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Understanding and influencing driver compliance

Final report

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Executive summary

Background

Highways England has a target to reduce by 40% the number of people killed and seriously injured on its roads by 2020.

One important contributor to road traffic collisions is driver behaviour, and in particular driver actions that are non-compliant with laws, regulations and good driving conduct. Highways England is currently developing an action plan to address compliance on the Strategic Road Network (SRN), to support reductions in KSI casualties. The work outlined in this report provides evidence and recommendations that will support this in two broad areas:

1. First the work sought to understand what types of car drivers tend to be non-compliant, with a particular focus on seven behaviours, and on users of the SRN. The seven behaviours were included as they all have links to either safety or efficiency outcomes:
 - a. Speeding
 - b. Drink-driving
 - c. Close following
 - d. Using a mobile phone while driving
 - e. Driving a vehicle that is not roadworthy
 - f. Driving while having difficulty remaining awake
 - g. Middle lane hogging
2. Second, the work sought to understand those characteristics of SRN users that predict their intentions to be non-compliant for these seven behaviours, to aid in designing and targeting interventions to increase compliance.

What we did

TRL undertook the following tasks to support the aims of the project:

1. A review of the literatures on compliance, and on interventions to address compliance
2. A segmentation analysis with over 2,000 users of the SRN (car drivers) focused on understanding levels of non-compliance and motivations for non-compliance in the seven behaviours listed above
3. An internal workshop with TRL experts working in compliance, vehicle safety, education and training, and safety innovations
4. Stakeholder interviews with 11 public and private organisations involved in road safety enforcement, policy, and research

What we found

There is existing literature on compliance, focused mainly on speeding and drink-driving, and on the effects of age and gender in determining non-compliance (with younger and male drivers tending to be over-represented in non-compliant behaviours). There is also

existing literature on interventions to address non-compliance, although most of this is focused on enforcement, which Highways England considers a measure of last resort.

Users of the SRN were asked about their intentions regarding non-compliance over the next three months. A statistical segmentation analysis suggested that for each of the behaviours under investigation people fell into one of two clusters; broadly people either state that they always or almost always intend to comply, or they state that they intend to be non-compliant (to varying degrees). The former group, those who state they always or almost always comply, represented a large part of the sample of SRN users surveyed, hence providing some evidence that compliance is effectively 'the norm' on the SRN, most of the time.

The key findings were as follows:

Psychological variables were found to be important in identifying group membership of non-compliers.

When SRN users were split into 'compliers' (people who always comply) and 'non-compliers' (people who non-comply at least sometimes) analysis revealed that it was necessary to use psychological variables measuring attitudes, motivations and traits to identify group membership accurately. Knowing only demographic information such as age and gender, and exposure information such as mileage and types of vehicle driven, did not enable accurate identification of non-compliers.

For the different behaviours, different demographic, exposure and psychological variables were necessary to identify non-compliers. This is of practical significance both in terms of identifying those users of the SRN who are likely to be non-compliant in the future (thus permitting intervention) and in terms of building tailored messages to reduce different types of non-compliant behaviour.

Stakeholders are reasonably well aligned in terms of their approaches to non-compliance, tending to accept that there is a range of motivations and that not all non-compliance is intentional.

Although different stakeholders tend to focus on different behavioural priorities, there is a common focus on 'people', and 'organisations' as two key themes in thinking about how to reach non-compliers and work with them to change behaviour. There was little suggestion that evidence-led approaches are consistently followed however, nor that evaluation is considered or embedded.

Recommendations for Highways England about targeting and tailoring messages

One assumption is that the Highways England Compliance Action Plan will be built partly on communication with road users about what is expected from them in terms of appropriate driver behaviour. This should be built in a way that continues to encourage compliant behaviour from those who are already compliant, but that can also work to develop better relationships with those who may sometimes fail to comply.

For each of the behaviours investigated here, we recommend that particular types of driver are targeted for communication-based interventions, and that these interventions focus on specific messages (see Section 5.2.1). These are outlined in the table below for each behaviour¹.

Recommended actions for Highways England – targeting and designing messages about compliance

If you want to stop people...	Focus your interventions on...	And tell them...
Speeding	<ul style="list-style-type: none"> High mileage drivers High income drivers Drivers with a careless, irresponsible, inattentive driving style Drivers who already speed 	<ul style="list-style-type: none"> That it can have dangerous consequences That the majority of drivers do not do it That 'skill' is no compensation for the extra risk That the motorway speed limits are appropriate
Drink-driving	<ul style="list-style-type: none"> Drivers who drive for work Drivers with a careless, irresponsible, inattentive driving style Drivers who are anxious Drivers who already drink-drive 	<ul style="list-style-type: none"> That it can have dangerous and other personal consequences That it is easy to avoid That avoiding it will lower anxiety
Close following	<ul style="list-style-type: none"> Drivers driving cars with larger engines Thrill-seekers Younger drivers Drivers who already close follow 	<ul style="list-style-type: none"> That it can have dangerous consequences That it is socially undesirable That drivers may not be as good as they think at responding to hazards when doing it
Using a mobile phone while driving	<ul style="list-style-type: none"> Thrill-seekers Drivers who already use a mobile phone while driving 	<ul style="list-style-type: none"> That it is easy to avoid That most drivers do not do it That skill is no compensation
Driving a vehicle they know to be unroadworthy	<ul style="list-style-type: none"> Drivers who do lots of leisure driving and commuting Drivers with a careless, irresponsible, inattentive driving style Drivers with a nervous, inexperienced and indecisive driving style Thrill-seekers 	<ul style="list-style-type: none"> That having a roadworthy vehicle reduces anxiety That skill is no compensation That roadworthiness is critical to the network
Driving while	<ul style="list-style-type: none"> Thrill-seekers 	<ul style="list-style-type: none"> That it can have dangerous

¹ Although outside of the specific focus of this report, some guidance is also provided in Appendix H based on previous work as to how information for motorcyclists might be targeted and delivered. The importance of engaging with employers (especially of van drivers) is also discussed in the main report, although again this is not the primary focus of this study.

If you want to stop people...	Focus your interventions on...	And tell them...
fatigued	<ul style="list-style-type: none"> • Drivers who live with their partner (married or not) • Drivers' partners • Drivers who already drive while fatigued 	consequences <ul style="list-style-type: none"> • That it can be avoided • That partners can help enable good sleep habits
'Hogging' the middle lane	<ul style="list-style-type: none"> • Drivers with a nervous, inexperienced and indecisive driving style • Thrill-seekers • Younger drivers • Drivers who have hogged the middle lane in the past 	<ul style="list-style-type: none"> • That skilful drivers use the nearside lane • That it is easy to avoid • That it is socially undesirable and unacceptable • That avoiding it reduces anxiety

Note that these recommendations should be seen as complementary to (rather than alternatives to) any existing good practice around intelligence led enforcement and broader road safety messages designed to remind all drivers about the importance of good driver behaviour.

The ways in which drivers are identified, and in which messages are designed to affect the best possible behaviour change outcomes, will need to be built into the forthcoming Highways England Compliance Action Plan, and supported by ongoing research and evaluation.

We also recommend that any overall approach to encouraging compliance is done in such a way as to be perceived as proportional, and 'helpful' (see Section 5.2.2). A 'graduated' response to non-compliant behaviour might be considered for example, in which those who break the rules of the road are given warnings (using the above recommendations) for early offences, and potentially corrective courses (again designed with the above recommendations in mind) before full enforcement through punishment or fines. Any such approach would need to be balanced against the effectiveness being demonstrated by existing more traditional approaches.

We also recommend that Highways England develop a greater public perception of roads policing on the SRN in general (see Section 5.2.3). Increasing the sense of certainty with which non-compliance will be detected is likely to improve compliance, even where the level of policing is unchanged.

What we recommend Highways England does next

We recommend five clear next steps for Highways England to ensure that this research informs the Highways England Compliance Action Plan and supports a reduction of KSI casualties:

First, we recommend that the findings in this report are fed into the communication of 'shared expectations' that are being developed as part of the Highways England Compliance Action Plan (and the communication plan being developed within that work). This will help ensure that strategies to communicate with the travelling public are developed and rolled out in a consistent and concise way across the entire SRN.

Second, we recommend that the research (particularly the findings about types of people who need to be targeted) is used to help identify scenarios where non-compliance

is more likely and where monitoring might be prioritised. Although not easy to monitor every possible behaviour all of the time, prioritisation would help to reinforce the message that detection of particular behaviours is likely.

Third, we recommend that existing and new technology solutions to detect non-compliant behaviours are sought so that specific messages can be targeted at those individuals who are already exhibiting the non-compliant behaviours of interest. The research highlights the importance of 'habit' in determining future intention to be non-compliant for most of the behaviours, so early intervention could focus on using already available technologies (such as cameras usually used for enforcement or CCTV) for monitoring behaviours such as middle lane hogging and close following. This will help Highways England to gain a better understanding of when and how such behaviours occur, and will serve as a tool in the development of a proportional response to non-compliance.

Fourth, we recommend that proportionate responses are developed that recognise the possibility that some non-compliance may be unintentional. The research supports the benefit of targeting habitual non-compliance, but also suggests that some motivations for non-compliance are less volitional. For example, some non-compliant behaviour may be due to a lack of knowledge and understanding of the rules of the road. These are inherently different to purposeful and 'habitual' behaviours which may be more deeply rooted in personality characteristics. The behaviours expected (and not expected) of road users on the SRN need to be clearly communicated, thus ensuring the proportionate response is transparent, legitimate and evidence led.

Fifth, we recommend that Highways England engages with a range of third parties to ensure that messaging around non-compliance is aligned with the wider road safety narrative. Involving a greater breadth of stakeholders who have a vested interest in better compliance on the Highways England Strategic Road Network will provide Highways England with greater exposure for the message within the Compliance Action Plan. Working closely with stakeholders will ensure that messages are consistent and remain in the public consciousness.

This approach will position Highways England to deliver evidence-led approaches to improve customer compliance and reduce the number of people killed and seriously injured on the SRN.

1 Background

The UK's road network is one of the safest in the world. However, in 2014 alone, 1,853 people were killed or seriously injured (KSI) while using the strategic road network (SRN); an increase of 8.4% compared with 2013 (Office of Rail and Road, 2015). Although these figures are part of an overall trend showing a reduction of KSIs (compared to the 2005-09 baseline) – which is compatible with Highways England's 40% casualty reduction target by 2020 – it is clear that much work still needs to be done.

Although identifying risk factors for collisions is often challenging, driver behaviour is clearly important (Evans, 2004; Sabey & Taylor, 1980). This is evidenced by a range of non-compliant behaviours (i.e. driver actions that are non-compliant with laws, regulations and good driving conduct) that are linked with collision risk, such as speeding, drink-driving and distraction.

In the UK, speed was identified as a causal factor in 13% of KSI incidents on the SRN in 2013 (Highways England, 2015). This is supported by previous research showing that crash rate (and the severity of crash outcomes) increases as a function of speed (Aarts & van Schagen, 2006). Moreover, work suggests that even small changes in speed have an impact on collisions (Elvik, Christensen & Amundsen, 2004, as cited in Smith, Lawton, Beard, Durrell, Scoons & Lloyd, 2015). Other non-compliant behaviours, such as drink-driving, also increase crash risk by affecting the cognitive and/or physical functions important to safe driving. Drink-driving is another behaviour associated with road casualties in GB. Data from Reported Road Casualties in GB 2014 show that an estimated 14% of all deaths in reported road traffic collisions (RTCs) involved at least one driver over the drink drive limit (DfT, 2014). In addition, the risk of injury and collision is known to increase with increased alcohol consumption (Killoran et al., 2010, as cited in Smith et al., 2015). Other behaviours, such as distracted driving (e.g. mobile phone use), are more difficult to record as a direct cause for collisions but the safety implications of such behaviours are well documented, particularly for younger drivers (e.g. Basacik, Reed & Robbins, 2011; Klauer, Guo, Simons-Morton, Ouimet, Lee & Dingus, 2014; TRL, TNO, RappTrans, 2015).

The reasons for engaging in non-compliant behaviour are varied and complex. While some SRN users may choose to purposefully engage in non-compliant and/or dangerous behaviours, others may do so accidentally (either as a result of attentional lapses or a lack of understanding). For both purposeful and accidental non-compliance, various individual differences and motivations will underpin the driver's undesirable behaviour. It is also possible that drivers inaccurately appraise their own ability and/or the level of risk present in the road environment. Poor calibration between perceived ability and real-world risk (or demand) will result in a smaller safety margin for the driver. Current methods for tackling non-compliance tend to offer 'blanket' solutions for all non-compliers without considering the inherent differences between individuals and between specific behaviours, and the motivations people may have for non-compliance. It is vital to ensure that the strategies used to discourage non-compliance are targeted and effective, as well as proportional. This can only be achieved through the development of a strong evidence-base.

The present work was commissioned by Highways England as part of their five-year Road User Compliance Action Plan (specifically this relates to Action 81). The objectives of the work are to identify users of the strategic SRN who are more likely to be non-

compliant, and to identify which non-compliant behaviours should be addressed (Highways England, 2015). By understanding customers' underlying motivations to engage in non-compliant behaviour when using the SRN, Highways England can continue to build an effective strategy for behaviour change to support a reduction in KSI casualties on the SRN. In addition, further knowledge in this area can help Highways England to work together with their customers to address unintentional errors and gaps in knowledge without resorting to penalties.

This report summarises all of the work undertaken as part of this project.

1.1 Research aims

The aims of the present work were:

1. To understand why drivers (with a focus on users of the SRN) engage in various non-compliant behaviours.
2. To understand those methods that have been used to reduce non-compliance, and what the evidence is for their effectiveness.
3. To advise Highways England on actions to address non-compliance on the SRN, taking these findings and the broader road safety context into account.

1.2 Method overview

In order to achieve the project aims, five subtasks were undertaken (Figure 1).

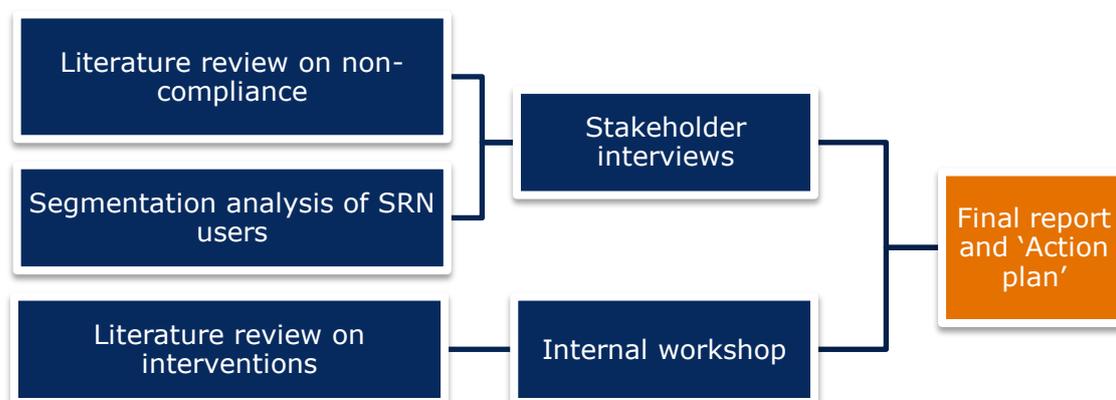


Figure 1: Project tasks

The two literature reviews covered the first two aims. The segmentation analysis focused on SRN users with respect to the first aim. Stakeholder interviews and an internal workshop at TRL sought to clarify the best approaches within the wider road safety context. This report provides Highways England with a summary of all of the research activities and concludes with actions to improve compliance on the SRN.

1.3 Report structure

Section 2 discusses the reasons why drivers fail to comply with the rules of the road. This is based on findings from the literature review and the segmentation analysis of current SRN users.

Section 3 highlights what is known about interventions designed to curtail non-compliant behaviour in motorists. Again this was done through a literature review and by exploring current knowledge on interventions that have been developed at the UK and EU-level.

Section 4 considers non-compliant behaviours and the existing road safety context in GB and how it relates to the messages that Highways England endeavours to deliver within its road safety agenda. This was assessed by engaging with leading organisations in the road safety arena through qualitative interviews.

Section 5 summarises the findings and makes recommendations about what Highways England might do next to improve compliance.

Section 6 then considers how the findings from the present work fit in with Highways England Compliance Action Plan and safety priorities.

1.4 Selecting the behaviours of interest

Seven specific driver behaviours were selected for this research:

- Speeding
- Drink-driving
- Close following
- Using a mobile phone while driving
- Driving a vehicle that is not roadworthy
- Driving while having difficulty remaining awake
- Middle lane hogging

Existing evidence suggests that there are specific behaviours which have been directly linked to crashes and crash severity. Speeding, drink-driving and using a mobile phone while driving are three behaviours that authorities often target when seeking to improve road safety. Along with seat-belt wearing these behaviours are collectively known as the 'Fatal four' and have been important in setting road policing strategies within the UK (Smith et al., 2015). Speeding and drink-driving have been widely researched in the compliance literature (see Sections 2.1 and 3.1), and have clear and uncontroversial links with safety outcomes (for reviews see Aarts & Van Schagen, 2006; Evans, 2004). A recent report by TRL, TNO and Rapp Trans (2015) estimates that between 10 and 30% of road collisions in the EU are due to distraction of some kind. Given the relationship with safety outcomes, it was considered important that speeding, drink-driving and mobile phone use while driving were included in the present study.

Close following or 'tailgating' is another behaviour with an evidential association with crash outcomes (Evans & Wasielewski, 1983; McKenna, 2007a); it can also cause frustration, anxiety and/or anger in other motorists (Diels, Reed & Weaver, 2009). Therefore it was included in the list of behaviours.

Another important behaviour in relation to crash risk is fatigue. Fatigue can be caused by a combination of factors but is usually a result of the psychological and physiological need to sleep. Research has found that fatigue can have severe effects on driving performance by increasing the risk of micro-sleeps (which in turn can reduce the time spent looking at the road), increasing the variability of lateral positioning, increasing reaction time and reducing a driver's attention (e.g. Anund, Keclun, Kircher, Tapani & Akerste, 2009; Grigo & Baldock, 2011). This is particularly risky for people who drive as part of their work, whether as a professional or business driver (see Grayson & Helman, 2011 for a review). For these reasons, fatigue was also included as one of the seven key behaviours of interest.

Discussions with Highways England established that there were two other behaviours of interest. The first of these is 'middle lane hogging'. Although there is no established direct link between middle lane hogging and crashes, it is undesirable and thought to cause frustration in other motorists. There is some evidence to support an increased risk of violations and crashes for drivers who are angry and/ or anxious (Underwood, Chapman, Wright and Crundall, 1999; Mesken, Hagenzieker, Rothengatter & de Waard, 2007).

The final behaviour of interest was vehicle roadworthiness (potentially covering a range of issues such as tyre safety, fuel, and maintenance). Vehicle defects are rarely primary crash causation factors (Sabey & Taylor, 1980), however, breakdowns on the network caused by un-roadworthy vehicles can cause delays and congestion, and put road workers (e.g. recovery drivers) in danger. Further, ensuring vehicles are roadworthy is a task that can be easily relayed to individual drivers or organisations who, if provided with the correct guidance, can help minimise delays and risk to themselves and others by driving properly maintained vehicles. By identifying the characteristics of those who are likely to drive unroadworthy vehicles, Highways England can ensure that the guidance is reaching the groups of SRN users that need the information the most.

2 Motivations behind non-compliant behaviour

2.1 What the existing research evidence says about driver compliance

2.1.1 Method

To ensure the review was based on the highest quality evidence available, a systematic approach was taken. This comprised five stages:

1. Creation of search terms
2. Undertaking search of literature
3. Deciding which studies were relevant (based on reading abstracts)
4. Deciding which of these studies were of sufficient quality (based on full-text review)
5. Reporting the findings

The aims of the review were to gain a better understanding of why some drivers fail to comply with the rules of the road, and to use this evidence to feed into the development of the questionnaire employed for the segmentation analysis (see Section 2.2.1.1).

The scope of this review (and the review described in Section 3.1) was to deliver a sense of the current state of knowledge rather than an exhaustive description of all available evidence in the field.

Appendix A describes this process in more detail. The literature review is presented in full in Appendix B; the key findings from this review are presented in the following section.

2.1.2 Key findings

Driver behaviour, and particularly the processes that determine whether or not a driver will comply with formal rules of the road on any given occasion, is complex. In short, internal and external motivations combine at a given time and place to produce a behavioural outcome.

Evidence exploring gender, age and exposure differences have provided evidence that younger, male drivers are at higher risk of intending to commit or committing violations (e.g. Stradling, Gormley, Fuller, Broughton, Kinnear, O'Dolan & Hannigan, 2007; Pöysti, Rajalin & Summala, 2005; Politis, Basbas & Papaioannou, 2013). Other factors, such as biases in risk perception have also been shown to be important (e.g. Xu, Li & Jiang, 2014; Tapp, Nancarrow & Davis, 2015). One important concept is that the driving environment is a highly social one, and contains a set of 'unwritten' rules as well as formal laws. The tacit agreement between drivers about what is 'acceptable' (i.e. their social norm) may be a major component in why drivers sometimes fail to comply with road law.

Drivers do not always break road laws or rules because of their own individual characteristics. Situational factors can also create affective states (such as anger or enjoyment) which in combination with external motivations, such as time pressure or an empty road, can increase the likelihood of drivers not complying. This is particularly the

case for behaviours such as speeding and using a mobile phone. Time pressure can also be related to journey purpose and a driver's occupation. Professional drivers (or those who drive for work) are a large population on the SRN whose annual mileage exceeds that of commuting and leisure drivers. With pressure on employees to be productive, organisations with fleets may be an important target group in terms of improving overall compliance on the SRN.

Behavioural theory, such as the Theory of Planned Behaviour (TPB) (see Figure 5, in Appendix B), is important for understanding and contextualising non-compliant behaviour. For example, studies have shown that drivers' attitudes towards a given behaviour, the perceived social norm (i.e. what other people do) and the control drivers perceive that they have over the behaviour can explain (in most circumstances) much of the non-compliant intentions relating to speeding, drink-driving and mobile phone use (e.g. Marcil, Bergeron & Audet, 2001; Letirand & Delhomme, 2005).

Regarding the specific characteristics of those who do not comply with the rules of the road, the literature is dominated by studies of age and gender effects, typically within a TPB framework. This literature suggests that in general, young males are more likely to not comply than their older, and/or female counterparts.

In the next section we summarise the findings of a segmentation analysis, which sets out to build on the literature review results by providing a more detailed understanding of those people who may be more likely to engage in specific unsafe behaviours when using the SRN.

2.2 What are users of the SRN like, in terms of their intention to comply?

A segmentation analysis was undertaken with approximately 2,000 users of the SRN to identify the characteristics that are associated with intention to comply with the seven behaviours of interest (see Section 1.4).

2.2.1 Method

2.2.1.1 Questionnaire development

An online questionnaire was used to collect data on a range of characteristics from users of the SRN. The following were the measures of interest:

- Theory of planned behaviour items – measuring attitudes, social norm and perceived behavioural control
- Habitual on road behaviour – measuring how frequently respondents had engaged in the behaviours of interest in the last three months
- Driver Stress Inventory – measuring driver stress, but including measures of trait anxiety of driving, anger, thrill-seeking and hazard monitoring
- 'Guppy' scales – measuring driving style
- Ten-Item Personality Inventory (TIPI) – measuring personality traits
- Risk perception of seven behaviours of interest – measuring attitudes toward risk
- Attitudes toward major roads in GB – measuring attitudes/ perception toward the SRN

- Demographic variables – capturing data on age, gender, income, etc.
- Exposure data – assessing previous collisions and annual mileage
- Driving experience – assessing year of licensure and driving qualifications
- Behavioural intentions – measuring respondents' intentions to engage in the behaviours of interest. This was the outcome variable of interest.

More details about the measures included in the questionnaire can be found in Appendix C.

2.2.2 Recruitment and sample characteristics

Two screening questions were used to ensure that all participants had some experience of the SRN. Potential respondents to the online questionnaire were asked:

1. Do you currently hold a valid full driving licence that allows you to drive on GB roads unaccompanied?
2. In the last three months, how often have you driven a CAR on a 'major' road (A-road, Dual-carriageway, Motorway etc.) in GB?²

People answering 'no' to the first question, or 'not at all' to the second, were excluded from participation.

A breakdown of the final sample by year of birth range and gender is shown in Table 1.

Table 1: Age and gender breakdown of sample

Year of birth	Approximate age range	Male	Female	Total
1925-1934	81-90	5	1	6
1935-1944	71-80	67	25	92
1945-1954	61-70	205	126	331
1955-1964	51-60	193	156	349
1965-1974	41-50	225	189	414
1975-1984	31-40	228	211	439
1985-1994	21-30	134	220	354
1995-1997	17-20	17	35	52
Total		1,074	963	2,037

The final sample was 52.7% male, 47.3% female and had a good range of ages.

2.2.2.1 Analysis design

In short, the analysis sought to do two things:

² The research focused on car drivers. Later questions did ask about use of other vehicles. Note that the second question did not mention 'the strategic road network' as this is not a concept that was thought to be sufficiently familiar to the general public.

1. Understand how people differ in their intention to not comply with the seven behaviours of interest.
2. Understand those variables that predict whether someone scores high or low on intention to not comply.

In order to undertake the analysis, first there were some checks run on the data to ensure that they were clean (i.e. minimise issues with missing data and outliers), and that the scales used were internally consistent. All scales were subject to principle components factor analysis. This analysis checks the items in each scale to see if any of them appear to measure the same underlying factor³. The factors that were identified were assessed for acceptable levels of internal consistency using the Cronbach's Alpha test.

A 'K means cluster analysis' was then used to determine the natural number of groups within the data on the main outcome measure for each of the seven behaviours. The actual outcome measure for each of the seven behaviours was the level of agreement (from 0=Never to 5=Nearly all the time) with the statement "In the next three months, how often do you intend to..." followed by the behaviour of interest as below:

1. ...exceed the posted speed limit on major roads?
2. ...drive on major roads even though you realise you may be over the legal blood-alcohol limit?
3. ...drive close enough to the vehicle in front that you are less than one second behind it at the speed you are travelling on major roads?
4. ...use a hand-held mobile device to make or receive a phone call or text, or for any other non-driving related task on major roads?
5. ...drive on major roads while knowing that your vehicle is not roadworthy?
6. ...drive on major roads while having to make some effort to stay awake?
7. ...drive in the middle lane of a motorway even though there is no vehicle in the left hand lane in your immediate vicinity?

Based on the data types collected from the questionnaire and the number of clusters on the outcome measures ('complier/non-complier' – see Section 2.2.3.1) logistic regression analysis was deemed to be the most suitable method to identify those variables and factors that best predicted group membership⁴.

A total of 14 logistic regression analyses were run (two for each of the seven behaviours). The first logistic regression analysis for each of the behaviours was run only using demographic variables and driving exposure data. This was done to verify findings from the literature review and to establish a group of predictors that would be easily

³ In short, a group of items measure the same thing if people who score high (or low) on one item also tend to score high (or low) on the others. Rather than include all such items in an analysis separately, they can be grouped together as a single factor.

⁴ This analysis was run using a stepwise method. This is where significant predictors are entered into the model in order of significance until the model is not improved by adding more predictors. The predictors discussed in this report are the ones identified through this process.

identifiable by Highways England in future attempts to tailor interventions for those users (for example, 'young males who drive for work'). The second analysis for each of the behaviours used all relevant variables. The aim of these analyses was to obtain a more detailed profile of non-compliers beyond what can be found using demographics variables (for example their attitudes towards the behaviours of interest, or their motivations for non-compliance); it was the intention that such findings would be used to inform the content and design of interventions to improve compliance, as well as to permit identification of non-compliers.

2.2.3 Results⁵

2.2.3.1 Cluster analysis results

The cluster analysis identified two clusters for each of the seven behaviours. One group was labelled 'general compliers' and the other 'general non-compliers'⁶. General non-compliers were likely to intend to be non-compliant to some degree and to have been non-compliant in the past. They also tended to report thinking that non-compliance is neither wrong nor dangerous. On the other hand, the general compliers intended to comply either always (the vast majority of the group) or most of the time and reported having been compliant in the past and that non-compliance is wrong and dangerous.

2.2.3.2 Groups defined for further analysis

To ensure a clear definition between the groups used in further analysis, the sample was divided into compliers and non-compliers, based on their intentions to comply with each of the behaviours of interest, using an arbitrary cut off. Non-compliers were those respondents who stated that they intended to not comply at least some of the time in the next three months. Compliers were people who stated they would always comply. Group membership, on this basis, was used as the outcome measure for the regression analysis.

2.2.3.3 Demographics only logistic regression results

The logistic regression analysis that used only demographic and exposure data to predict group membership produced a statistically significant model for each of the seven behaviours (speeding, drink-driving, close following, using a mobile phone, driving a non-roadworthy vehicle, driving fatigued, and middle lane hogging). However the accuracy with which non-compliers could be identified was not high. For speeding, the model could identify 78.2% of non-compliers, but for all other behaviours only 32-40% of non-compliers were correctly identified.

This suggests that in this dataset simply knowing a driver's demographic information and exposure data (such as amount of driving, type of driving) is not sufficient to predict

⁵ The results here are a summary of the main findings. Full technical details of the analysis and models used are available in a separate technical appendix from the report authors.

⁶ Note that these terms are used as labels of group membership on the basis of self-reported intentions. They should not be taken as meaning that participants in each group are definitely compliant or non-compliant in their actual on-road behaviour.

with much accuracy whether or not the person will comply. Therefore the models based only on demographic and exposure variables will not be discussed in more detail here.

2.2.3.4 Psychological logistic regression results

Using psychological variables as well as demographics and exposure variables also produced significant models of predictors for each of the outcome behaviours of interest. These models were much better than the demographics and exposure models in terms of prediction accuracy for both compliers and non-compliers, with very high percentages of compliers and non-compliers assigned to the correct groups. The predictive accuracy of each model is shown in Table 2.

Table 2: Predictive accuracy of the psychological models

	Speeding	Drink-driving	Close following	Mobile phone	Vehicle roadworthiness	Fatigue	Middle lane hogging
Compliers	73.1%	97.9%	82.1%	96.7%	98.3%	95.1%	88.3%
Non-compliers	82.4%	92.6%	91.1%	88.0%	90.5%	84.1%	80.6%

Across all behaviours, the findings imply that the psychological variables are important for predicting the intention to not comply.

There were very few common predictors (i.e. those variables that predict group membership in nearly all behaviours).

The thrill-seeking factor from the DSI was a significant predictor in all models. An increase in this factor score was associated with an increase in the likelihood of being in the non-complier group. The average thrill-seeking scores for the compliers was between -0.28 and -0.45 whereas the average for the non-compliers was between 0.34 and 1.0 for each of the seven models (a positive score indicating greater thrill-seeking tendencies).

How safe or dangerous the non-compliant behaviour was perceived to be was also a common predictor, significantly predicting five of the seven non-compliant behaviours. People who thought that the non-compliant behaviours speeding, drink-driving, close following, fatigued driving, and middle lane hogging were safer were more likely to intend to do these things in the future than those who thought they were less safe.

How often the non-compliant behaviour had been performed in the past three months was a predictor in six of the models. People who reported they had gone over the speed limit, driven over the alcohol limit, close followed, driven a vehicle that was not roadworthy, driven whilst fatigued, and middle lane hogged in the last three months were more likely to intend to do it again than people who had not done these things.

Overall, it was found that the following variables predict being in the non-complier group for each of the seven behaviours of interest:

Speed non-compliers

- Have higher thrill-seeking scores
- Have higher anxiety of driving scores
- Have a more irresponsible, careless, risky, and inattentive driving style
- Have higher levels of belief that skill can compensate for the added risks of speeding
- Think that speeding is safer
- Have gone over the speed limit more regularly in the past three months
- Have a higher level of agreement that motorway speed limits are too slow
- Have a higher income
- Have higher leisure/commuting miles

Drink-driving non-compliers

- Drive for work
- Have a more nervous, inexperienced, and indecisive driving style
- Have higher anxiety of driving scores
- Have higher anger scores
- Think that it is harder to avoid drink-driving
- Think that drink-driving is safer
- Have driven over the alcohol limit more regularly in the past three months

Close following non-compliers

- Have a larger engine
- Are younger
- Have higher thrill-seeking scores
- Have lower hazard monitoring scores
- Have lower levels of belief that close following is unsafe and should be punished more harshly
- Think that close following is safer
- Have close followed more regularly in the past three months

Mobile phone non-compliers

- Have higher thrill-seeking scores
- Have a level of belief that skill and knowledge can compensate for the risks of using a mobile when driving
- Think it is harder to avoid using a mobile phone when driving
- Think that others use a mobile when driving more regularly
- Have used a mobile phone when driving more regularly in the past three months

Vehicle roadworthiness non-compliers

- Do not drive for leisure or commuting purposes
- Have higher thrill-seeking scores
- Have higher anxiety of driving scores
- Have lower hazard monitoring scores
- Have a more irresponsible, careless, risky, and inattentive driving style
- Have a more nervous, inexperienced, and indecisive driving style
- Have level of belief that skill and knowledge can compensate for the risks of driving a vehicle that is not roadworthy
- Have driven a non-roadworthy vehicle more regularly in the past three months
- Have a higher level of enjoyment of driving on single carriage A roads
- Are male

Fatigued driving non-compliers

- Have higher thrill-seeking scores
- Have lower hazard monitoring scores
- Think it is harder to avoid driving fatigued
- Think that driving fatigued is safer
- Have driven when having to make an effort to stay awake more regularly in the past three months
- Live with a partner, live alone, live with parents, or recorded their marital status as 'other'

Middle lane hogging non-compliers

- Have higher thrill-seeking scores
- Have higher anxiety of driving scores
- Have lower hazard monitoring scores
- Have a more nervous, inexperienced, and indecisive driving style
- Have a higher level of belief that skill can compensate for the added risks of middle lane hogging
- Think it is harder to avoid middle lane hogging
- Think that middle lane hogging is safer
- Have hogged the middle lane more regularly in the past three months
- Are younger

2.3 Summary

From the cluster analysis two groups emerged; general compliers and general non-compliers. The vast majority of the complier group stated that they would always comply, so this cut-off was used to define group membership in the further analysis.

The inclusion of psychological variables (as well as demographic and exposure variables) in the models was necessary to permit accurate identification of group membership.

Different variables are used to identify group membership (i.e. 'complier' or 'non-complier') for the seven behaviours. This has practical importance in two ways:

1. Identifying people (non-compliers) for targeted proactive intervention will need to consider different factors depending on the behaviour
2. The content of interventions (e.g. messages) will need to focus on different factors depending on the behaviour

The practical actions that Highways England might take for reducing non-compliance (and promoting compliance) with the seven behaviours under investigation are discussed in Sections 5 and 6.

3 Interventions to reduce non-compliance

3.1 What the existing literature says about interventions to improve compliance or reduce non-compliance

3.1.1 Method

The process followed to undertake the literature review, and the scope, were the same as that in Section 2.1.1. Appendix A contains additional details about the method followed.

The aim of this literature review was to investigate current use of interventions to reduce non-compliant behaviour. The complete review is in Appendix D.

3.1.2 Key findings

Much of the literature has focused on speed, and on enforcement. Overall the literature suggests that enforcement is important in increasing levels of compliance with road laws. Research has shown that the presence of speed cameras, particularly average speed cameras, leads to an increase in compliance with speed limits as well a decrease in the severity of non-compliance to speed limits (Montella, Punzo, Chiaradonna, Mauriello & Montanino, 2015; Vadeby & Forsman, 2014). There is also evidence that the effect of speed cameras (particularly mobile speed cameras) may be more pronounced when drivers are aware that such enforcement is taking place (Wilmots, Hermans, Brijs & Wets, 2013).

Enforcement is often regarded as 'a last resort'. It is therefore important to understand what other methods have been used to address non-compliant road user behaviour.

A number of studies have investigated the impact on more structural changes, such as modifying road designs (Martens, Comte & Kaptein, 1997). An extensive review of the literature has suggested that modifying the design of the road can be effective in reducing non-compliance, particularly with respect to speeding offences.

While overall educational programs have not traditionally been particularly effective in reducing non-compliant behaviour (Vernick, Ogaitis, MacKenzie, Baker & Gielen, 1999), there is some promise that the development of new approaches such as e-learning courses could be effective (Af Wählberg, 2011). Similarly it would seem that using techniques such as cognitive behavioural therapy as part of the method of delivery of educational programs could increase the effectiveness of such interventions. One such intervention aimed to increase future drivers' (i.e. learner drivers') perceived behavioural control by providing them with a self-monitoring and self-regulation exercise, teaching them how to recognise and respond to impulsive tendencies (Paaver, Eensoo, Kassik, Vaht, Mäestu & Harro, 2013). The study found that those in the control group (i.e. those that did not receive the intervention) had a greater amount of speeding violations and passive crashes. By increasing their perceived behavioural control, the intervention was targeting one of the main factors in the theory of planned behaviour (Ajzen, 1991) and a factor that has been consistently found to be a significant predictor of behaviour change (Elliott & Armitage, 2006).

Interventions that aim to change the social perception of a particular driving offence have also been found to be effective in reducing non-compliance (Van Houten, Malenfant, Blomberg, Huitema, & Casella, 2013). Interventions aimed at targeting social

norms with the aim of making a specific behaviour socially unacceptable (and perceived as rare – see Cialdini, 2003) are important to consider when devising future interventions.

Deterrence theory is based on the principle that increasing the perceived certainty and immediacy of being caught performing a specific behaviour, and the severity of the outcome, will lead to a positive change in behaviour. The certainty of detection is especially important (Nagin & Pogarsky, 2001; cited in McKenna, 2007b); this can explain positive findings from studies that involve increasing the presence of police enforcement on the roads. These studies report significant increases in compliance if drivers perceive an increase in police enforcement and in turn the certainty of punishment for breaking the rules of the road (Smith et al., 2015). Most importantly this has been found to be the case for a number of different behaviours including speeding, drink-driving, pedestrian right of way and overall levels of non-compliance (Goodwin, Wells, Foss & Williams, 2006; Smith et al., 2015).

Similarly, a more recent form of intervention involving the use of financial incentives to encourage drivers to behave in a more compliant way has been found to be particularly effective (Stigson, Hagberg, Kullgren & Krafft, 2014). Interestingly the study revealed that simply providing drivers with a financial incentive that was not dependent on their behaviour did not lead to the same effect, stressing that in order to be effective these types of incentives have to be dependent on maintaining compliant behaviours. Furthermore, it would seem that providing drivers with timely feedback regarding their driving behaviour is also an efficient way of increasing their compliance. For example, providing drivers with visual and auditory feedback when they are exceeding the speed limit has been found to be effective. This can be attributed to the increase in perceived behavioural control provided by such a personalised and timely feedback (Newman, Lewis & Warmerdam, 2014; Stigson et al., 2014). However, it is also important to consider that the effectiveness of these interventions did decrease once the feedback was no longer provided.

3.2 Which intervention types should be prioritised?

3.2.1 Method

TRL held a half day workshop with experts from across the business who specialise in compliance issues, vehicle safety, education and training, and safety innovation. The purpose of the workshop was to discuss plausible interventions to improve levels of compliance on the SRN, particularly in relation to the seven behaviours of interest, and taking into account the findings from the literature reviews and segmentation analysis.

3.2.2 Findings

Although no 'off the shelf' interventions were discussed, this is likely to do with the fact that very few existing interventions (other than standard approaches such as speed cameras) have proven effectiveness in reducing non-compliance.

Figure 2 provides a summary of the key findings from the prioritisation workshop.

Clear and targeted messaging

- Use knowledge of customer characteristics and how these may influence non-compliance to develop effective messages.

Increase 'awareness' of roads policing

- Use messaging and campaigns to increase perception of roads policing and likelihood of being caught.

Proportionality

- Develop responses that are proportional to the type of offence, the offender and the conditions surrounding the offence.
- Create a distinction between intentional non-compliance and accidental/erroneous non-compliance.

Engaging with fleets

- Increase compliance in these sectors (by engaging with the insurance industry and by lobbying changes to vehicle regulations).

Consideration of changes to vehicle standards

- Highways England could play a role in lobbying current in-vehicle technologies at an EU level.

Figure 2: Proposed methods/ techniques to increase compliance

Appropriate and targeted communication, particularly in relation to safety messages, was highlighted as an important area of consideration. Communications should consider the differences between the types of non-complier and the types of non-compliant behaviours; 'blanket' responses may not be effective for all drivers and all offences.

Fleets were identified as a potential market for safety improvements. Estimates from the Health and Safety Executive (HSE) suggest that more than a quarter of all road traffic accidents involve somebody who is driving for work at the time (HSE, 2014). Similarly, the latest national travel survey showed that company cars had an annual mileage more than double that of private cars (DfT, 2015). Driving for work is known to be a particularly risky type of driving due to the presence of risk factors such as fatigue, distraction and time pressure (see Grayson & Helman, 2011, for a review). Given the research findings highlighting the importance of social norms and how drivers may use others as reference points for their own driving behaviours, fleets could play an important role in increasing compliance by reducing the number of drivers who visibly engage in non-compliance behaviour.

Finally, a truly holistic Safe System approach must consider roads, drivers and vehicles. Changes in vehicle capabilities are happening at a fast pace, in many cases driven by consumer demand for in-vehicle technology to make the driving task easier, improve connectivity or communications and achieve integration of in-vehicle systems with personal mobile devices. Although an in-depth account of such technologies is beyond the scope of this report, a recent European Commission report provides an overview of the feasibility of a wide-range of available in-vehicle technologies in improving safety (Hynd, McCarthy, Carroll, Seidl, Edwards, Visvikis, Tress, Reed & Stevens, 2015).

It is clear some of these technologies will have potentially positive impacts on safety. On-board systems such as anti-lock braking systems (ABS), Emergency Brake Assist and Electronic Stability Control are now common across the vehicle fleet; other technologies such as Adaptive Cruise Control, Lane Departure Warning Systems and Intelligent Speed Adaptation are penetrating the vehicle fleet rapidly and are likely to become ubiquitous within the life of Road Investment Strategy period 1 (RIS1). Other technologies (such as eCall) are proposed or mandated for widespread adoption in the foreseeable future but are unlikely to have a major impact on safety within RIS1.

In-vehicle information, communication and entertainment systems are continuously increasing in capability, providing drivers with more information and more methods to interact with the systems in their vehicle. Systems such as these can have important positive impacts on network management but can have negative impacts on driver behaviours, driver performance and crash avoidance. There is a risk of unintended consequences from some of the systems being implemented; for example, in-vehicle systems may increase the potential for driver distraction or on-board vehicle safety features may lead to a tendency for drivers to take greater risks or be less attentive to the driving task in the false belief that the vehicle will protect them in an accident.

Understanding the impact on driver behaviour of the changes in vehicle technology is critical to understanding how changes in vehicles can contribute to improved road safety and will remain so until vehicles become fully or significantly autonomous. It is therefore strongly recommended that Highways England considers current and forthcoming changes to vehicles and their likely rate of uptake within the sub-set of the vehicle fleet that uses the SRN. Understanding the rate of turnover within this fleet sub-set and the nature of vehicles that use it will allow Highways England to understand the impact that vehicle technology changes are likely to have on crash risk across the SRN.

It is also important that Highways England considers how much and how widely in-vehicle technology and on-board vehicle systems may change driver behaviours. This should focus on two timeframes: the first is until 2020 (the end of RIS1) and second is in the longer term (suggested as to 2040). Specific attention needs to be paid to technologies that may have potentially negative effects on driver behaviour and thus increase crash risk (for example vehicle connectivity technologies that may increase distracted driving). In the short term (i.e. pre-2020) this may require a range of additional measures to be prioritised to ensure the benefits from improved vehicle safety are realised; one potential priority for Highways England more widely would be to work with fleet managers to ensure that driver behaviour around new connectivity technologies is managed well at an organisational level, and also that vehicles with effective safety features (e.g. active crash avoidance technologies) are preferred in procurement.

3.3 Summary of interventions/ methods to be prioritised

Part of the Highways England Compliance Action Plan is to find positive interventions to reward compliant behaviour. Although no 'off the shelf' interventions have been identified through the literature review or the prioritisation workshop, the results from these tasks suggest that it is possible to develop theory- and evidence-led targeted interventions as alternatives to enforcement.

The concept of proportionality is important in this context as it would allow the use of existing technology (and/ or enforcement efforts) such as cameras to warn drivers of the

non-compliant behaviours they may be, perhaps unknowingly, engaging in. For example, authorities (local authorities or Highways England) could warn drivers of incidences of middle lane hogging and close following along with the possible risks of engaging in such behaviours. If there is in fact a knowledge gap, this could help drivers to increase their understanding of these behaviours and reduce future non-compliance.

Similarly, in-vehicle technologies continue to offer routes to lowering non-compliance. Intelligent Speed Adaptation, Lane Keeping Assistance and Lane Change Assistance systems can be helpful in reducing incidents on the road. However, not all drivers may be aware that their vehicles are equipped with this technology; Highways England could play a role in educating the travelling public and encouraging them to understand their vehicles and the safety systems available to them.

Both the literature review and data analysis highlighted the need to develop messages carefully and to ensure the language and target audiences are selected appropriately. It will also be important to ensure that messages are not conflicting, particularly as the research identified different characteristics of non-compliers (depending on the behaviour of interest).

For example, in targeting nervous and inexperienced drivers (who, according to the data, may be more likely to drive a vehicle that is not roadworthy) caution should be taken to not highlight increased skill as a compensatory trait, particularly as the data showed that people who tend to speed are also more likely to believe that skill can compensate for the heightened risk of engaging in this behaviour.

This also applies when considering the implications of the present research on other road user groups, such as motorcyclists and van drivers. While their motivations for engaging in non-compliant behaviours may be different to that of car drivers, they are still worthy of targeting with interventions due to the risks they present (being vulnerable road users and work-related drivers respectively). For example, some motorcyclist sub-groups (as discussed in Section 5.2.1.8) may have less safe attitudes toward riding and may identify strongly with feelings of speed, performance, and a sense of competition with other drivers/ riders. Messages to discourage speeding again become important; however, while motorcyclists who focus on performance may view skill as key in reducing collision risk, others (such as those using motorcycles purely for commuting) may be aware of performance limitations and hence 'knowledge' may be less of an issue.

4 What approaches do other organisations take to compliance, and how can Highways England best engage with partners?

The Highways England Compliance Action Plan states that a 'multi agency approach' will be adopted. In order to align itself with other agencies, it will be beneficial for Highways England to identify similarities and differences in how compliance is perceived by potential partners. One purpose of this research, described in this section, was to understand the 'narrative' in which compliance is discussed by potential partner organisations, so that this can be taken into account for Highways England's recommended next steps.

4.1 Method

Eleven telephone interviews with stakeholders from across the road safety industry were undertaken. The stakeholders represented in the sample included those involved in enforcement, policy, public and private sectors, research, and charitable organisations. The interviews lasted between 30 and 45 minutes, and the topics discussed included organisational road safety priorities, current activities relating to non-compliant behaviours, and views on existing and possible partnerships between stakeholders.

The interviews were undertaken by an experienced qualitative researcher using a semi-structured topic guide, to ensure consistency in approach and topics covered across interviews, which in turn facilitated the thematic analysis of the data. Interviews were audio recorded and transcribed to facilitate the analysis. The topic guide developed for the purpose of this work can be found in Appendix G.

Thematic analysis is a widely used qualitative technique based on the identification of prominent 'themes' or messages that arise consistently through the engagement exercise. The themes emerging from the interviews are reported in Section 4.2, below.

4.2 Results

A selection of word clouds are presented in Figure 3 to depict the key messages and the language that characterised the interviews undertaken. These six were the most representative of the themes that emerged from the qualitative interviews. Each cloud represents a different stakeholder and the size and boldness of each word represents the number of times these particular words emerged throughout the interviews. When the interviews are reduced to key words, there are a few 'themes' that emerge from the data. Themes are topics or issues that emerged consistently throughout the interview process. These are discussed in the sections below (Sections 4.2.4 to 4.2.3).

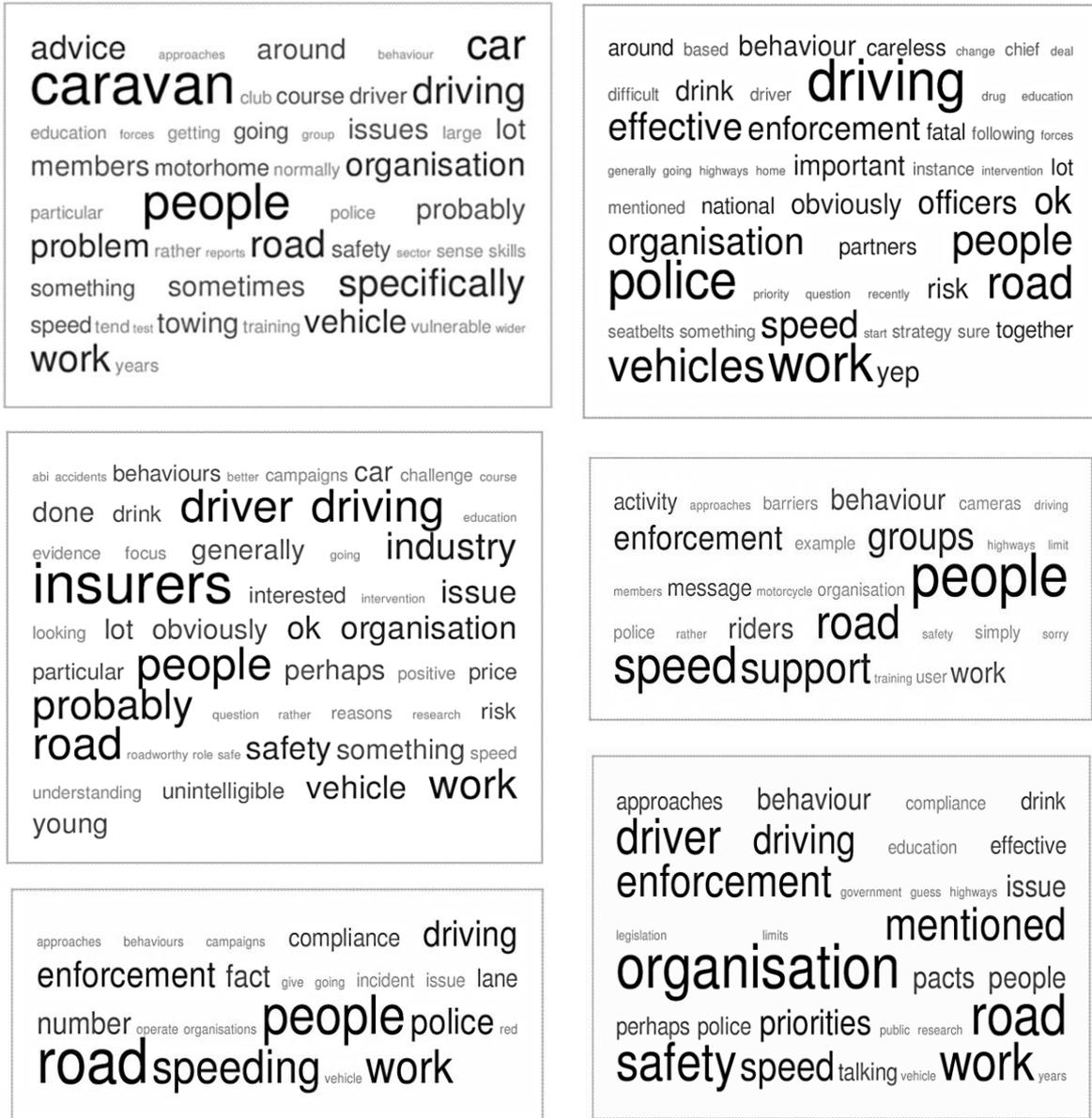


Figure 3: A selection of word clouds depicting interview themes

4.2.1 Evidence

The word clouds also show that there is very little mention of ‘evidence’ and/or ‘research’. In fact, most interviewees reported that they rely on ‘common knowledge’ and experience.



"...a lot of this is based on professional judgement."

"...simply anecdotally from riders who have been caught, for example, speeding."



Although experience is important in developing strategies, the evidence base should also play a key role in setting behavioural priorities and interventions. Some organisations, though very few, reported relying on formal evidence to guide their strategic decisions.



"So I think in a way it's just the evidence that we've seen about....the severity of the problem and the things that are available to fix it."

This is a common challenge in road safety as, generally speaking, there is little evidence-based practice when it comes to the development and application of interventions. Although this is slowly changing, Highways England could play an important role in promoting evidence-based practice that could set an example throughout the industry.

4.2.2 People

All organisations talked quite consistently about 'people'; this concept seemed to play a key role in the road safety narrative of these organisations.

This aligns quite well with Highways England's strategic objectives, particularly in relation to the desire to speak about 'the customer' when referring to the people who use the SRN in England.

However, it is important to note that the current narratives of road safety organisations quite often make reference to terms such as 'enforcement' and 'police'.

"We're concerned about reductions in levels of roads policing and the effectiveness of roads policing, or concerned it might become less effective."



Moreover, police presence (or perception of the lack of it) is believed to be an important reason for non-compliant behaviour.



"One of the key things is visibility or lack of visibility of police officers."

This may be a challenge to Highways England particularly as one of their priorities on compliance is to move away from traditional enforcement methods. The Strategic Compliance Action Plan states "...we [Highways England] are seeking to drive compliance in a positive way by helping our customers to be compliant." This statement implies a refocus from remedial interventions (such as fines and penalty points) to a preventative approach. Despite a focus on 'softer' measures, it will be important to remain engaged with enforcement, particularly as the threat of enforcement is known to help with non-compliance.

There is also evidence that some stakeholders are interested in promoting alternatives to enforcement.

"These people need help."



"We want to try and help, not just be the regulators and enforcers."

Highways England can work with these organisations to promote alternatives to penalties.

Importantly, and following on the 'theme' relating to people, there was also acknowledgement by many stakeholders that some non-compliant behaviour is due to error; such underlying reasons lend themselves well to a proportional approach.



"The foremost reason genuinely, I believe, is forgetfulness."

4.2.3 Organisation

The term 'organisation' was used frequently in the context of the interviews. Most organisations interviewed were already involved in partnerships with public and charitable organisations promoting campaigns, lobbying and providing other resources.

There is, however, more to be done if organisations are to work together effectively. Stakeholders interviewed recognised some of the key challenges in forging partnerships and pursuing common goals. For example, some stakeholders believed that road safety may only be pursued as part of a specific agenda.

"People have different agendas."



"I think most partners only ever work together if there's something in it for them."

In order to work through these barriers, stakeholders believed organisations need to recognise that they cannot achieve road safety goals in isolation and clear industry leaders must be identified.

"Less silo working...acknowledgement that there is a common problem."



"Need to bring in other organisations beyond 'main ones'."

However one stakeholder warned of the issues that arise from having too many key players and the need to ensure clear objectives and clear leaders on these issues.

"You can get an area of conflict in there without understanding the priority structure of the agencies involved...sometimes there needs to be a bit of clarity of who's doing what."



Such statements suggest that an organisation such as Highways England would be well placed to play a leading role in any strategic approach to compliance.

4.2.4 Priorities

Some of the organisations interviewed reported that they focused on specific behaviours due to their organisation's remit. Table 3 shows the frequency of 'Top 3' ratings for each of the seven prioritised behaviours, along with scores based on their prioritisation by the stakeholders interviewed. The scores in the second column have been achieved by allocating a score from 1 (lowest) to 7 (highest) to each behaviour based on the stakeholder's ratings of priority. Drink-driving, for example, has achieved a higher cumulative priority score as it was rated as a number one priority (i.e. scored as a 7) more often than speed and driving a vehicle that is not roadworthy.

Table 3: Stakeholders rating of priority of non-compliant behaviours

Behaviour	Cumulative priority score ⁷	Times in Top 3	No. of participants who mentioned (any position)
Drink-driving	37	5	6
Speed	32	4	6
Driving a vehicle that is not roadworthy	30	5	7
Driving while having difficulty remaining awake	29	3	6
Mobile phone use while driving	21	3	4
Close following	10	0	3
Middle lane hogging	6	0	3

⁷ A raw score can be calculated by assigning a basic score (1 through 7 points) for each rating, where a score of 7 is given to the behaviour that was rated as the most important by the participant and a score of 1 is given to the behaviour rated as the least important. Thus a higher score indicates more importance.

Note that although 'Driving a vehicle that is not roadworthy' has a similar relative rating to 'Speed' and 'Drink-driving' (in terms of times mentioned and times in top 3), it was less likely to be rated as a number 1 priority (this is reflected in its lower 'score'). It was also less likely to come up in the general narrative of the organisations' priorities; as seen in the word clouds in Figure 3 there is little consistent use of terminology relating to vehicle roadworthiness.

Interestingly, the extent to which 'Drink-driving' was mentioned in the interviews was at odds with the relative rankings of its priority provided by stakeholders. While it emerged as the most cited key priority, speeding was more likely to be part of the general discussion throughout the interview. This may have partly been due to the differentiation between personal and organisational priorities.



"Speeding would be one of the key ones."

"So for me, considering 25% of all road deaths relate to alcohol in one way or another or drugs, then I think that would be the most important, but others might say within the same organisation, that speed enforcement or seatbelt (use) is just as important."



4.2.5 Summary

The key themes that emerged from the stakeholder interviews show that stakeholders talk about both 'people' and 'organisations'.

The use of the term 'people' is important because, within the context of non-compliance, it would be easy to characterise those who fail to comply as 'offenders', implying volition. The dominance of 'people' suggests that organisations are also looking to help those who do not comply and that although enforcement is seen as an important element to reduce non-compliance, it is also accepted that enforcement is one component of an overall approach.

The frequency of the term 'organisation' partly relates to the discussion around how organisations can work together to achieve road safety targets. Although some challenges were identified, for example, the concern that some organisations may want to pursue particular personal 'agendas', generally speaking stakeholders believed that working together is a necessary component of improving the levels of compliance on the road.

Finally, any mention of 'evidence' was lacking, both in the support of organisational priorities and the implementation of strategies to pursue these priorities. This is not to say that none of the stakeholders interviewed relied on evidence; however, with such important issues at hand, it would be expected that evidence (and the use thereof) would play a more important role in the road safety narrative in the UK. This is an area that Highways England can potentially lead by ensuring that strategic priorities are based on evidence, and thus, resources are appropriately allocated to dealing with key compliance issues.

5 What are the next steps

5.1 Summary of findings

The literature review of non-compliance and the segmentation analysis showed that there is not a single 'type' of driver that is less likely to comply across all behaviours. Non-compliance relating to different behaviours has different underlying factors associated with it. In terms of existing literature, research has largely focused on speeding and drink-driving, and on age and gender effects (with younger and male drivers typically found to be more likely to be non-compliant).

The literature review of interventions showed that the research regarding current interventions is also mixed. Enforcement is clearly an important element for increasing compliance, and engineering methods such as changes to the road layout have also shown promise. Other approaches are utilised (education and communication with road users for example) but there are no 'off the shelf' interventions that have been properly evaluated. Nevertheless, a targeted, evidence led, theoretically driven intervention can be developed.

The segmentation analysis showed that a broad sample of SRN users tend to fall into two clusters. Drivers in one cluster ('general compliers') tend to report no or very little intention to be non-compliant over the next three months of driving; drivers in the other cluster tend to report a range of levels of intention to not-comply ('general non-compliers').

Slight adjustment was made to the two clusters for the purpose of further analysis. The two groups defined were people who state an intention always to comply ('compliers' – from 44% to 78% of drivers in the sample, depending on the behaviour of interest), and those who state an intention to not-comply at least some of the time ('non-compliers' – from 22% to 56% of drivers in the sample, depending on the behaviour of interest). When models were built using only demographic and exposure-based variables as predictors of cluster membership, these models were unable to identify non-compliers with any real accuracy. When various psychological and attitudinal variables are added as predictors the models become much better at identifying non-compliers for each of the seven behaviours of interest.

Organisations within the UK tend to report that they are prioritising speed, drink-driving and vehicle roadworthiness (and to some extent fatigued driving) as areas for increased attention. It is clear that 'people' are at the centre of the broad narrative around compliance and that the undertones of this narrative convey the non-volitional element in (some) non-compliant behaviours; that is, there is an appreciation for the reality that motorists may fail to comply for reasons that are not necessarily deliberate. As such, there is a push for a strategy that involves helping individuals using clear and targeted messaging around compliance and a proportional response. Fleets were raised as one important route to reaching a large number of motorists on the SRN.

Despite the appeal of preventative approaches in the first instance, the role of enforcement remains important. With the combined knowledge of why people fail to comply and what mechanisms are effective in reducing these behaviours, enforcement can be used as a last resort to work with non-compliers who engage in repeat (and possibly more aggressive) offending.

The overall messages from the stakeholder interviews suggest there is an openness to engage with likeminded organisations.

Based on the findings from all of the work in the project, the recommendations for Highways England are as described in Section 5.2. Suggested next steps (particularly regarding how this work fits in with the wider Highways England action plan on compliance) are presented in Section 6.

5.2 Recommendations

In this section, we present recommendations for Highways England in terms of the approach they might take to improve compliance with each of the seven behaviours of interest covered in the current study.

An assumption when formulating these recommendations is that Highways England is committed to taking a broadly information- and education-based approach to non-compliance, with enforcement still included as a proportional response based on severity and frequency of non-compliance

Given that there are no 'off the shelf' interventions with sufficient evidence to support their effectiveness (outside of traditional enforcement approaches such as safety cameras) the recommendations focus first on the clear and targeted messaging that ought to be used for each of the specific target behaviours, based on the findings of the reviews and segmentation analysis.

Recommendations are then made around how enforcement can be used (and taking into account that Highways England consider it to be a last resort) within the wider strategic approach, and how proportionality might be built into the system.

5.2.1 Develop clear and targeted messaging

Appropriate and targeted communication, particularly in relation to safety messages, is critical. The evidence in the current report showed that not only are there many reasons for non-compliance among motorists, but also that the types of people who engage in different non-compliant behaviours are diverse. Road safety campaigns are an easy and frequently employed method, particularly as a wide audience can be reached simultaneously. Although there is limited evidence of the effectiveness of such approaches (e.g. Van Houten et al., 2013), it is widely accepted that campaigns are more likely to have a positive effect on driving attitudes (and, possibly as result, behaviour) if their messages are developed and targeted appropriately. That is, messages should be targeted based on differences in motivations (and personal characteristics).

Messaging can also be a first step in correcting unsafe attitudes or misinformation of people using the SRN, particularly those who are less likely to intentionally engage in non-compliant behaviours.

Although the current report did not focus on other road users, such as motorcyclists, van drivers, and professional drivers, compliance in these groups can also be targeted through appropriate messaging. However, it is important to understand that the motivations for (and levels of) non-compliance in these groups are also likely to be varied, and motorcyclists in particular are known to be a less homogenous group than car drivers; Christmas, Young, Cookson and Cuerden (2009) suggest that motorcyclists

can be divided into seven 'types' or segments, all driven by different motivations in their riding style, choices and behaviours relating to safety, and perceptions of other riders.

Van drivers and professional drivers (for example of HGVs) on the other hand are likely to link their driving motivations to work-related pressures (broadly time pressure, fatigue and distractions – see Grayson and Helman, 2011, for a review). The UK has also seen growth in this mode of transport. For example Clarke, Johnson, Nankivell and Turpin (2014) report that the number of vans registered in the UK has increased by 29% over the past 10 years, while the number of HGVs has decreased by 5% over the same period. Similarly Helman, Christie, Ward, Grayson, Delmonte and Hutchins (2014) reported that the number of vans licensed for use was 2.13 million in 1994, rising to 3.28 million in 2012 (corresponding to an increase from 8.4% to 9.5% of all licensed vehicles in the UK).

The resulting need for introducing messaging (and other strategies) to ensure compliance in these diverse road user groups is, therefore, increasingly evident.

In the following sub-sections we note how campaigns targeting the seven behaviours of interest should be designed.

5.2.1.1 *Speeding*

Out of the seven behaviours of interest, speeding was the only behaviour where demographic and exposure variables alone enabled a reasonably reliable identification of non-compliers. This finding was also apparent in the literature review and there is much evidence to show that age (being young) and gender (being male) are predictors of speeding, as well as evidence for the importance of other factors such as vehicle type, driving purpose (e.g. driving for work) and various attitudinal variables. It is important to highlight that 'young' doesn't always mean '17-24 years old' (the usual characterisation used in road safety in the UK). A study by Watson, Watson, Siskind, Fleiter, and Soole, (2015), who also found an effect of age in non-compliant behaviour, characterised the 'younger' group as those less than 30 years. This is somewhat replicated by the segmentation analysis in the current study as the 'younger', less compliant group is represented by drivers born between the 1970s and 1990s (i.e. ~25-45 years old).

In the segmentation analysis, when the participants' psychological, attitudinal and personality variables were considered in addition to demographics and exposure, the model performed much better, and nine variables were identified that predicted drivers' intentions to speed. Non-compliers were more likely to:

- Have higher leisure and commuting mileage
- Have a greater belief that skill can compensate for the added risk of speeding
- Have an irresponsible, careless, risky, inattentive driving style
- Have a higher thrill-seeking score
- Have a higher anxiety of driving score
- Not believe speeding to be dangerous
- Have reported speeding in last three months
- Hold the belief that the speed limits on motorways are too low

- Have a higher income

Taking the above findings into account we recommend that Highways England take the following approach to improving speed compliance on the SRN:

1. Target the delivery of information and education campaigns about speed at high mileage, high income drivers who have a driving style that is careless, irresponsible, inattentive and risky, and who speed regularly
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people that speeding can have dangerous consequences
 - b. Remind people that the majority of drivers are compliant with speed limits
 - c. Remind people that skill alone is not sufficient to compensate for the risk of speeding
 - d. Justify the level of the motorway speed limit

5.2.1.2 *Drink-driving*

Findings from the literature review showed that age, gender, mileage and various attitudinal variables have been associated with drink-driving.

In the segmentation analysis seven variables were identified that predicted drivers' intentions to drink-drive, and the model performed well in identifying non-compliers. Non-compliers were more likely to:

- Drive for work
- Have an irresponsible, careless, risky, inattentive driving style
- Have a higher anxiety score
- Have a lower anger score
- Perceive it to be difficult to avoid drink-driving
- Perceive drink-driving to be safe to some degree
- Report drink-driving in the last three months

Taking the above findings into account we recommend that Highways England take the following approach to improving drink-driving compliance on the SRN:

1. Target the delivery of information and education campaigns about drink-driving on drivers who drive for work, who have a driving style that is careless, irresponsible, inattentive and risky, and who already report drinking and driving⁸
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people that drink-driving can have dangerous consequences

⁸ The higher anxiety of this group is difficult to explain, and in our judgement requires more research to understand. Therefore we have not recommended that anxiety is used in any targeting.

- b. Remind people of the personal impact of being caught drink-driving (e.g. criminal conviction, loss of licence, impact on work)
- c. Remind people that it is easy to avoid drink-driving (designated driver systems, public transport, taxis, etc.)
- d. Inform people of alternative options available in their locality

The literature review showed that, when considering social aspects (such as social norms), drink-driving was somewhat different to other behaviours, particularly as drink-driving has become less socially acceptable in recent years, and is likely to be seen as a source of blame in accidents (Cazzulino, Burke, Muller, Arbogast & Upperman, 2014).

The fact that yearly 'THINK!' campaigns are run on drink-driving is also something that already sets a consistent message around this behaviour. This presents an opportunity for Highways England to engage with the 'THINK!' brand, and potentially develop a campaign on drink-driving specifically designed for the SRN. Caution should be taken to ensure messages are carefully developed and statistics about the number of drunk-drivers are carefully handled. Messages should seek to present statistics in such a way as to make the behaviour appear uncommon (e.g. "almost all drivers stopped were found not to have been drinking"), but also to make it appear likely that the relatively few people who do drink and drive will be caught (e.g. "police are deliberately targeting and looking for drink drivers").

Fleets and business drivers are potential targets for messaging around drink-driving. Those driving for work may feel a pressure to drive (e.g. the morning after) even when they know they may be over the drink-drive limit. This practice may be best targeted by working with businesses to ensure a supportive environment exists where drivers can report such circumstances without fear of reprisal. Nevertheless, further research would help to understand the motivations to engage in this behaviour at an individual level and who among those who drive for work are most at risk.

5.2.1.3 *Close following*

Findings from the literature review showed that age and some cognitive variables were associated with close following.

In the segmentation analysis seven variables were identified that predicted drivers' intentions to close follow, and the model performed well in identifying non-compliers. Non-compliers were more likely to:

- Have cars with larger engines
- Not consider close following to be unsafe
- Have a higher thrill-seeking score
- Have a lower hazard monitoring score
- Believe close following is safe to some degree
- Report previous close following behaviour
- Be young

Taking the above findings into account we recommend that Highways England take the following approach to improving close following compliance on the SRN:

1. Target the delivery of information and education campaigns about close following on those who have close followed before. Also target young and thrill-seeking drivers, who drive cars with larger engines
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people that close following can have dangerous consequences
 - b. Highlight that close following is a socially undesirable behaviour
 - c. Remind drivers that they may not be as good at reacting to hazards as they think when driving close to the vehicle in front

The strength of the relationship between having close followed within the last three months and intending to do it again in the future was particularly strong (people who answered '2 or more' on the scale for the 'last three months' question from 0=Never to 5=Nearly all the time were 94.5 times more likely to be in the non-complier group than those who answered '0'). Therefore we recommend that the detection and early intervention with previous close followers is made a priority.

5.2.1.4 *Mobile phone use*

Findings from the literature review showed that a large number of variables were associated with mobile phone use, including age, gender, mileage, various attitudes, and the perception that other drivers were engaged in the behaviour.

The segmentation analysis identified five variables that predicted drivers' intentions to use a mobile phone while driving. These variables were all psychological and attitudinal in nature. Non-compliers were more likely to:

- Have a higher thrill-seeking score
- Hold the belief that skill and knowledge can compensate for the risks of using a mobile when driving
- Perceive it to be difficult to avoid using a hand-held mobile when driving
- Perceive that others use a hand-held mobile less often when driving
- Have used a hand-held mobile when driving in the past three months

Taking the above findings into account we recommend that Highways England take the following approach to improving mobile phone compliance on the SRN:

1. Target the delivery of information and education campaigns about mobile phone use on those who have used a mobile phone when driving before, possibly thrill-seekers
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people that it is easy to avoid and provide examples of strategies
 - b. Remind people it is a socially unacceptable behaviour
 - c. Remind people that skill alone cannot compensate for the risk of using a mobile phone while driving; humans have limited processing capacities

Mobile phone use is one area where the 'perceived social norm' is particularly important. Hence, messages in this area should focus on reducing the social acceptance of mobile phone use while driving. Messaging should also avoid the use of statistics relating to any reported use of mobile phones while driving; these may have an undesired effect on drivers by inadvertently normalising the behaviour in question. One example of such a use of messaging can be found in a campaign in the United States in 2012. One of the campaign communications stated that '82% of drivers said they have texted while driving' (NHTSA, 2012; see Figure 4).

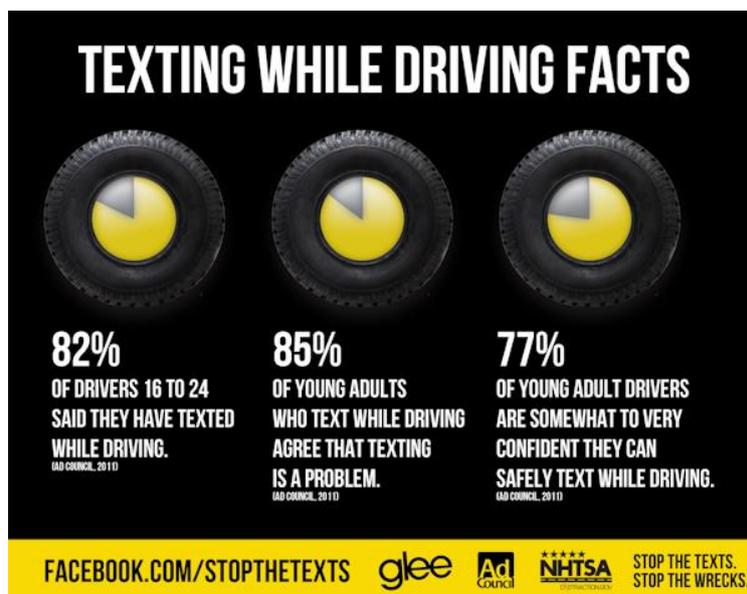


Figure 4: National Highway Traffic Safety Administration (NHTSA) distracted driving campaign, 2012.

Messages should instead promote information and statistics about drivers who do not use their mobile phone while driving. Information about current changes to organisational practices in relation to mobile phone use while driving (e.g. companies who have banned mobile phone use or hands-free use while driving) may also be of use. Although driving for work did not predict intentions once psychological variables were included in the model, it is known from previous work that distraction is a key risk factor linked to work-related driving, and driving for work and work mileage were both predictors in the absence of psychological variables.

5.2.1.5 *Driving a vehicle that is not roadworthy*

No specific literature was found on the behaviour of driving non-roadworthy vehicles. In the segmentation analysis, the addition of psychological and personality variables to demographic variables made a very large contribution to the model's reliability.

Non-compliers were more likely to:

- Not drive as much for leisure/commuting purposes
- Have an irresponsible, careless, risky, inattentive driving style (non-compliant higher)
- Have a driving style that is nervous, inexperienced and indecisive
- Have a higher thrill-seeking score

- Have a higher anxiety of driving score
- Have a lower hazard monitoring score
- Hold a belief that knowledge/skill can compensate for the risks of driving a non-roadworthy vehicle
- Have driven a non-roadworthy vehicle in the last three months
- Have no strong opinions about driving on single carriage A roads
- Be male

This list includes what could be characterised as two types of predictors for non-compliant drivers:

1. Predictors related to overconfidence and thrill-seeking – thrill-seeking, gender (male), a riskier or more nervous driving style and confidence in skill to 'overcome' the risks.
2. Predictors related to anxiety of driving, indecisiveness and hazard monitoring

The scope of the current analysis precludes us from understanding how these variables relate to each other and if in fact the data are showing two different (unique) sets of underlying motivations. These seemingly different typologies could reflect the fact that the term 'vehicle roadworthiness' was used as an umbrella term for a number of different actions (e.g. servicing, tyre condition, fuel). It may be that the model is predicting for several types of 'un-roadworthiness', and that this has led to the variety of predictors observed.

Taking the above findings into account we recommend that Highways England take the following approach to improving vehicle roadworthiness compliance on the SRN:

1. Target the delivery of information and education campaigns about vehicle roadworthiness on two groups of drivers (or ensure that campaigns appeal to both)
 - a. Male thrill-seekers who have a driving style that is careless, irresponsible, inattentive and risky, and who believe that they can use their skill to 'protect' them from the risks of driving an un-roadworthy vehicle
 - b. Anxious, indecisive drivers
- In both cases, people who already report driving a vehicle in an un-roadworthy state should be targeted.
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people that when a vehicle is roadworthy it will reduce anxiety
 - b. Remind people that skill alone cannot compensate for the risk of driving an un-roadworthy vehicle
 - c. Remind people of why roadworthiness is important to the network

5.2.1.6 *Driving while fatigued*

The segmentation analysis showed that non-compliers were more likely to:

- Have a higher thrill-seeking score

- Have a lower hazard monitoring score
- Perceive it to be difficult to avoid driving when having to make an effort to stay awake
- Perceive it to be safe when having to make an effort to stay awake
- Have driven while having to make an effort to stay awake in the last three months
- Live with a partner

Taking the above findings into account we recommend that Highways England take the following approach to improving fatigue compliance on the SRN:

1. Target the delivery of information and education campaigns about fatigue on people who live with a partner (married or not), and who have already reported driving when fatigued
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people how dangerous fatigue can be, especially in terms of the impact on injury severity
 - b. Provide people with advice on how easy it is to avoid fatigued driving (for example sleep habits, and how to take breaks before the signs of fatigue are advanced)

Marital status was unique as a predictor to this behaviour. Participants who reported living with their partner were more likely to intend to drive while fatigued than those who reported being married. In turn, those that were married were more likely to report intending to engage in this behaviour than those who reported being divorced, widowed or living alone. It is likely that life-stage and family-related variables play a part in this relationship. Therefore it may be beneficial to allude to family members in fatigue messaging, or even to directly focus some messaging to family members in an effort to get them involved in changing behaviour.

5.2.1.7 Middle lane hogging

No specific literature was found on the behaviour of middle lane hogging. The segmentation analysis identified nine variables that predicted middle lane hogging.

Non-compliers were more likely to:

- Have a nervous, inexperienced, indecisive driving style
- Have a higher thrill-seeking score
- Have a higher anxiety of driving score
- Have a lower hazard monitoring score
- Hold the belief that skill can compensate for the added risks of middle lane hogging
- Perceive it to be difficult to avoid middle lane hogging
- Perceive middle lane hogging to be safe
- Have hogged the middle lane in the last three months

- Be younger

Taking the above findings into account we recommend that Highways England take the following approach to reduce middle lane hogging on the SRN:

1. Target the delivery of information and education campaigns about middle lane hogging at younger drivers, ensuring that both anxious and nervous drivers and those who are thrill-seeking are targeted. Particularly target those who have already been caught.
2. Ensure that the content of those information and education campaigns includes messages to:
 - a. Remind people that skilful drivers move into the nearside lane when it is available
 - b. Remind people that middle lane hogging is easily avoided
 - c. Remind people why middle lane hogging is undesirable and socially unacceptable
 - d. Remind people that driving in the nearside lane can help to avoid anxiety

5.2.1.8 Messaging for motorcyclists and van drivers

As mentioned in the introductory text, there are likely to be subtle differences between road user groups in terms of their motivations to engage in non-compliant behaviour. Motorcyclists are believed to be a less homogenous group in so far as several sub-groups have been identified, all of which vary in their motivations to take up motorcycling as well as their perceptions of the road environment and attitudes to safety.

Christmas et al. (2009) discuss the differences between these motorcyclist sub-groups. As highlighted in Table 8, motorcyclists can be divided into seven segments or 'types'. These are:

- Riding hobbyists
- Performance disciples
- Performance hobbyist
- Look-at-me enthusiasts
- Riding disciples
- Car aspirants
- Car rejecters

Some of these subgroups, such as the 'performance hobbyists', are relatively low on collision propensity (when compared to other subgroups) and tend to value elements of the riding environment rather than the performance aspect. They may therefore be less of an at-risk sub-group. However, the motivations of the 'performance disciples' and 'look-at-me enthusiasts' for riding may link more closely to non-compliance (and therefore, collision risk), such as the rated importance of accelerating, getting away quickly and pitting oneself against others (i.e competing with others). Although, as discussed, this road user group may differ from car drivers (the primary focus of the present report) some of the messaging strategies discussed in the sections above are also applicable to this road user group. Some suggestions for targeting motorcyclists are

contained in A.1.1.1 Appendix H, though note these are mostly based on the Christmas et al. (2009) work, rather than data collected in the current study.

Van drivers and their companies are also an important road user group to consider when designing messages to increase compliance. As discussed in Appendix B.2.1.4, time pressure plays an important role in decisions around non-compliant behaviour; driving for work is a common source of time pressure, and may be particularly important for van drivers making deliveries.

The HGV industry is highly regulated. However, these regulations rarely extend to drivers of vans. With projected increases in the numbers of vans, and increasing time pressure in order to meet demand from activities like online shopping, it will become increasingly important to ensure that van drivers remain compliant.

Although no detailed account of van driver behaviour and motivations to comply has been undertaken to date (to the researchers' knowledge), a recent report by the RAC foundation found that the vast majority of van drivers were male (99% for privately-owned vans, where known), married, aged between 30-40, and that most of their driving occurred in local or urban areas (Clarke et al., 2014). The development of messages around compliance for van drivers behaviours could take these factors into account when targeting and designing messages. Messaging around fatigued driving is also likely to be useful, particularly given the poor regulation of driving hours among this road user group.

A study by Poulter and colleagues in 2008 sought to understand the motivations for compliance in a group of lorry drivers in the United States. They found that perceived behavioural control (one of the three elements of the Theory of Planned Behaviour, discussed in Appendix B.2.1.3) was the most important predictor of non-compliant behaviour; thus, compliance was related to whether drivers felt complying was within their control (Poulter, Chapman, Bibby, Clarke & Crundall, 2008). This, added to the increased time pressure many professional and non-professional drivers are under, can help to undermine the sense of 'control' over the decision to comply. Therefore, messaging here could target the wider industry so as to increase knowledge about driver risk to all business and professional drivers, as well as to encourage safer organisational practices. The need for work-related driving risk to be taken as seriously as general health and safety can be another area of focus for Highways England (see e.g. Helman et al., 2014).

One of the safety concerns in relation to an increase in van activity is that while more vehicles will be on the roads, these will be driven by less qualified drivers (assuming no change in regulations). Clarke et al. (2014) reported that training is something many van drivers are proud of. Efforts in this area could focus on promoting and providing additional training for van drivers. As with other behaviours, though, it is important that increased training is not simply associated with an inflated confidence in vehicle control skills and thus potentially increase speeding and other non-compliant behaviours.

5.2.2 Proportionality

In this context, proportionality refers to ensuring that the interventions used (especially any enforcement options) are proportional to the offence and perceived to be proportional to the person committing the offence. One useful distinction that can be made is between intentional non-compliance and accidental or erroneous non-compliance, both of which may have potentially different behavioural and attitudinal

pathways. Some of the underlying predictors for non-compliance in the current study can be characterised as signalling unintentional processes (e.g. a nervous and indecisive driving style, anxiety of driving, a belief that the behaviour is difficult to avoid) while others seem to signal some intent (e.g. thrill-seeking, a belief that skill can compensate for additional risk).

The 'gradual' response to non-compliant behaviour being considered by Highways England may help here. By offering offenders in some cases a 'warning' before proceeding with more standard enforcement approaches, and by trying to advise people using targeted and relevant messages, Highways England should be able to foster the perception by customers that the road authorities are trying to 'help' them maintain compliance. In addition to the obvious focus on reducing KSI casualties on the network (as stated in its Health and Safety Plan) this is a key priority for Highways England as stated in their Compliance Action Plan. There is some evidence that this type of intervention can be effective (e.g. Masten & Peck, 2004), particularly in dealing with motorists who are not habitual non-compliers.

A simple model might be for a first offence to involve a warning (with appropriate targeting of content as advised throughout this section), with a second offence requiring the completion of a driver improvement course (similar to the National Driver Offender Retraining Scheme, NDORS). The third response could then involve a fixed penalty and/or enforcement activity that is targeted at curtailing repeat non-compliers.

There are a number of important considerations that should be made with relation to this type of system. The most important of these is that the targeted graduated interventions should be developed and based on evidence (such as the data reported here) and formal theory. Such interventions require evaluation to ensure they are delivering their intended aims and to inform continual improvement and decision making.

5.2.3 Increase 'awareness' of roads policing

Deterrence theory suggests that certainty of detection (as well as immediacy and severity of punishment) plays an important role in compliance. Hence, another key method that cuts across all approaches here is to increase the public perception that people who do not comply get caught. This does not necessarily have to involve enforcement activities, but could employ messaging and communication campaigns involving 'case studies' and information about people who were caught. Such campaigns should ensure different vehicle, driver and road types are included and that campaigns are not limited to high profile cases only.

5.2.4 Summary

The recommendations set out in the sections above are summarised in Table 4.

Table 4: Summary of recommendations

Behaviour	Features of the target audience	Features of messaging
Speeding	<ul style="list-style-type: none"> • High mileage • High income • A careless, irresponsible, inattentive and risky driving style 	<ul style="list-style-type: none"> • That speed can have dangerous consequences • Majority of drivers comply • Skill is no compensation

Behaviour	Features of the target audience	Features of messaging
	<ul style="list-style-type: none"> • Already speed 	<ul style="list-style-type: none"> • Motorway speed limits are appropriate
Drink-driving	<ul style="list-style-type: none"> • Drive for work • A careless, irresponsible, inattentive and risky driving style • Anxious • Already drink drive 	<ul style="list-style-type: none"> • That drink-driving can have dangerous consequences • Personal consequences of drink-driving • Easy to avoid drink-driving • Inform of alternative options • Avoiding drink-driving will lower anxiety
Close following	<ul style="list-style-type: none"> • Drive cars with larger engines • Thrill-seeking • Younger • Already close follow (particularly important group) 	<ul style="list-style-type: none"> • That close following can have dangerous consequences • Close following is socially undesirable • Drivers may not be as good as they think at responding to hazards when close following
Mobile phone use	<ul style="list-style-type: none"> • Thrill-seeking • Already use a mobile phone while driving 	<ul style="list-style-type: none"> • Easy to avoid using a mobile phone while driving • Most drivers do not use a mobile phone while driving • Skill is no compensation to using a mobile phone while driving
Driving a vehicle that is not roadworthy	<ul style="list-style-type: none"> • Drive for leisure/commuting • A careless, irresponsible, inattentive and risky driving style • A nervous, inexperienced and indecisive driving style • Thrill-seeking • Have previously driver a vehicle even though it was not roadworthy • More likely to be male 	<ul style="list-style-type: none"> • Roadworthy vehicles reduce anxiety • Skill is no compensation for a vehicle that is not roadworthy • Why roadworthiness is important to the network
Driving while	<ul style="list-style-type: none"> • Thrill-seeking 	<ul style="list-style-type: none"> • That driving while fatigued

Behaviour	Features of the target audience	Features of messaging
fatigued	<ul style="list-style-type: none"> • Live with partner • Have already driven fatigued 	<p>can have dangerous consequences</p> <ul style="list-style-type: none"> • Fatigue can be avoided (potential messaging to partners too)
Middle lane hogging	<ul style="list-style-type: none"> • A nervous, inexperienced and indecisive driving style • Thrill-seeking • Younger • Have already hogged the middle lane 	<ul style="list-style-type: none"> • Skilful drivers move into the nearside lane • It is easy to avoid • Socially undesirable and unacceptable • Driving in the nearside lane reduces anxiety

6 Next steps

The outcome from this research provides a critical input into the Compliance Action Plan currently being developed by Highways England, and will support delivery of key actions from the Health and Safety Plan. This leads to five clear next steps:

1. Feed the results and proposed recommendations into the development and communication of the Compliance Action Plan shared expectations

The segmentation analysis and proposed need to develop clear and targeted messaging must be fed into the communication of the shared expectations being developed as the first pillar of the Compliance Action Plan.

For example, taking speeding as a non-compliant behaviour, the proposed messages from the research support the clear expectation of speed limit compliance by:

- providing evidence for why this is important (potentially dangerous consequences);
- explaining why it applies to all drivers (skill alone cannot compensate for the increased risk from speeding); and
- saying why speed limits (including variable mandatory speed limits) are necessary and so are credible and legitimate (justifying the level).

The research can provide the evidence to counter the potential “*so what?*” attitude of customers and enables Highways England to explain why compliance is important, as well as starting to define how compliance expectations should be promoted and targeted. The approaches recommended in the research will advise those responsible for promoting compliance and developing communications plans to support the Compliance Action Plan, allowing the message, the target audience and the metrics for message acceptability to be evidence-led.

2. Use the research to identify scenarios where non-compliance is more likely and so where monitoring of customer behaviours should be prioritised

The research supports *monitoring behaviours and reinforcing these expectations*, the second pillar of the Compliance Action Plan, by providing intelligence about which types of non-compliant behaviours are most likely to be exhibited by which specific customer groups. While these groups are difficult to detect on the SRN, generalisations may be possible (based on evidence) that would allow focus on monitoring for these behaviours by location, time of day, traffic flow and/or composition etc.

This intelligence-led approach would implement the finding that enforcement, when perceived as likely, acts as a deterrent. The intention that customer behaviour is monitored on the SRN allows Highways England to support the customer before and during their journey and to improve awareness of the need for customers to be compliant.

3. Seek technology that can support the delivery of targeted messaging to reduce specific non-compliant behaviours

The use of monitoring technology and targeted messaging can be aligned for certain behaviours such as close following and middle lane hogging. The research undertaken by Highways England (see below) suggests there is a benefit to targeting those who have

been caught exhibiting non-compliant behaviours, even if the intervention cannot result in an enforcement action.

Current work to identify close following should be expanded to provide evidence to target non-compliant behaviours via notification letters (as trialled by Highways England for hard shoulder abuse) as a key intervention which could deliver benefit. Additionally, extending this approach to “middle lane hogging” would provide for targeted communications to deter this non-compliant behaviour. Overall, this ‘staged’ approach could be beneficial in encouraging changes in attitudes among non-compliant drivers, particularly by dealing fairly with unintentional non-compliance (rather than using enforcement as a catch-all approach).

Both these approaches also carry the benefit of promoting proportionality, showing customer behaviours are monitored and demonstrating the consequence of non-compliance in the absence of formal enforcement.

4. Ensure that proportionate responses are developed that recognise the possibility that non-compliance is sometimes not intentional

The need for proportionality is a recommendation from the research and supports the third pillar of the Compliance Action Plan, which is *responding to non-compliance*.

Key to the proportionality of response is the difference between intentional and unintentional processes that lead to non-compliance. The intent to target habitual non-compliers and deliberate non-compliance is well founded in the research; however, the assumption that all non-compliance is intentional and/or deliberate is difficult to justify. The research provides for an alternative strategy via the segmentation analysis, which provides key information on the groups most likely to be non-compliant.

While this is not the sole consideration when designing a proportionate response it is important that it is taken into account. A proportionate response needs to consider, as far as possible, cases where customers have been unintentionally compliant and use these to target interventions that drive awareness and improvement in customer behaviours and compliance. The justification for these factors needs to be clearly communicated, thus ensuring the proportionate response is transparent, legitimate and evidence led.

5. Gain greater involvement of third-party groups to drive change and to promote the expectation of compliance / consequence of non-compliance

Communication with third-parties is required to increase the perceived certainty that non-compliance will be enforced. Customers need to be aware of the consequences of non-compliant behaviour to the point that it is not believed to be ‘acceptable’, though measures should be put in to ensure that issues are dealt with proportionally. Therefore, ensuring a focus on improving customer behaviours rather than punishing the non-complier is important (see point 4 for consideration of proportionality). Additionally, the success of communications needs to be evaluated continuously, as the effectiveness and impact must be established and maintained against a backdrop of rapidly changing communication and social media platforms. This should include the evaluation of any communications plan developed as a result of this and other work relating to compliance. Highways England should ensure that the messages are being communicated effectively across the organisation (including partners and/ or subcontractors) in order to ensure these are being used effectively.

Involving a greater breadth of stakeholders (including partners) who have a vested interest in better compliance on the Highways England Strategic Road Network will provide Highways England with greater exposure for the message within the Highways England Compliance Action Plan. Working closely with stakeholders will ensure that messages are consistent and remain in the public consciousness. It is vital that such stakeholders are involved in the Compliance Action Plan, as Highways England recognises it will not be able to deliver improved compliance on the SRN in isolation.

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Appendix A Overview of the literature search methods

A.1 Overview

The following list summarises the method used to evaluate and select the literature:

1. Search terms were defined and agreed
2. The search extended back to 1995
3. Papers were assessed for **relevance** and only those meeting the following criteria were included for quality review:
 - a. First review: papers directly examining the ways in which people differ in levels of compliance while driving or directly examining the underlying reasons for non-compliance with a driving behaviour
 - b. Second review: papers directly examining the effectiveness of an intervention designed to improve driver compliance
4. Papers were assessed for **quality** against the following criteria:
 - a. The extent to which the study of the design is able to control for confounding variables and factors or background trends
 - b. The extent to which data collected are subject to treatment using appropriate statistical techniques to rule out chance variation
5. Due to the scope and time available, it was agreed a priori that (up to) 30 papers of the highest quality would be included.

The following sub-sections describe the method fully.

A.1.1 Identification of potential candidate studies

Literature was sourced from the Transport Research International Documentation (TRID⁹) database. The search of TRID was conducted through the TRL library. The review of 'Reasons for non-compliance' used the following search terms:

(Driv OR Rid*) AND (Compliance OR comply OR non-compliance OR Infring* OR reject* OR breach* OR violat* OR disregard OR agree* OR accept*) AND (Reason* OR why OR decision* OR risk factor* OR motiv* OR level OR degree OR rule* OR regulat* OR law* OR standard* OR restriction* OR safe* OR enforc* OR SRN (Strategic road network) OR transport* OR traffic* OR road)*

The search returned 181 potentially relevant papers for review. Additional papers and background material were gathered through following up papers from the reference section of the articles sourced in the first search, a Google Scholar search and from papers known to the study team and their contacts.

However, the search did not yield sufficient relevant material and an additional search had to be carried out in order to ensure all the appropriate sources were uncovered. The additional search was undertaken using the following search terms:

⁹ TRID combines ITRD (OECD's International Transport Research Documentation Database) and the US-based database TRIS (Transport Research Information Service)

(Driv OR Rid*) AND (Compliance OR Comply OR non-compliance OR infring* OR reject* OR breach* OR violat* OR disregard OR agree* OR law OR regulations OR rules OR exceed OR choose OR choice) AND (Speed* OR mobile* OR distract* OR drink* OR drug* OR seatbelt* OR tailgate* OR close follow* OR headway OR vehicle roadworth* OR vehicle maintenance OR highway* OR highway code)*

The search returned 166 potentially relevant papers for review. Once again additional papers and background material were gathered through a similar process to that previously mentioned.

The review of 'Behavioural interventions' followed a similar procedure, and the search was carried out using the following terms:

(Driver OR Rid*) AND (Compliance OR comply OR non-compliance OR infring* OR Reject* OR breach* OR violat* OR disregard) AND (Intervention* OR tool* OR help* OR strategy* OR nudg* OR improv* OR technique* OR chang* OR influenc* OR enhanc* OR educat* OR enforce* OR incentiv* OR encourag* OR modif* OR road OR transport* OR traffic)*

This search returned 134 potentially relevant papers for review. Additional papers and background materials were gathered through following up papers from the reference sections of the articles sourced in the first search, and from papers known to the study team and their contacts.

A.1.2 Filtering to exclude irrelevant and low quality studies

Due to the large number of studies returned by the search the filtering was split into two stages. The first was a review of the abstracts and the second a more thorough and in-depth review of the full text versions of the papers making it through the first stage.

A.1.2.1 First pass abstract review

Abstracts were evaluated based on their relevance to the research question and whether the paper met relevance and quality inclusion criteria. At this stage each paper was rated as either a 'yes', 'no' or 'maybe'. All papers that were rated as either a 'yes' or a 'maybe' were included in the next stage of the review. In total 62 papers were identified from the first review and 42 from the second review to be taken forward to full text filtering.

A.1.2.2 Full text review

Full text copies were sought for each of the papers that made it through the first-pass filtering as 'yes' or 'maybe'. These were then scored again for relevance (to double-check that they met the inclusion criterion) and on quality measured on the following three point scale:

- 3: Adequate methods (e.g. control groups) or statistical procedures (e.g. multivariate modelling) to control for confounding variables and bias as well as appropriate statistical methods to state confidence limits of statistical significance of any effects found
- 2: Incomplete control of confounding variables or bias but some attempt made as well as inappropriate or no statistical methods used, but some attempt to assess the likely confidence limits or significance of effects

1: No controls and no attempt to address confounding variables or random variability in the data

As the review was designed to summarise the key knowledge regarding the area defined previously, only papers of the highest relevance and of the top two quality levels were included in the final review. In total, 31 papers relating to 'Reasons for non-compliance' and 26 papers relating to 'Behavioural interventions' were deemed to meet the criteria for inclusion in the study.

A.1.3 Conducting the final review

The key aim of the inclusion criterion and quality scoring was to ensure that all conclusions drawn from the review were based on the most relevant and best available evidence.

All papers that met the inclusion criterion and were judged to be of high enough quality were reviewed in order to obtain the specific information considered relevant to the goals of the study.

Appendix B Literature review on compliance

B.1 Introduction

The specific aim of this review was to establish current scientific knowledge regarding the differences in the levels of non-compliance exhibited by different types of drivers, as well as their motivations and reasons for engaging in this type of behaviour.

The intention of the review is to present a current 'state of the evidence' rather than providing an exhaustive review of all existing literature on the topic. As such, the results presented should be considered within the context of the wider driver behaviour literature.

B.1.1 Methodology

In order to ensure that the review was based on the highest quality evidence available a systematic approach was taken to conduct the literature search and undertake the inclusion and quality assessment.

The method used to undertake the review consisted of four broad stages:

1. Creation of a list of search terms and commissioning the database searches
2. Identification of potential candidate studies for inclusion based on relevance (based on abstract review)
3. Request of texts and quality assessment based on full-text review
4. Shortlisting best quality literature and reporting the findings

Appendix A describes this process in more detail.

B.2 Reasons for non-compliance

This review examines the individual and situational factors that are associated with compliant and non-compliant behaviour. The discussion identifies how drivers differ in their motivations to not comply with the rules and regulations of the road. Such evidence ensures that the development of interventions to change non-compliant behaviour can be designed with a strong evidence-base and can be carefully targeted and deployed.

B.2.1 Why do people fail to comply with the rules of the road?

The road is a social environment where road users interact with one another to ensure progress and avoid collisions. Driving is also an individual endeavour where personal motivations and goals may moderate these road user interactions. Driving is, therefore, a dynamic process of evaluation and performance adjustment based on self (and our own cognitive and perceptual cues) and others' behaviours, environmental, and situational factors that work together to produce a behavioural outcome. This process is complex, and it is likely that the reasons for taking risks, including the risk of not complying with the rules and regulations of the road, are also complex.

Non-compliance in road use has been researched, sometimes indirectly (for example under the construct of risk-taking¹⁰), using a number of behavioural measures. Speed in particular has received widespread attention, probably due to the fact that speeding is related to a large proportion of KSIs (killed and seriously injured) (Smith, Lawton, Beard, Durrell, Scoons, & Lloyd, 2015) but also because speed enforcement allows the objective measurement of this variable. Drink-driving and mobile phone use while driving have also been researched within this context.

The focus of much research, especially when considering risk taking, has been on young drivers. Neuro-psychological theories of development have established that the adolescent brain is undergoing important structural changes which may result in a number of cognitive limitations when compared with post-adolescent individuals. These may result in increased risk-taking, reward and sensation seeking behaviours, and impulsivity (e.g. Steinberg, 2008). This is supported by a large international evidence-base showing the increased risk of collisions by young drivers, compared to drivers in older age groups (WHO, 2014).

Non-compliant behaviour has also been explored within the context of behavioural theories. The most salient (and frequently employed) is the Theory of Planned Behaviour (TPB) (Ajzen, 1991). The theory posits that behavioural intentions are the strongest predictors of actual behaviour, and that there are three key components involved in the formation of intentions: attitudes toward the behaviour in question, social norms, and perceived behavioural control. The TPB has been directly evaluated with relation to its capacity to explain non-compliant behaviours (such as speeding and drink-driving) and results have shown that although all three components add predictive value, it is 'attitudes' that most consistently predict intentions to not comply (e.g. Marcil, Bergeron & Audet, 2001; Forward, 2009). TPB is important because it informs researchers about the close relationship between intentions and actions, particularly in topic areas where objective data may be limited or lacking.

However, intentions (and thus, the principles of TPB) can only be helpful in the prediction of behaviours under volitional control (Ajzen, 1991). This is, behaviours that are under the person's direct control. Moreover, drivers' own personal motivations to comply with the rules may be more important in directing behaviour. In this case, the road space and transient situational factors (such as time pressure) could also lead to intentional or unintentional breaches of the law. This is where the individual and personal characteristics such as mood, personality, and life and social pressures (sometimes operationalised by type of occupation) play an important role in the understanding of non-compliant behaviour.

Finally, a distinction must be made between purposeful (conscious) and accidental (unconscious) non-compliance. Not all drivers who break the rules have overtly decided to do so; in fact, perceptual and cognitive biases as well as the road environment itself could lead drivers to engage in non-compliant behaviour. This is particularly the case for behaviours such as speeding and close following.

¹⁰ Risk-taking has been researched within the context of non-compliance, and although it may generally be viewed as one of the reasons for this type of behaviour, it is not the only reason and should not be considered a synonym of non-compliance.

Overall, several factors have been found to relate to or predict non-compliant (or in some cases, compliant) behaviour. These, as well as the research these are based on, are detailed in Section B.2.1.1.

B.2.1.1 Factors

Table 5 provides a breakdown of all the factors that have been identified through the present review in relation to four behaviours of interest: speeding, drink-driving, mobile phone use while driving and close following (or tailgating). An 'other' category has been included to account for areas where research has been scarce (or considered to be less relevant to the present study), but where similarities have been found in terms of the attitudes and behaviours that may relate to non-compliant behaviour.

Motivations and factors behind non-compliance with posted speed limits is the most widely researched topic in this area. For this reason, a large part of the research contained in the present review will focus on speed limit compliance/ non-compliance. However, the research identified that deals with other behaviours such as drink-driving and mobile phone use while driving has shown that the overall factors underlying the reasons for engaging in these types of behaviours are largely the same. As such, conclusions relating to non-compliant behaviour will be generalised when possible.

Table 5: Literature findings of factors influencing non-compliant behaviour

Factors	Behaviour					
	Speeding	Drink-driving	Mobile phone use	Close following	Other: VMS, pedestrian rules	Violations/general non-compliance
Age	√	√	√	√		√
Gender	√	√	√		√	√
Mileage	√	√	√		√	
Driving experience					√	
Vehicle type	√				√	
Collision history	√					
Previous violations	√					
Driving purpose	√		√			
Attitudes (TPB)	√	√	√			√
Subjective norms (TPB)	√		√			√
Perceived behavioural control (TPB)	√	√				√
Cognitive/perceptual	√			√		
SES or proxy (e.g. education level)					√	
Occupation	√		√		√	
Time pressure						√
Mood (anger)	√					√
Personality	√					√

Factors		Behaviour				
Usual speed	√					
Other motorists ('optimism bias')	√		√			√
Risk perception	√		√			
Biology						√
	Renner & Anderle, 2000; Ahie et al., 2015; Haglund & Åberg (2000); Watson et al., 2015; Giles, 2004; Letirand & Delhomme, 2005; Webster & Wells, 2000	Marcil et al., 2001; Politis et al., 2013	White et al., 2004; Cazzulino et al., 2014; Walsh et al., 2008; Pöysti et al., 2004	Brackstone & McDonald, 2007	Zhong et al., 2012 (VMS); Granié, 2007 (pedestrians);	González-Iglesias et al., 2012; Renner & Anderle, 2000; Xu et al., 2014; Lajunen et al., 1998; Vardaki & Yannis, 2013; Schwerdtfeger et al., 2010; Hassan & Abdel-Aty, 2013; Castanier et al., 2013; Forward, 2009; Poulter et al., 2008

B.2.1.2 Age, gender and the neuro-psychological perspective

Neuro-psychological theories of adolescent behaviour have usually been at the forefront of research relating to risk-taking and (often) by extension non-compliant behaviour. Youth has almost unanimously been found to predict intentions to perform a behaviour or actual engagement in speeding (e.g. Forward, 2009; Letirand & Delhomme, 2005; Watson, Watson, Siskind, Fleiter, & Soole, 2015; Stradling, Gormley, Fuller, Broughton, Kinnear, O'Dolan & Hannigan, 2007; Ahie, Charlton & Starkey, 2015; Webster & Wells, 2000), drink-driving (Politis, Basbas & Papaioannou, 2013; Pöysti, Rajalin & Summala, 2005), using a mobile phone while driving (Walsh, White, Hyde & Watson, 2008) and even Variable Message Sign (VMS) compliance (Zhong, Zhou, Ma & Jia, 2012).

A study on speeding by Stradling et al. (2007) used data from a large study funded by the Department for Transport in the UK (High UnSafe Speed Accident Reduction, or HUSSAR). Six hundred and eighty six drivers aged 17-91 (with equal gender distribution) who reported having driven on three specific road types (built-up areas, and single and dual carriageway roads) in the past three months were included in the sample. Participants were asked a series of questions relating to their driving behaviour and attitudes toward driving; demographic information was also requested. The study results showed that three 'clusters' (or types) of drivers emerged from the analysis. Those who were in the cluster characterised by faster driving and higher crash propensity were more likely to be young and male. This group was also found to be more likely to become more aggressive when driving, and more likely to nominate higher normal and maximum speeds in open road scenarios.

In relation to mobile phone use while driving, Pöysti et al., (2005) undertook a study in Finland where 834 drivers aged 18-76 years who owned a mobile phone were asked about their phone use, background factors (such as occupation and yearly mileage) and their self-image as a driver. The results showed that younger males used their phone while driving more often than older drivers or females. The regression analysis also showed that people who drove more miles per year were more likely to use their mobile phone more often than those who drove less (e.g. less than 30,000 km/ year).

Another study by Politis, Basbas and Papaioannou (2013) surveyed 305 patrons at bars and cafeterias using a 24-item scale including demographics, views toward interventions (such as enforcement), their drink-driving behaviour as well as knowledge of penalties for drink-driving. The results of the analysis (undertaken using structural equation modelling) showed that age was one of the most crucial factors related to drink-driving, with the propensity to drink and drive being reduced for older age groups. In addition, the number of bar/ cafeteria visits was also positively related to drink-driving behaviour in that more visits related to more self-reported incidences of drink-driving. One finding that seemed to be contrary to previous research was that women were found to be more likely to drink and drive. The authors hypothesise about the reasons for this difference; they suggest that as women metabolise alcohol differently to men, they may exceed the BAC at the same dose. However, the study does not state how many women were included in the sample; it also provides no insight relating to the conditions (e.g. time of day, social context such as whether they were alone) under which the women in the sample decided to drink and drive. It is possible that for women under some circumstances, when making the assessment relating to the relative safety of getting home after an outing, seeking alternative transport can be perceived as more dangerous

(especially if alone). This is particularly likely as data for this study was collected at bars and cafeterias between 11pm and 2am.

Gender has also been found to predict traffic violations and non-compliant behaviours. A study by Vardaki and Yannis, 2013 exploring attitudes toward traffic violations (such as speeding, drink-driving and mobile phone use while driving) took a sample of 601 Greek drivers from a pan-European project (SARTRE) undertaken between November 2010 and February 2011. Participants were asked questions regarding their self-reported behaviours and attitudes toward driving. Similar to work by Stradling et al. (2007), the authors carried out a cluster analysis to identify 'risky' typologies. Cluster 1 contained drivers who were more likely to be male. They were also more likely to state they would exceed the speed limit and although 78% reported they had "never" or "rarely" driven after having consumed alcohol, they expressed this view to a lesser extent than drivers in the other two clusters (i.e. the other clusters contained drivers who were more likely to report they had/ would "never" drive a car after having consumed even a small amount of alcohol). Similarly, drivers in the first cluster were also more likely to report that their friends would demonstrate a similar behaviour (78% agreed "fairly" or "very much" that their friends would speed; 46% agreed "fairly" or "very much" that their friends would drink and drive); thus participants who were most likely to speed and have riskier attitudes toward drink-driving believed (relative to other groups) that these behaviours were normalised among their peers.

A detailed discussion of the biological underpinnings of gender differences is beyond the scope of the present study. Nonetheless it is worth noting that some research has identified that hormonal differences, such as testosterone, can influence risk-taking and non-compliance. One such study explored the effects of higher testosterone exposure during prenatal development on violations (measured by self-reported penalty points) for 77 male drivers. A measure known as Digit ratio (2D:4D) was used which, according to the authors, represents a putative marker of prenatal hormone exposure and relates to the ratio of the length of the index (2D) to the ring finger (4D). The research found that those with higher prenatal exposure to testosterone (i.e. lower digit ratio) were more likely to have more penalty points than those with higher exposure (i.e. a higher digit ratio) (Schwerdtfeger, Heims & Heer, 2010).

There is also some evidence that gender differences in compliance can be found from a young age. For example, a study by Granié (2007) sought to understand gender differences in compliance with pedestrian rules in a sample of 162 five year-old students. Children were assessed on pedestrian danger appraisals ('is it dangerous to do...'), rule knowledge and rule compliance (based on photographs presenting pedestrian safety behaviours). Altogether, these items formed the 'declared compliance' score. Students were also observed while undertaking journeys as a pedestrian with their parents; this formed the behavioural compliance scores. The results showed that although compliance with a number of pedestrian rules (such as walking on the sidewalk, and walking - not running - across the street) were high in the sample, on the whole, boys tended to obey rules less often than girls. For example, girls were more likely than boys to walk rather than run on the footway and when crossing the road. Nevertheless, boys were more likely than girls to check the surrounding environment as they travelled. In addition, the results showed that declared behavioural compliance was linked to behavioural compliance among girls, but not in boys. The authors conclude that this result in particular may indicate a gap between compliance decisions and compliance behaviours and that the motivations to comply may be different for boys and girls.

Although age and gender have been shown to consistently predict risk-taking and non-compliant behaviour, young drivers' motivations to engage in non-compliant behaviour are likely to be different (when compared to drivers in older age groups) and partly related to inexperience and age-related developmental changes. Moreover, the operationalization of 'young' is not necessarily the same across studies. For example, in the study by Vardaki and Yannis (2013), drivers in cluster 1 (the riskiest group) were characterised as being under 55 years of age. A study by Watson et al. (2015), who also found an effect of age, characterised the 'young' age group as being under 30 years.

Further, being young and male does not automatically result in risky behaviour, thus, categorising all young male drivers as risky and/or non-compliant could be unfair on the safe drivers among this group. In short, there are likely to be other factors of interest. Hence, expanding the understanding of other underlying factors may help to further understand what differentiates drivers who comply from those who don't.

B.2.1.3 Attitudes and the Theory of Planned Behaviour

The Theory of Planned behaviour (TPB) has been widely used to understand behaviour in different areas of life, including driving, and as such it has acquired an extensive evidence-base. The theory was developed as an extension to its predecessor, the Theory of Reasoned Action, and is focused on the links between intentions to perform a given behaviour, and actual performance of the behaviour (Ajzen, 1991). Intentions are formed on the basis of three determinants. These are attitude toward the behaviour in question, subjective norm (i.e. the perceived social pressures to perform or not to perform the behaviour) and perceived behavioural control (i.e. the perceived ease or difficulty of engaging in the behaviour, perceived obstacles and previous experience). Figure 5 provides a breakdown of the components of the theory and how they relate to each other.

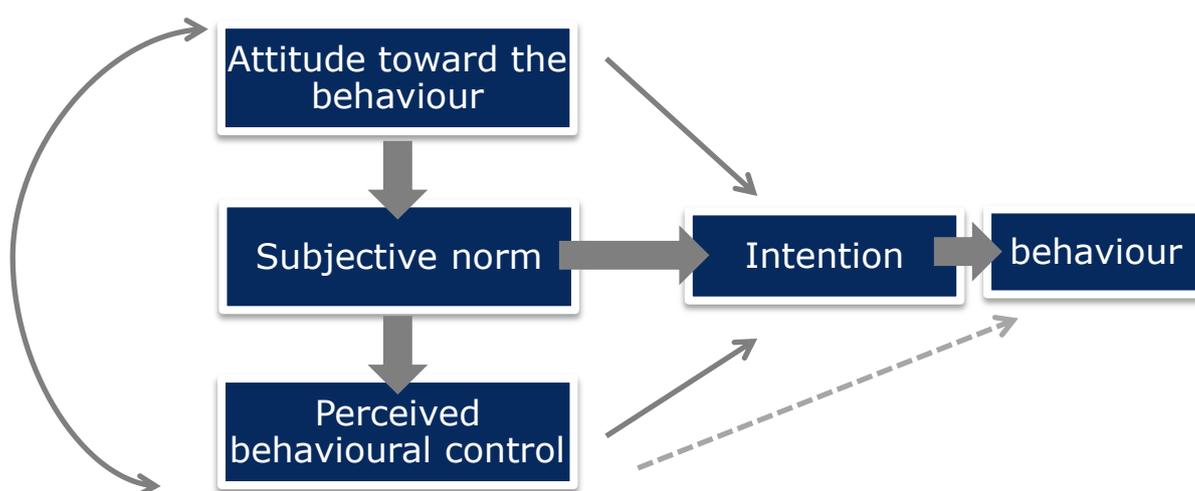


Figure 5: Theory of planned behaviour (Ajzen, 1991)

The TPB has been found to strongly correlate with intentions to comply (or not comply) with speed limits, drink-driving laws and mobile phone use regulations (e.g. Marcil, Bergeron & Audet, 2001; Letirand & Delhomme, 2005; Forward, 2009; Castanier, Deroche & Woodman, 2013). Although in general, all three components of TPB have

been found to relate to intentions to perform the behaviours in question, 'attitudes' toward the behaviour are usually the strongest predictor of intentions to not comply (or comply) with the laws governing driving.

A Canadian study by Marcil, Bergeron and Audet (2001) sought to better understand the reasons for drinking and driving in a sample of 115 male university students (ages 18-24). Students completed a questionnaire based on the TPB, and questions about demographic information. Multiple regression analysis showed that all three components of TPB predicted the intention to drink and drive (64% of the total variance of intentions was explained¹¹). Moreover, participants' attitudes toward drink-driving were the most important predictor of their intentions to drink and drive.

Another study, this time in Australia, examined which factors influenced intentions to use a mobile phone while driving in a sample of 796 drivers aged 17-76 years. Participants completed a 10 minute questionnaire including TPB and risk perception items. TPB factors were used to predict intentions of general mobile phone use while driving, but also for calling and texting specifically in four different scenarios. The scenarios varied in terms of the time pressure ('running late' and 'not in a hurry') and vehicle speeds ('driving at 100km/h' and 'waiting at traffic lights'). The results showed that TPB components of attitudes and subjective norms were significant predictors of intentions to use a mobile phone while driving (32% of the variance was explained). Moreover, the results suggest that having more positive attitudes toward mobile phone use while driving, and a greater perception of approval from others, were both likely to increase the intention to use a phone while driving (Walsh et al., 2008). Interestingly, the work was not completely successful in predicting intentions to text and drive. The correlation between texting and driving, and general mobile phone use while driving, was only moderate. The authors suggested that this may be due to texting and talking while driving being viewed as very different behaviours, possibly with different underlying motivations.

Another study assessed five traffic violations: speeding, drink-driving, close following, using a mobile phone while driving and disobeying road signs. A sample comprising 153 women and 127 men was selected and surveyed at two time points. The first survey assessed the TPB components as well as intentions to commit one of the five road violations; the latter was assessed using four items for each road violation (e.g. "Within the next six months, I intend to [commit this road violation]"). The second questionnaire (which was administered 6 months later) measured self-reported on-road behaviours. Results were that attitudes, subjective norms and perceived behavioural control explained over 56% of the variance in intentions for drink-driving, excessive speeding, following a car too closely, phoning and driving, and disobeying road signs. The highest predictive value was found for phoning and driving with 73% of the variance explained (Castanier, Deroche & Woodman, 2013).

The TPB has also been used with professional driver groups to examine compliance. For example a study by Poulter and colleagues (2008) explored lorry driver behaviour and

¹¹ Regression analysis is a statistical technique used to look at a set of factors and understand how they work together to predict an outcome (i.e. another variable, such as scores on a scale). A calculation is provided relating to the total amount of variance (or variation in the responses, scores, etc.) that is accounted for by the combined predictive model. The model is created by entering the variables of interest one by one until no further predictive power is added to the model.

compliance within the context of TPB in a sample of 232 drivers (225 of whom were male). The authors reported that the sample in the study was reflective of the overall trucking population in terms of gender split, annual mileage (average annual mileage = 49,524 miles) and age (average age = 46.8 years). The results showed that TPB accounted for 28% of the variability in self-reported driving behaviour and attitudes did not have a significant association with intentions. When compliance with UK regulations was considered, the subcomponent perceived behavioural control had the largest direct effect on compliance behaviour. Some caveats of this study include the sampling method as questionnaires were sent to operators who were asked to distribute them among their drivers. Not all operators distributed the questionnaire, and not all allowed their drivers to complete the questionnaire on company time. Therefore, there might be a significant difference in terms of the characteristics (and workplace safety culture) between those drivers who completed the questionnaire and those who did not.

Although results have sometimes been variable, the TPB and its components have provided insight into some of the reasons why drivers may fail to comply with the rules of the road. Moreover, one significant finding from research based on the TPB is that it is generally found that drivers believe that significant others (or other reference groups) would disapprove of violating behaviour (e.g. speeding, Letirand & Delhomme, 2005; Marcil et al., 2001). This evidence suggests that non-compliance, at least within the context of the behaviours researched, is widely accepted as morally wrong. However, as the study on mobile phone use by Walsh et al. (2008) showed that participants who had a greater perception of approval from others were more likely to intend to use a phone while driving. This may highlight a difference between social norms and personal-peer influenced norms. While the latter may be captured by the TPB social norm construct, peer influenced norms may be related to descriptive norm (discussed in Section B.2.1.7).

B.2.1.4 Goal attainment and the function of time pressure

Some research suggests that there is a gap between intentions and actions (e.g. Granié, 2007), and that this gap is not accounted for by the TPB. Liourta & van Empelen (2008) suggest a number of theoretical models that can be used to bridge this gap, including models that emphasise the importance of goal attainment.

Goal attainment can relate to driving-related behaviours, but may be subject to influences from conflicting or higher valued goals (Liourta & van Empelen, 2008). In a conscious (or subconscious) evaluation process, a goal, for example the goal to remain within the speed limit, may become undermined by the need to get to a destination on time, particularly if other environmental factors (traffic, road conditions) are also at play.

Getting to a destination on time is an important goal that every road user shares at one point or another. However, when under time pressure, this goal may become a priority and the evaluation of the risks of not complying with the law may become undermined by a more salient perceived reward. For example, a study by Hassan and Abde-Aty (2013) sought to identify some of the reasons why young drivers (ages 17-24) engage in risky driving, and how these associate with crashes and traffic violations. Six hundred and eighty young drivers randomly selected in Florida (USA) completed a questionnaire relating to risk perception, risk-taking attitudes, in-vehicle distractions and aberrant driving behaviour (measured by the Driver Behaviour Questionnaire or 'DBQ', Reason, Manstead, Stradling, Baxter & Campbell, 1990). The sample was 49.4% male. The

findings showed that 82.4% of participants reported that “running late” was the main reason for taking risks while driving. Adams-Guppy and Guppy (1995, as referenced in Xu, Li & Jiang, 2014) found that under high time pressure drivers were more likely to perceive punctuality as desirable (and less likely to perceive speeding as a risk factor).

This effect of time pressure could also be evidenced by research findings showing that people in managerial positions drive faster than comparison groups (such as manual workers, housewives, students and the unemployed) (see Webster & Wells, 2000). Similarly, a study on mobile phone use found that younger and business-use drivers were more likely to intend to use their mobile phone while driving than older and private-use drivers (Walsh et al., 2008). Pöysti and colleagues (2005) found similar results in their study of 834 Finish drivers; after age, occupation was the highest predictor of (self-reported) hazardous situations experienced while driving. Specifically, participants in ‘leading positions’ (i.e. managers and executives) were three times more likely than those who were retired to report they “very often” experienced hazards relating to their mobile phone use when driving (Pöysti et al., 2005). Although the authors do not specify the types of hazards experienced by drivers, these could include episodes of near misses, dangerous distractions or driving errors; it is possible that drivers also reported collisions, all of which could be indicative of increased risk. However, it is important to note that participants reported having experienced hazards in the previous six months and as such answers could be subject to issues with memory (participants may have been likely to only recall memorable events). The authors suggest that the social desirability bias could have also played a role as those who considered themselves to be more skilled drivers may have opted to not report certain situations.

A study by Ahie and colleagues (2015) showed that the motivations for driving can also influence the way drivers choose travelling speeds. The study involving 193 participants for whom on-road speed measurements were made (at seven different locations), interviews were undertaken. The questions related to perceived and preferred travelling speed, as well as travelling speed preferences for four different driving reasons: to save money on fuel, to drive safely, to maximize fun and their usual speed on that road. Participants were divided into two sub groups, ‘slow movers’ (drivers whose rating of usual speed was more than 10% slower than what they believed the speed limit to be) and ‘fast movers’ (participants whose speed ratings were 10% faster than they believed the speed limit to be). The results showed that ‘driving for fun’ resulted in the highest speed ratings, with ‘fast movers’ stating speed preferences over 30% faster than their speed limit belief (Ahie et al., 2015). One caveat of this study is the fact that the methods employed meant that participants’ reports of preferred speed under different situations may have been biased by commonly held beliefs and stereotypes of what it means to ‘drive for fun’ versus ‘driving for safety’; particularly as there was no objective measurement of actual speed choice. For example, ‘safe driving’ is likely to be generally perceived to involve slower speeds, while driving ‘for fun’ is likely to be perceived as relating to faster speeds.

Overall, personal motivations can play a direct or indirect role in the choices made while driving. In addition, although a driver may have safety-related goals, environmental factors (such as time pressure) could lead to new goals being formed and pursued (such as getting to work on time).

B.2.1.5 Driving experience and vehicle characteristics

A number of studies have suggested that driving-related characteristics such as annual mileage, crash involvement and previous violations can also be related to non-compliant behaviour. In their study on speeding, Stradling et al. (2007) found that previous crash involvement predicted belonging to the high-risk, high-speeder group. Watson and colleagues also undertook a study relating to speeding, particularly the characteristics of speeding offenders (Watson et al., 2015). Their sample included demographic, offence and crash history data from 84,456 offenders obtained from the Queensland Department of Transport (Australia). Data ranged from May 1996 to August 2007. Drivers were categorised into three different groups: low range offenders (those who committed one low range speeding offence in the time), high-range offenders (offenders who committed two or more speeding offences in the study period, where at least two of them were for a recorded speed of 30km/h or higher than the posted speed limit), and other offenders (all others who committed at least one mid-range or high-range offence, but no more than 1 offence at 30km/h or above the speed limit). When comparing low and high range offenders, the researchers found that high range offenders were more likely to have a previous crash history, have a previous alcohol related traffic offence or offences, and to hold a motorcycle licence. Similarly, when compared with 'other' offenders, high range offenders were more likely to have a crash history and have at least one seatbelt offence (Watson et al., 2015).

Vehicle type has also emerged as a possible correlate to driver non-compliant behaviour, for example, in relation to close following. Brackstone and McDonald (2007) provided an overview of literature relating to tailgating and they describe the close following scenario as one of constant evaluation and corrective action; the driver establishes a 'target' following distance, but it is often difficult to maintain a set distance. This then results in the driver needing to take corrective action at a given point and either fall back or catch up. One of the factors discussed by the authors relates to the ability to 'read the road' (this is, modifying behaviour based on context and the actions of the vehicle in front); the authors suggest that headway distances can be attributed to the type of vehicle being followed. For example, some research shows that drivers follow trucks more closely than smaller vehicles (Brackstone et al., 2007; as referenced in Brackstone & McDonald, 2007). The authors theorise that this could be due to lorry drivers being perceived as being more skilled at 'reading the road' ahead, hence making it safer to follow closely. However, it is also possible that a driver following a lorry may have a reduction in workload given the reduced amount of available information in their field of view. Regardless of the reason, a consideration of the vehicle mix on a given road may help to understand close following behaviour.

B.2.1.6 Personality and Mood

Certain personality characteristics have been found to relate to risk-taking and traffic violations. For example, a study assessing situational factors and impulsiveness on intentions to commit traffic violations (e.g. red light running and driving through a cycle path) found that impulsiveness significantly predicted violation intentions, but only among novice drivers (less than 3 years driving experience) (Xu, Li & Jiang, 2014). The study involved 232 drivers aged 18-60 (n=116 females), most of which were non-professional drivers (83%). Several measures were assessed including impulsiveness (as measured by the brief Barratt Impulsiveness Scale), perceived descriptive norm, time pressure and intentions to violate. The authors conclude that more experienced drivers

rely more on the environment, while novice drivers are more likely to be guided by personal characteristics when driving (Xu et al., 2014). This adds strength to the notion that the decision to not comply in young drivers is part of a complex decision-making process, and as such may require a more multifaceted approach to combat.

Another study assessed personality characteristics, as measured by the Eysenck personality questionnaire (a commonly employed personality assessment tool in clinical psychology). The study with 98 juvenile traffic offenders (81 men) who had committed general traffic offences (not specified, but excluding alcohol-related offences) were assessed on the personality traits of extraversion, neuroticism, psychoticism and 'venturesomeness' and compared with a control group of 149 participants (82 men). These characteristics have been previously found to relate to traffic convictions, particularly extraversion. Venturesomeness, according to the authors, implies a tendency to act on the spur of the moment and relates to impulsiveness. Venturesomeness was found to significantly differ between groups, with traffic offenders scoring significantly higher than controls. Similarly, traffic offenders also scored higher on the extraversion scale (Renner & Anderle, 2000). One major limitation to this study is the fact that participants in the control group were driving school students and thus had not yet received a full driving licence. Although participants in the experimental group were within the first two years of their two year licence probation period (licences in Australia are issued on probation for the first two years), it is unlikely that the groups were comparable, particularly as participants in the control group had reduced exposure and opportunity to violate.

Negative mood while driving is another factor that has been evaluated in the literature, particularly as it is likely to be experienced widely and may be affected by situational factors that have already shown to relate to traffic violations and non-compliance, such as time pressure.

One particular affective state, anger, has received widespread attention in road safety, particularly as previous research has shown that anger can increase crash involvement (e.g. Underwood, Chapman, Wright & Crundall, 1999). Anger has also been found to relate to traffic offences. González-Iglesias, Gómez-Fraguela & Luengo-Martín (2012) found that anger while driving was predictive of traffic violations in a sample of 541 drivers (ages 20-73). The authors employed previously validated scales, the Driving Anger Scale (DAS) and Driving Anger Expression Inventory (DAX) as well as the Driver Behaviour Questionnaire (DBQ), all of which have been widely used within the context of road safety. The study identified specifically that anger at slow driving and illegal driving were the individual variables best explaining traffic violations (once age, gender and annual mileage had been taken into account). In addition, the study showed that males and females differed in terms of the driving situations considered to be anger-inducing; for example, males were more likely to be angered by police presence (as exhibited by a significantly higher score on the DAX subscale) and females were more likely to report being angered by traffic obstructions (as measured by the DAX). However, both genders reported similar levels of anger caused by slow driving and illegal driving.

Another study by Lajunen, Parker and Stradling (1998) was undertaken with 270 participants (165 male) using similar measures to González-Iglesias et al. (2012). The authors found that both Highway Code violations (e.g. speeding and running red lights) and aggressive violations (i.e. sounding one's horn or giving chase to other drivers) were related to the anger factors. The findings also showed that the predictive power of reported anger was mediated by self-assessed safety skill (as assessed by the Driver

Skill Inventory). That is, the effects of anger on behaviour were reduced for drivers who reported a higher safety skill (such as avoiding competition in traffic and allowing sufficient following distance). Note that the safety skill measured in this study relates to the drivers capability of behaving within traffic, and is quite different to performance-related self-assessed skill (i.e. rating oneself as a better driver than others). The latter is related to the self-enhancement bias (the tendency of drivers to overestimate their own driving abilities and underestimate others' ability) and is likely to have a differential effect on driving behaviour (as discussed by Tapp, Nancarrow & Davis, 2015).

There are other studies linking personality characteristics with other dangerous behaviours such as risk-taking in general, and with collision involvement. This area of research is also likely to relate to age-based theories of behaviour, particularly as work undertaken has identified heightened impulsivity during adolescence (e.g. Steinberg, 2008). However, the present review sought to identify literature specifically related to non-compliance with road rules, and as such the literature is limited. Nonetheless, personality may be an important factor relating to non-compliance and one that merits further research.

B.2.1.7 Risk perception and the knowledge gap fallacy

It is often assumed that drivers do not have sufficient knowledge of the risks of engaging in non-compliant behaviour when they choose to engage with non-compliant acts. However, there is little to no evidence to support this hypothesis; in fact, many studies have found that reported knowledge of risks is high (e.g. White, Eiser & Harris, 2004). Knowledge of risks (i.e. acceptance that a given activity is risky) does not necessarily result in increased assessments of one's own personal risk of being involved in a collision ('risk estimates') and some studies have found that sometimes risk estimates can be low (Xu et al., 2014). Nonetheless, even when high risk estimates are reported, safer behaviour does not necessarily ensue (e.g. Cazzulino et al., 2014; Walsh et al., 2008; White et al., 2004).

For example, in the study by Cazzulino et al. (2014) the authors discuss that in most studies, a high frequency of texting and talking on the phone while driving was reported regardless of the high perceived risk. Similarly, in their study they found that although participants were more likely to perceive those who were texting before a collision to be more responsible for the collision, they were less likely to assign punishment to those that were texting or talking on their mobile phones than to drunk-drivers. This demonstrates that while drivers acknowledge that texting while driving is risky (and more likely to lead to a collision), they do not perceive it to be legitimate to severely punish what is a common activity.

Xu et al.'s study (2014) also explored the effects of risk perception, as characterised by drivers' reported intentions to violate traffic rules in scenarios where the accident risk base rates (the estimated frequency of a collision occurring in a particular scenario) were high. The accident base rate was operationalised according to information relating to the frequency of accident occurrence (e.g. low 'accidents rarely occur in this area' and high 'accidents frequently occur in this area'). Descriptive norms were also measured; this refers to individuals' perceptions of what is commonly performed regardless of whether it is morally correct or not (two levels were assessed in this study: safe driving norm and unsafe driving norm) and differs from subjective norms (as discussed in Section B.2.1.3) which refers to the approval of a behaviour within a social group. These variables were

manipulated over eight scenarios, along with time pressure ('being late' or not). The results from the study showed that when risk perception was low (as measured by a low accident base rate), participants were more likely to violate. However, when the accident base rate was high ('accidents frequently occur') participants relied more on the descriptive norms. This is, they were more likely to use an alternative source to inform their decision to (or not to) violate. Hence, although the estimated risk played an important role in the decisions to violate, so did the drivers perceptions of 'others' behaviours.

Overall, the research shows that it is not necessarily the knowledge of road safety risks that is low, instead it is perhaps the ability of drivers to translate this knowledge into an appropriate appraisal of personal risk. Similarly, as per Xu et al.'s study, it is also possible that other sources of information are creating biases that, when combined with external influences, can lead drivers to make dangerous decisions.

B.2.1.8 The 'false consensus' and driver's perceptual biases

The study by Xu and colleagues (2014) highlights the role of descriptive norms in the development of a course of action. Similarly, one of TPB's major components, social norm, has been found to be relevant (and important) in the prediction of non-compliant behaviours of drivers of different ages (discussed in Section B.2.1.3). Both elements highlight the importance of social cues (whether perceived or real) and how they relate to how drivers choose their on-road behaviours.

One important bias that has been discussed in the literature refers to the 'false consensus' or 'optimism bias'. This is the inflated perception that other drivers engage in non-compliant behaviour more often than they actually do (Haglund & Åberg, 2000). A study carried out in Sweden sought to better understand the effects of other drivers on drivers' speed choice and found that the average estimated percentage of other drivers exceeding the speed limit was 51%, while the observed percentage was closer to 23% (Haglund & Åberg, 2000). Similarly, results showed that significantly more drivers in the high speed group (58%), this is drivers whose observed speed was found to be 100 km/h and over, estimated that other drivers exceeded the speed limit. The study involved 1,029 drivers (75% of which were male) ages 18-83 who provided speed measurements (estimated using video analysis) and self-reported questionnaire data (including questions about the circumstances of the road, the journey and participants' behaviour when they were stopped by researchers). White et al.'s (2004) study of mobile phone use while driving found that although respondents perceived that the chance of a collision due to mobile phone use was high for themselves, they were perceived it as even higher for their peers.

Tapp et al. (2015) discuss the normative effects of other drivers on driving behaviour. They cite work by Connolly and Åberg describing the 'social contagion' model in which drivers adopt a travelling speed based on other drivers' speed (Connolly & Åberg, 1993; as referenced in Tapp et al., 2015). This, combined with a false consensus can lead to distorted driving norms. To test this hypothesis in light of the possible reduction to 20mph speed limits in the UK in some areas, the authors surveyed 2,297 drivers. Measures of attitudes and self-reported behaviours relating to 20mph limits were collected and analysed. The results showed that those who reported they may not comply with 20 mph speed limits (regardless of self-reported support or opposition to the change in speed limits) had very similar driving styles, and were more likely to agree

with the statements “*I tend to drive at the speed of other people on the road*”, “*I use my own judgement, not speed limits, to decide on my speed on the road*”, and “*I tend to unconsciously drive faster than speed limits quite often*”.

The statement, “*I tend to drive at the speed of other people on the road*”, can also be indicative of the social pressures involved in driving. That is, some drivers may engage in certain behaviours, such as speeding, because they feel pressured to do so by other road users. For example, a qualitative study in 2010 aimed to assess the social influence on driving speeds in 67 Australian drivers of different ages. The key themes that emerged from the analysis relating to ‘other’ drivers included speeding to keep up with traffic flow and perceived pressure to drive faster. These factors can also interact with the individual and environmental cues to produce an undesirable behavioural outcome, which is not always planned or necessarily conscious (Fleiter, Lennon, & Watson, 2010).

Webster and Wells (2000) also discuss the ‘false consensus’ issue but highlight that other biases, such as the perception that speeding is a less serious offence, could also play an important role in compliant behaviour. This is similar to the study by Cazzulino and colleagues who, in their assessment of mobile phone use while driving, found that although participants were more likely to rate those who were texting before a crash to be more responsible (i.e. at fault) than those talking on the phone or drink-driving, they were less willing to assign punishment to those engaging in texting and talking on a mobile phone than to drink-drivers (Cazzulino et al., 2014).

This subsection highlights the importance of reference groups in informing decisions to comply or not to comply with the rules of the road. This relationship was first highlighted by the TPB (Section B.2.1.3), where social norm is considered one of the key determinants of intentions to engage in non-compliant behaviour. However, there are other referents that drivers may use, such as the descriptive norm (Section B.2.1.7), which also require the use of social references but that may be less guided by morality. However, driving is a social activity and when unsure about a particular course of action, drivers may use their perceptions of what others would do in a similar situation, possibly to help inform their estimates of risk or to validate their behaviour. This is likely to result in an endless cycle where drivers’ incorrect behaviours are constantly validated by their perceptions of what is commonly done. In this case, the most effective approach is likely to be a change in the general road safety culture.

B.2.2 Summary

There are a number of factors that have been identified through the literature that relate to non-compliant behaviour. However, driver behaviour, and particularly the cognitive process involved in deciding whether or not to comply with the rules of the road is complex; it also involves internal and external motivations which combine at a given time and place to produce a behavioural outcome. As many violations are likely to be precursors to collision involvement, research in this area has sought to better understand the factors underlying violations of the rules of the road.

Behavioural theories have been used through the years to develop a framework to understand drivers’ decisions to take risks and/ or failures to comply with the rules of the road. These theories have informed researchers about the importance of a number of factors in this decision-making process. Evidence exploring gender, age and exposure differences have provided evidence that younger, male drivers are at higher risk of intending to commit or committing violations. Other factors, such as biases in risk

perception and 'reading' other drivers have also been shown to be important, particularly as they feed into the notion that the driving environment is a highly social environment regimented by a set of 'unwritten' rules that most drivers follow (whether consciously or not). In fact, this tacit agreement between drivers about what is 'acceptable' and 'appropriate' may be a major component in the decisions to break the rules.

However, situational factors can also create negative affective moods (such as anger) which in combination with external motivations, such as time pressure, can increase the likelihood of drivers not complying. This is particularly the case for behaviours such as speeding and using a mobile phone. Time pressure can also be related to the driver's occupation, and the type of role they perform in their organisations. With increasing pressure on employees to be productive, and considering the large population of professional drivers whose annual mileage exceeds that of non-professionals, it is important to consider work-related road safety. It may be necessary to encourage a change in safety culture in this domain.

Finally, while the strong theoretical background provided by the TPB has shown that drivers' attitudes, their social norm and their perceived behavioural control can explain (in most circumstances) much of the non-compliant intentions or behaviours, these theories are of little help if they cannot be translated into positive action. This is, interventions are needed that will reduce the likelihood of drivers failing to comply with the law and/ or regulations of safe driving (for example, as stated in the Highway Code). Interventions are likely to be more effective if they are designed within a strong theoretical framework (McKenna, 2010) such as that of the TPB. However, these must also take into account that not everyone who breaks the rules of the road does so intentionally, or at least their prime motivation was not to do so. As such, issues such as time pressure and situational anger and frustration should also be considered.

Section D.1 provides an overview of current interventions aimed at people who fail to comply with the law, and highlights those that have demonstrated effectiveness based on empirical evidence.

Appendix C Measures included in the questionnaire

Table 6: Characteristics measured in the online questionnaire

Measures	Description
Theory of planned behaviour items	Three bespoke scales (containing seven items each) were developed in order to measure participants' attitudes, social norm, and perceived behavioural control for the seven behaviours of interest.
	TPB - Attitudes The scale assessed drivers' attitudes in relation to the risk of engaging in each of the seven behaviours of interest. Items were assessed on a five-point Likert-type scale ranging from 'Extremely dangerous' to 'Extremely safe'. A high score signals that the respondent believes the non-compliant behaviour is safe.
	TPB – Social norm The scale assessed the degree to which participants witness other drivers not complying with the behaviours of interest. Responses to the items were measured on a five-point Likert scale that ranged from 'Never' to 'Nearly all the time'. A high score suggests that the respondent believes that other road users engage in the non-compliant behaviour frequently.
	TPB – Perceived behavioural control The scale assessed how easy respondents believed it was to avoid each of the seven behaviours of interest. The scale was rated on a five-point Likert-type scale ranging from 'Extremely easy' to 'Almost impossible'. A high score suggests that the respondent believes it is difficult to avoid the non-compliant behaviour.
Habitual on-road behaviour	A seven item scale was developed to assess participants' habitual behaviour regarding the seven behaviours of interest. Participants were asked to rate how often they had engaged in each of the seven behaviours in the previous three months. Items were measured on a five-point Likert-type scale ranging from 'Never' to 'Nearly all the time'. The higher the score, the more often the respondent has engaged in the non-compliant behaviour in the previous three months.
Driver Stress Inventory (DSI)	A 48-item self-report scale developed by Matthews et al. (1997) to measure stress vulnerability. The scale is divided into four subscales: aggression ('AGG', 12 items), dislike of driving ('DIS', 12 items), thrill-seeking ('TS', 8 items) and hazard monitoring ('HM', 8 items). The items were rated on an 11 point scale ranging from

Measures	Description
	<p>'Very rarely/ Not at all' to 'Very often'/ 'Very much'. A high (cumulative) score suggests that the respondent had a higher propensity of driving stress; individually, a high score on each measure suggests a higher propensity to be anxious, angry and/or thrill-seeking and a lower propensity to monitor hazards while driving.</p>
Guppy scales	<p>A twelve item scale measuring self-reported driving style; this scale has been used previously in road safety research (Maycock & Forsyth, 1997; Quimby, Maycock, Palmer & Buttress, 1999). Items on the scale are presented on a seven-point scale with opposite anchors. Participants are asked to rate their responses on the 'continuum' for each scale. The scale typically reduces to three factors characterising particular driving styles. Previous work has shown that these factors can relate to accident risk (e.g. Wells Tong, Sexton, Grayson & Jones, 2008).</p>
Ten-Item Personality Inventory (TIPI)	<p>This is a ten-item instrument developed by Gosling et al. (2003) to measure the 'Big-five' dimensions of personality. These dimensions have been developed over decades of research and are generally accepted as the core personality constructs. The five personality traits measured are extraversion, agreeableness, conscientiousness, emotional stability and openness to experience (Gosling, Rentfrow, & Swann, 2003). These are assessed on a seven-point Likert scale ranging from 'Agree strongly' to 'Disagree strongly'. A higher score for each personality construct would suggest that the respondent has a higher propensity to be characterised by that personality trait.</p>
Risk perception of seven behaviours of interest	<p>Seven bespoke five-item scales were developed to measure attitudes toward the seven behaviours of interest. The items included a range of topics including attitudes toward the introduction of harsher penalties and risk perception. Attitudes were measured on a five-point Likert scale ranging from 'Strongly agree' to 'Strongly disagree'. A higher score on these scales would suggest the respondent has a lower perception of the risks relating to non-compliant behaviours.</p>
Attitudes toward major roads in GB	<p>A bespoke nine item scale was developed to assess participants' attitudes toward the SRN in Great Britain, including attitudes toward posted speed limits, quality of the SRN and enjoyment of driving on the different types of road. Questionnaire items were assessed on a five-point Likert scale ranging from 'Strongly agree' to 'Strongly disagree'. A higher score on this scale suggests the respondent shows a more negative regard for the SRN in GB.</p>
Demographic variables	<p>Participants were asked to provide information on a range of demographics including age, gender, annual income, educational attainment, employment status and civil status.</p>
Exposure data	<p>Participants were asked questions relating to their use of the SRN, particularly motorways and dual carriage ways (these served as</p>

Measures	Description
	qualifying questions for survey participants as those who did not meet the minimum requirement were not allowed to continue with the survey). Similarly, participants were also asked to provide information about their annual mileage by various forms of transport (e.g. car, motorcycle, HGV), and collision involvement.
Driving experience	Participants were asked to provide information about their date of licensure and any advanced driving qualifications.
Behavioural intentions	This was the outcome measure used for the analysis. Participants were asked how often they intended to engage in each of the seven behaviours of interest in the next three months. The items were assessed on a five-point Likert scale ranging from 'Never' (compliers) to 'Nearly all the time' (non-compliers). The higher the score on this measure the more the respondent intends to engage in the non-compliant behaviours in the next three months.

Appendix D Literature review on interventions to improve compliance

D.1 Interventions

The purpose of this chapter is to examine the current literature investigating the effectiveness of interventions designed to increase levels of compliant behaviour. The review will identify the different types of interventions that have been carried out as well as whether they have been found to be effective in reducing non-compliant behaviour. Furthermore, it will also provide some explanations regarding the reasons for the level of effectiveness based on key behavioural change theories.

The intention of the review is to present a current 'state of the evidence' rather than providing an exhaustive review of all existing literature on the topic. As such, the results presented should be considered within the context of the wider driver behaviour literature.

D.1.1 Overview

Reducing non-compliant behaviour by drivers is a key aim for most governments today as by doing so they will be able to significantly reduce the number of killed and seriously injured (KSI) on the road. Indeed, behaviours such as speeding or drink-driving have been repeatedly found to be some of the most significant factors contributing to the levels of KSI on the roads (Smith et al., 2015; Montella, Punzo, Chiaradonna, Mauriello & Mantanino, 2015). It is for this reason that an increasing number of interventions aiming to reduce levels of non-compliance are being developed

Interventions aimed at reducing non-compliance have in the past focused on education and enforcement. This includes increased police enforcement, increased severity of a punishment or attending education based courses, such as speed awareness courses. Many education based interventions rely on the belief that the reason for drivers' non-compliance is a lack of awareness and knowledge of the rules of the road. It is assumed that an increase in knowledge will lead to a positive change in behaviour. The role of enforcement, meanwhile, is to increase the perceived threat of being punished, as threat and fear have been found to be a factor that can lead to behaviour change in some situations (Smith et al., 2015).

More recently there have been a number of changes regarding the type of interventions that are being introduced. Intervention design has evolved to adopt a more psychological approach, by including methods aimed at targeting key constructs that have been found to impact behaviour, such as social norms and perceived behavioural control (see Section B.2.1.1 for definitions). Indeed, there seems to have been a move away from the belief that knowledge was the source of the problem towards a realisation that other motivating factors might be the root cause of non-compliance. These motivating factors have in turn become the focus of new types of interventions.

In addition, the development of more advanced in-built vehicle devices has also led to a new types of intervention allowing drivers to visualise and obtain feedback on their behaviour in a much more accurate and timely way than before. Similarly, there has been a number of developments regarding the interventions which could be considered as more traditional such as speed cameras and road design to account for advances in the understanding of factors that lead to behaviour change.

A number of interventions have been evaluated in order to measure their effectiveness in reducing levels of non-compliance. These, as well as the research they are based on are detailed in Section D.1.2.

Table 7 provides a breakdown of which type of interventions have been used to target specific behaviours, these include: speeding, drink-driving, graduated driver licensing, other types of non-compliance (e.g. red light running, pedestrian right of way, seat-belt use) and general non-compliance (e.g. general violation of road rules).

D.1.2 Interventions

D.1.2.1 Speed cameras

A number of different interventions have been carried out involving speed cameras as they have been found to have an impact on drivers' levels of compliance with posted speed limits (Smith et al., 2015). The different types will be discussed in the following subsections (D.1.2.2 to D.1.2.5).

D.1.2.2 Point-to-point or average speed cameras

In their recent review Soole, Watson and Fleiter (2013) reviewed both the published and 'grey' (i.e. unpublished) literature surrounding the effectiveness of average speed enforcement and suggested that such cameras had a number of benefits. They were found to increase compliance rates with speed limits, reduce both the average and 85th percentile speed and reduce the speed variability between drivers. Such an approach was found to be particularly efficient for reducing excessive speeding behaviour.

These findings were supported by two recent studies carried out on motorways in Italy (Montella et al., 2015; Montella, Imbriani, Marzano & Mauriello, 2015). Montella, Punzo et al. (2015) found that the implementation of the new cameras led to a 10% decrease in average speed, with the greatest reduction being for the 85th percentile (14% reduction). Similarly there was a significant reduction in the speed variability, especially among lighter vehicles (26% decrease). Levels of non-compliance were reduced to 31% (compared to 56% prior to the implementation of the cameras) and the percentage of cars exceeding the speed limit by more than 20km/h was reduced by 84%. Overall, the effectiveness of the intervention was found to be greater for lighter vehicles and during the day. However, the research did suggest that the impact on compliance did reduce over time (as did the impact on average speed and speed variability).

In an earlier study Montella, Punzo and Montanino (2012) found that one year after the implementation of point-to-point speed cameras the number of cars exceeding the speed limit by 5km/h was greater than prior to their implementation. However, this was partly attributed to the design of the road, as the particular motorway used for this study had two sections deemed as dangerous with lower existing speed limits. It was believed that drivers were not adapting their speed to meet the new lower speed limit, a result that may not have been so substantial had there been higher enforcement.

D.1.2.3 Mobile radar

Goldenbeld and Van Schagen (2005) carried out a longitudinal evaluation (five years) aiming to measure the effects of targeted speed enforcement using mobile cameras. Their study focused primarily on rural single carriageway roads. The enforcement period

consisted of weekly checkpoints on each of the selected roads lasting no more than two hours. Results showed that on the enforced roads the average speed was reduced by 4km/h compared with only 1.5km/h on comparison roads with no speed enforcement. Similarly, the amount of non-compliant drivers was reduced by 12% on enforced roads. The effectiveness of this intervention can be explained by deterrence theory – whereby the increased perceived likelihood of being caught will reduce the likelihood of people carrying out non-compliant behaviour (Smith et al., 2015).

A study carried out in Belgium aimed to evaluate whether mobile speed cameras were more effective with or without advance warning signs (Wilmots, Hermans, Brijs & Wets, 2013). The study was carried out on two different road types, with 70km/h and 90km/h speed limits, where stationary unmarked police cars were equipped with mobile radars. The results showed that the advanced warning sign led to a 10km/h decrease in the 85th percentile, compared with a 5km/h decrease when the warning signs were not present. This suggests that while the mobile radars always lead to a decrease in non-compliant behaviour, a greater increase is observed when advanced warning signs are present.

D.1.2.4 Fixed speed cameras

De Pauw, Daniels, Brijs, Hermans and Wets (2014) carried out a study to evaluate the effectiveness of fixed speed cameras on motorways. The research included two locations where there were plans to install new fixed speed cameras and compared the speed 13 months before the cameras were installed (data were collected over the course of a week) with speeds 10 months after their implementation (once again data were collected over the course of a week). Data were collected at five locations between 2.5km upstream of the camera and 3.8km downstream. While the results showed that the cameras were very effective at reducing speed at the camera site (the average speed reduction was of 6.4km/h and the levels of non-compliance were reduced from 14% to 3% at the first site and from 40% to 12% at the other), a very distinctive 'V-effect' was noticed, whereby drivers were only slowing down at the level of the speed camera before increasing their speed again once they had passed it. Indeed, there was only a slight difference in the average speed in the up and downstream cameras, with a slight increase compared with the original speed for some of the locations. However, it is important to note that Stradling et al.'s (2007) found that driver characteristics seemed to impact their driving behaviour at fixed speed cameras, with the 'V-effect' only being seen in certain types of drivers.

Porter, Johnson and Bland (2013) evaluated the effectiveness of cameras at red lights aimed at reducing red-light running. In 2005 the law allowing automatic enforcement of red-light running expired in Virginia and the state decided not to renew this law. This allowed the authors to carry out a longitudinal study aiming to establish whether the absence of such enforcement would lead to an increase in the number of red-light running violations. Observations were carried out immediately after the cameras were removed, and one year on. This data was then compared with data collected prior to the removal of the cameras. The results showed that within a year of removing the cameras the likelihood of red-light running was four times greater than when the cameras were active. The results show the importance of this type of enforcement and how removing existing automatic enforcement could lead to significant decrease in compliant behaviour.

D.1.2.5 Speed cameras vs. reducing speed limits

In a recent study Vadeby and Forsman (2014) examined whether it would be more effective to reduce speed limits in certain areas, or put speed cameras in place. The study investigated the impact of reducing the speed limit from 110km/h to 100km/h on a road without cameras, reducing the speed limit from 90km/h to 80km/h on roads with speed cameras, as well as introducing new speed cameras on rural roads with a 90km/h speed limit (by comparing data collected up to two years prior to the changes with data collected a year after the changes to the speed limits had been). The results suggested that while reducing the speed limit from 110km/h to 100km/h led to a decrease in average speed (of 3km/h), it also led to a decrease in the levels of compliance (85% of drivers complying compared with 95% complying prior to the speed limit reduction). Reducing the speed limit from 90km/h to 80km/h on roads that already had speed cameras did lead to a decrease in average speed by 6.1km/h, but once again led to an increase in the proportion of cars exceeding the speed limit. The roads with the new speed cameras showed a decrease in average speed of 7km/h, and the proportion of drivers complying to the speed limits increased from 60% to 90%. This suggests that introducing additional enforcement, such as speed cameras, might be more effective at reducing non-compliant behaviour than lowering speed limits. By introducing speed cameras this will not only reduce the average speed but also reduce the number of drivers who are exceeding the speed limit, while reducing the speed may only reduce the average speed.

D.1.2.6 Financial mechanisms

Incentives

Stigson, Hagberg, Kullgren and Krafft (2014) carried out a study in Sweden aiming to evaluate whether financial incentives would decrease the levels of non-compliance with speed limits. Their study was carried out using Intelligent Speed Adaptation (ISA) based on a GPS receiver linked to a digital road map containing all of the speed limits from the Swedish road network. The group taking part in the intervention was provided with visual information when they were exceeding the speed limit, as well as being provided with personalised feedback by being able to follow their speeding behaviour online. The financial incentives took the form of a discount on their insurance premium (up to 30%). A control group was not provided with any feedback, but were given a 20% discount on the insurance premium regardless of their behaviour. The results showed that the intervention significantly reduced the amount of non-compliance, with only 6% of the drivers in the test group driving 6km/h over the speed limits, compared with 14% in the control group. Similarly, the speed variability was found to be lower for the intervention group (8.8% were in the 85th percentile compared with 25.3% in the control group).

Fines

Mixed results have been found in studies investigating the impact of fines on reducing non-compliance. A study in New Zealand aimed to establish the effectiveness of fines in reducing non-compliant behaviour (Moffat & Poynton, 2007). It evaluated the behaviour of 73,541 offenders who had received a fine as a result of non-compliance within a period of two years (between 1998 and 2000), and examined their reoffending behaviour over a period of five years. The study found very little evidence to suggest that increasing fines would impact the levels of recidivism. On the other hand, Al Naser, Hawas and Maraqa (2013) found that following a change in the traffic law in the United

Arab Emirates (UAE) that significantly increased the value of traffic fines there was a slight decrease in traffic violations. This could once again be explained by deterrence theory, whereby an increase in perceived severity and certainty of punishment will lead to behaviour change. Here the steady increase in fines could have led to an increase in the perceived severity of punishment, but as this was not accompanied with an increased certainty of punishment this impact was only minor. The overall literature seems to suggest that fines might be one way to increase compliance on a general level, but may not be the most appropriate way to reduce non-compliance for those who are categorised as high-risk (Smith et al., 2015). Increasing the severity of fines for what might be perceived to be 'minor' non-compliance behaviour may also reduce the perceived legitimacy of the rule, sanction and the issuing authorities (McKenna, 2010).

D.1.2.7 Removal of access to driving

Penalty points and licence suspension

There has been increasing evidence relating to the effectiveness of penalty points leading to licence revocation or suspension in increasing driver compliance. In their study Corbett, Delmonte, Quimby and Grayson (2008) established that the threat of penalty points led drivers to modify their driving behaviour. Drivers who had two previous speeding convictions were much less likely to reoffend than those who had a single conviction, whose rates were similar to those without any prior convictions. Similarly, the threat of disqualification had a far greater impact on behaviour for drivers who had no prior disqualifications than those who had previously lost their licence (Corbett et al., 2008,). This was supported by the findings in Al Naser's et al., (2013) research which found a decrease in the levels of non-compliance following the addition of penalty points (which would lead to license suspension) to UAE traffic laws. However, it is important to note that while there was an increase in levels of compliance, this was not a large one. Deterrence theory can once again provide an explanation for this: the changes in the law could have led to an increase in the perceived severity of the punishment, but as this was not accompanied by an increased certainty of punishment these could lead to a small increase in compliance.

These results were supported by DeYoung (2011) in current review of literature investigating the effectiveness of license suspension on reducing recidivism of drunk driving. Overall, the literature suggested that license suspension was more effective at reducing offences while driving under the influence (DUIs) than simply attending educational programs, and similarly was more effective than a short amount of jail time. The author emphasises that this type of intervention was found to be most efficient under strict enforcement, whereby the license suspension was initiated from the moment a driver is stopped rather than after waiting for court proceedings. However, based on past literature DeYoung does suggest that to ensure the highest level of compliance, especially for drunk-driving, license suspension should be combined with other methods, such as educational programs.

Finally, a study carried out by Goodwin, Wells, Foss and Williams (2006) aiming to reduce the levels of non-compliance with graduated driving licence (GDL) restrictions¹² found that the threat of delaying full licensure led to an increase in compliance. Indeed, the threat of delayed licensure combined with an increased certainty of detection led to greater compliance.

Vehicle impoundment

A study carried out in Israel investigated the effectiveness of impoundment following non-compliant behaviour (Rosenbloom & Eldror, 2013). The behaviour of 1,549 drivers whose vehicles had been impounded was compared with that of 1,354 drivers who had committed similar violations but had not had their cars impounded (as the violations were committed prior new legislation permitting such impoundment). The study compared the subsequent level of accident involvement, the subsequent overall-traffic violations convictions, the subsequent traffic-violations included in the impoundment regulations and the subsequent convictions for the same type of violation (the data were obtained once car drivers had received their car back). Results showed that impoundment was a strong predictor of subsequent convictions. Drivers who did *not* have their car impounded were 20 times more likely to be convicted for any type of traffic violations and 17 times more likely to commit a violation that would lead to impoundment than those who had. Once again it seems that the presence of immediate severe punishment led to a significant increase in compliance, as can be explained once again through deterrence theory. Indeed, the fear of immediate severe punishment has been found to lead to an increase in perceived severity and certainty of punishment, both of which are strong predictors of deterrence (Smith et al., 2015). However, when considering these results it is important to take into account the fact that those drivers who had their cars impounded have fewer opportunities to offend than those who had not, while the study did try to take this into account it could have had an impact on the level of significance of the results.

D.1.2.8 Role of enforcement

Enforcement itself has been found to be particularly important in increasing compliant behaviour. A study carried out by Stanojević, Jovanović and Lajunen (2013) in Serbia and Northern Kosovo provided a very rare opportunity to measure the impact of enforcement on levels of compliance. Northern Kosovo had no kind of road enforcement for 13 years, providing the authors an opportunity to compare two countries, one with and one without traffic enforcement. The difference in levels of drunk-driving, speeding, seat-belt and head-light use were compared as well as the general attitudes relating to risky behaviour. The results showed that the levels of non-compliance across all of the behaviours were far greater in Northern Kosovo. Part of this was because people's perception of traffic enforcement in Northern Kosovo was non-existent, which was reflected in reported riskier behaviour, as well as having much more lenient attitudes towards traffic violations (Stanojević et al., 2013). One way of interpreting this is that the lack of 'social norms' reflecting the need for compliant behaviour had a significant

¹² GDL systems vary from country to country, but most operate some system of restrictions on post-test driving, such as having post-licence periods during which new drivers are prohibited from driving under certain situations of high risk (such as night driving, or carrying peer-age passengers).

impact on behaviour. Past research has consistently supported the impact of social norms on behaviour, as people are inclined to behave in ways that they perceive to be acceptable by their own society (Ajzen, 1991). Therefore, the complete absence of traffic enforcement in Northern Kosovo presumably led to the development of a culture where traffic violations are no longer seen as socially unacceptable, leading to an increase in the levels of non-compliance.

Enforcement itself has been found to be particularly effective in the case of drink-driving. Shults and colleagues (2001) carried out a review of the literature to evaluate the effectiveness of interventions aimed at reducing the amount of drink-driving. The use of sobriety checkpoints was found to be particularly effective in reducing the amount of alcohol-related crashes; a 20-24% decrease resulted from selective breath testing, and a 16-22% decrease resulted from random breath testing (Shults et al., 2001).

D.1.2.9 Educational programs

Driver training

There have been numerous studies evaluating the effectiveness of educational programs for increasing driver compliance. Vernick, Ogaitis, MacKenzie, Baker and Gielen (1999) evaluated the literature regarding the effectiveness of high school education programs and found that there was no reliable evidence suggesting that these educational programs led to any reduction in levels of non-compliance. In a slightly earlier study Gebers (1995) evaluated the effectiveness of 'traffic violator schools'¹³ in improving driver compliance. He measured both the levels of knowledge and the drivers' attitudes before and after the intervention. In addition to this, Gebers accounted for the possible impact of the teaching method, the nature of the school (public or private) and the possible incentives to take part, in order to establish whether these could influence the effectiveness of a particular program. The results showed little if any influence of the programs on the post-test performance, and this was the case for all groups. The evidence base as a whole suggests that such programs have no real effect, in isolation, on reducing the levels of non-compliance.

Similarly, Michael (2004) aimed to evaluate whether attending traffic survival school would lead to a decrease in the number of future tickets given to non-compliant drivers. When drivers commit a violation that is serious enough for them to be referred to a traffic survival school they are asked whether they would rather attend the traffic school or have their license suspended, this was also taken into account when investigating recidivist behaviour. The study compared the behaviour of drivers who had been referred to traffic survival schools (high-risk offenders), after they had taken part in the program with that of drivers who had only received a ticket (low-risk offenders). The results suggested that a greater percentage of men opted to have their driver's license suspended rather than attend traffic schools. The results also showed that twice as many drivers who complete traffic survival school were cited within the 18 months following the intervention that those who chose to have their license suspended. Furthermore, non-referred drivers (low-risk offenders) were the ones who received the fewest citations

¹³ Traffic violator schools are an educational program provided in a number of US states, allowing drivers who are facing license suspension to take part in an educational program rather than lose their license. The courses aim to improve drivers' behaviours by increasing knowledge of traffic laws.

over the following year. This suggests that educational programs may not be the most efficient solution to reduce non-compliance for high-risk offenders. However, it is important to note that drivers themselves chose to take part in the course (the other option would have been license suspension). Therefore the type of driver choosing to attend the course may have been less responsive to the programme than those choosing to have their license suspension.

E-learning focused on compliance

Af Wählberg (2011) evaluated whether the method of delivery of driver training programs aiming to reduce levels of non-compliance in young drivers had an impact on their effectiveness. As part of the young driver scheme carried out in the Thames Valley, young drivers under the age of 25 who were caught by police officers for non-serious driving offences were given the opportunity to take part in an initial workshop involving face-to-face interaction with a driver trainer, followed by an online course consisting of five e-learning modules. In order to complete each module a multiple choice test had to be answered (an 80% correct level of performance was required to permit continuation to the next course). To evaluate the effectiveness of this methodology there were two comparison groups; those who attended a traditional classroom based speed awareness course, and those who received nothing more than a fixed penalty. The results showed that the e-learning course led to a significant decrease in the number of subsequent offences and penalty points, which was not the case in either of the two comparison groups. While not conclusive, such evidence shows that if properly designed, some educational courses can suggest effectiveness in reducing non-compliance. It is important to note however that for this particular program drivers have to put themselves forward to take part. Therefore, the results could have been subjected to self-selection biases, as drivers choosing to take part could have been more willing to change their behaviour and therefore more responsive to the program's aims.

Focus on the individual

Paaver, Eensoo, Kassik, Vaht, Mäestu and Harro (2013) tested the effectiveness of a new type of intervention aiming to reduce non-compliant behaviour. This intervention was carried out prior to learning to drive and consisted of a 45 minute lesson followed by a 45 minute group exercise, and 1,886 students took part in this study. The lecture focused on the role of impulsivity as a personality trait and how it could be partly determined by genetics, the different types of impulsivity, how they could relate to risk taking, how to recognise impulsive tendencies and finally the potential triggering factors as well as encouragement to keep track of such factors. In order to teach self-monitoring and self-regulation the instructors used cognitive behavioural therapy techniques. During the group exercises students had to identify the psychological factors that were involved in traffic accidents as well as estimate their own risk of being part of such an accident and ways in which they could reduce that risk. The study also accounted for the moderating effect of a specific gene which is known to be linked to ADHD, and in turn increase impulsiveness. The study found that those in the control group had a greater amount of speeding violations and passive crashes. The focus of this particular intervention on increasing awareness of impulsive tendencies as well as identifying triggering factors on an individual level seems to be successful in improving levels of non-compliance. This intervention focused on increasing individuals' perceived behavioural control, by enabling them to think about and establish methods by which

they could avoid impulsive responses. Perceived behavioural control is one of the factors in the theory of planned behaviour (Ajzen, 1991) and has consistently been found to be a predictor of behaviour change (Elliott & Armitage, 2009) (see Section B.2.1.3 on page 66). It is important to note, however, that in the Paaver et al., study, significant results were only found in relation to speeding behaviour.

D.1.2.10 Road design

Martens, Comte & Kaptein (1997) carried out an extensive review of the literature evaluating the impact of various forms of road designs on driver compliance. Their research showed that the road layout could have a significant impact on reducing levels of non-compliance, particularly relating to speeding. Although not all of these treatments are suitable for high speed and strategic roads, they are considered here in turn since it is useful to consider the mechanisms associated with their effectiveness.

Speed humps

Overall speed humps were found in the Martens et al. review to be very effective at reducing speeding behaviour, but primarily in urban areas, as they are not suitable for areas with high levels of heavy vehicles or high speed roads. It was suggested that every cm increase in the height of the speed bump would lead to a speed reduction of approximately 1km/h (Engel & Thomsen, 1992). However, it is important to note that while speed humps can have a positive effect on speed reduction, they can also increase speed variability of traffic as drivers often find themselves reducing their speed significantly prior to the hump before increasing their speed again after.

Roundabouts

Roundabouts were found to be effective in reducing speeding behaviour. Bigger roundabouts were found to be particularly effective on long, straight rural roads, presumably as they break up the straightness of the road and force drivers to pay attention. Small roundabouts were found to be less effective on this particular type of road but effective in more urban areas. A number of studies carried out in Sweden evaluated the effectiveness of small roundabouts in towns and found that for both the pre-existing roundabouts and additional junctions converted into roundabouts the average speed was reduced by up to 13km/h (Vàrhelyi, 1993).

Village gateways

The authors report on a number of studies that have investigated the impact of installing gateways at the entrance to villages in order to reduce speed (Martens et al., 1997). Both studies found that such treatments did lead to a decrease in drivers' speeds, but drivers were still not compliant with the required speed limit. However, both studies emphasised the importance of the visual impact that the gateway played. Similarly, a number of additional warnings and amendments were made to the road design in the gateways (such as advanced warning signs informing of reduced speed, contrasting the road surface to increase visual awareness and using different coloured poles in order to make the road seem narrower). All of these additional variables could also have helped contribute to the speed reduction.

Lane width

Reducing the width of lanes was found to have a significant impact on speeding behaviour. Indeed, by reducing the width drivers are required to pay more attention to their driving behaviour as they have less physical space to respond to unexpected changes. Research has found that reducing lane width leads to an increase in accurate steering, better lane keeping and speed reduction (Martens et al., 1997), although there are some obvious limitations regarding the extent to which lanes can be reduced. In addition, the impact of reducing lane width would seem to be dependent on visibility, whereby reducing lane width is only effective if it does not provide a significant increase in visual guidance. If lane width is reduced by installing a central area between two lanes, this has been found to lead to increase speeding behaviour as it improves visibility and visual guidance (van der Horst, 1983). A simulator based study carried out in New Zealand (Lewis-Evans & Charlton, 2006) also measured the impact of changes in road structure on speed and found that objective risk could be a strong predictor. Their study compared the impact of the width of three different roads and found that only a narrow road led to a consistent change in speed, as this was perceived as being more difficult and with an increased risk of an accident.

Lateral clearance

Research has found that reducing lateral clearance at the road's edge can reduce speeding behaviour to some extent. However, it would seem that this method can only be effective in reducing speed if the lateral clearance is significantly reduced (Van der Heijden, 1978). Similarly, the type of shoulder and amount of danger attributed to leaving the road has been found to moderate the effectiveness of the intervention. For example Knoflach and Gatterer (1981) found that the closer the obstacles were to the side of the road, the greater the decrease in speed. A possible explanation for this is that by being closer to the road, obstacles can make drivers feel more vulnerable to potential collisions, as they would have fewer opportunities (e.g. less manoeuvring space) to avoid the obstacle in case of an emergency.

Road markings

Road markings have been found to be an effective way of providing guidance. They have been found to be particularly efficient at providing guidance to drivers in areas that require particular care. Yellow markings for example have been found to act as a warning for a dangerous zone, informing drivers that they need to adapt their speed appropriately. Similarly, the impact of transverse lane markings in reducing speed has been investigated and found to be particularly effective prior to bends as they create the illusion that the width of the road is reducing (Rockwell et al., 1974). This type of design has been found to be particularly effective for heavy vehicles as the increased height emphasises the effect of lane reduction (Rockwell et al., 1974). Edge lining on straight sections of road does not show any effect on either average speed or speed variability, but were however effective in maintaining central lane positioning (Martens et al., 1997).

Rumble strips

Rumble strips have been found to reduce speeding behaviour as they create greater levels of discomfort for anyone driving over a given speed and research has found that there is a negative correlation between driver discomfort and speed (Martens et al.,

1997). This intervention has been found to be particularly effective in reducing approach speeds, and more effective than road markings. Similarly, it appears to be effective in indicating dangerous areas, allowing drivers to adapt their speed prior to dangerous areas and obstacles. Rumble strips also remain effective in the long term (Kermit & Hein, 1962).

Road curvature

Road curvature has been found to be an effective way of reducing speed as it requires increased attention from the driver. Indeed, the increased curvature of a road requires drivers to pay more attention as more manoeuvres are required of them. Similarly these roads require greater amounts of attention as they are more demanding requiring more effort to maintain central lane positioning. Similarly, the reduced visibility on these roads requires that drivers adapt their speed because of the increase in uncertainty of the future road conditions. While the curvature of a road has been found to reduce speed, it has been found that drivers still tend to exceed the speed limit (Tenkink & Van der Horst, 1991). This could once again be due to the fact that drivers tend to overestimate their ability to drive in more complex situations (Montella et al., 2012).

D.1.2.11 Multi-faceted interventions

Some interventions have attempted to reduce non-compliant behaviour by adopting a multi-faceted approach. For example Van Houten, Malenfant, Blomberg, Huitema and Casella (2013) were aiming to increase driver compliance with pedestrian right-of-way laws, and did so by using a multi-faceted approach including public information campaigns, public signs, increased enforcement and engineering changes. Throughout the entire intervention people were made aware through feedback signs of the level of compliance to date, with signs being regularly updated informing drivers that, while the levels of compliance were increasing, the increased enforcement would not stop until these levels reached 100%. A particular characteristic of the enforcement was the use of additional signs informing drivers of the reasons why a particular car had been stopped. If a driver was stopped for violating the pedestrian yield laws, specific signs were put up. This led to an increased awareness as well as drivers' perceptions of the likelihood of being stopped. This particular technique, when combined with the additional public information and media campaigns led to a change in the perception of this type of violation, making it more socially unacceptable. As noted earlier, social acceptability is a factor that has been found to have an important impact on behaviour, as people are less likely to carry out a specific behaviour if it is seen as unacceptable within society (Ajzen, 1991), and especially if they can be identified as having taken part in it. The results from Van Houten et al.'s study show a significant increase in compliance, which was persistent throughout the duration of the intervention. This can again be explained by general deterrence theory, whereby an increased perception of the risk of being caught undertaking a specific violation will lead to an increase in compliance (Smith et al., 2015). Interestingly, the increased compliance was also found to have spread to more than just the enforcement sites, and although the increase in compliance was lower at the control sites, there was still a significant increase from the baseline levels.

Goodwin and colleagues (2006) developed an intervention aiming to increase the level of compliance with GDL restrictions. Their intervention followed a multi-faceted approach including increased enforcement, media advertising of the enforcement, as well as encouraging schools themselves to develop their own enforcement activities to increase

awareness of the campaign across their community. The best school campaign received \$1000. In addition, parents and children took part in interviews, and parents of the children in the intervention community who agreed to take part were provided with additional information regarding the GDL restrictions (parents in the control community did not receive any additional information). As mentioned previously, if young drivers were caught violating any of the restrictions they saw the amount of time until they could receive full licensure increase. The increased enforcement consisted of 25 checkpoints located near the schools, as well as public areas where young people were known to spend time. The intervention demonstrated a significant increase in compliance; the number of cars with additional young passengers decreased throughout the entire programme, while an increase in compliance was seen in both intervention and control communities, the increase was greater in the intervention community. Interestingly, the school that carried out the best awareness campaign was in the community that showed the greatest increase in compliance, suggesting that including young drivers themselves in the campaign might have increased the awareness and effectiveness of the intervention. The interviews reflected that there was a significant increase in the awareness of the enforcement in both communities. This was not due to media campaigns, but the presence of police officers who had been trained and were paying particular attention to compliance with the GDL restrictions. This increased awareness led to an increase in the perception of the likelihood of being caught by the police, in turn increasing compliance.

D.1.2.12 Other interventions

A study carried out in Australia aimed to test the effectiveness of goal setting and personalised feedback on reducing speeding violations in a group of work-related drivers (Newman, Lewis & Warmerdam, 2014). The intervention was made up of three phases carried out over a period of five weeks. The first phase involved monitoring driving speed for a period of five days (this was later used as a baseline measure) as well as completing a demographic and driving exposure questionnaire. The second phase (lasting three weeks) consisted of feedback, which included the amount of time spent within and exceeding the speed limit, and the amount of time spent exceeding the speed limit compared with the other drivers in the trial, which was presented to drivers in the form of rankings. The feedback was provided in booklets with the slogan of the program which was designed to emphasise important values such as caring about others, and ensuring others' safety. The second phase also consisted of goal setting which was introduced during weekly sessions, and designed to provide drivers with a specific speed reduction target. The final phase was post-intervention monitoring. The results showed a 75% reduction in speeding violations after the intervention. The personalised and comparative feedback provided drivers with a chance to visualise their behaviour and position themselves in a group. This comparative framework allowed them to visualise how they were behaving compared with another group of similar individuals regarding a socially undesirable behaviour, which when paired with the goal setting could have had significant influence on drivers adapting their behaviour. A study carried out by Gwyther and Holland (2015) established that attitude, subjective norms and affective attitudes were significant predictors of goal achievement. Therefore, combining personalised feedback relative to others as well as an emphasis of other people's safety and affective attitudes with a goal setting task, this intervention provided a strong foundation for more long lasting behaviour change. However, it is important to note that the current sample size was relatively limited (16 people), and were quite a specific sub-group (they all

worked as carers for people within the community, which may suggest they would be more responsive to other people's safety) which could limit the generalisability of the results. Similarly, while the study was carried out over a period of five weeks and showed significant change suggesting the potential for a long term impact, the study did not undertake any further follow-ups making it impossible to know whether the change initiated by the intervention lasted once the intervention ended.

A current programme is underway in Sweden aiming to reduce the number of drink drivers. It consists of collaboration between the Swedish police force, the road administration and the social services aiming to provide drink-drivers with additional support in order to change their behaviour. The programme is called SMADIT and involves the police informing offenders as soon as they are stopped about the programme and asking drivers if they are willing to be contacted by the social services. Forsberg (2013) carried out a qualitative study investigating the effects of the programme. The figures showed that approximately 27% of the drivers who were informed of the programme agreed to be contacted by social services. Drivers reported that being stopped by the police and taking part in the programme was a turning point which led to them to stop drinking in general, not just drink-driving. The study also showed that the behaviour and attitudes of police officers towards drivers had an impact on their willingness to take part. If officers were kind and understanding then drivers were more willing to take part. While the results from this study are very promising it is important to note that the sample size was limited to 14 participants and that the results were based on self-report data. However, the literature does seem to suggest that more individualised interventions could be particularly effective in reducing non-compliant behaviour, where such levels of contact are possible.

Following on from earlier studies, Ouimet, Dongier, Di Leo, Legault, Tremblay, Chanut and Brown (2013) aimed to establish whether brief motivational interviewing (BMI) was an efficient way of reducing drink-driving. While their previous study evaluated the effectiveness of this technique over a 12 month period (Brown, Dongier, Ouimet, Tremblay, Chanut, Legault et al., 2010), this second study investigated the outcome over a five year period. They aimed to investigate whether BMI was an effective technique in reducing the time to the next violation as well as the number of crashes compared with other drink drivers who had not received this type of intervention. In addition, they explored whether demographic characteristics moderated the effects of this intervention. The BMI consisted of helping drivers recognise and explore the reasons behind their behaviour to facilitate behaviour change, in turn increasing self-efficacy as well as encouraging drivers to set intentions and commitments. Setting intentions has been found to be effective in promoting behaviour change, as they target the volitional stages of cognitive processing aiming to change motivation into action (Elliott & Armitage, 2006). The control group were subject to a more traditional intervention, including the provision of information regarding the dangers of alcohol misuse, advice on how to change alcohol misuse and information about treatment services. Overall there was a smaller number of re-convictions over the following five years, as well as a longer time until next arrest, in the intervention group. However, age was found to be a strong moderator of the effectiveness of the intervention; while there was an overall decrease for all age groups, only drivers aged 26-42 showed a significant decrease in recidivism.

Following previous work in the field Merrikhpour, Dommez and Battista (2012) carried out a study investigating the impact of in-built reward and feedback systems on speed limit compliance as well as the degree of non-compliance when this behaviour does

occur. Cars were equipped with integrated display, on-board diagnostic interfaces, internal GPS devices (including the posted speed limit information) and in-vehicle displays that provided real time feedback through the use of symbols and indicator lights. If drivers were fully compliant a green light was displayed, if they were only compliant with one of the two measures the light turned yellow. The symbols presented on the display also varied depending on whether or not the drivers were compliant. Compliance points were provided to the driver when they were compliant with both measures for a period of 15s, these points were accumulated and provided to the participants via a website. The intervention was made up of three phases: baseline (2 weeks), feedback (12 weeks) and post-feedback (2 weeks). The sample consisted of people aged between 20 and 70 years, split into four different age categories. The results showed that driver compliance was significantly greater in the feedback stage than the baseline stage. This was the case regardless of whether or not there was another vehicle present ahead. This shows that the feedback system was not only effective in reducing non-compliance in what might be considered as more dangerous situations, but in all driving situations including those where drivers might feel more inclined to speed. The results did show that age and gender had an impact on the effectiveness of the feedback. Males tended to be less compliant in 70km/h zones, and their level of non-compliance was also greater. Drivers in their forties were found to be less compliant in 90km/h zones, but when they were non-compliant in the 100km/h zones their level of non-compliance was smaller than that of other age groups. It is important to consider that compliance rates did reduce in the post-feedback stage (once feedback was no longer being provided), suggesting that continuous provision of feedback could be particularly effective in reducing levels of non-compliance.

D.1.3 Summary

There are a number of interventions being used to try and improve the levels of driver compliance. However, there seem to be some patterns emerging regarding which are likely to be most effective in achieving their end goal.

Overall it would seem that increasing levels of enforcement leads to an improvement in driver compliance whether this is through an increased presence of police enforcement or specific technologies. The presence of speed cameras, particularly average speed cameras (Montella et al., 2015), has been shown to lead to a decrease in non-compliance as well a decrease in the severity of non-compliance (Vadeby & Forsman, 2014). Interestingly, the effect of mobile speed cameras seemed to be even more pronounced when drivers were aware that such enforcement was taking place (Wilmots et al., 2013).

Deterrence theory has emerged as an important theory to explain the results of the studies reviewed. The theory is based on the principle that increasing the perceived certainty and severity of being caught performing a specific behaviour will lead to a positive change in behaviour. Deterrence theory particularly supported studies that involved increasing the presence of police enforcement on the roads. These studies report significant increases in compliance if drivers perceive an increase in police enforcement and in turn the certainty of punishment for breaking the rules of the road (Smith et al., 2015). Most importantly this was found to be the case for a number of different behaviours including speeding, drink-driving, pedestrian right of way and overall levels of non-compliance (Goodwin et al., 2006; Smith et al., 2015).

A number of studies have investigated the impact of more structural changes, such as modifying road designs (Martens et al., 1997). An extensive review of the literature has suggested that modifying the design of the road can be effective in reducing non-compliance, particularly with respect of speeding offences.

While overall educational programs have not traditionally been particularly effective in reducing non-compliant behaviour (Vernick et al., 1999), there is some promise that the development of new approaches such as e-learning courses could be efficient in improving their effectiveness (Af Wåhlberg, 2011). Similarly it would seem that using techniques such as cognitive behavioural therapy as part of the method of delivery of educational programs could be efficient in increasing the effectiveness of such interventions. Indeed Paaver et al.'s (2013) intervention aimed to increase future drivers' perceived behavioural control by providing them with self-monitoring and self-regulation exercise, teaching them how to recognise and respond to impulsive tendencies. By increasing their perceived behavioural control, the intervention was targeting one of the main factors in the theory of planned behaviour (Ajzen, 1991) and a factor that has been consistently found to be a significant predictor of behaviour change (Elliott & Armitage, 2006).

This particular framework has been found to be consistently effective in inducing behaviour change. Indeed, interventions that aimed to change the social perception of a particular driving offence were also found to be effective in reducing non-compliance (Van Houten et al., 2013). Therefore interventions aimed at targeting social norms with the aim of making a specific behaviour socially unacceptable are important to consider when devising future interventions.

Similarly, a more recent form of intervention involving the use of financial incentives to encourage drivers to behave in a more compliant way has been found to be particularly effective (Stigson et al., 2014). Interestingly the study revealed that simply providing drivers with a financial incentive that was not dependent on their behaviour did not lead to the same effect, stressing that in order to be effective these types of incentives have to be dependent on maintaining compliant behaviours. Furthermore, it would seem that providing drivers with timely feedback regarding their driving behaviour is also an efficient way of increasing their compliance. Providing drivers with visual and auditory feedback when they are exceeding the speed limit for example was found to have a significant impact on changing their behaviour. Once again this can be attributed to the increased in perceived behavioural control provided by such a personalised and timely feedback (Newman et al., 2014; Stigson et al., 2014). However, it is also important to consider that the effectiveness of these interventions did decrease once the feedback was no longer provided.

Table 7. Literature findings of the different types of intervention aiming to reduce non-compliant behaviour

Type of intervention	Behaviour				
	Speeding	Drink-driving	Graduated Driver Licensing	Other: red light running, pedestrian right of way, seat-belt use	Violations/general non-compliance
Enforcement Cameras	√			√	
Financial mechanisms	√				√
Removal of access to driving		√	√		√
Enforcement	√	√	√	√	√
Education program					√
Road design	√			√	
Public information campaign			√	√	
In built feedback system	√				
Motivational interviewing		√			
Cameras at traffic lights				√	
Goal setting	√				
Personalised interventions		√			

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Appendix F Questionnaire

TRL Driving Questionnaire

Intro

You've been chosen to take part in our latest questionnaire.

As we're keen to hear from specific types of people, it's important that we start by asking you a few questions about yourself to see if you're eligible to take part.

Please click 'Next' to begin.

Our research is anonymous and confidential and in line with the Market Research Society (MRS) Code of Conduct. We are an MRS Company Partner.

SCREENING QUESTIONS

Ask all

S1. Do you currently hold a valid full driving licence that allows you drive on GB roads unaccompanied?

Single response

- 1) Yes → Go to S2
- 2) No → Thank and end

Ask all

S2. In the last three months how often have you driven a motor vehicle (e.g. car, motorcycle, van, heavy goods vehicle) on a 'major' road (A-road, Dual-carriageway, Motorway etc.) in GB? DP SINGLE CODE

Single response

- 1) I have not driven a motor vehicle at all on a 'major' road in the last three months
- 2) Less than once per month
- 3) About once a month
- 4) About once a fortnight
- 5) About once a week
- 6) About once every two to three days
- 7) Almost every day
- 8) Every day

Please screen out all respondents that answer option 1 thank and end survey. Otherwise continue.

Great, you're exactly the type of person we're keen to hear from!

This survey will take approximately 20 minutes to complete and is part of a project investigating drivers' behaviour, attitudes and style.

All the information you provide will be strictly anonymous and will not allow you to be identified. The postcode information you are asked for will only be used for geographical references that will help to describe the data from the survey. Furthermore, all of the information collected in this survey will not be used for anything other than this research; neither will it be passed it on to any third parties.

Remember for almost all of the questions there is no right or wrong answer – we are interested in your opinions, and even for questions where you are not 100% sure how to answer, please answer as best you can. You can terminate the survey at any point. If you want to pause completing the survey you can log out and re-enter at a later time. All of your previous answers are automatically saved and you will re-enter the questionnaire at the point you left off.

We hope you find this survey interesting and we appreciate your input into this important study.

A. YOUR DRIVING EXPERIENCE

Ask all

A1. When did you pass your driving test? (If you cannot remember the exact month or year, just give an approximate answer)

month _____ year _____

Ask all

A2. Approximately how many miles do you drive each year in the following vehicle types, FOR WORK PURPOSES? ('For work purposes' means any journey you make on behalf of your employer, EXCLUDING commuting to and from your usual place of work.) If it is less than a year since you passed your test, enter your estimated mileage for the year. MULTICODE

Enter approximate number of miles per year for each that applies.

DP allow numeric responses only. Blank fields ok

		Miles per year
A2a.	Car	_____miles per year
A2b.	Motorcycle	_____miles per year
A2c.	Car-derived van or light/micro van	_____miles per year
A2d.	Any other vehicle less than 3.5T maximum gross weight	_____miles per year
A2e.	Any other vehicle between 3.5T and 7.5T maximum gross weight	_____miles per year
A2f.	Any other vehicle greater than 7.5T maximum gross weight	_____miles per year

A2g. DP carry forward answer with most miles from A2. You said you drove the most miles per year in a **insert vehicle from Q2**. Please enter its engine size (e.g. 1 litre, 2.4 litre etc)

Engine size _____

Unsure

Ask all

A3. Approximately how many miles do you drive each year in the following vehicle types, FOR LEISURE AND COMMUTING PURPOSES? If it is less than a year since you passed your test, enter your estimated mileage for the year. MULTICODE

Enter approximate number of miles per year for each that applies. DP allow numeric responses only. Blank fields ok

		Miles per year
A3a.	Car	_____miles per year
A3b.	Motorcycle	_____miles per year
A3c.	Car-derived van or light/micro van	_____miles per year
A3d.	Any other vehicle less than 3.5T maximum gross weight	_____miles per year
A3e.	Any other vehicle between 3.5T and 7.5T maximum gross weight	_____miles per year
A3f.	Any other vehicle greater than 7.5T maximum gross weight	_____miles per year

A3g. DP carry forward answer with most miles from A3. You said you drove the most miles per year in a **insert vehicle from Q3**. Please enter its engine size (e.g. 1 litre, 2.4 litre etc)

Engine size _____

Unsure

Ask all

A4. Do you have any advanced driving qualifications (with organisations such as IAM, RoSPA, DIAMond, BSM)?

Single response

- 1) Yes – I have one or more advanced driving qualifications
- 2) No – I do not have any advanced driving qualifications

B. YOUR OPINION ABOUT DRIVING BEHAVIOURS

Ask all

B1. Below are some statements about mobile phones. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
B1a.	Harsher penalties should be introduced for using a mobile phone while driving	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1b.	Using a mobile phone while driving is one of the main causes of road accidents	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1c.	When I see another driver using their mobile phone it makes me angry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1d.	I am skilled enough to safely use a mobile phone while driving	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1e.	It's ok to use a mobile phone while driving if you take extra care	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Ask all

B1. Below are some more statements about drinking. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
B1f.	Random breath testing of drivers should be introduced	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1g.	Drink-driving is one of the main causes of road accidents	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1h.	When I see a driver I think is driving under the influence of alcohol it makes me angry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

B1i.	I know exactly how much I can drink and still be under the limit	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1j.	It is quite acceptable to drive after only one or two drinks	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Ask all

B1. Below are some more statements about speed limits. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
B1k.	Harsher penalties should be introduced for driving in excess of the speed limit	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1l.	Speeding is one of the main causes of road accidents	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1m.	When I see another driver speeding it makes me angry	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1o.	I am skilled enough to sometimes be able to drive a little over the speed limit without increasing my risk of crashing	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1p.	It's OK to drive faster than the speed limit as long as you drive carefully	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Ask all

B1. Below are some more statements about distance between vehicles while driving. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
B1q.	Harsher penalties should be introduced for driving too close to the vehicle in front	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1r.	Close-following is one of the main causes of road accidents	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

B1s.	When I see another driver following my vehicle closer than recommended it makes me angry	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1t.	I have good enough reactions to drive a little closer than recommended to the vehicle in front	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1u.	It is quite acceptable to drive closer to the car in front than is recommended as long as you concentrate	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Ask all

B1. Below are some more statements about the road worthiness of vehicles. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
B1v.	Harsher penalties should be introduced for drivers who don't keep their vehicles roadworthy	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1w.	Vehicles that are not roadworthy are one of the main causes of road accidents	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1x.	When I see another driver with a vehicle that is not roadworthy it makes me angry	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1y.	I know the limits of my vehicle and even if it not fully roadworthy I can still drive it safely	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
B1z.	It's ok to drive a vehicle that is not roadworthy as long as you take extra care	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Ask all

B1. Below are some more statements about tiredness. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
B1aa.	Harsher penalties should be introduced for drivers who drive while tired	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ab.	Tiredness is one of the main causes of road accidents	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ac.	When I see another driver who I think is falling asleep at the wheel it makes me angry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ad.	I know just how tired I can be before I start to get unsafe when driving	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ae.	It's ok to drive while tired as long as you take extra care and try to remain awake	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

Ask all

B1. Below are some more statements about the lane discipline. Please indicate how much you agree or disagree with each statement. ROTATE

Please remember, your answers are anonymous.

Single response in each row.

		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
B1af.	Harsher penalties should be introduced for drivers who hog the middle lane on motorways	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ag.	Hogging the middle lane on motorways is one of the main causes of road accidents	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ah.	When I see another driver hogging the middle lane it makes me angry	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1ai.	I am a skilled enough driver to drive in the middle lane whenever I want without it being a concern	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
B1aj.	It's ok to hog the middle lane as long as you pay attention to traffic behind you	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

C. DRIVING STYLES

Ask all – and single response for each.

The following questions use scales with opposing options at each end. For each question, please select where on the scale best describes how you feel about your own driving. The closer your response to one of the ends, the more strongly you agree with that description. ROTATE C1 TO C12. DP use large bold font on response text.

C1. How attentive or inattentive are you as a driver?

Attentive

Inattentive

C2. How careful or careless are you as a driver?

Careful

Careless

C3. How decisive or indecisive are you as a driver?

Decisive

Indecisive

C4. How experienced or inexperienced are you as a driver?

Experienced

Inexperienced

C5. How irritable or placid are you as a driver?

Irritable

Placid

C6. How nervous or confident are you as a driver?

Nervous

Confident

C7. How patient or impatient are you as a driver?

Patient



Impatient

C8. How responsible or irresponsible are you as a driver?

Responsible



Irresponsible

C9. How safe or risky are you as a driver?

Safe



Risky

C10. How selfish or considerate are you as a driver?

Selfish



Considerate

C11. How slow or fast are you as a driver?

Slow



Fast

C12. How tolerant or intolerant are you as a driver?

Tolerant



Intolerant

D. QUESTIONS ABOUT YOU

D1. Here are a number of personality traits that may or may not apply to you. Please click on a button next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other. ROTATE

Single response in each row.

I see myself as...	Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Agree strongly
...extraverted, enthusiastic.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...critical, quarrelsome.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...dependable, self-disciplined.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...anxious, easily upset.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...open to new experiences, complex.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...reserved, quiet.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...sympathetic, warm.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...disorganised, careless.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...calm, emotionally stable.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7
...conventional, uncreative.	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7

D2. Please answer the questions and statements in this section on the basis of your usual or typical feelings about driving. Each question or statement asks you to answer according to how strongly you agree with one or other of two alternatives. Please read each of the two alternatives carefully before answering, then click on the button that most closely reflects your opinion... DP programme this D2 as separate questions. Also ensure the statements at each end of the range 0 to 10 are in large bold font so that the participant sees more clearly what they mean.

Please be sure to answer all the questions, even if some of them do not seem to apply to you.

1. Does it worry you to drive in bad weather?

Not at all 0 1 2 3 4 5 6 7 8 9 10 **Very much**

2. I am disturbed by thoughts of having an accident or the car braking down

Very rarely 0 1 2 3 4 5 6 7 8 9 10 **Very often**

3. Do you lose your temper when another driver does something silly?

Not at all 0 1 2 3 4 5 6 7 8 9 10 **Very much**

4. Do you think you have enough experience and training to deal with risky situations on the road?

Not at all 0 1 2 3 4 5 6 7 8 9 10 **Very much**

5. I find myself worrying about my mistakes and the things I do badly when driving.

Very rarely 0 1 2 3 4 5 6 7 8 9 10 **Very often**

6. I would like to risk my life as a racing driver.

Not at all 0 1 2 3 4 5 6 7 8 9 10 **Very much**

7. My driving would be worse than usual in an unfamiliar hired car.

Not at all 0 1 2 3 4 5 6 7 8 9 10 **Very much**

8. I sometimes like to frighten myself a little while driving.

Very much 0 1 2 3 4 5 6 7 8 9 10 **Not at all**

9. I get a real thrill out of driving fast.

Very much 0 1 2 3 4 5 6 7 8 9 10 **Not at all**

10. I make a point of carefully checking every side road I pass for emerging vehicles.

Very much 0 1 2 3 4 5 6 7 8 9 10 **Not at all**

11. Driving brings out the worst in people.

Not at all 0 1 2 3 4 5 6 7 8 9 10 **Very much**

12. Do you think it is worthwhile taking risks on the road?

Very much 0 1 2 3 4 5 6 7 8 9 10 **Not at all**

13. At times, I feel like I really dislike other drivers who cause problems for me.

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

14. Advice on driving from a passenger is generally:

Useful **Unnecessary**
 0 1 2 3 4 5 6 7 8 9 10

15. I like to raise my adrenaline levels when driving.

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

16. It's important to show other drivers that they can't take advantage of you.

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

17. Do you feel confident in your ability to avoid an accident?

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

18. Do you usually make an effort to look for potential hazards when driving?

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

19. Other drivers are generally to blame for any difficulties I have on the road

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

20. I would enjoy driving a sports car on a road with no speed limit

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

21. Do you find it difficult to control your temper when driving?

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

22. When driving on an unfamiliar road do you become more tense than usual?

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

23. I make a special effort to be alert even on roads I know well

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

24. I enjoy the sensation of accelerating rapidly

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

25. If I make a minor mistake when driving, I feel it's something I should be concerned about

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

26. I always keep an eye on parked cars in case somebody gets out of them, or there are pedestrians behind them

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

27. I feel more anxious than usual when I have a passenger in the car

Not at all 0 1 2 3 4 5 6 7 8 **Very much** 9 10

28. I become annoyed if another car follows very close behind mine for some distance

Very much 0 1 2 3 4 5 6 7 8 **Not at all** 9 10

29. I make an effort to see what's happening on the road a long way ahead of me

Not at all 0 1 2 3 4 5 6 7 8 **Very much** 9 10

30. I try very hard to look out for hazards even when it's not strictly necessary

Not at all 0 1 2 3 4 5 6 7 8 **Very much** 9 10

31. Are you usually patient during the rush hour?

Very much 0 1 2 3 4 5 6 7 8 **Not at all** 9 10

32. When you overtake another vehicle do you feel in command of the situation?

Not at all 0 1 2 3 4 5 6 7 8 **Very much** 9 10

33. When you overtake another vehicle do you feel tense or nervous?

Not at all 0 1 2 3 4 5 6 7 8 **Very much** 9 10

34. Does it annoy you to drive behind a slow moving vehicle?

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

35. When you're in a hurry, other drivers usually get in your way

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

36. When I come to negotiate a difficult stretch of road, I am on alert

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

37. Do you feel more anxious than usual when driving in heavy traffic?

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

38. I enjoy cornering at high speed

Not at all **Very much**
 0 1 2 3 4 5 6 7 8 9 10

39. Are you annoyed when the traffic lights change to red when you approach them?

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

40. Does driving usually make you feel aggressive?

Very much **Not at all**
 0 1 2 3 4 5 6 7 8 9 10

E. SOME MORE QUESTIONS ABOUT DRIVING

Ask all

E1. Now we would like you to judge how easy or difficult it is to avoid a number of driving behaviours when driving on MAJOR roads in Great Britain (A-road, Dual-carriageway, Motorway etc.). Indicate your judgments by clicking one of the buttons next to each item.

Please remember that all of your answers will be treated in strict confidence.

ROTATE

Single response in each row.

How easy is it to...		Extremely easy			Almost impossible		
E1a.	...avoid exceeding the posted speed limit on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
E1b.	...avoid driving even though you realise you may be over the legal blood-alcohol limit on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
E1c.	...avoid driving close enough to the vehicle in front that you are less than one second behind it at the speed you are travelling on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
E1d.	...avoid using a hand-held mobile device to make or receive a phone call or text, or for any other non-driving related task on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
E1e.	...avoid driving on major roads while knowing that your vehicle is not roadworthy?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
E1f.	...avoid driving while having to make some effort to stay awake on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
E1g.	...avoid driving in the middle lane of a motorway even though there was no vehicle in the left hand lane in your immediate vicinity?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

F. SOME QUESTIONS ABOUT OTHER DRIVERS' DRIVING

Ask all

F1. Now we would like you to judge how often you think OTHER DRIVERS engage in these behaviors, when driving on MAJOR roads in Great Britain (A-road, Dual-carriageway, Motorway etc.). Make this judgment based on your opinion of OTHER DRIVERS as a whole. Indicate your judgments by clicking one of the buttons next to each item.

Please remember that all of your answers will be treated in strict confidence.

ROTATE

Single response in each row.

When driving on major roads...		Never Nearly all the time					
F1a.	... I think OTHER DRIVERS exceed the posted speed limit on major roads...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
F1b.	... I think OTHER DRIVERS drive even though they realise they may be over the legal blood-alcohol limit on major roads...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
F1c.	...I think OTHER DRIVERS drive close enough to the vehicle in front that they are less than one second behind it at the speed they are travelling on major roads...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
F1d.	... I think OTHER DRIVERS use a hand-held mobile device to make or receive a phone call or text, or for any other non-driving related task on major roads...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
F1e.	... I think OTHER DRIVERS drive while knowing that their vehicle is not roadworthy on major roads...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
F1f.	... I think OTHER DRIVERS drive while having to make some effort to stay awake on major roads...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
F1g.	... I think OTHER DRIVERS drive in the middle lane of a motorway even though there is no vehicle in the left hand lane in their immediate vicinity...	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

G. SOME MORE QUESTIONS ABOUT WHAT YOU THINK OF SOME DRIVING BEHAVIOURS

Ask all

G1. Now we would like you to judge how SAFE OR DANGEROUS the following behaviours are, when driving on MAJOR roads in Great Britain (A-road, Dual-carriageway, Motorway etc.). Indicate your judgments by clicking one of the buttons next to each item.

Please remember that all of your answers will be treated in strict confidence.

ROTATE

Single response in each row.

How safe or dangerous is it for a driver to...		Extremely dangerous			Extremely safe		
G1a.	...exceed the posted speed limit on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
G1b.	...drive on major roads even though they realise they may be over the legal blood-alcohol limit?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
G1c.	...drive close enough to the vehicle in front that they are less than one second behind it at the speed they are travelling on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
G1d.	...use a hand-held mobile device to make or receive a phone call or text, or for any other non-driving related task on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
G1e.	...drive on major roads while knowing that their vehicle is not roadworthy?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
G1f.	...drive on major roads while having to make some effort to stay awake?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
G1g.	...drive in the middle lane of a motorway even though there was no vehicle in the left hand lane in their immediate vicinity?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

H. SOME MORE QUESTIONS ABOUT DRIVING

Ask all

H1. No one is perfect. Even the best drivers make mistakes, do foolish things, or bend the rules at some time or another. For each item below please indicate how often, if at all, this kind of thing has happened to you in the last three months of driving on MAJOR roads (A-road, Dual-carriageway, Motorway etc.). Indicate your judgments by clicking one of the buttons next to each item.

Please remember that all of your answers will be treated in strict confidence.

ROTATE

Single response in each row.

In your last three months of driving how often have you...		Never Nearly all the time					
H1a.	...exceeded the posted speed limit on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
H1b.	...driven on major roads even though you realised you may be over the legal blood-alcohol limit?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
H1c.	...driven close enough to the vehicle in front that you are less than one second behind it at the speed you are travelling on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
H1d.	...used a hand-held mobile device to make or receive a phone call or text, or for any other non-driving related task on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
H1e.	...driven on major roads while knowing that your vehicle is not roadworthy?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
H1f.	...driven on major roads while having to make some effort to stay awake?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
H1g.	...driven in the middle lane of a motorway even though there was no vehicle in the left hand lane in your immediate vicinity?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

I. SOME MORE QUESTIONS ABOUT WHAT YOU THINK OF SOME DRIVING BEHAVIOURS

Ask all

I1. For each item below please indicate **how often**, if at all, you intend to perform each driving behaviour in your next three months of driving on MAJOR roads (A-road, Dual-carriageway, Motorway etc.). Indicate your judgments by clicking one of the buttons next to each item.

Please remember that all of your answers will be treated in strict confidence.

ROTATE

Single response in each row.

In the next three months, how often do you intend to...		Never					Nearly all the time
I1a.	...exceed the posted speed limit on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
I1b.	...drive on major roads even though you realise you may be over the legal blood-alcohol limit?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
I1c.	...drive close enough to the vehicle in front that you are less than one second behind it at the speed you are travelling on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
I1d.	...use a hand-held mobile device to make or receive a phone call or text, or for any other non-driving related task on major roads?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
I1e.	...drive on major roads while knowing that your vehicle is not roadworthy?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
I1f.	...drive on major roads while having to make some effort to stay awake?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
I1g.	...drive in the middle lane of a motorway even though there is no vehicle in the left hand lane in your immediate vicinity?	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

J. SOME QUESTIONS ABOUT YOUR PERCEPTION OF MAJOR ROADS IN GB

Ask all

J1. We now want you to tell us what you think of some specific features of the major roads you drive on in GB (A-roads, Dual-carriageways, Motorways etc.). Please indicate how much you agree or disagree with each statement.

Please remember that all of your answers will be treated in strict confidence.

ROTATE

Single response in each row.

		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
J1a.	Speed limits on single-carriageway A-roads are generally set too low	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1b.	Speed limits on dual carriageway A-roads are generally set too low	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1c.	Speed limits on motorways are generally set too low	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1d.	Single carriageway A-roads in GB are generally of a very high quality	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1e.	Dual carriageway A-roads in GB are generally of a very high quality	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1f.	Motorways in GB are generally of a very high quality	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1g.	I enjoy driving on Single carriageway A-roads in GB	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1h.	I enjoy driving on Dual carriageway A-roads in GB	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
J1i.	I enjoy driving on Motorways in GB	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

K. SOME MORE QUESTIONS ABOUT YOU

Well done, you've reached the final section which is all about your driving record, who you are and where you come from. Remember, our research is anonymous and confidential.

Ask all

K1. In the last three years how many accidents, regardless of blame, have you been involved in as a driver? (If you have been driving for less than three years, just answer for the period since passing your test).

Single response

- 1) 0
- 2) 1
- 3) 2
- 4) 3
- 5) 4+
- 6) Unsure
- 7) Prefer not to answer

Ask all

K2. How many penalty points do you have on your licence?

Single response

- 1) 0
- 2) 1-3
- 3) 4-6
- 4) 7-9
- 5) 10+
- 6) Unsure
- 7) Prefer not to answer

Ask all

K3. Are you...

Single response

- 1) Male
- 2) Female

Ask all

K4. What is your year of birth?

YYYY

Ask all

K5. Please tell us your highest educational qualification

Single response

- 1) University Higher Degree (e.g. MSc; PhD)
- 2) First degree level qualification (e.g. BA; BSc; PGCE)
- 3) Diploma in higher education; HNC, HND, Nursing or Teaching qualification (excluding PGCE)
- 4) A Level; AS Level; NVQ Level 3; GNVQ Advanced or equivalent
- 5) GCSE; CSE, NVQ levels 1&2; GNVQ Foundation & Intermediate or equivalent
- 6) None of the above

Ask all

K6. What is your employment status?

Single response

- 1) Employed
- 2) Self employed
- 3) Unemployed and seeking work
- 4) Looking after family or home / not seeking work
- 5) Long term sick or disabled
- 6) Retired
- 7) In full time education
- 8) Other

Ask all

K7. Please tell us your TOTAL personal annual or weekly income from all sources BEFORE tax and other deductions.

Single response

- 1) Up to £9,999 per annum (£199 per week)
- 2) £10,000 to £19,999 per annum (£200 - £389 per week)
- 3) £20,000 to £29,999 per annum (£390 - £579 per week)
- 4) £30,000 to £39,999 per annum (£580 - £769 per week)
- 5) £40,000 to £49,999 per annum (£770 - £969 per week)
- 6) £50,000 to £74,999 per annum (£970 - £1,449 per week)
- 7) £75,000 to £99,999 per annum (£1,450 - £1,959 per week)
- 8) £100,000 to £149,999 per annum (£1,960 - £2939 per week)
- 9) £150,000 or more per annum (£2,940 or more per week)
- 10) I would rather not answer

Ask all

K8. Are you...

Single response

- 1) Married/Civil partnership
- 2) Living with a partner
- 3) Separated/ Divorced
- 4) Widowed
- 5) Living alone
- 6) Living with parents
- 7) Other

Ask all

K9. And finally....

What is the first part of your home postcode?

For example, if your post code was AB25 3XB, you would write AB25

Please be assured that this will ONLY be used for this research, it will not be passed on to any third parties and all your responses to this survey will be kept strictly anonymous.

Open question – Text box

Appendix G Topic guide

Understanding and influencing driver compliance

Introduction:

[Researcher name] I am from The Transport Research Laboratory and we are undertaking this work on behalf of Highways England.

Purpose:

We are looking to gain insight regarding the current ways in which road safety and driver behaviour are approached by key stakeholders in Great Britain. We would also like to explore synergies between organisations, and how organisations with common road safety goals can work together to achieve these.

Information:

- Your participation is voluntary.
- Interview will last no longer than 45 minutes.
- There are no right or wrong answers; we just want to hear your views and any information you provide will not be traced back to you in any publications without your permission.
- With your permission, the interview will be audio-recorded so that we can refer back to the recording in the future. All recordings will be destroyed when the research has been completed and any quotes used in reporting will be anonymous.
- We may choose to use quotes from your interview, however, you will not be personally identified in any of these.

Start recording and ask participant to confirm they are happy to take part and for the interview to be recorded.

Background

1. What organisation do you work for?
2. What is your position/ role within the organisation?
3. What are your responsibilities?
4. Does your organisation have any priorities/ major goals in road safety and driver behaviour? (specific groups or behaviours)

[Note: 'driver behaviour' in this context is used to refer to anyone using motorized vehicles, including motorcycles]

Non-compliance

5. Next, I am going to read a list of non-compliant behaviours. I would like you to order these such that the behaviour you/ your organisation believe is most important to deal with/ prioritise is the first, and then the second and so on.

Behaviour	Importance (rating)	Reasoning
Speeding		
Close following		

Behaviour	Importance (rating)	Reasoning
Driving a vehicle that is not roadworthy		
Mobile phone use while driving		
Drink-driving		
Middle lane hogging		
Driving while having difficulty remaining awake		
Others mentioned by participant:		

6. What have you based this order on? (e.g. based on particular outcomes, issues)
***only ask if not clear or if they have used some other mechanism – due to the type of organisation or other*

7. Are there any other behaviours you/ your organisation consider important?

a. How do they fit in with the above hierarchy? (how would you rate them in terms of importance to your organisation?)

8. Why do you think drivers fail to comply with the rules of the road?

a. What do you base this on? (experience, evidence, 'common knowledge')

Current practice

9. What is your organisation currently doing to tackle non-compliance?

a. Specific behaviours?

10. Why have these behaviours been prioritised? (local issues identified, organisational focus, evidence)

11. Why have these approaches been adopted by your organisation? (cost, perceived effectiveness, evidence-base)

12. How effective do you think these approaches have been?

a. Has your organisation undertaken any evaluation?

i. How was it done?

ii. What were the results?

iii. **If yes**, Could you provide us with any of this research?

Current approaches and perceived barriers

13. In brief, in your opinion, what is positive about the following types of intervention/ approaches?

Approach/ intervention	What is positive about these approaches? (e.g. strong evidence base, easy to use, accessible, targets problem groups, cost-effectiveness)	Barriers? (Q14)
a. Education		
b. Technology		
c. Skills-based		
d. Mixed methods		
e. Enforcement/ legislation		
f. Any other approaches you/ your organisation are using or have used in the past?		

14. Do you think there are any barriers to the use of particular types of approaches/ interventions to deal with non-compliance?

15. How can organisations work together to achieve common road safety goals?
 a. Are there any barriers to working together?

16. Do you currently work together with similar organisations?
 a. Are there any organisations you/ your organisation would be keen to align with (in terms of road safety and driver behaviour objectives; or other outcomes such as compliance and/or strategy)?
 iv. How so?

17. Who can/ should be responsible for breaking through barriers?

Is there anything relating to dealing with non-compliance that we have not yet covered and that you would like to mention?

*****Thank you for taking part in the interview*****

Appendix H Motorcyclists subgroups (according to Christmas et al., 2009) and possible messaging strategies

Table 8: Motorcyclists characteristics (as per Christmas et al., 2009), and possible messaging strategies

Motorcyclist segment	Demographics (tend to be...)	Elements that are of importance to this group	Elements that are <u>not</u> of importance to this group	Messages
Riding Hobbyists	<ul style="list-style-type: none"> • Married • Mostly male • 45 years and older • Summer/ leisure riding • Lowest in accident propensity (in relation to rest of sample) 	<ul style="list-style-type: none"> • Social interaction and feeling of belonging 	<p>Significantly low ratings for the importance of:</p> <ul style="list-style-type: none"> • Demonstrating skills, • Going fast, get places quicker, • Pitting self against others, • Getting away faster than cars. • Less likely than average to ride when fatigued, in a rush or poor visibility 	<p>This is a relatively safe motorcyclists group, however, the strong sense of belonging in this group could help target safety messages. Messages could focus on the safety of all motorcyclist and statistics/ figures relating to safety behaviours within this road user group.</p>
Performance disciples	<ul style="list-style-type: none"> • Married • Males • Ages 25-44 • High on accident liability 	<p>Significantly higher than mean ratings on the importance of:</p> <ul style="list-style-type: none"> • Getting places quicker, • Going really fast, • Acceleration, • Getting away faster than cars, • Test self & abilities. 	<ul style="list-style-type: none"> • Low perception of risk, particularly considering personal risk of collision • Low on savings and general 'feeling' when on the bike (e.g. noise, scenery, vibration) 	<p>This group's primary focus is on performance, including speed and skill. Skill is an important part of this group's identity and messages would need to emphasise how safe riding is (partly) benefited by increased skill. Caution should be given to ensure the message delivered</p>

Motorcyclist segment	Demographics (tend to be...)	Elements that are of importance to this group	Elements that are <u>not</u> of importance to this group	Messages
		<ul style="list-style-type: none"> • High on social aspects of riding as well. • Higher declared incidence of riding when tired, including 5% collision involvement due to tiredness • Focus on skill, even in avoidance of collisions. 		<p>does not reinforce the notion that skill prevents collisions.</p> <p>This group is also more likely to ride in a rush, when tired or long distances, therefore messaging could also focus on how fatigue can impair performance (and thus, safety).</p>
Performance hobbyist	<ul style="list-style-type: none"> • Male • Ages 25-44 • Both high and low collision propensity 	<p>Significantly higher than mean ratings on the importance of:</p> <ul style="list-style-type: none"> • Getting places quicker, • Exhilaration, • Going really fast, • Acceleration, • Getting away faster than cars, • Sounds, smell, weather, scenery while riding <p>People in this group are also:</p> <ul style="list-style-type: none"> • Likely to view risk higher for self and other motorcyclists • Likely to accept they may overestimate skill • More likely to ride while 	<p>Significantly low ratings for the importance of:</p> <ul style="list-style-type: none"> • Demonstrate skill • Pitting self against others, • Social interaction, comradery 	<p>For this rider group, fatigue and speed seem to be key risks. Therefore messages should focus on these behaviours, and how their own skill may be overestimated.</p>

Motorcyclist segment	Demographics (tend to be...)	Elements that are of importance to this group	Elements that are <u>not</u> of importance to this group	Messages
tired (25% admit this)				
Look-at-me enthusiasts	<ul style="list-style-type: none"> • Single • Young, under 25 years • Highest collision propensity, and experiencing risky situations • More likely to be novices 	<p>Significantly higher mean ratings than all other segments on importance of:</p> <ul style="list-style-type: none"> • Demonstrating skill • Pitting self against others, • Looking good – ‘others’ are important, but the social aspect is seen as competitive. <p>Riders in this group are also more likely to:</p> <ul style="list-style-type: none"> • View riding as safe • Ride on all occasions, including after too many drinks, end of hard day of work, minor fault w/ bike. 	<p>Significantly low ratings for the importance of:</p> <ul style="list-style-type: none"> • Awareness of surroundings, • Motorcycle understanding and taking care of it – the motorcycle may be viewed as a means to an end. 	<p>As shown by Christmas et al., this is a high risk group characterised by young people ‘showing off’, and therefore message reception is likely to be biased by biological factors (discussed in appendix B.2.1.2).</p> <p>Bike understanding and maintenance was rated lowest among this group, therefore, messaging can also help focus attention on vehicle roadworthiness. Although messaging should be designed so as to ensure that negative attitudes are not reinforced, messages relating to roadworthiness of bikes could focus on how ‘looking good’ can be enhanced by appropriate functioning and maintenance.</p>
Riding	<ul style="list-style-type: none"> • Married older 	Significantly higher than	Significantly lower than	For this group there is a focus on

Motorcyclist segment	Demographics (tend to be...)	Elements that are of importance to this group	Elements that are <u>not</u> of importance to this group	Messages
disciples	<ul style="list-style-type: none"> Males, 45+ years Below average experience of risk events but 9% reported having received speeding fines. Spread of accident propensity but mostly lower risk. 	<p>mean ratings on the importance of:</p> <ul style="list-style-type: none"> Elements relating to control of bike (e.g. balance, achievement, understanding bike) Social interaction (e.g. comradery, belonging) Riding as part of identity <p>This group is also likely to believe "arriving safely" is a priority when riding.</p> <p>They are, however, likely to undertake long journeys – i.e. Likely to continue riding beyond 2 hours.</p>	<p>mean ratings on the importance of:</p> <ul style="list-style-type: none"> Going fast Getting away faster than cars, Demonstrate skill Pitting self vs others 	<p>the identity of being a rider and the feeling of being on a bike, rather than performance. This is a social group that values safety; however, as riders in this group are also likely to undertake long journeys, messaging could focus on providing info about fatigued riding and how this could ensure their safe arrival at their destination.</p>
Car aspirants	<ul style="list-style-type: none"> Male, Youngest riders Living with parents, Smaller bikes (<50cc) Highest collision propensity 	<p>Significantly higher than mean ratings on the importance of:</p> <ul style="list-style-type: none"> Fuel/parking savings, Not relying on others <p>To this group, a key issue is the economy of riding.</p> <p>However, riders in this group are also most likely to:</p>	<p>People in this group are less likely to ride when fatigued.</p>	<p>Messaging here can focus around purchasing and wearing appropriate equipment. The types of messages can also communicate the benefits of riding, but highlight the importance of safety.</p> <p>As this group of riders was found to be more likely to give up riding due to risk statistics, care</p>

Motorcyclist segment	Demographics (tend to be...)	Elements that are of importance to this group	Elements that are <u>not</u> of importance to this group	Messages
		<ul style="list-style-type: none"> Consider giving up riding due to risk statistics Not wear appropriate protective gear 		<p>should be given in the development of messages, so as to not discourage riding.</p>
Car rejecters	<ul style="list-style-type: none"> More women in this segment (compared with other six) with 28% Ages 25-44, Lower income Married Low mileage, mostly for commuting purposes Average on collision propensity, with some very safe and some very risky riders 	<p>Significantly higher than mean ratings on the importance of:</p> <ul style="list-style-type: none"> Savings/ economy and independence (as above), <p>Riders in this group are also more likely to:</p> <ul style="list-style-type: none"> View riding as risky, including acceptance of personal risk of riding Focus on "arriving safely" 		<p>Similarly to the hobbyists, there are no overwhelming specific risks for this rider group, other than the general consideration of overall motorcyclist collision risk.</p> <p>However, as this group contains the highest proportion of females, the development of safety messages should consider this and ensure that the language used is inclusive and relatable.</p> <p>Similarly, messages could reinforce the risks of commuting (stress, frustration, particularly when in a hurry or confronted with a delay).</p>