reduction of 2% in mean speeds, 5% in 85th percentile speeds, and 30% in speeding. On 40 mph roads, mostly urban arterials, advisory ISA brought the mean speeds down 3%, the 85th percentile speeds down 4%, and speeding down 40%. On 70 mph roads, the effect of advisory ISA was even more prominent, which resulted in a 4% cut in mean speeds, a 6% cut in 85th percentile speeds, and a 56% cut in speeding.

Since the participants were free to choose whether they wished to use the system or not, data collected from the trial period when ISA was enabled actually represented intermittent, rather than continuous, exposure to ISA. This jeopardised the effectiveness of ISA. However the effect of advisory ISA in curtailing speeding was still pronounced. Throughout the period when ISA was available, the amount of speeding reduced by 18%, 23% and 31% on 30 mph, 40 mph, and 70 mph roads respectively.

It is interesting to compare these results with those obtained in the ISA-UK trials (Lai, Chorlton and Carsten, 2007). The system installed in the ISA-UK vehicles was a stronger form of ISA in that it defaulted to being on and intervened in throttle control to prevent speeding unless it was actively overridden. However, the Lancashire ISA system was a “zero tolerance” one — it beeped when there was any infraction of the speed limit. By contrast the ISA-UK system did not intervene until the speed limit was exceeded by 10%, and even then the car might continue to speed in certain circumstances, e.g. when going downhill.

In terms of impact on speeding (percentage of distance travelled over the speed limit), the ISA-UK system reduced speeding by 11% on 30 mph roads and by 22% on 70 mph roads. Here the Lancashire ISA results appear to indicate greater impact. However, it should be noted that the Lancashire ISA system did remind drivers about speeding, even when that speeding was within 10% of the limit. It therefore makes more sense to compare the impact of the two systems on 85th percentile speed. The availability of the Lancashire ISA system reduced 85th percentile speed on 30 mph roads by 2%; the ISA-UK system by 7%. On 70 mph roads, availability of the Lancashire ISA system reduced 85th percentile speed by 2%; the ISA-UK system by 5%. So it can be concluded that the Lancashire ISA system did indeed have a more substantial effect on low-end speeding (which the ISA-UK system did not really aim to affect), but that the ISA-UK system had far greater impact on high-end speeding.

The effect of the Lancashire ISA system also varied among different driver groups to some extent. In terms of cutting down excessive speeds, the effect was greater for drivers aged below 25 and for drivers with less than 3 years experience, in comparison with their counterparts. However, these

drivers were also more resistant to speed limit compliance than their counterparts, indicated by the amount of reduction in speeding. Drivers' density of exposure to traffic played a role when it came to reduction in speeding; those with an annual mileage over the 10,000 mark showed somewhat stronger resistance to speed limit compliance. Gender did not appear to influence the effectiveness of advisory ISA.

Drivers' attitudes towards exceeding the speed limit and towards ISA were elicited at four time points during the trial. Whilst drivers reported that their behaviour and habits did not change as a result of using ISA, this is not the case when the objective data are taken into account, suggesting that advisory ISA offers a subtle way of positively changing driver behaviour. Drivers may not be aware of these subtle changes and perhaps that is why the acceptability scores were found to be generally positive and the willingness to pay value remained pretty much the same before and after the trial.

Acceptability relating to the construct of Anxiety reduces over time and by correlating the anxiety factor scores with actual ISA use, we find that this is significant. Drivers, it seems, are driven to use or not use ISA based on emotive factors, rather than its ease of use for example. In this trial, personality was not a predictor of use.

Measured at two time points (Time 1 and Time 4), willingness to pay for the ISA system was gauged both prior to and after use. The cumulative percentage of respondents willing to purchase ISA at increasing prices is shown in Figure 13. For ease of interpretation, the "Indifference Price Point" (IPP) is indicated, via the arrows. The IPP is the point at which the number of respondents who consider the product a bargain is equal to the number of respondents who consider it to be getting expensive, but still worth considering. In this study, prior to use, the IPP is just over £100, decreasing only slightly after use. Two-thirds of drivers who took part in this trial would consider buying advisory ISA.

9.2 Implications for future deployment

9.2.1 Next steps for large scale deployment

The trial results suggest that, as long as the driver chooses to use advisory ISA, it helps in reducing vehicle speeds. The sensible way forward is therefore to encourage uptake. There are a few key elements for encouraging adoption:

- An accurate and up-to-date speed limit database: incorrect information jeopardises drivers' confidence in the system and in turn affects adoption.
- Make the speed limit information user friendly: providing appropriate add-on application and speed limit information in a variety of common formats (e.g. *.ov2, *.csv, *.kml etc) which would cater to the vast majority of portable satellite navigation systems.
- Work with fleet managers: average company-owned cars travel more than twice as far as the average privately owned car (DfT, 2011), and hence a high penetration of ISA into the company car fleet would greatly strengthen its effect across the entire vehicle fleet. In addition to social benefits, businesses would benefit from cost saving due to incident reduction and reduced fuel consumption (Lai, Carsten, and Tate, in press).

9.2.2 Wider implications

The advisory ISA system trialled in this project was delivered by a nomadic device, which served the objective of cost effective deployment. However, system exposure relied on drivers making use of the device; i.e. bring the device into the vehicle and turning it on before commencing a trip. The low system usage observed during the field operational tests is somewhat disappointing. Nevertheless, it provides a realistic indication of actual usage of the trialled system configuration.

The system used in the trial was turned off by default, i.e. a driver had to turn the device on to receive speed limit information and over-speed-limit warnings. The drivers also had to connect the device to the power source to ensure the device was kept on throughout the journey. This is to some extent similar to an onboard OEM system which requires the driver to turn it on when wishing to use a support system (e.g. cruise control), but different in the respect that it is a non-integrated system. An integrated OEM system would always be in the vehicle, while a driver might forget to bring a nomadic device into the vehicle or might not wish to spend the time required to setting up the system up (e.g. on short trips or when starting a trip in a rush). If it was a system which sat in the vehicle permanently and was turned on with ignition (as is the case with a seat belt warning system), the usage patterns would most probably be very different and the effectiveness of ISA would be further enhanced. There is clearly a trade-off between the cost of deployment across the vehicle fleet and the benefit that a support system brings to the network.

The deployment of ISA as an integrated system would be more cost-effective (in terms of social costs) via the OEM route instead of by retrofit. The safety benefit of in-vehicle systems assisting the drivers controlling their maximum speed has been recognised by EuroNCAP (2009), which has recently started awarding points for vehicle models that offers such functionality.

The trialled system currently would not be able to support the drivers when the vehicle is driven out of the boundary of Lancashire. This is due to the absence of a national speed limit database. The results from this trial suggest a high value of establishing a national speed limit database, which would make advisory ISA available nationwide. The need for such speed limit information across Europe has in fact been recognised and discussed (EuroRAP, 2011).

The trial results also revealed that the patterns of system adoption are affected by road characteristics and driver demographics. Two noticeable trends were revealed. Firstly, usage of the system diminished along with a decrease in speed limit regardless of driver characteristics. One potential reason for this would be travelling on roads with a lower speed limit is typically associated with shorter trips when the participants might be less prone to spending time in setting the system up before driving off. However drivers are most likely to encounter vulnerable road users on roads with a lower speed limit, and hence it appears that ISA was used the least where it was needed the most. Secondly, there was a tendency that participants who would benefit from ISA the most used ISA the least; e.g. drivers with strong intention to speed, younger drivers and novice drivers. These observations are largely in line with the patterns revealed in the previous ISA-UK trial on an intervening system (Lai, Chorlton, and Carsten, 2007), which suggests that system adoption is independent of system configuration. This highlights the potential of educational approaches such as safety campaigns as part of the deployment of ISA.

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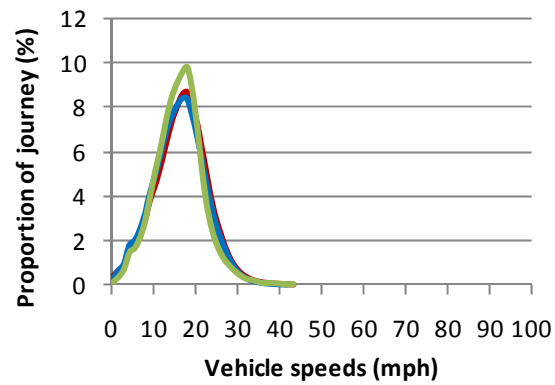
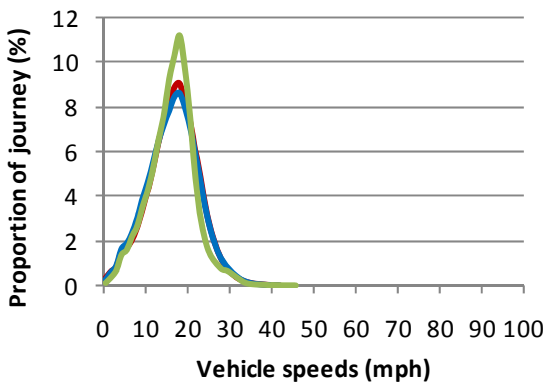
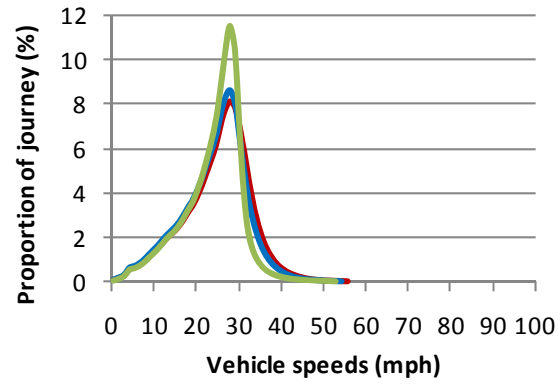
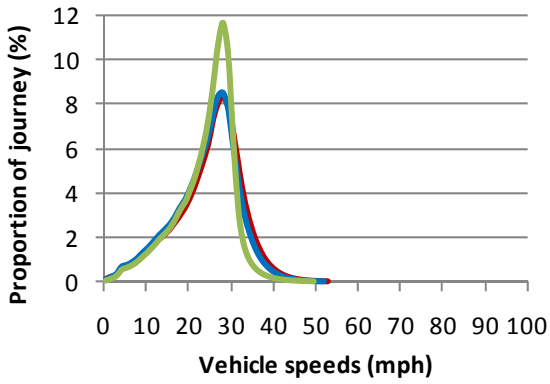
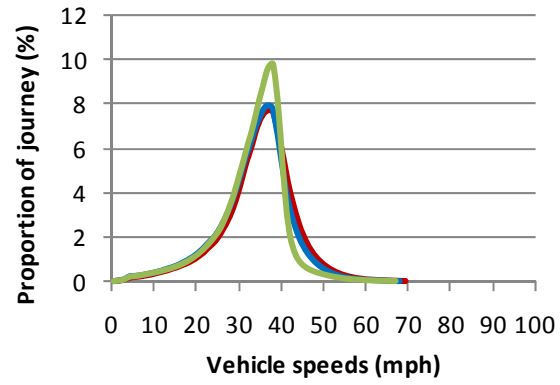
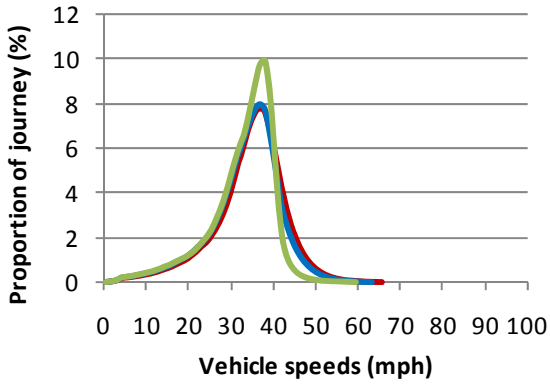
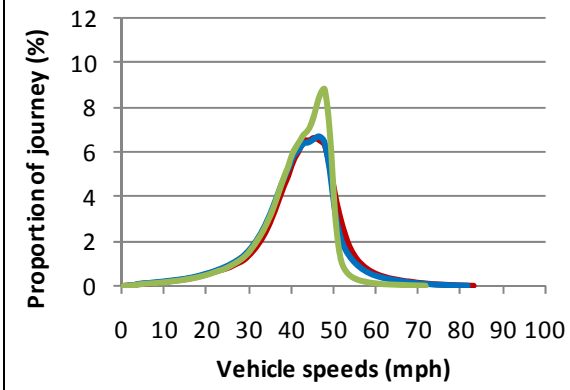
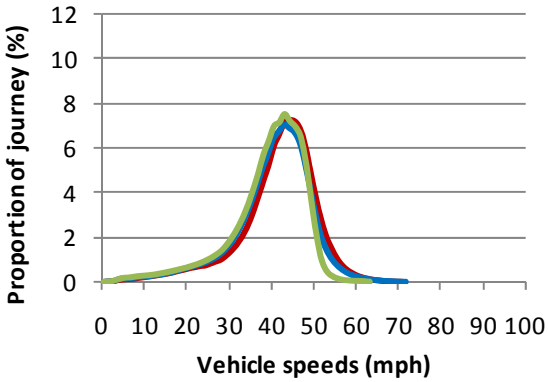
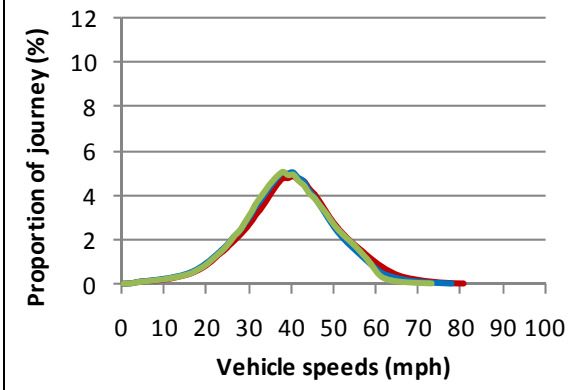
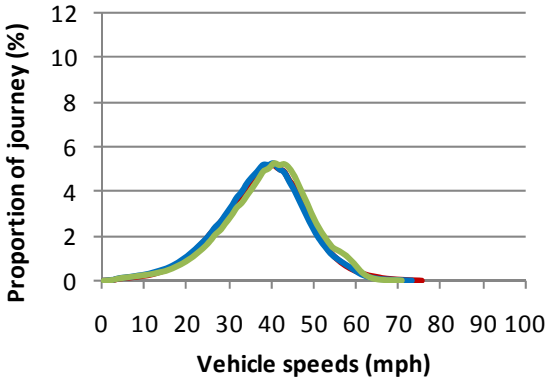
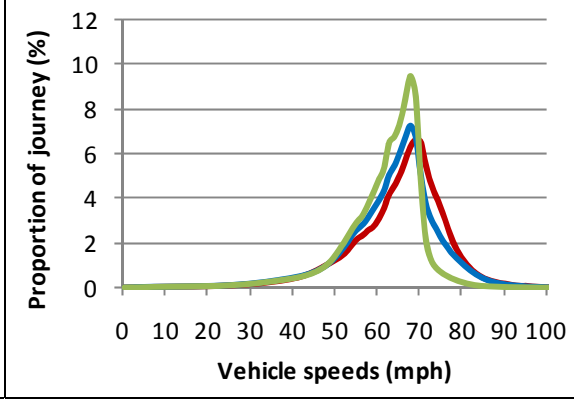
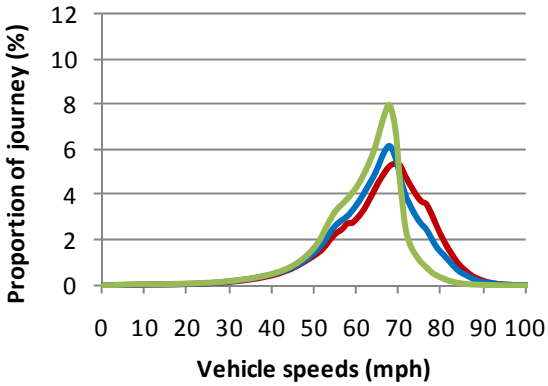
Appendix 1: Raw speed data of the car fleet

Speed limit	Performance indicator	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
					(1) → (2)	(1) → (3)	
20	Mean (mph)	17.2	17.1	17.1	-1%	-1%	294
	85th (mph)	23.0	23.0	22.3	0%	-3%	294
	Speeding (%)	33.9	31.8	31.4	**-6%**	-7%	267
30	Mean (mph)	24.7	24.1	24.3	**-3%**	**-2%**	352
	85th (mph)	31.8	31.0	30.2	**-2%**	**-5%**	352
	Speeding (%)	23.8	19.5	16.6	**-18%**	**-30%**	346
40	Mean (mph)	33.9	33.1	32.9	**-2%**	**-3%**	345
	85th (mph)	41.1	40.2	39.3	**-2%**	**-4%**	345
	Speeding (%)	20.5	15.8	12.3	**-23%**	**-40%**	332
50	Mean (mph)	40.3	39.6	39.4	**-2%**	**-2%**	320
	85th (mph)	48.2	47.6	46.5	**-1%**	**-3%**	320
	Speeding (%)	12.9	9.8	7.3	**-24%**	**-44%**	250
60	Mean (mph)	37.9	37.5	37.5	**-1%**	-1%	329
	85th (mph)	47.8	47.3	47.0	**-1%**	**-2%**	330
	Speeding (%)	2.5	2.1	2.0	**-16%**	**-21%**	208
70	Mean (mph)	63.0	61.8	60.5	**-2%**	**-4%**	330
	85th (mph)	72.2	70.7	68.0	**-2%**	**-6%**	330
	Speeding (%)	32.7	22.6	14.5	**-31%**	**-56%**	296

Appendix 2: Raw speed data and speed distributions for gender groups

Speed limit	Performance indicator	Gender	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
20	Mean (mph)	Male	17.2	17.0	17.2	-2%	0%	174
		Female	17.2	17.2	17.1	0%	-1%	116
	85th (mph)	Male	23.1	22.9	22.4	-1%	-3%	174
		Female	22.8	23.1	22.2	1%	-3%	116
	Speeding (%)	Male	33.7	31.6	31.6	-6%	-6%	160
		Female	34.2	32.2	31.3	-6%	-8%	103
30	Mean (mph)	Male	24.7	24.1	24.4	**-2%**	**-1%**	203
		Female	24.8	24.1	24.2	**-3%**	**-2%**	144
	85th (mph)	Male	31.7	31.0	30.2	**-2%**	**-5%**	203
		Female	31.9	31.1	30.3	**-2%**	**-5%**	144
	Speeding (%)	Male	23.5	19.2	16.6	**-18%**	**-29%**	200
		Female	24.4	20.0	16.8	**-18%**	**-31%**	142
40	Mean (mph)	Male	34.0	33.3	33.2	**-2%**	**-2%**	201
		Female	33.7	32.7	32.5	**-3%**	**-4%**	140
	85th (mph)	Male	41.3	40.3	39.4	**-2%**	**-5%**	201
		Female	41.0	40.0	39.2	**-2%**	**-4%**	140
	Speeding (%)	Male	20.9	16.2	12.9	**-22%**	**-38%**	191
		Female	20.0	15.3	11.6	**-23%**	**-42%**	137
50	Mean (mph)	Male	40.6	39.9	39.7	**-2%**	**-2%**	184
		Female	39.9	39.1	39.0	**-2%**	**-2%**	132
	85th (mph)	Male	48.6	47.9	46.9	**-1%**	**-4%**	184
		Female	47.6	47.0	46.0	**-1%**	**-3%**	132
	Speeding (%)	Male	13.8	10.7	8.0	**-22%**	**-42%**	144
		Female	11.5	8.4	6.3	**-27%**	**-46%**	104
60	Mean (mph)	Male	38.2	37.9	38.1	-1%	0%	194
		Female	37.6	36.9	36.8	**-2%**	**-2%**	131
	85th (mph)	Male	48.1	47.9	47.4	0%	-2%	195
		Female	47.3	46.6	46.5	**-2%**	**-2%**	131
	Speeding (%)	Male	2.6	2.3	2.0	-9%	-21%	131
		Female	2.4	1.8	1.9	**-28%**	-21%	75
70	Mean (mph)	Male	63.3	62.1	61.4	**-2%**	**-3%**	193
		Female	62.6	61.5	59.1	**-2%**	**-6%**	133
	85th (mph)	Male	72.4	70.9	68.7	**-2%**	**-5%**	193
		Female	72.0	70.5	67.0	**-2%**	**-7%**	133
	Speeding (%)	Male	32.1	22.1	14.5	**-31%**	**-55%**	180
		Female	33.5	23.3	14.4	**-30%**	**-57%**	113

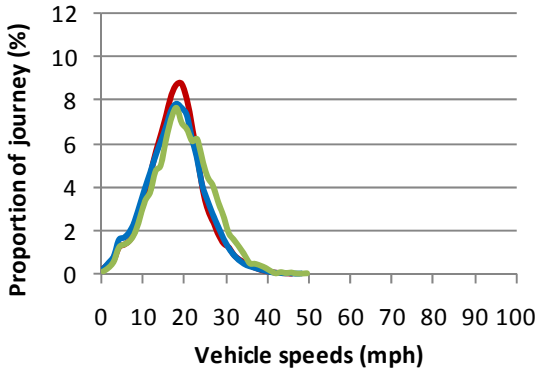
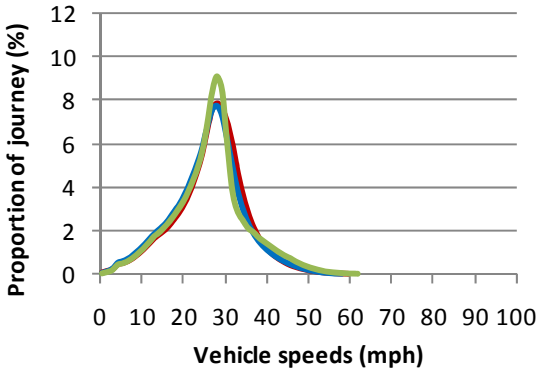
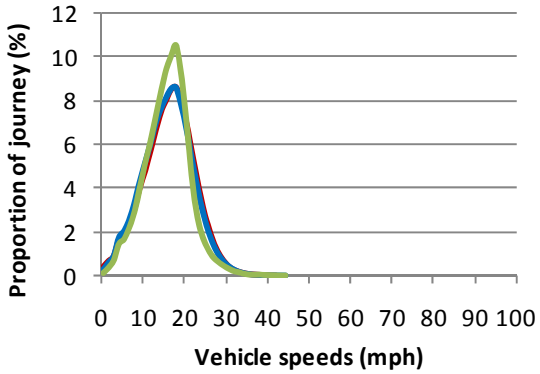
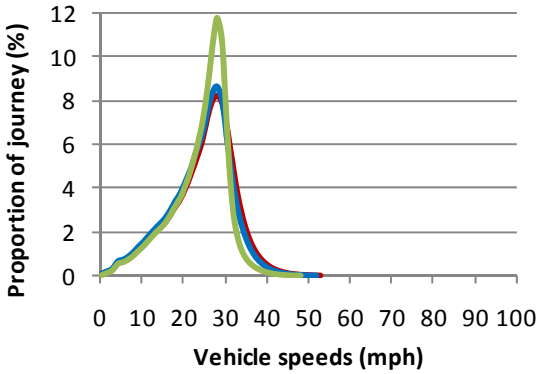
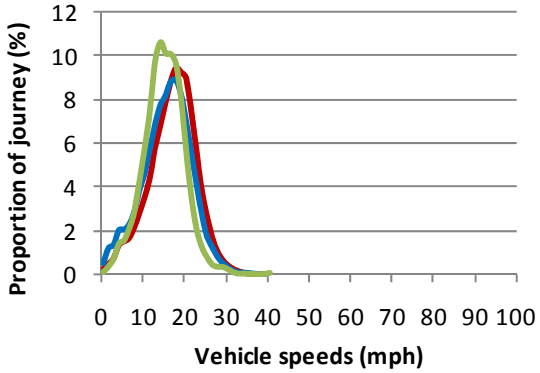
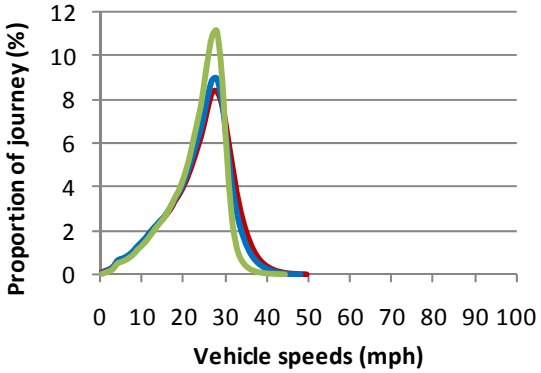
	Male	Female
	No ISA ISA available ISA in use	
20 mph roads		
30 mph roads		
40 mph roads		

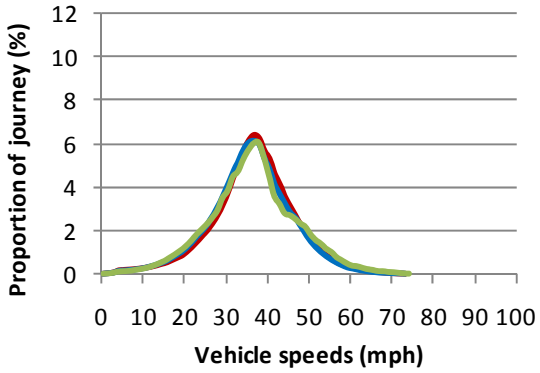
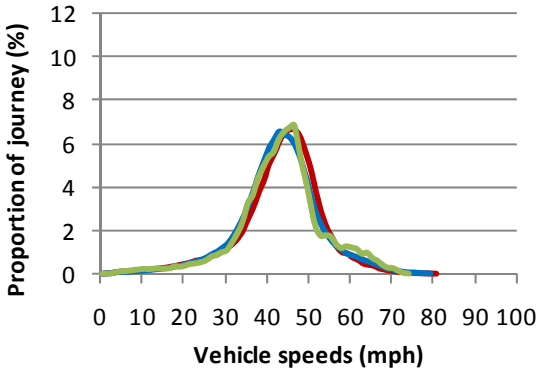
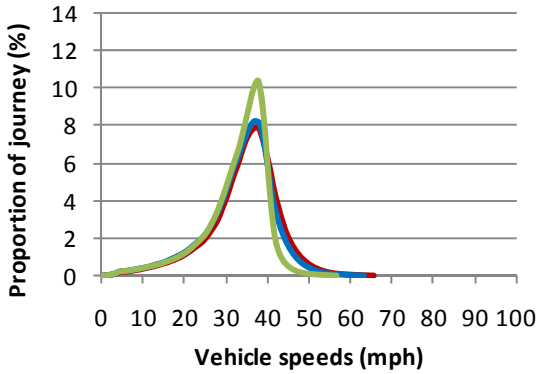
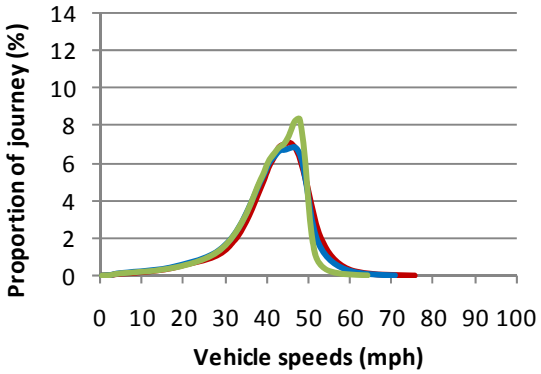
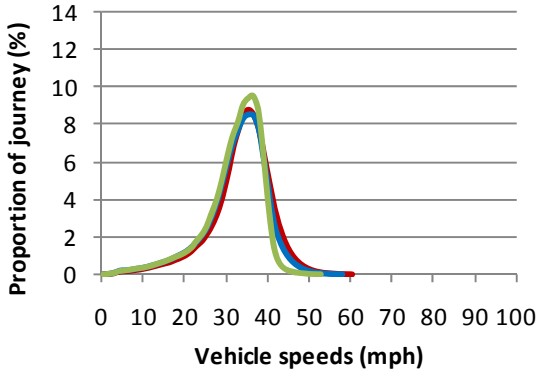
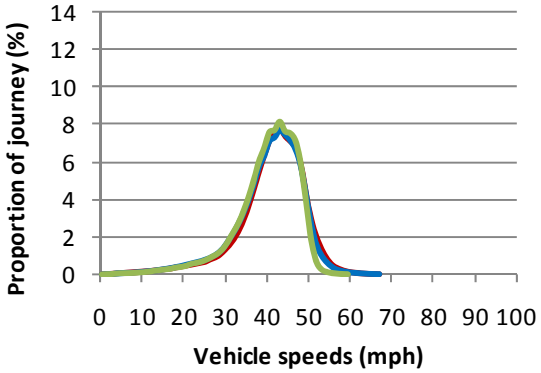
	Male	Female
	No ISA, ISA available, ISA in use	
50 mph roads		
60 mph roads		
70 mph roads		

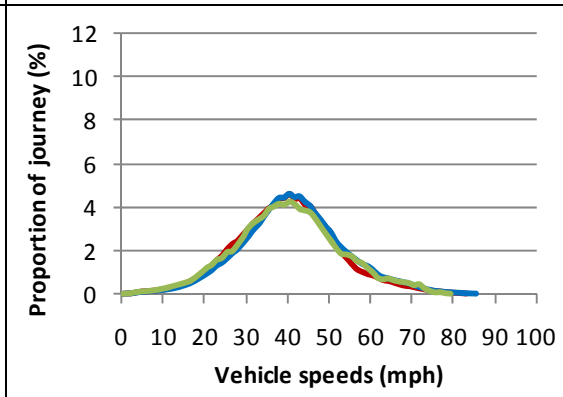
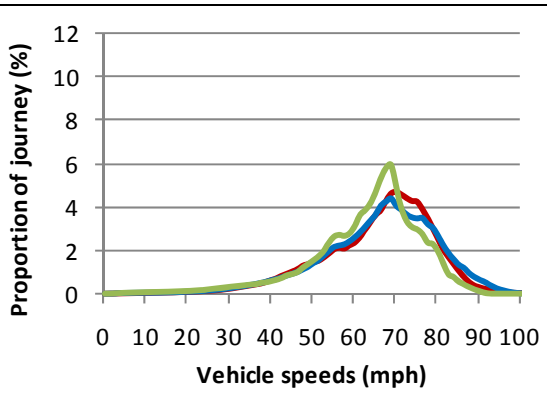
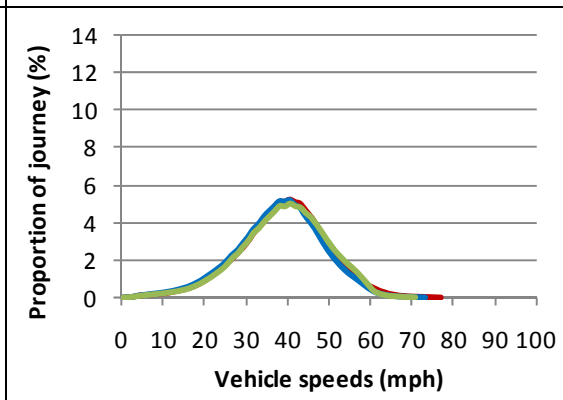
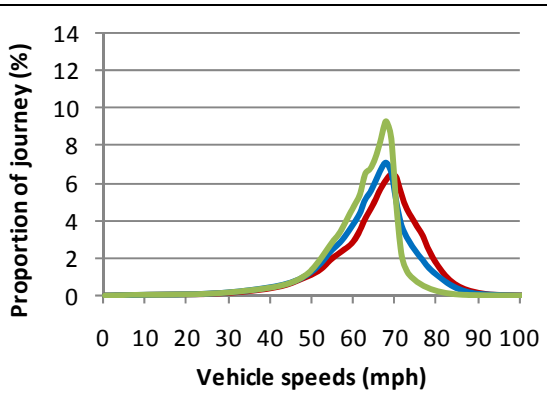
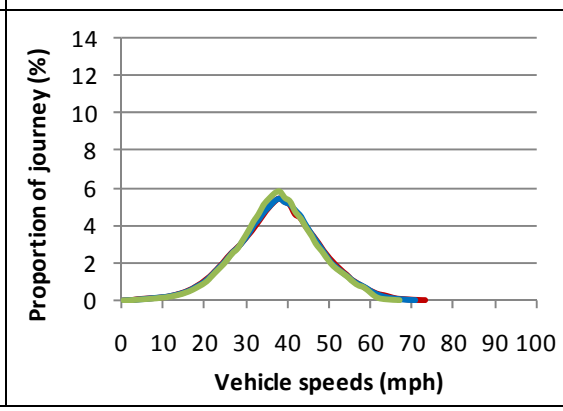
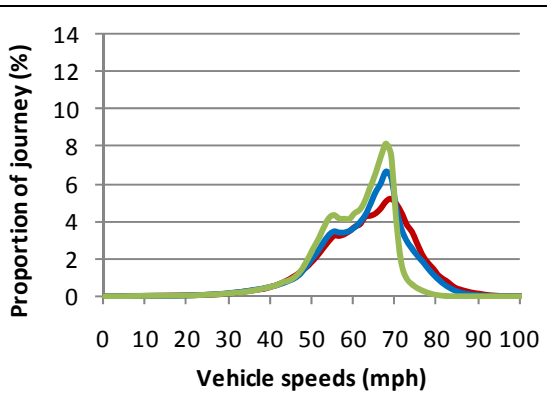
Appendix 3: Raw speed data and speed distributions for age groups (3 bands)

Speed limit	Performance indicator	Age (3 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
20	Mean (mph)	< 25 yrs	17.5	17.7	17.6	1%	1%	11
		25-59 yrs	17.4	17.0	17.2	-2%	-1%	188
		>= 60 yrs	16.1	16.5	16.9	3%	5%	46
	85th (mph)	< 25 yrs	23.4	23.4	22.8	0%	-3%	11
		25-59 yrs	23.2	22.9	22.5	-1%	-3%	188
		>= 60 yrs	21.6	22.2	21.7	3%	0%	46
	Speeding (%)	< 25 yrs	34.6	39.6	33.9	14%	-2%	10
		25-59 yrs	34.5	31.2	30.6	**-10%**	**-11%**	176
		>= 60 yrs	29.7	28.2	26.5	-5%	-11%	39
30	Mean (mph)	< 25 yrs	26.3	25.5	25.0	**-3%**	-5%	21
		25-59 yrs	24.7	24.0	24.2	**-3%**	**-2%**	219
		>= 60 yrs	23.9	23.5	23.9	**-2%**	0%	53
	85th (mph)	< 25 yrs	34.0	33.0	31.4	**-3%**	-8%	21
		25-59 yrs	31.7	30.9	30.2	**-3%**	**-5%**	219
		>= 60 yrs	30.9	30.0	29.5	**-3%**	**-5%**	53
	Speeding (%)	< 25 yrs	31.4	27.4	24.5	**-13%**	**-22%**	19
		25-59 yrs	23.9	19.2	16.4	**-20%**	**-31%**	216
		>= 60 yrs	19.6	15.2	11.9	**-22%**	**-39%**	53
40	Mean (mph)	< 25 yrs	35.1	34.7	34.2	-1%	-3%	19
		25-59 yrs	34.0	33.0	32.8	**-3%**	**-3%**	216
		>= 60 yrs	33.0	32.3	32.4	**-2%**	**-2%**	53
	85th (mph)	< 25 yrs	43.0	42.4	40.0	-1%	**-7%**	19
		25-59 yrs	41.3	40.2	39.3	**-3%**	**-5%**	216
		>= 60 yrs	39.5	38.6	38.2	**-2%**	**-3%**	53
	Speeding (%)	< 25 yrs	26.7	24.0	14.4	**-10%**	**-46%**	18
		25-59 yrs	21.4	16.0	12.7	**-25%**	**-41%**	207
		>= 60 yrs	14.1	10.2	7.4	**-27%**	**-47%**	52
50	Mean (mph)	< 25 yrs	42.5	41.5	41.8	**-2%**	-2%	16
		25-59 yrs	40.2	39.3	38.7	**-2%**	**-3%**	202
		>= 60 yrs	39.8	39.4	39.5	-1%	-1%	52
	85th (mph)	< 25 yrs	51.4	50.0	48.9	**-3%**	**-5%**	16
		25-59 yrs	48.1	47.4	46.2	**-2%**	**-4%**	202
		>= 60 yrs	46.8	46.4	45.8	-1%	**-2%**	52
	Speeding (%)	< 25 yrs	19.9	15.2	11.9	**-24%**	**-40%**	15
		25-59 yrs	12.8	9.2	6.8	**-28%**	**-47%**	159
		>= 60 yrs	7.8	6.5	3.5	-18%	**-56%**	37

Speed limit	Performance indicator	Age (3 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
60	Mean (mph)	< 25 yrs	39.6	37.9	37.5	**-4%**	**-5%**	17
		25-59 yrs	37.8	37.3	37.5	**-1%**	-1%	205
		>= 60 yrs	37.0	37.3	37.3	1%	1%	53
	85th (mph)	< 25 yrs	50.4	48.4	47.7	**-4%**	**-5%**	17
		25-59 yrs	47.6	47.2	47.0	-1%	-1%	206
		>= 60 yrs	46.5	46.4	46.1	0%	-1%	53
	Speeding (%)	< 25 yrs	6.7	6.6	3.9	-2%	**-41%**	8
		25-59 yrs	2.2	1.8	1.9	-18%	-15%	138
		>= 60 yrs	1.7	1.4	1.0	-16%	-38%	29
70	Mean (mph)	< 25 yrs	64.8	63.8	63.1	-2%	-3%	20
		25-59 yrs	63.5	62.0	61.2	**-2%**	**-4%**	206
		>= 60 yrs	59.9	59.3	57.8	-1%	-4%	52
	85th (mph)	< 25 yrs	75.4	73.8	71.6	-2%	**-5%**	20
		25-59 yrs	72.5	70.8	68.9	**-2%**	**-5%**	206
		>= 60 yrs	68.8	67.6	64.7	-2%	**-6%**	52
	Speeding (%)	< 25 yrs	42.9	36.7	27.2	-15%	**-37%**	18
		25-59 yrs	32.6	21.7	14.3	**-33%**	**-56%**	191
		>= 60 yrs	24.2	15.9	7.4	**-35%**	**-69%**	42

	20 mph roads	30 mph roads
	No ISA, ISA available, ISA in use	
Less than 25 years old		
25-59 years old		
Over 60 years old		

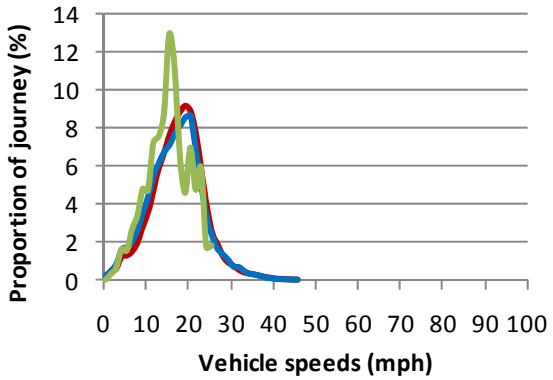
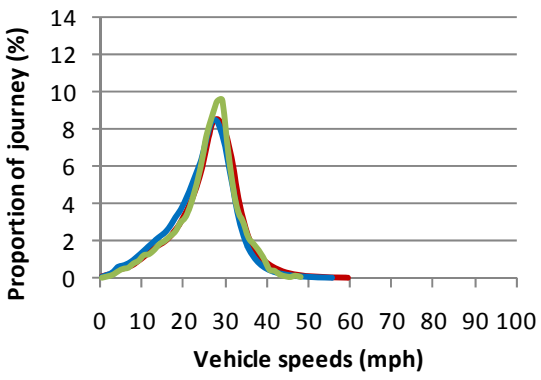
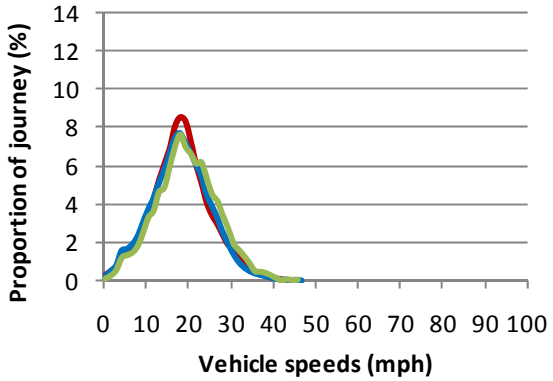
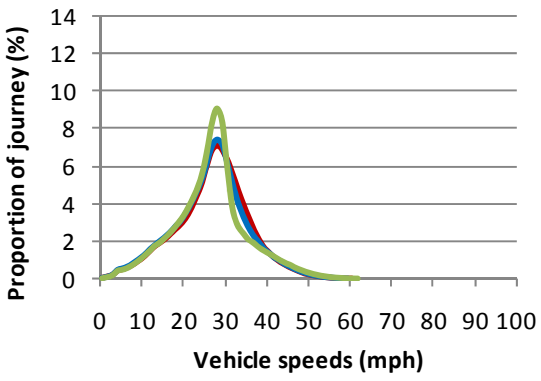
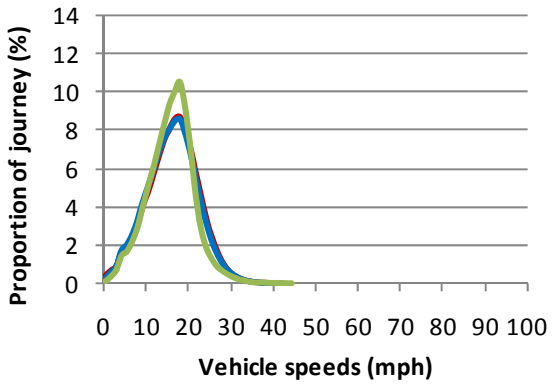
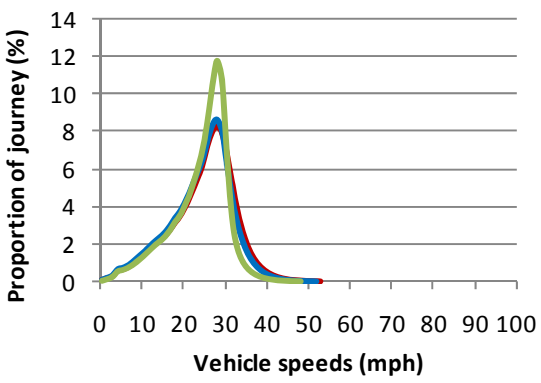
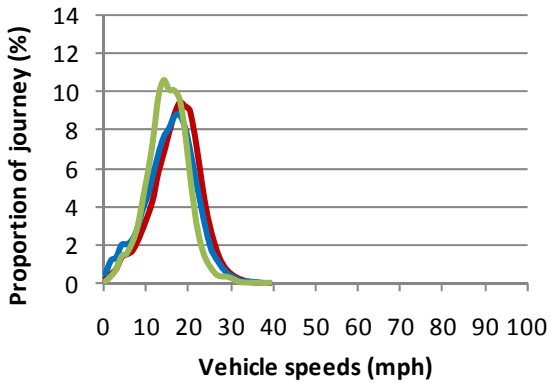
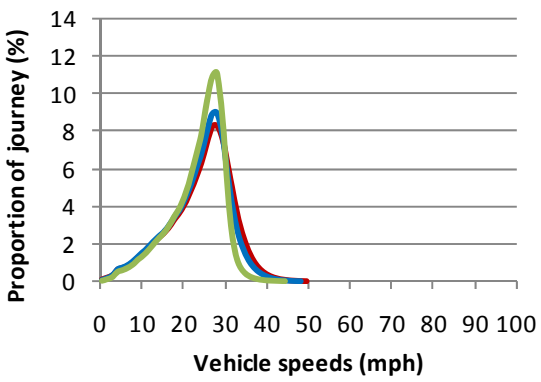
	40 mph roads	50 mph roads
	No ISA, ISA available, ISA in use	
Less than 25 years old		
25-59 years old		
Over 60 years old		

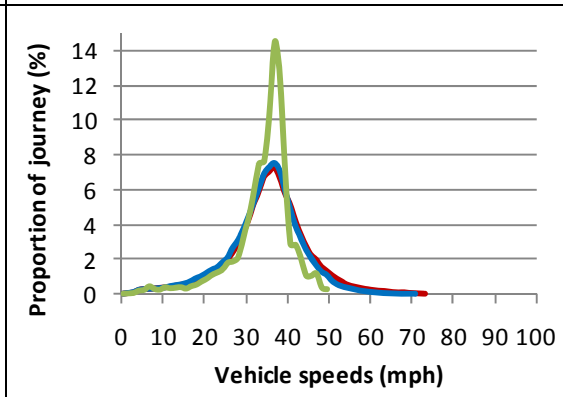
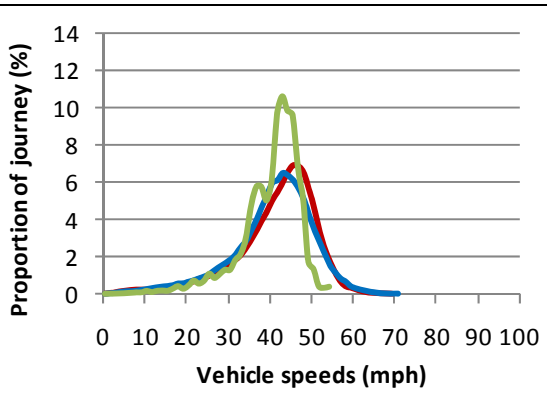
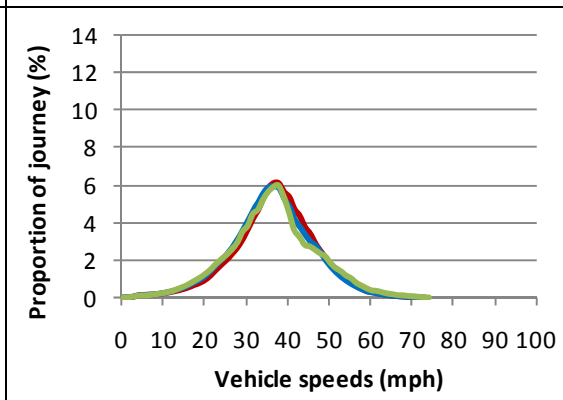
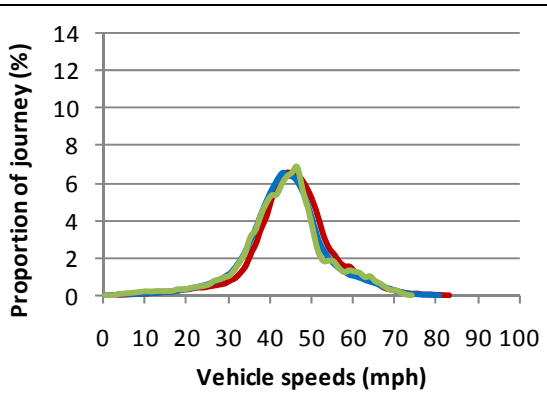
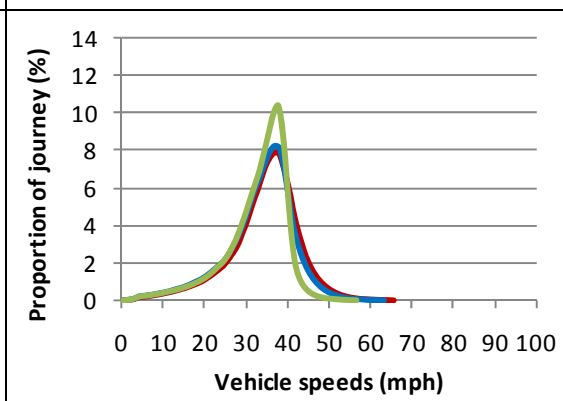
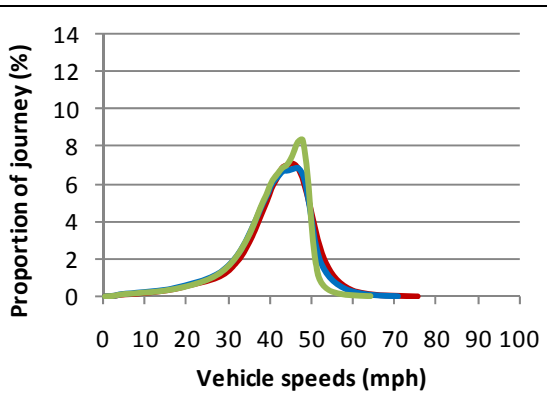
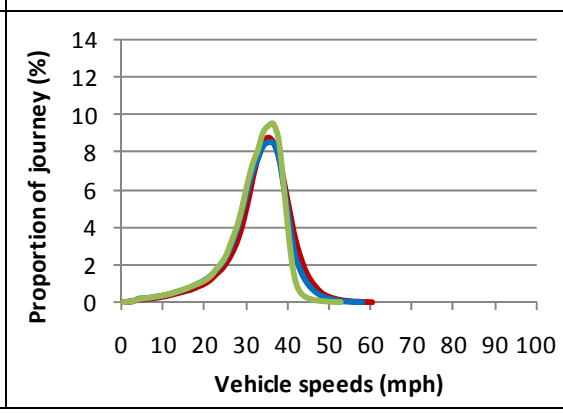
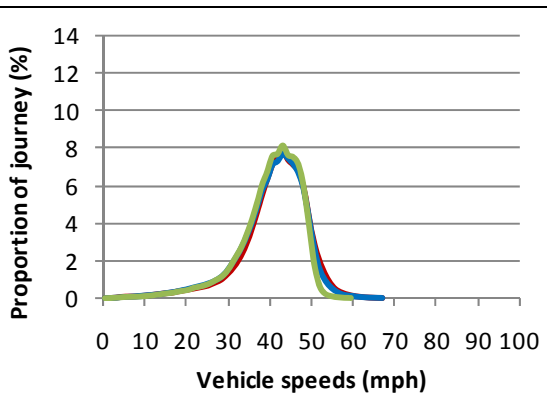
	60 mph roads	70 mph roads
	No ISA, ISA available, ISA in use	
Less than 25 years old		
25-59 years old		
Over 60 years old		

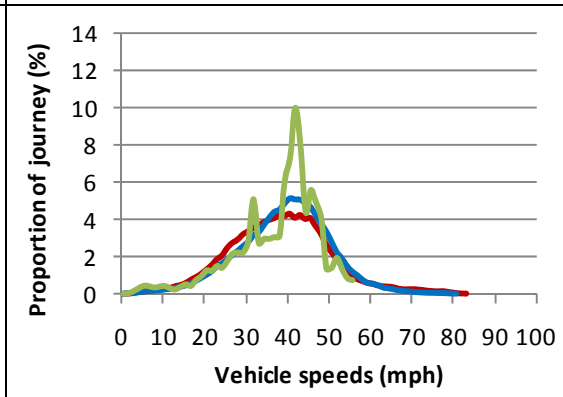
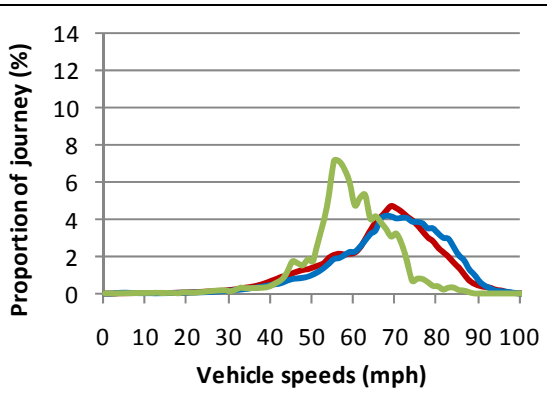
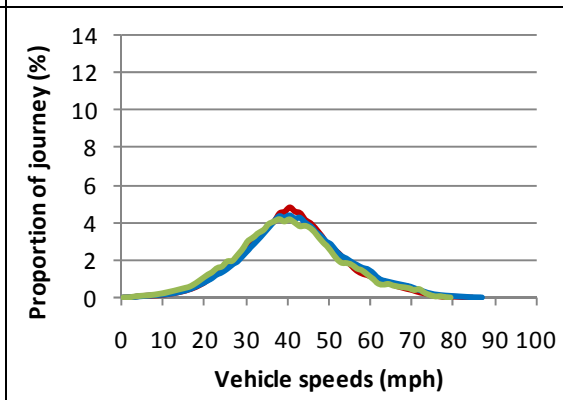
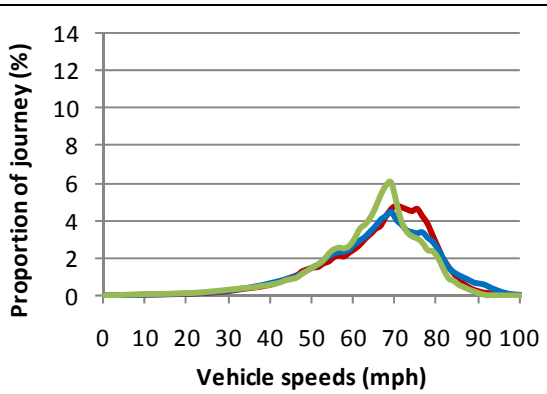
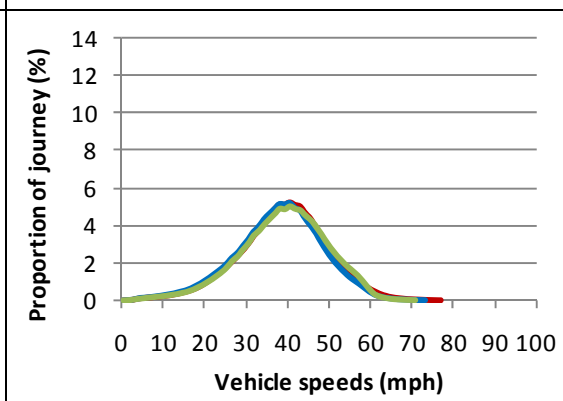
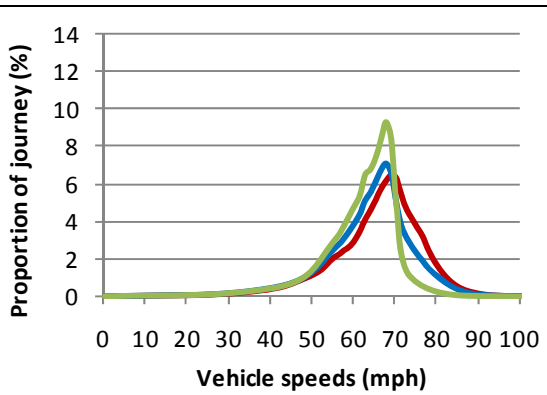
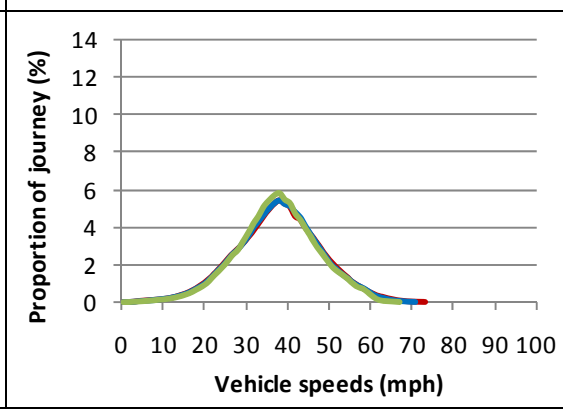
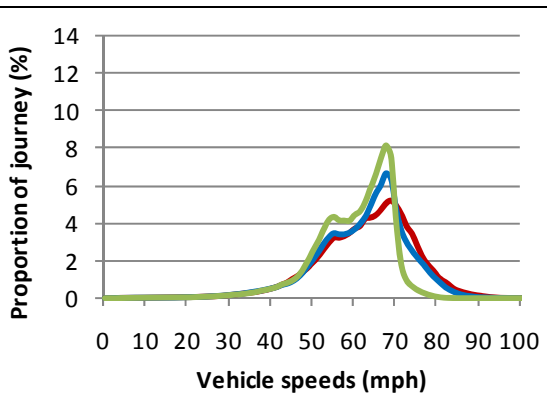
Appendix 4: Raw speed data and speed distributions for age groups (4 bands)

Speed limit	Performance indicator	Age (4 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
20	Mean (mph)	<= 19 yrs	16.7	15.8	15.5	-5%	-7%	3
		20-24 yrs	17.8	18.4	18.5	4%	4%	8
		25-59 yrs	17.4	17.0	17.2	-2%	-1%	188
		>= 60 yrs	16.1	16.5	16.9	3%	5%	46
	85th (mph)	<= 19 yrs	22.2	21.5	21.7	-3%	-2%	3
		20-24 yrs	23.9	24.1	23.2	1%	-3%	8
		25-59 yrs	23.2	22.9	22.5	-1%	-3%	188
		>= 60 yrs	21.6	22.2	21.7	3%	0%	46
	Speeding (%)	<= 19 yrs	30.1	23.4	16.6	-22%	-45%	3
		20-24 yrs	36.6	46.5	41.3	27%	13%	7
		25-59 yrs	34.5	31.2	30.6	**-10%**	**-11%**	176
		>= 60 yrs	29.7	28.2	26.5	-5%	-11%	39
30	Mean (mph)	<= 19 yrs	26.5	24.4	23.2	**-8%**	-13%	5
		20-24 yrs	26.2	25.8	25.6	-2%	-3%	16
		25-59 yrs	24.7	24.0	24.2	**-3%**	**-2%**	219
		>= 60 yrs	23.9	23.5	23.9	**-2%**	0%	53
	85th (mph)	<= 19 yrs	34.2	31.6	28.7	-8%	-16%	5
		20-24 yrs	34.0	33.4	32.3	-2%	-5%	16
		25-59 yrs	31.7	30.9	30.2	**-3%**	**-5%**	219
		>= 60 yrs	30.9	30.0	29.5	**-3%**	**-5%**	53
	Speeding (%)	<= 19 yrs	28.4	20.1	24.6	-29%	-13%	4
		20-24 yrs	32.2	29.4	24.5	-9%	**-24%**	15
		25-59 yrs	23.9	19.2	16.4	**-20%**	**-31%**	216
		>= 60 yrs	19.6	15.2	11.9	**-22%**	**-39%**	53
40	Mean (mph)	<= 19 yrs	34.0	34.1	35.3	0%	**4%**	5
		20-24 yrs	35.6	34.9	33.7	**-2%**	**-5%**	14
		25-59 yrs	34.0	33.0	32.8	**-3%**	**-3%**	216
		>= 60 yrs	33.0	32.3	32.4	**-2%**	**-2%**	53
	85th (mph)	<= 19 yrs	41.6	41.4	39.9	-1%	-4%	5
		20-24 yrs	43.5	42.8	40.1	-2%	**-8%**	14
		25-59 yrs	41.3	40.2	39.3	**-3%**	**-5%**	216
		>= 60 yrs	39.5	38.6	38.2	**-2%**	**-3%**	53
	Speeding (%)	<= 19 yrs	20.8	19.4	13.3	-7%	-36%	5
		20-24 yrs	29.0	25.7	14.9	**-11%**	**-49%**	13
		25-59 yrs	21.4	16.0	12.7	**-25%**	**-41%**	207
		>= 60 yrs	14.1	10.2	7.4	**-27%**	**-47%**	52

Speed limit	Performance indicator	Age (4 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
50	Mean (mph)	<= 19 yrs	40.6	39.5	40.6	-3%	0%	4
		20-24 yrs	43.1	42.2	42.2	-2%	-2%	12
		25-59 yrs	40.2	39.3	38.7	**-2%**	**-3%**	202
		>= 60 yrs	39.8	39.4	39.5	-1%	-1%	52
	85th (mph)	<= 19 yrs	48.9	46.9	46.3	**-4%**	**-5%**	4
		20-24 yrs	52.2	51.0	49.8	**-2%**	-5%	12
		25-59 yrs	48.1	47.4	46.2	**-2%**	**-4%**	202
		>= 60 yrs	46.8	46.4	45.8	-1%	**-2%**	52
	Speeding (%)	<= 19 yrs	12.1	6.2	2.3	**-49%**	**-81%**	3
		20-24 yrs	21.9	17.4	14.3	**-20%**	-35%	12
		25-59 yrs	12.8	9.2	6.8	**-28%**	**-47%**	159
		>= 60 yrs	7.8	6.5	3.5	-18%	**-56%**	37
60	Mean (mph)	<= 19 yrs	39.3	36.1	35.1	**-8%**	-11%	4
		20-24 yrs	39.7	38.5	38.2	-3%	-4%	13
		25-59 yrs	37.8	37.3	37.5	**-1%**	-1%	205
		>= 60 yrs	37.0	37.3	37.3	1%	1%	53
	85th (mph)	<= 19 yrs	49.4	45.2	45.6	-8%	-8%	4
		20-24 yrs	50.7	49.3	48.3	-3%	-5%	13
		25-59 yrs	47.6	47.2	47.0	-1%	-1%	206
		>= 60 yrs	46.5	46.4	46.1	0%	-1%	53
	Speeding (%)	<= 19 yrs	—	—	—	—	—	0
		20-24 yrs	6.7	6.6	3.9	-2%	**-41%**	8
		25-59 yrs	2.2	1.8	1.9	-18%	-15%	138
		>= 60 yrs	1.7	1.4	1.0	-16%	-38%	29
70	Mean (mph)	<= 19 yrs	61.3	60.0	58.2	-2%	-5%	5
		20-24 yrs	66.0	65.0	64.7	-2%	-2%	15
		25-59 yrs	63.5	62.0	61.2	**-2%**	**-4%**	206
		>= 60 yrs	59.9	59.3	57.8	-1%	-4%	52
	85th (mph)	<= 19 yrs	71.8	70.1	66.1	-2%	-8%	5
		20-24 yrs	76.6	75.0	73.5	-2%	**-4%**	15
		25-59 yrs	72.5	70.8	68.9	**-2%**	**-5%**	206
		>= 60 yrs	68.8	67.6	64.7	-2%	**-6%**	52
	Speeding (%)	<= 19 yrs	43.2	40.2	17.1	-7%	-60%	3
		20-24 yrs	42.9	36.0	29.2	-16%	**-32%**	15
		25-59 yrs	32.6	21.7	14.3	**-33%**	**-56%**	191
		>= 60 yrs	24.2	15.9	7.4	**-35%**	**-69%**	42

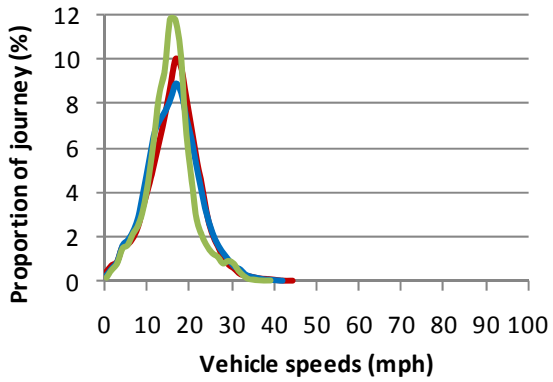
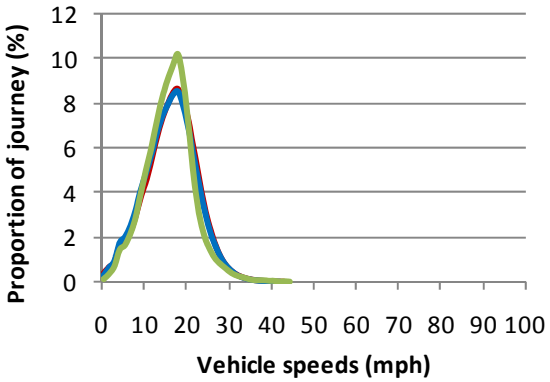
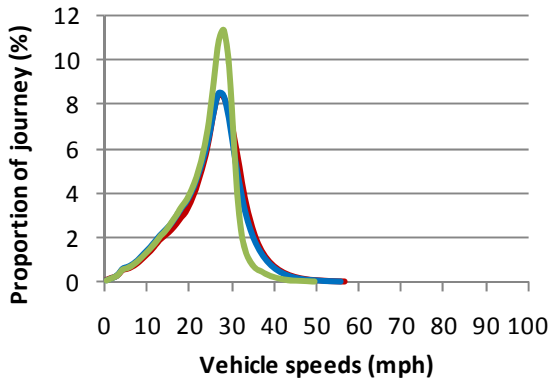
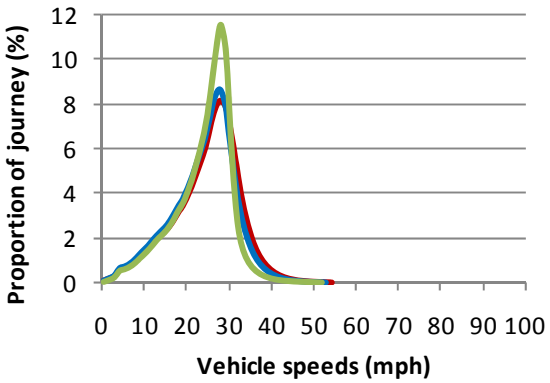
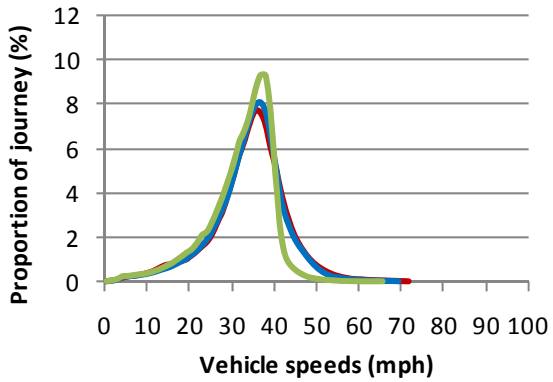
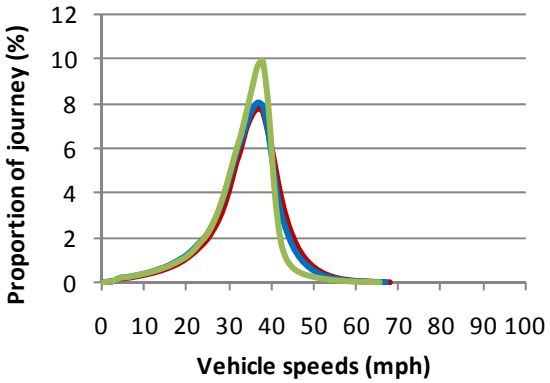
	20 mph roads	30 mph roads
	No ISA, ISA available, ISA in use	
Less than 19 years old		
20-24 years old		
25-59 years old		
Over 60 years old		

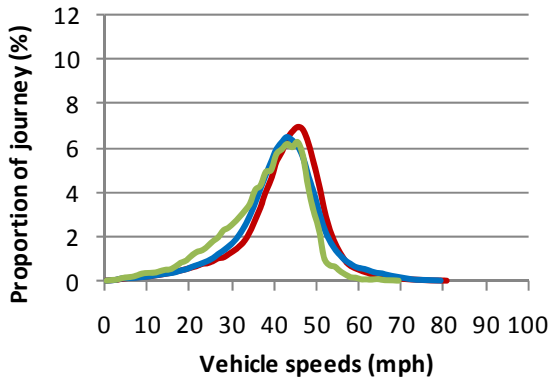
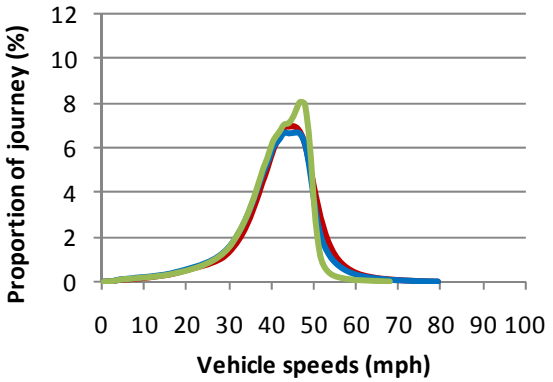
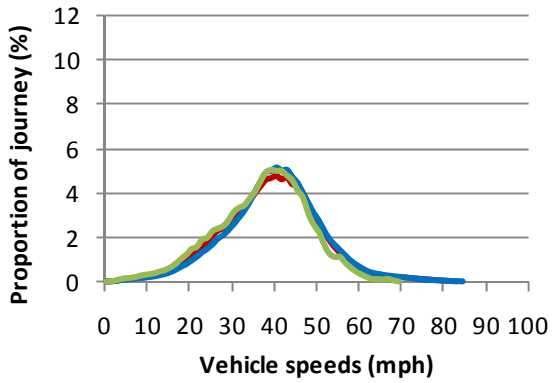
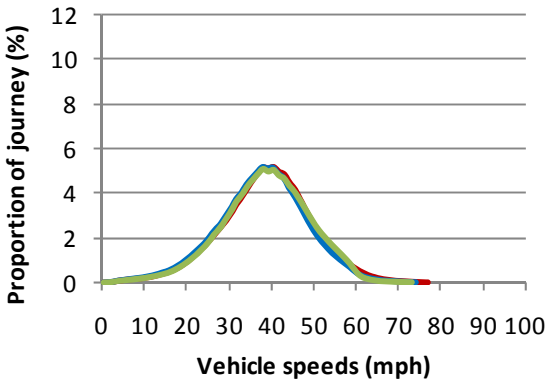
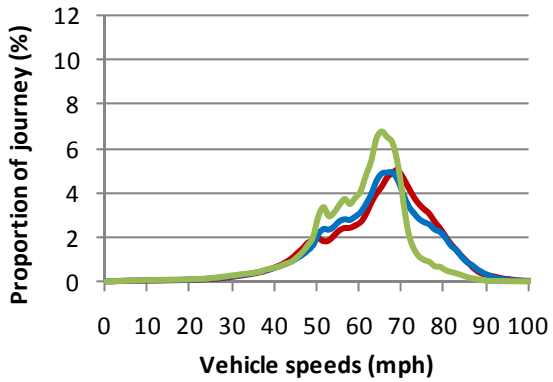
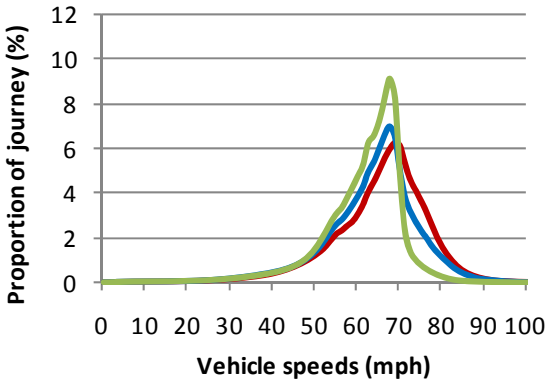
	40 mph roads	50 mph roads
	No ISA, ISA available, ISA in use	
Less than 19 years old		
20-24 years old		
25-59 years old		
Over 60 years old		

	60 mph roads	70 mph roads
	No ISA, ISA available, ISA in use	
Less than 19 years old		
20-24 years old		
25-59 years old		
Over 60 years old		

Appendix 5: Raw speed data and speed distributions for experience groups (2 bands)

Speed limit	Performance indicator	Experience (2 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
20	Mean (mph)	< 3 yrs	16.4	16.6	16.7	1%	2%	18
		> 3 yrs	17.2	17.0	17.2	-1%	0%	230
	85th (mph)	< 3 yrs	21.8	22.2	22.0	2%	1%	18
		> 3 yrs	22.9	22.8	22.4	0%	-2%	230
	Speeding (%)	< 3 yrs	24.5	29.5	27.2	20%	11%	17
		> 3 yrs	34.3	31.2	30.2	**-9%**	**-12%**	212
30	Mean (mph)	< 3 yrs	25.1	24.4	24.1	**-3%**	-4%	26
		> 3 yrs	24.6	24.0	24.2	**-3%**	-2%	270
	85th (mph)	< 3 yrs	32.3	31.4	29.9	**-3%**	**-7%**	26
		> 3 yrs	31.7	30.9	30.2	**-3%**	**-5%**	270
	Speeding (%)	< 3 yrs	24.1	20.9	18.1	-13%	**-25%**	24
		> 3 yrs	23.5	18.9	16.1	**-19%**	**-32%**	267
40	Mean (mph)	< 3 yrs	34.4	34.0	33.3	-1%	**-3%**	25
		> 3 yrs	33.8	32.9	32.8	-3%	**-3%**	266
	85th (mph)	< 3 yrs	41.7	41.2	39.1	-1%	**-6%**	25
		> 3 yrs	41.0	40.0	39.1	**-3%**	**-5%**	266
	Speeding (%)	< 3 yrs	21.8	19.4	11.6	**-11%**	**-47%**	24
		> 3 yrs	20.3	15.3	11.9	**-25%**	**-41%**	256
50	Mean (mph)	< 3 yrs	40.5	40.1	40.0	-1%	-1%	22
		> 3 yrs	40.2	39.4	39.0	-2%	-3%	252
	85th (mph)	< 3 yrs	49.1	48.6	47.5	-1%	-3%	22
		> 3 yrs	48.0	47.3	46.2	**-1%**	**-4%**	252
	Speeding (%)	< 3 yrs	15.2	12.7	9.4	-17%	-38%	18
		> 3 yrs	12.5	9.2	6.6	**-26%**	**-47%**	196
60	Mean (mph)	< 3 yrs	38.9	37.8	37.2	**-3%**	**-4%**	22
		> 3 yrs	37.7	37.3	37.5	**-1%**	**-1%**	256
	85th (mph)	< 3 yrs	49.0	47.8	47.5	-2%	-3%	22
		> 3 yrs	47.5	47.2	46.8	-1%	-1%	257
	Speeding (%)	< 3 yrs	3.0	3.3	2.0	9%	**-35%**	12
		> 3 yrs	2.3	1.9	1.8	-17%	-21%	167
70	Mean (mph)	< 3 yrs	63.5	62.5	61.4	-2%	-3%	24
		> 3 yrs	63.0	61.7	60.7	-2%	-4%	257
	85th (mph)	< 3 yrs	74.1	72.1	69.7	**-3%**	**-6%**	24
		> 3 yrs	72.0	70.4	68.3	**-2%**	**-5%**	257
	Speeding (%)	< 3 yrs	37.6	30.5	19.5	**-19%**	**-48%**	21
		> 3 yrs	31.7	21.4	14.0	**-33%**	**-56%**	234

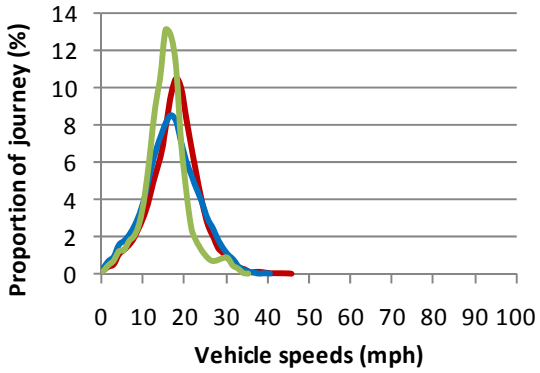
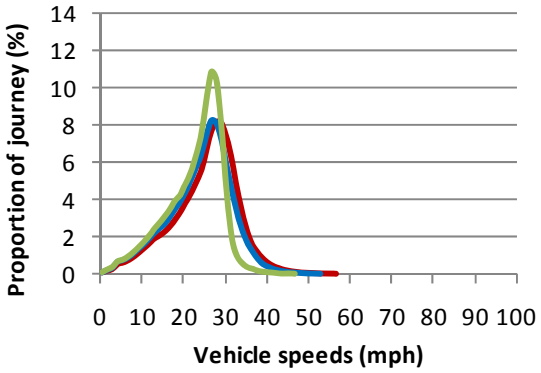
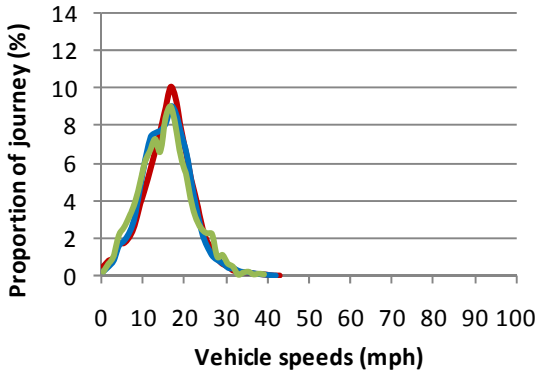
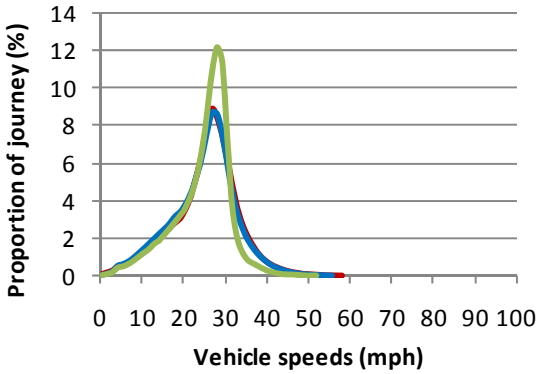
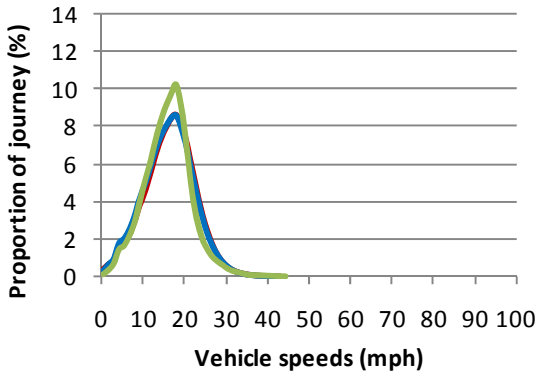
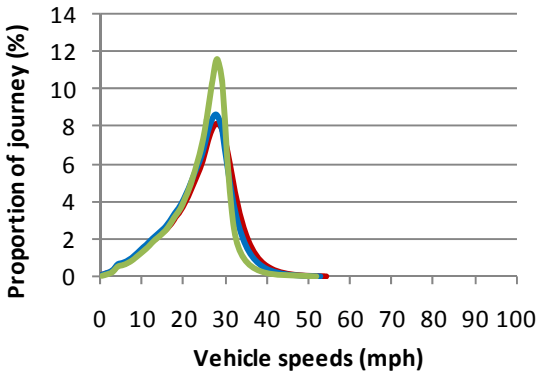
	Less than 3 years of experience	Over 3 years of experience
	No ISA / ISA available / ISA in use	
20 mph roads		
30 mph roads		
40 mph roads		

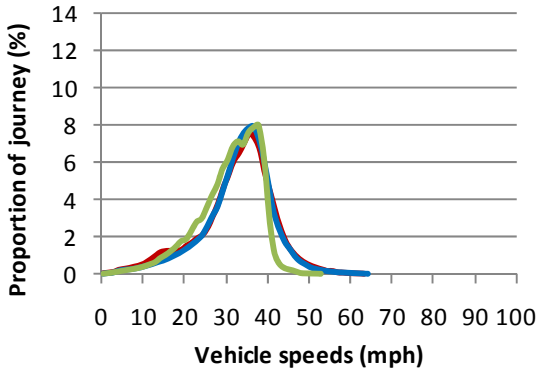
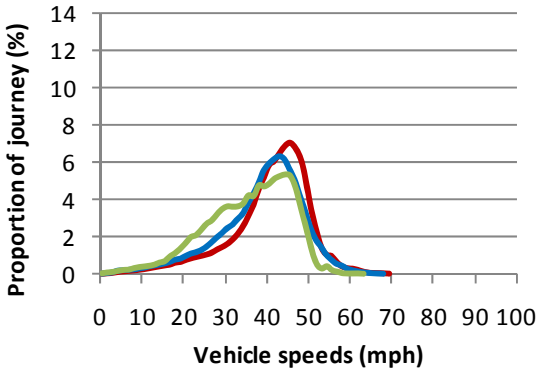
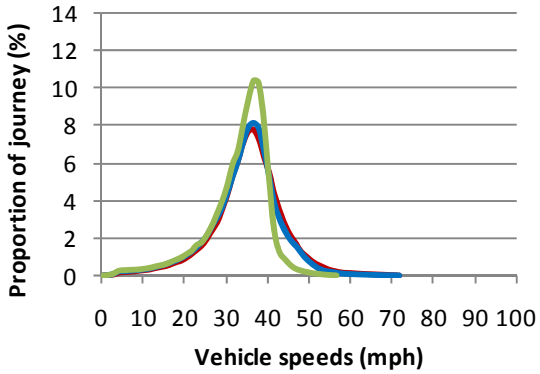
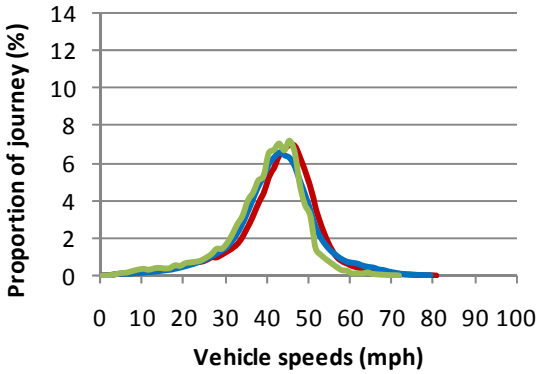
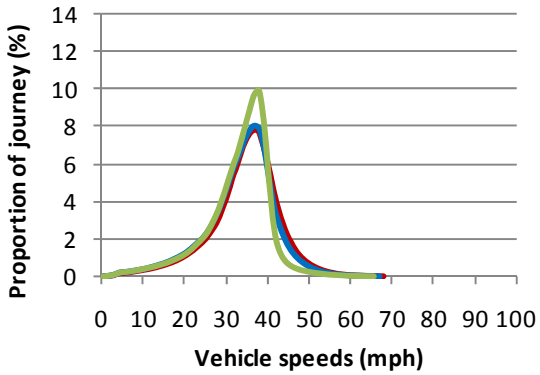
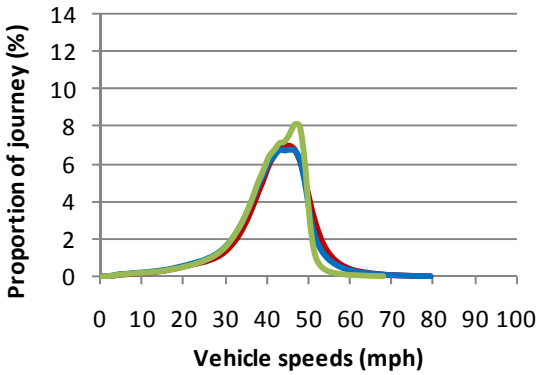
	Less than 3 years of experience	Over 3 years of experience
	No ISA / ISA available / ISA in use	
50 mph roads		
60 mph roads		
70 mph roads		

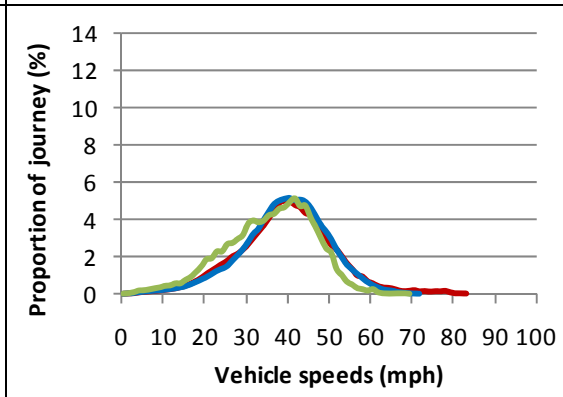
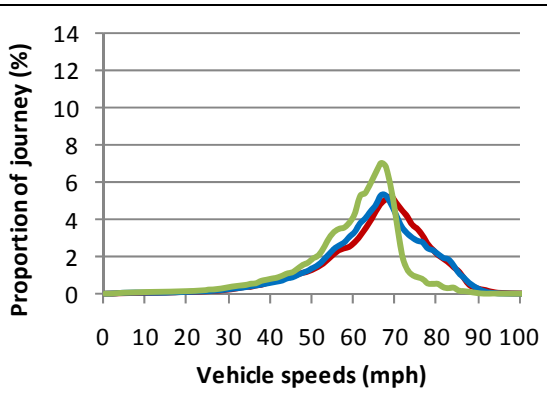
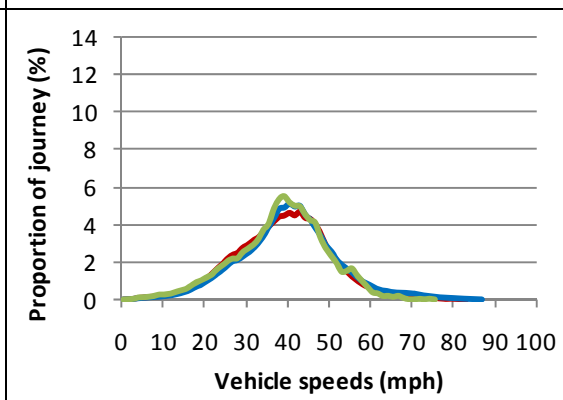
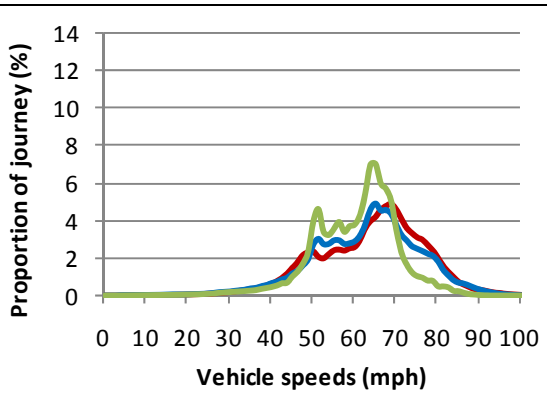
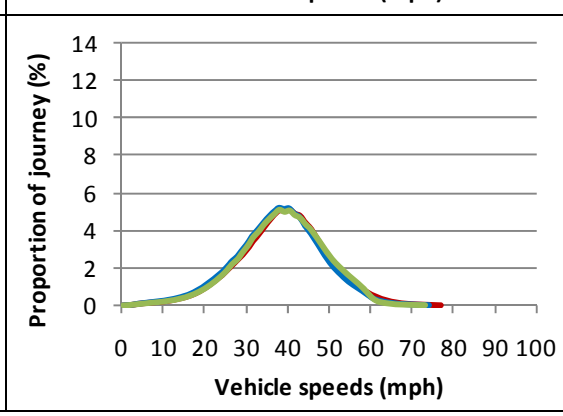
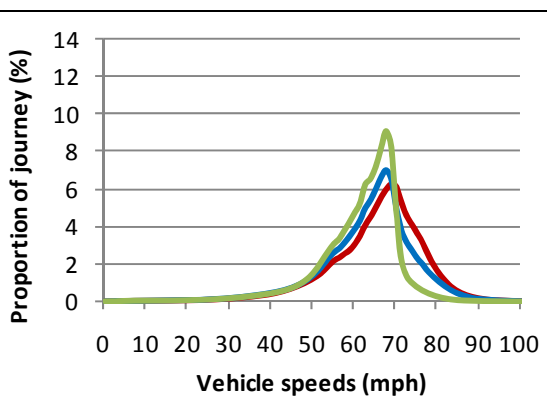
Appendix 6: Raw speed data and speed distributions for experience groups (3 bands)

Speed limit	Performance indicator	Experience (3 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
20	Mean (mph)	< 1 yr	17.1	16.2	15.8	-5%	-8%	8
		1-3 yrs	15.8	16.9	17.4	7%	10%	10
		> 3yrs	17.2	17.0	17.2	-1%	0%	230
	85th (mph)	< 1 yr	22.6	22.2	20.6	-2%	-9%	8
		1-3 yrs	21.1	22.2	23.0	6%	9%	10
		> 3yrs	22.9	22.8	22.4	0%	-2%	230
	Speeding (%)	< 1 yr	28.5	25.3	16.8	-11%	-41%	8
		1-3 yrs	21.0	33.3	36.4	58%	73%	9
		> 3yrs	34.3	31.2	30.2	**-9%**	**-12%**	212
30	Mean (mph)	< 1 yr	25.1	23.9	23.6	**-5%**	-6%	11
		1-3 yrs	25.2	24.8	24.5	-2%	-3%	15
		> 3yrs	24.6	24.0	24.2	**-3%**	**-2%**	270
	85th (mph)	< 1 yr	32.4	30.9	29.2	-4%	-10%	11
		1-3 yrs	32.3	31.8	30.5	-2%	**-6%**	15
		> 3yrs	31.7	30.9	30.2	**-3%**	**-5%**	270
	Speeding (%)	< 1 yr	22.5	17.7	17.5	-21%	-22%	10
		1-3 yrs	25.3	23.3	18.6	-8%	**-27%**	14
		> 3yrs	23.5	18.9	16.1	**-19%**	**-32%**	267
40	Mean (mph)	< 1 yr	34.1	33.9	34.1	0%	0%	11
		1-3 yrs	34.7	34.0	32.7	-2%	**-6%**	14
		> 3yrs	33.8	32.9	32.8	**-3%**	**-3%**	266
	85th (mph)	< 1 yr	41.3	40.9	39.7	-1%	-4%	11
		1-3 yrs	41.9	41.5	38.7	-1%	**-8%**	14
		> 3yrs	41.0	40.0	39.1	**-3%**	**-5%**	266
	Speeding (%)	< 1 yr	20.2	18.4	13.0	-9%	-35%	11
		1-3 yrs	23.2	20.4	10.4	-12%	**-55%**	13
		> 3yrs	20.3	15.3	11.9	**-25%**	**-41%**	256
50	Mean (mph)	< 1 yr	38.9	38.6	39.8	-1%	2%	9
		1-3 yrs	41.5	41.2	40.2	-1%	-3%	13
		> 3yrs	40.2	39.4	39.0	**-2%**	**-3%**	252
	85th (mph)	< 1 yr	47.5	46.6	47.1	-2%	-1%	9
		1-3 yrs	50.2	49.9	47.8	-1%	-5%	13
		> 3yrs	48.0	47.3	46.2	**-1%**	**-4%**	252
	Speeding (%)	< 1 yr	9.5	5.6	5.6	**-41%**	-41%	8
		1-3 yrs	19.7	18.3	12.4	-7%	-37%	10
		> 3yrs	12.5	9.2	6.6	**-26%**	**-47%**	196

Speed limit	Performance indicator	Experience (3 bands)	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
60	Mean (mph)	< 1 yr	38.7	37.5	35.9	-3%	-7%	8
		1-3 yrs	39.0	37.9	37.9	-3%	-3%	14
		> 3yrs	37.7	37.3	37.5	**-1%**	-1%	256
	85th (mph)	< 1 yr	48.9	47.2	46.7	-3%	-4%	8
		1-3 yrs	49.0	48.1	47.9	-2%	-2%	14
		> 3yrs	47.5	47.2	46.8	-1%	-1%	257
	Speeding (%)	< 1 yr	0.6	0.9	0.5	62%	-17%	5
		1-3 yrs	4.8	5.0	3.1	4%	**-36%**	7
		> 3yrs	2.3	1.9	1.8	-17%	-21%	167
70	Mean (mph)	< 1 yr	64.1	62.5	60.2	-2%	**-6%**	10
		1-3 yrs	63.2	62.5	62.3	-1%	-1%	14
		> 3yrs	63.0	61.7	60.7	**-2%**	**-4%**	257
	85th (mph)	< 1 yr	75.9	72.2	68.4	-5%	**-10%**	10
		1-3 yrs	72.8	71.9	70.7	-1%	-3%	14
		> 3yrs	72.0	70.4	68.3	**-2%**	**-5%**	257
	Speeding (%)	< 1 yr	35.4	27.5	13.8	-22%	**-61%**	9
		1-3 yrs	39.3	32.8	23.9	-17%	**-39%**	12
		> 3yrs	31.7	21.4	14.0	**-33%**	**-56%**	234

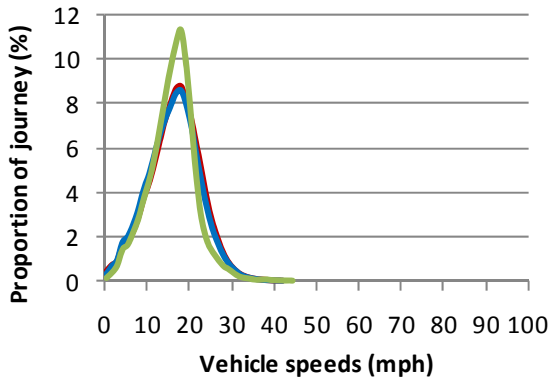
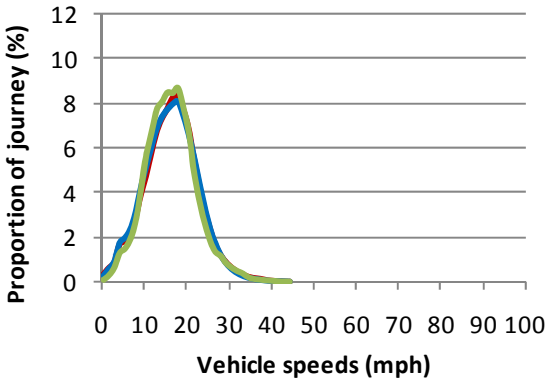
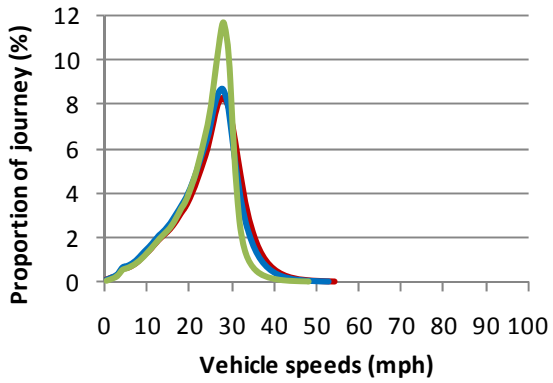
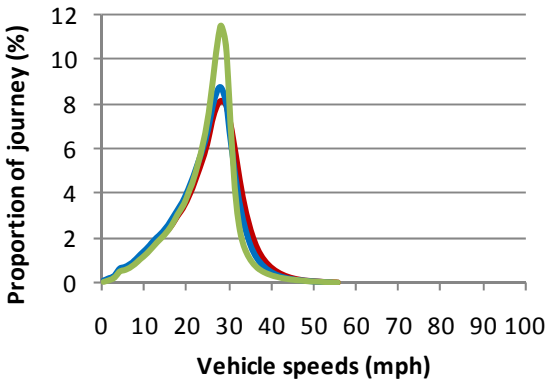
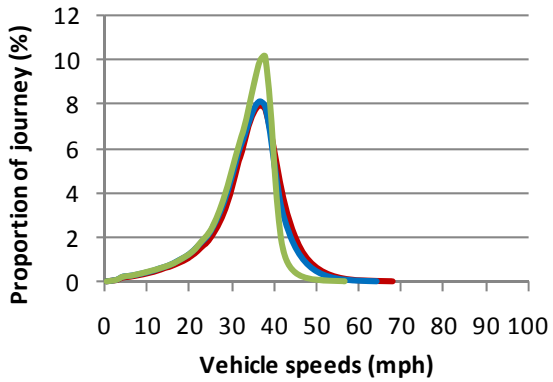
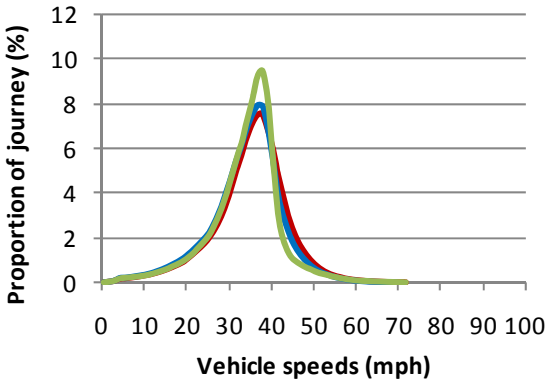
	20 mph roads	30 mph roads
	No ISA, ISA available, ISA in use	
Less than 1 year		
1-3 years		
Over 3 years		

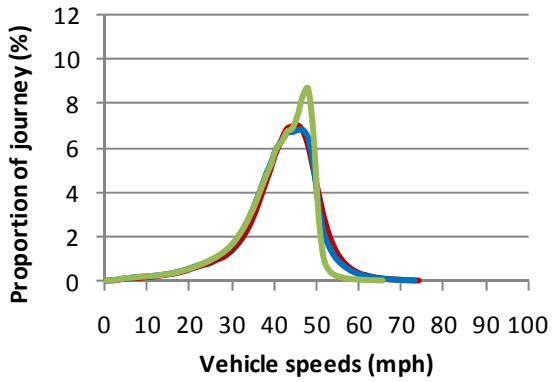
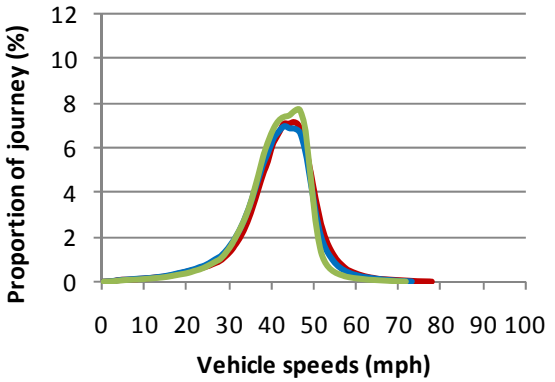
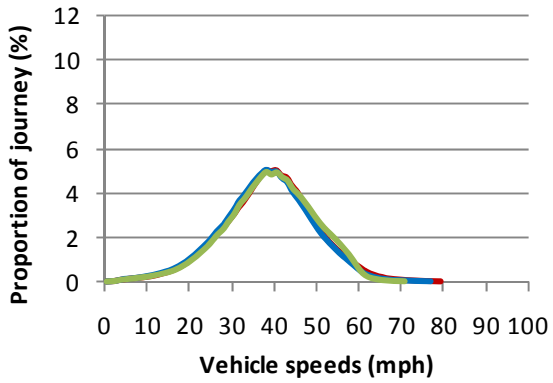
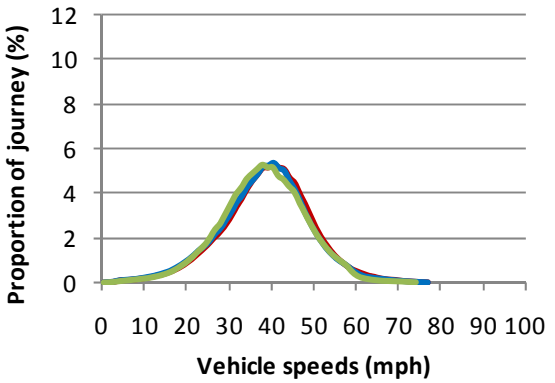
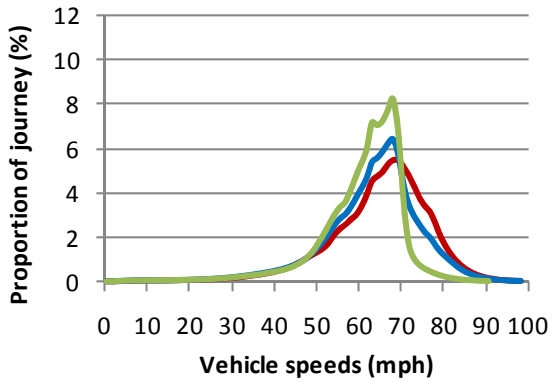
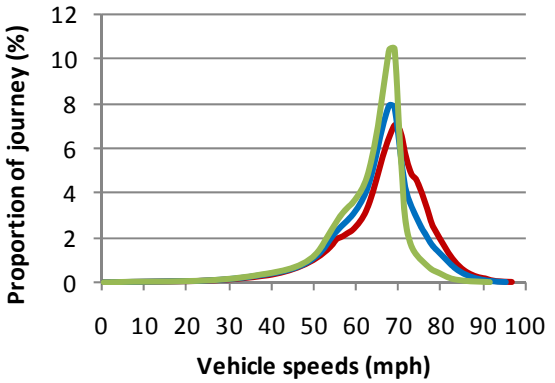
	40 mph roads	50 mph roads
	No ISA, ISA available, ISA in use	
Less than 1 year		
1-3 years		
Over 3 years		

	60 mph roads	70 mph roads
	No ISA, ISA available, ISA in use	
Less than 1 year		
1-3 years		
Over 3 years		

Appendix 7: Raw speed data and speed distributions for annual mileage groups

Speed limit	Performance indicator	Annual mileage	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
						(1) → (2)	(1) → (3)	
20	Mean (mph)	<= 10000	17.2	17.1	17.1	0%	0%	166
		> 10000	17.1	16.8	17.6	-2%	3%	63
	85th (mph)	<= 10000	22.8	22.9	22.2	0%	-3%	166
		> 10000	22.8	22.6	23.0	-1%	1%	63
	Speeding (%)	<= 10000	34.1	31.4	29.0	**-8%**	**-15%**	151
		> 10000	33.1	31.0	33.3	-6%	1%	59
30	Mean (mph)	<= 10000	24.7	24.0	24.2	**-3%**	**-2%**	199
		> 10000	24.7	24.1	24.2	**-3%**	**-2%**	77
	85th (mph)	<= 10000	31.8	30.9	30.1	**-3%**	**-5%**	199
		> 10000	31.8	31.1	30.2	**-2%**	**-5%**	77
	Speeding (%)	<= 10000	23.6	19.0	16.3	**-19%**	**-31%**	196
		> 10000	23.9	19.1	15.8	**-20%**	**-34%**	75
40	Mean (mph)	<= 10000	33.8	32.9	32.5	**-3%**	**-4%**	197
		> 10000	34.3	33.4	33.6	**-3%**	**-2%**	75
	85th (mph)	<= 10000	41.0	40.0	38.8	**-2%**	**-5%**	197
		> 10000	41.6	40.5	39.9	**-3%**	**-4%**	75
	Speeding (%)	<= 10000	20.2	15.4	10.8	**-24%**	**-47%**	187
		> 10000	22.0	16.5	14.7	**-25%**	**-33%**	73
50	Mean (mph)	<= 10000	40.3	39.4	39.0	**-2%**	**-3%**	185
		> 10000	40.7	39.9	39.2	**-2%**	**-4%**	69
	85th (mph)	<= 10000	48.2	47.4	46.3	**-2%**	**-4%**	185
		> 10000	48.4	47.5	46.3	**-2%**	**-4%**	69
	Speeding (%)	<= 10000	12.8	9.5	6.2	**-26%**	**-52%**	147
		> 10000	12.5	9.2	8.1	**-27%**	**-35%**	52
60	Mean (mph)	<= 10000	37.8	37.4	37.7	-1%	0%	188
		> 10000	37.8	37.1	36.8	**-2%**	**-3%**	71
	85th (mph)	<= 10000	47.7	47.2	47.3	-1%	-1%	188
		> 10000	47.5	47.1	45.5	-1%	**-4%**	72
	Speeding (%)	<= 10000	2.5	2.1	2.0	-20%	-22%	122
		> 10000	1.8	1.7	1.4	-7%	-24%	43
70	Mean (mph)	<= 10000	63.3	61.6	60.8	**-3%**	**-4%**	190
		> 10000	63.3	62.7	61.2	-1%	**-3%**	72
	85th (mph)	<= 10000	72.5	70.7	68.7	**-2%**	**-5%**	190
		> 10000	72.0	70.8	68.0	**-2%**	**-6%**	72
	Speeding (%)	<= 10000	31.6	21.1	13.0	**-33%**	**-59%**	179
		> 10000	33.7	24.5	17.8	**-27%**	**-47%**	60

	Annual mileage less than 10,000	Annual mileage over 10,000
	No ISA / ISA available / ISA in use	
20 mph roads		
30 mph roads		
40 mph roads		

	Annual mileage less than 10,000	Annual mileage over 10,000
	No ISA / ISA available / ISA in use	
50 mph roads		
60 mph roads		
70 mph roads		

Appendix 8: Raw speed data of the bus fleet

Speed limit	Performance indicator	Baseline (1)	ISA available (2)	ISA in use (3)	Reduction		Sample size
					(1) → (2)	(1) → (3)	
20	Mean (mph)	16.8	16.4	16.1	-3%	-4%	11
	85th (mph)	21.8	21.6	21.2	-1%	-3%	11
	Speeding (%)	29.6	28.1	27.2	-5%	-8%	10
30	Mean (mph)	23.7	23.2	22.8	-2%	-4%	12
	85th (mph)	30.1	29.4	29.0	**-2%**	-4%	12
	Speeding (%)	14.6	13.3	11.9	-9%	**-19%**	11
40	Mean (mph)	30.3	30.0	30.1	-1%	-1%	10
	85th (mph)	37.4	37.0	36.9	-1%	-1%	10
	Speeding (%)	6.7	6.6	6.2	-2%	-7%	10
50	Mean (mph)	41.0	40.9	40.8	0%	-1%	9
	85th (mph)	48.6	48.6	48.3	0%	-1%	9
	Speeding (%)	10.0	10.3	10.2	3%	2%	8
60	Mean (mph)	34.7	35.6	35.8	2%	3%	10
	85th (mph)	45.1	45.5	45.1	1%	2%	10
	Speeding (%)	—	—	—	—	—	—
70	Mean (mph)	47.9	48.2	48.1	1%	0%	10
	85th (mph)	54.0	54.0	53.6	0%	-1%	10
	Speeding (%)	—	—	—	—	—	—