Centre for Transport & Society

Driver attitudes and behaviours literature review

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1. Introduction

Transport Focus is the statutory transport user's watchdog, which includes users of the Strategic Road Network (SRN) in England - the motorways and major 'A' roads. Transport Focus commissioned this literature review to identify existing knowledge and continuing research gaps around driver behaviour and attitudes.

Transport Focus is specifically interested in how driver behaviour and attitudes inform two key performance indicators (KPIs) for the SRN. The first is the implications for road user satisfaction (which Transport Focus are evaluating through the National Road User Satisfaction Survey (NRUSS) and is a KPI for Highways England); and the second, road safety (also a KPI for Highways England in the form of reduction in killed or seriously injured figures).

The focus of this report is on vehicle drivers and motorcyclists as the main users of the SRN. Considerations of pedestrians and cyclists in this particular report is limited to specific circumstances, such as where they have to cross the SRN, or where cycling along sections of all-purpose trunk roads, whether on adjacent segregated infrastructure or on the main carriageway.

The report firstly summarizes two key documents published by the Department for Transport (DfT) in 2010 that consider road user behaviour and attitudes (Section 2). One reviews existing research to 2008 and the other reports on findings from workshops with road users. These two publications set out knowledge gaps and areas for further research; however, they cover all roads and road users rather than just the SRN.

The report then moves on to the review of more recent research. Transport Focus was involved in refining the areas of interest that informed the scoping of the themes and keywords for the literature searches. The scoping and review process is presented in Appendix A.

Sections 3-5 review research mostly published after 2008, which either provides new knowledge or expands on particular themes identified as important to Transport Focus. A number of publications reviewed offer further relevant insights to driver behaviour, speed, drugs and enforcement. A significant new area included in this report is the use of mobile technology while driving and the rise of in-vehicle technology for more autonomous driving (Section 5). The final section (6) of the report summarises findings and highlights continuing gaps in areas of interest, which offer potential for future research.

2. Existing Knowledge and Gaps

In 2010 the DfT published two key documents that inform this review document. The first ***Understanding Public Attitudes to Road-User Safety – Literature Review*** sets out the existing knowledge from research with a focus on research published between 2000-2007 (Musselwhite et al., 2010a). The second ***Understanding Public Attitudes to Road User Safety*** reports on research undertaken with the general public to confirm the earlier research and explore identified knowledge gaps (Musselwhite et al., 2010b).

Both these publications considered roads in the widest sense – roads in cities and towns, rural roads, trunk roads and motorways. Likewise, they looked at all road users - pedestrians, cyclists, motorcyclists, and drivers.

This section of the report provides an overview of the research findings from these two reports, and the research gaps. The aim is to clarify the areas of existing knowledge and to highlight the areas where new research might be beneficial.

'Understanding Public Attitudes to Road-User Safety – Literature Review 2010'

The Literature Review 2010 brought together information from 72 articles (academic journal papers, government reports, etc.), most of which were published between 2000 and 2007. The aim was to identify existing knowledge, set out the theories that assist the interpretation of attitudes and behaviour, and to highlight gaps in then-existing research, the latter to be explored through the workshops reported in the second report.

The review has a strong focus on **psychological theory,** which is used to explain how public attitudes are formed and impact on the way people behave. It sets out the psychological model (the theory of planned behaviour) that help interpret what people say about what they do.

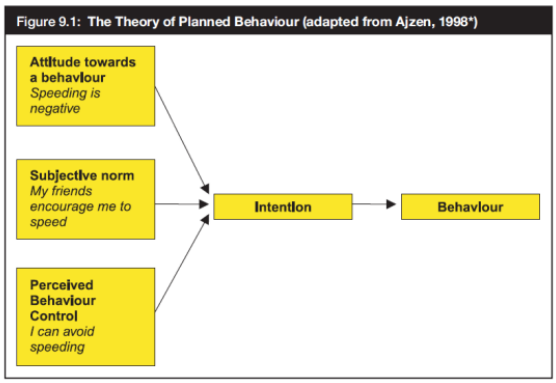

Figure 1 : Theory of Planned Behaviour as visualised by Musselwhite et al. (2010a: 72)

The theory of planned behaviour is best for explaining conscious individual behaviour where objective, rational factors such as cost and time are important (Sherwin, Chatterjee, and Jain, 2014) and less good for more 'automatic' or habitual behaviours, where 'bounded rationality' (Kahneman, 2003) limits willingness to re-evaluate an established pattern, or in cases in which emotions and perceptions are influential in the decision making process (van Exel and Rietveld, 2009). Also, whilst social norms are included, the model has an individual focus, whereas it can be

argued that the social context is much more important and influential on (at least some) individuals than the theory of planned behaviour suggests (see Sherwin et al., 2014 for alternative approaches applied to decisions to cycle).

The literature review identified different **types of road users**. It considered the following groups in relation to differences in behaviour and attitudes:

- Drivers, with some references to people who drive for work. However, it does not specifically address professional drivers such as lorry, coach or taxi drivers.
- motorcyclists, cyclists and pedestrians
- different age groups – predominantly younger drivers, older people, and children
- gender differences
- ethnicity, with limited specific reference to Black and Minority Ethnic (BME) groups and safety of children on the road
- people living in economically deprived and affluent locations with reference to road safety in residential locations.

These categories are indicative of the reviewed research rather than a comprehensive attempt to show social differences.

The Literature Review 2010 considered **attitudes** to **risk**, perceptions of **behaviour** and **safety,** with a strong focus on **speed** and highlighted a number of key issues:

- Road users see ‘other people’ as the problem, not themselves.

- Men and women often show differences in attitudes and behaviour, with women more likely to adhere to rules such as speed limits than men.

- Attitudes and behaviour change over the life course, e.g. younger men are more likely to take risks and speed. Older drivers are concerned about having their driving licence taken away, so attempt to drive more carefully.

- Identities/personality types that impact on safety, as well as the impact of passengers on changing driving behaviour.

- The level of experience of driving, and amount of driving undertaken (e.g. those who drive regularly for work), also affects attitudes and behaviours. For example, those who drive for work are more likely to speed.

- People have different attitudes and experiences relating to the geographic context; some see it as more important to drive more carefully on urban streets than on

quiet rural roads, and speeding on motorways is more acceptable than on other roads.

- The evaluations of different road design features that aim to reduce speed in urban areas presented mixed evidence, but it suggests there is declining public support for such measures.

- Generally people have zero tolerance of driving under the influence of alcohol or drugs, and use of mobile phones while driving, but in practice people's behaviour varies in respect of the relevant laws with age, gender and level of driving experience.

The Literature Review 2010 considered issues around the **enforcement** of 'good' driver behaviour. It noted that most drivers believed they were law abiding, but still speed. Drivers could express the view that the police should focus on other aspects of 'bad driving' over speeding offences. Attitudes towards enforcement change over the life course with people becoming more positive over time. It identified three enforcement behaviour issues:

- **Seat belt** laws had high compliance; in psychological terms, non-compliance is associated with a distancing of the self from a potential accident.

- There are negative perceptions towards **drink driving** and **drug driving**, but importantly it was highlighted that some younger people believed cannabis has a lower risk than driving under the influence of alcohol, and some believe drugs as enabling a heightened sense of awareness while driving.

- The third area concerned **mobile phone** use. While people recognized that using a mobile phone can have dangerous impacts on driving, support for enforcement was low.

Speed cameras, as an enforcement tool, have been an emotive topic in the media, but the literature review suggested that public support was increasing. The research discussed indicated that drivers adapted to fixed site cameras by slowing down and then speeding up again, so the value is low for reducing speeds overall. The literature review also identified that research had categorised drivers by their types of response to speed cameras: as conformers, defiers, manipulators and deterred, and these concepts may be useful for future research.

The **education** of drivers and **campaigns** aim to shape attitudes and behaviour: the literature review pointed to arguments that driver training does not equip new drivers appropriately, especially for motorway driving. It highlighted some evidence to public

support for ongoing training/re-testing, and the belief of drivers that retaking the test could show deficiencies in their skills.

The Literature Review 2010 indicated mixed evidence regarding the effectiveness of campaigns and different media, but targeted campaigns appeared to have had greater success in changing attitudes. The review suggests that focusing on the benefits of slower speeds and more efficient driving on cost savings, rather than the negatives (e.g. risk of fatality), may prove more effective. Campaigns targeting school children were shown to have mixed evaluations, with observing drama with actors recounting real life incidents found to have relatively higher effect than watching videos.

The Literature Review 2010 considered **pedestrians, cyclists** and **motorcyclists** as specific subgroups of road users.

It noted that existing research has focused mainly on children and older people as they are the most vulnerable **pedestrian** groups. Specifically, attitudes to safety here were linked with child age, with safety declining in teenage years due to peer pressure. It notes the lack of evidence around adult pedestrians' attitudes and behaviours.

Perception of safety was confirmed as deterring people from **cycling.** Cycle helmet uptake was observed to be comparatively low in the UK: the Literature Review 2010 identified the importance of social influence on wearing or not wearing a helmet, especially for children. Not wearing a helmet was associated with a low perception of risk. Research indicated a perception that wearing a helmet as a cyclist makes drivers less careful due to the process of 'risk compensation'[1]. Children were more likely to perceive that a cycling accident will result in injury rather than death.

Road users perceive **motorcyclists** to be the least safe road users. Dedicated motorcyclists believe they ride safely, but evidence shows speed and risk taking is higher for motorcyclists than car drivers. The Literature Review 2010 summarised research that show attitudes towards motorcyclists as mixed across different age groups and men and women, but where an individual had ridden a motorcycle, or a family member rode a motorcycle, then they would have a more positive perception of motorcyclists in general. This last point is useful in that it shows how people associate themselves with particular groups or behaviours.

To conclude, the Literature Review 2010 covers the whole of the road network and the research gaps presented reflect that aim in respect to the follow-on qualitative research (summarised below). Not all of these gaps are relevant to the aims of the present report's objectives.

[1]Whereby the cyclist is perceived as less vulnerable due to the protective equipment, but this additional safety margin is then not retained by the cyclist but 'consumed' by the motorist through more risky driving in the vicinity of the cyclist.

Research gaps highlighted in the literature review:

- how broader cultural perspectives of time efficiency shape driving speeds
- the reasons why people believe that being a good driver is a fast driver
- how drivers defend their own speeding in the context of other drivers being the problem
- changes in attitudes and behaviours across the life-course
- more coherent evaluations of traffic calming measures, including design features like ‘shared space’
- better understanding of attitudes to in-vehicle technologies and impacts on behaviour
- speed cameras and sustained behaviour change, including type of camera, and what is measured (e.g. is a lapse or deliberate violation)
- more evidence required on how people absorb and respond to campaigns.

Understanding Public Attitudes to Road User Safety

This second report builds on the evidence and research gaps outlined above. The report sets out findings from a series of workshops involving 240 members of the public. Twelve workshops were held in four locations (London, Bradford, Glasgow and North West Wales). People of different ages, with and without children, and different attitudes to risks, took part in a series of three workshops in each location. Workshop 1 explored risk taking on the road, Workshop 2 explored the relationship between different road user groups, and Workshop three explored views on potential road safety interventions.

The findings presented in the research begin with how the public thinks about risks in the context of road travel. **People believed that the road network in the UK was safe for car drivers**. There was agreement that motorcycling was dangerous, and walking and cycling are less safe than driving. People saw public transport as safe too, but consider public transport and walking as less safe at night. They are more tolerant of routine risks such as driving than extreme risks. Drawing on psychological theory, it was concluded that, where an individual has control over a risk, it is perceived as a lower risk. Drink or drugs were identified as compromising that control.

The workshop prompted people to talk about what they perceived might be dangerous road user behaviour. From across the workshops they identified ten key areas:-

- **distraction** from things inside and outside of the vehicle, as well as mental distractions

- **failure to adjust to conditions** such as weather, fatigue, and drug/alcohol impairment
- **poor road design and maintenance**, with potholes a specific issue in rural areas
- **congestion** occasionally seen as a contributing factor
- **unfamiliarity** versus **complacency** relating to drivers' knowledge of routes
- **attitudes, personality and emotion** focused on drivers' patience, stress, anger and road rage
- **peer pressure,** particularly in respect of younger drivers
- **time pressure** relating to travelling to or in the course of work, or for those with children
- **lack of skills** in discussion of younger and older drivers, but cyclists' skills and violations generated greater concern to all drivers
- **Stereotypes** emerged, specifically in relation to younger drivers as key risk takers, older drivers as being slow and having out-of-date experience, professional drivers viewed as dangerous and erratic, cyclists and motorcyclists undertaking risky behaviours.

Participants considered their own driving behaviour. They admitted to **speeding** but defended why. These reasons included speed restrictions being too stringent and out of date with the ability of modern cars, the road was empty, or driving on a motorway. Other **risky driving behaviour** noted was around particular manoeuvres, overtaking, distractions like using a mobile phone, driving when tired, drunk driving and not wearing a seatbelt.

Participants justified their risk taking because of being late, in a hurry or wanting to get home or to work more quickly. Individual risks related to familiarity with a route, but were sometimes influenced by the flow of traffic or the expectations of others. Some saw risk taking as making them feel better, boosting their ego or fun. Not all risk-taking is deliberate, and participants felt they reduced their risk taking over the life course as a result of adjusting their behaviours in response to experience gained.

The workshops considered the **design** of roads. Here participants identified three key concerns about the safety of infrastructure that may have specific relevance to the SRN:

- long straight roads encouraged speeding
- the design of the end of urban motorways can impact on the perception of safety where drivers are slowing down and manoeuvring between merging lanes particularly in peak hour traffic
- the design of junctions and roundabouts do not give a sense of safety for all road users, where for instance cyclists and pedestrians have to interact with traffic either on the road or crossing such intersections.

Another challenge highlighted in the report was access to residential properties on main roads, where cars have to cross a pavement to reach the road and other infrastructure, such as bus shelters, may be impede sightlines to oncoming traffic.

Rural residents were very concerned about the **speed** of traffic on rural roads, and the workshop participants supported average speed cameras[2] in rural areas. The workshops participants also discussed a potential reduction in the **national speed limit** but there was not a consensus view on the value or impact. More generally, they viewed speed as an individual, context-dependent judgement, and few were in favour of reductions, fixed speed cameras, or speeding penalties.

The workshop report set out participants' views on the impact of road safety **campaigns** and associated road signage. It noted that people believe those groups most often identified with risk-taking behaviour, such as young men, did not take on board campaign messages. Participants saw value in 'shocking' adverts that create a sense of guilt. They also saw potential in improving driver training, such as increasing the range of road experiences including motorway training, and an emphasis on the driver's responsibility and the consequences of careless or dangerous driving to be embedded in the theory test.

The workshops identified the impact of **social influence** on driving behaviour:

- passengers influence driver behaviour
- younger drivers feel the need to impress friends with more risky and aggressive behaviour, which can increase when they are driving in separate cars 'in convoy'
- parents feel they have to conform to safer driving behaviours
- older drivers are concerned how others judge them and therefore try to drive more safely
- children as passengers can be distracting, but equally encourage safer driving behaviours.

The workshops demonstrated that most road issues are seen through the eyes of motorists and this perspective identifies motorcyclists, cyclists, pedestrians as at risk and young drivers as taking risks. Generally they demonstrated support for a range of enforcement measures that would make an impact directly on young people emotionally and economically (e.g. confiscating the cars of uninsured drivers and crushing them) and technically (e.g. speed limiters).

Drink and drug driving has a low tolerance. However, the workshops found that people still drive under the influence of alcohol above the legal limit despite the

[2] A speed monitoring systems which logs vehicle registration plates at different locations and uses elapsed time to calculate whether the vehicle has passed the logging points sooner than possible had the average speed been at or below the speed limit. Generally average speed detection is used on the SRN, and particularly as a temporary feature where roadworks are in progress.

associated negative attitude, and their willingness to talk about it indicated there was some ongoing social acceptability. The workshops suggested that as people assume the police cannot test for drug driving they can ‘get away with it’. There was support for stronger enforcement measures to identify people driving under the influence of drugs.

2.1. Conclusions

At the time of publication, the two reports summarised above represented a up-to-date understanding of road users’ attitudes and behaviours within the UK. They demonstrated that people like to make their own choices about how they drive, particularly in relation to setting their speed on the road. Road users were found to self-perceive as making ‘good’ decisions, and others as making ‘bad’ decisions, which have consequences for their own safety. Arguably, in the UK there is a culture that makes speeding in non-residential areas socially acceptable, as does certain levels and instances of driving under the influence of alcohol. However, social influence was also identified as a behaviour change factor, as people noted how their driver behaviour changed in company with different types of passenger. Likewise, older people had different attitudes and behaviours to younger people, suggesting that these evolve over the lifecourse.

However, the two publications do not specifically analyse these issues in relation to the SRN and customer satisfaction and safety, therefore the rest of this report adds to some of these debates covered above to draw conclusions specifically regarding the SRN. In particular they address the cultural aspects of driver behaviour and attitudes, and considers the emotional aspects of the driving experience including road rage and aggression.

One of the largest gaps of the previous reviews, due to their publication dates, is the limited discussion around the use of mobile technologies by drivers, and issues of automation, which are of a particular interest to policymakers. These are discussed in Section 5.

3. Driver behaviour and Safety

The research findings discussed in Section 2 demonstrate that people generally feel that the roads are safe in the UK. Such a belief suggests a good outcome for customer satisfaction on the SRN, but research undertaken by Transport Focus suggests that road safety is a still a priority for improvement among most road users (Transport Focus 2015a, 2015b). This issue was also raised in qualitative research for the DfT by Toombs et al (2014) regarding customer satisfaction on the SRN. Market research with UK motorists by the Institute of Advanced Motorists (IAM, 2015) presents a range of concerns about driver behaviour, particularly that of other road users, but also reveals how some behaviours such as speeding on motorways or talking on the phone continue to be more acceptable than other behaviours.

Here in Section 3, the report firstly identifies known causes of fatal road accidents, and then provides additional evidence around some of the social and psychological factors that shape driver behaviour and attitudes raised in Section 2.

3.1. Road accidents

According to Clarke et al. (2010), fatal road traffic accidents in the UK were not falling in line with targets. Clark et al. (2010) examined the evidence in police reports from 1,185 fatal vehicle-occupant crashes 1994-2005, from across the *whole* road network. The findings identified that over sixty-five percent of fatal accidents involved speeding, driving having consumed alcohol above the legal limit, or not wearing a seat belt.

However, there is also an interaction between behaviour and the type of road. Younger drivers tended to crash due to 'losing control on bends', often at night and driving for leisure (2010: 764). Often these crashes are associated with speed, alcohol and insufficient care. However, fatal crashes caused by losing control on a bend were four times as likely to occur on a rural road as on an urban road. The crashes either stemmed from the driver not being able to navigate the bend at all, or from overcorrecting and thus skidding. Of the fatal accidents that involved losing control on a bend (44% of total accidents), about five times as many were by male drivers than female. In terms of the SRN this issue is likely to be less important due to the nature of the network being largely purpose-built for motor traffic and therefore having by design a lower incidence of tight bends, but it does not negate the problem of younger drivers more likely to be undertaking more risky driving behaviours which are discussed later.

Clarke et al. (2010) identified that almost twenty percent of fatalities involved a driver over the legal alcohol limit for driving, whilst four percent involved drugs, with cannabis being the most common drug being used (see Section 3.3.). Twenty-three percent of accidents caused by male drivers involved drink or drugs, compared to

13% by female drivers. A quarter of all drug-related accidents were caused by drivers aged 30 or under. Not surprisingly given the temporal patterns of leisure time, accidents involving drink or drugs increased after 20.00. Alcohol levels amongst drivers involved in fatal crashes averaged over twice the legal limit, suggesting the driver would be well aware that they were driving under the influence of alcohol.

Clarke et al. (2010) suggest that there is a subgroup of drivers who engage with multiple 'bad driving' behaviours; for example those not wearing a seatbelt are more likely to be speeding. Thirty-four percent of those killed were not wearing a seat belt, and only fifty percent of fatalities were definitely wearing a seatbelt. Not wearing a seat belt was not a factor associated with variation in age. It can be noted that the coincidence of such factors will, other things being equal, affect other research findings: the protective effect of wearing a safety belt may be somewhat over-stated if those not wearing safety belts are exposed to higher risk of crash or collision.

Age has an impact on road fatalities. Drivers who are aged 20 years or less, and involved in a crash with a fatality involved, were almost 12 times more like to have 'caused' it than 'not caused' it (Clarke et al. 2010). A report by the RAC Foundation specifically investigates the issue of younger drivers and road fatalities (Box and Wengraf 2013). They do note that there has been a decline in the numbers of KSI in the 15-19 year-old age group, but argue this may be the outcome of fewer young men learning to drive. It supports the evidence given by Clarke et al. above, and looks more closely at why young drivers might be more unsafe than others. It notes the potential of stage of brain maturity being a factor affecting the capacities to drive safely, and hence argues from a biological basis that young adults are more likely to take risks. It also suggests that younger people are more susceptible to physical fatigue, which can result in poor driving. Factors highlighted such as drugs, phone use and emotion/aggression are discussed below.

Older drivers were found to be involved in fewer fatalities. For those older people who did have a fatal crash, there was a tendency for misjudgements to be involved, particularly regarding right-of-way.

Any examination of changes in the incidence of KSIs on the SRN, therefore, needs to consider the specific behaviours and needs of different age groups, and target those consuming drugs or alcohol. However, there may be some opportunity for engagement with road users to identify specific locations on the SRN where drivers feel less satisfied with safety due to the road design, or where there is increased risk associated with 'bad' driving and the road layout.

While the SRN may offer a 'safer' physical driving environment than the wider road network, a recent paper by Olsen et al. (2016) argued that new urban motorways (such as the M47) do not reduce road traffic accidents in their surrounding areas. Olsen et al. (2016) argue that any downward trends in road traffic collisions are the

result of other local measures and not attributable to traffic moving onto purpose-built roads.

According to research by Transport Focus (2015), car drivers can feel intimidated by HGVs. Transport Focus was interested in exploring further the relationship between drivers and such vehicles. The only research found during the search in fact looked at the behaviour of drivers of Large Goods Vehicles (LGVs, classified as gross weight over 3500kg) and their compliance with regulations (Poulter et al., 2008). This group is more likely to be involved in crashes that result in fatalities because of the weight and size of the vehicles and stopping distances, but per kilometre travelled are involved in fewer crashes than other non-commercial vehicles. Poulter et al (2008) concluded that there are opportunities to deliver tailored messages to drivers that might change the intended behaviours. They also note the challenge for operational managers is shaping drivers' perception that they have enough time to maintain vehicles and managing fatigue, and suggest further research of operational practices. Many commercial vehicles are technologically 'monitored' and this is discussed in Section 5. They may also have tight time schedules, which could impact on driver behaviour and is discussed further below Section 4.1.

While the research by Clarke et al. (2010) provides evidence of speed and impaired judgement through alcohol and drugs, there is less discussion of wider issues of driver distraction as a problem. The IAM survey indicates that 77% of motorists believe that driver distraction is getting worse. Young and Salmon (2012) consider what constitutes driver error and what causes it, and highlight that it is an area requiring further research (see also Basacick and Stevens, 2008). Some of the publications reviewed in the rest of this report consider how particular behaviours may cause errors, e.g. lapses in concentration due to driver boredom, mobile phone use. These all link to the cognitive, visual and manual skills required to drive. Participants in Basacick and Steven's 'experts' workshops suggested that there is a continuous scale of distractions from minor to major, and not all distractions affect all drivers the same way. The impact of distraction on driver behaviour and ultimately on road accidents and fatalities is seen as a critical area for further research.

3.2. Emotions and Boredom

How an individual feels can affect the way he or she drives. Much of the research into emotional responses focuses on aggressive behaviour and anger, as discussed below. However, more broadly research by Transport Focus (2015a) suggests that affective factors influence road user satisfaction. A review by Jain et al (2015) proposes the driving environment such as the landscape, listening to music or radio, and having time to think, as well as factors like a seamless a to b journey contributed to a good journey experience. The symbolic value of having a car and driving it can play to the emotional senses too (Jain et al., 2015). Conversely, external negative emotions due to stress or worry will again affect customer satisfaction. The

combination of safety, frustration/stress and the need to concentrate all contribute to road users' level of satisfaction (Toombs et al. 2014).

Experiencing the impact of aggression from other road users is likely to negatively impact on satisfaction with the SRN, and those who feel more vulnerable are less likely to want to use it. For instance, Transport Focus was concerned about reports of aggression towards disabled drivers on the SRN, but currently there is not any research in this field.

The focus on aggression is due to the association of a higher risk of being involved in road traffic accidents than less aggressive drivers. King and Parker (2008) demonstrated the links between general aggression, the commission of driving violations, and accident involvement. In general, the more aggressive a person was, the more often they committed driving violations, and the more often they perceived others to be committing driving violations. This assertion is supported by a meta-analysis of 51 studies published in the last two decades examining driver anger by Zhang and Chen (2016).

King and Parker (2008) propose that drivers in general believed that other drivers committed poor driving behaviour significantly more than they did themselves. However, what is interesting is how their respondents positioned their behaviour against other drivers to justify their own actions. For instance, people who are driving at a speed above the speed limit will often justify their action because other road users are doing so. As more aggressive road users see themselves as similar to other road users, they may view other peoples' violations as hostile rather than accidental and respond in a more aggressive way. This assertion infers that some bad driving behaviour is socially and motivationally based as opposed to being based in driving skill. This could be particularly important in contexts in which drivers are more likely to perceive violations by others, for example in speed restricted areas, in shared space where the rules are less distinct, in heavy traffic, or where there are changes to the expected road layout which require negotiation (such as roadworks).

Thus, King and Parker (2008) suggested that to understand bad driving we need to understand people's emotional and affective traits. From this perspective, safety campaigns aimed at improving people's driving might be best directed at changing aggressive behaviour than improving skills, as many of the bad drivers in the study showed acceptable levels of skill, and yet committed violations that were linked to their aggressive traits.

At the next level, Zhang and Chan (2016) look specifically at anger, rather than aggression. They argue that the goal of driving is to arrive on time and safely. If other road users impede these goals (e.g. congestion or unsafe driving) then drivers can become angry. The nature of being in a vehicle gives an individual anonymity and thus a degree of actual or perceived protection, and reduces the downwards social

pressure on behaviours triggered by that anger. In turn, the meta-analysis supports the view that people who are angry are more likely to take risks and make driver errors (which in turn can be expected further to trigger aggression in others. For example, Zhang and Chan state (2016:7): “There is evidence that angry drivers scan a narrowed area, which can increase the risk of failing-to-see potential traffic hazards in time and consequently commit errors.” However, there is mixed evidence as to the causality of accidents due to anger.

The meta-analysis conducted by Zhang and Chan (2016) indicates that anger affects younger drivers more negatively, as people have greater ability to control their anger as they get older. The authors suggest that further research is required especially with drivers in the middle ages, those who drive as part of their work and who have high mileage, and to examine gender differences. They also suggest that training needs to include anger management techniques.

Music may affect the emotional state of a driver (and passengers). While there has been interest in the social sciences around music and driving[3], van der Zwaag et al. (2012) are amongst the first to investigate its influence on drivers’ mood and performance in the context of driver behaviour and safety. Music can create arousal when drivers are becoming sleepy or bored, or it can distract the driver and impact on safety where drivers need to concentrate. Using a small number of participants in a driving simulator experiment, van der Zwaag et al. (2012) tested the effect of different types of music on driving performance. They concluded that music could be beneficial to performance compared to driving without music, but music with negative associations can reduce performance too. They note that driving with music with positive associations caused slower speeds than no music, which may be a result of having to concentrate more. High intensity music can decrease performance in demanding conditions. An interesting outcome is how music reduces the sense of time when waiting, which could be important in managing mood in congested or with other unexpected delays. However, van der Zwaag et al. (2012) caveat the findings as a new experimental design with specific selections of music, and the subjective nature of categorising music, so further research is required to validate these ideas.

The idea of arousal discussed in relation to music connects with driver boredom and safety. Heslop (2014) argues that there is a need to understand how driver boredom influences behaviour and safety. Heslop (2014) surveyed 1,550 drivers, which included a cross-section of ages, and a gender mix of 56% men and 44% women. Heslop (2014) found that those who were younger and less enthusiastic about driving were much more likely to experience driver boredom, as well as those with lower annual mileages. Unsurprisingly those who were enthusiastic about driving were less likely to be bored while driving. Personality traits and gender affected levels of boredom. Importantly for driver safety, those who reported high levels of

[3] For example: Walsh, M. (2010) Driving to the beat of one's own hum: automobility and musical listening. *Studies in Symbolic Interaction.* 201-221

boredom were ‘much more likely’ to report high driver distraction and error-proneness, and ‘slightly more likely’ to report speeding on motorways and having a speeding penalty in the previous three years.

Heslop (2014) concludes from his findings that driver boredom was strongly related to driver distraction, but not to (self-reported) speed. He suggests that bored drivers may find additional stimulus in other activities whilst driving, rather than simply driving faster to make driving more exciting. (Distractions could include use of technology discussed in Section 5.) While Heslop proposes driver boredom is likely to pose a threat to road safety, he suggests that reducing experiences of driver boredom may be difficult to achieve safely. The issue of speeding as an antidote to boredom is also discussed in Section 4.

3.3. Drugs

Drivers are increasingly concerned about ‘drug driving’ and associated aggressive behaviour (IAM, 2015). Musselwhite et al. (2010b) argue that generally it is perceived negatively, albeit less so by younger drivers. They indicate that younger people are more likely to drug drive than any other age group, and that people believe that drug driving cannot be detected in the same way as alcohol, and therefore feel they are less likely to be prosecuted. However, while research into drug use and driving has been conducted elsewhere in the world, there needs to be further research in the UK to understand specific cultural nuances to this behaviour.

Following an intervention in Queensland, Australia, Freeman et al. (2010) considered the factors influencing drug driving. They surveyed a group of young people using a snowballing methodology[4]. Participants self-reported their drug driving, and provide opinions about deterrents.

In terms of taking drugs generally (not necessarily before driving), 29% of participants had taken substances in the last year, with cannabis being the most common. Freeman et al. (2010) found that about one in five drivers confessed to drug driving once or more in the last six months, 5% confessed to drug driving more than ten times in the past six months, and 17% of participants indicated that they intended to drug drive once or more in the next six months. Around one third of participants had also been a passenger where the driver was drug driving, in the preceding six months.

Importantly their findings show that 50% of their participants were particularly influence by how they thought others perceived their behaviour. This finding is very important to how messages are conveyed to this group. Those who felt they would

[4] A recruitment technique whereby new participants are attracted through already-engaged participants, and can be particular effective in recruiting ‘hard-to-reach’ groups. However, snowballing tends to encourage homogeneity in sample characteristics, which limits the ability to generalize finds to a larger population.

not be apprehended, or who were little concerned by potential social sanctions, were more likely to intend to drug drive. However, a large proportion of participants seemed unclear about how likely they were to be apprehended and what would happen if they were.

While there is more confusion and concern around taking drugs and driving, the issues raised in section 2 by Musselwhite et al. (2010a, 2010b) around a level of acceptability of driving under the influence drugs with certain groups, and more generally driving under the influence of alcohol, in the UK warrants further investigation to understand what the impact might be on the SRN as opposed to local or rural roads.

3.4. Looking across the life course

The various research papers reviewed for this report highlight the problems associated with younger drivers. In particular, the research above indicates that younger people are more likely to be involved in particular types of road traffic collisions, to drug drive, and exhibit anger or aggression when driving. This has led the RAC Foundation to suggest that driver training needs to more actively counter such behaviours, and for the UK to adopt a 'graduated' driver licence programme[5].

People's attitudes and behaviours change as they become older, especially when they have children, according to the research by Musselwhite et al. (2010a, 2010b). However, there is little evidence specifically considering the ages between 30 and 70 years. Like young drivers, older drivers are often under the spotlight in terms of driver safety, and associated questions about the need to undergo further tests and re-training.

Participants in a study by Musselwhite and Haddad (2010c) viewed themselves as better drivers than their younger selves, and other young drivers on the road. However, older drivers are in a more vulnerable position, as they have to justify their continued ability to drive safely. Musselwhite and Haddad (2010c) suggest that older drivers are likely to over-emphasise their driving skill and ability (a trait which is true of drivers generally), and thus as a group hide some of the difficulties they have with driving.

A specific finding made by Musselwhite and Haddad (2010c) in relation to safety was the difficulty experienced by older people in quickly reading the speedometer after having previously focussed on the road. As the human eye ages, it takes longer to

[5] An approach to driver licencing which differs from the traditional 'binary' approach of fully licensed or not licensed by limiting a driver's options, typically for a set period of years in which the driver is regarded as a 'novice'. Restrictions may include the time of day the holder is permitted to drive (avoiding driving in the dark), maximum speed, rights to carry passengers (number and/or age). In addition an associated measure in some jurisdictions gives novice licence holders a lower penalty points threshold at which they will receive a ban for poor driving.

refocus between distant and close objects, and information processing is slower, and as a result it was difficult sometimes for older drivers to ‘keep their speed in check’ and maintain the speed limit.

The study also notes that the older people in the study did not mention in any depth or level of detail anxiety or concern with intersections or turning right (in the UK—i.e. across the oncoming traffic), despite this being an area where older people are over-represented in road traffic collisions. Indeed, discussion on intersection issues highlighted that problems arose due to other elements— being distracted by signs prior to or at the intersection and being dazzled by the lights of other traffic, for example.

Awareness training for older people could concentrate on such manoeuvres, as older people appear less aware of this potential danger. However, the research suggests that such collisions are not caused simply by the process of engaging in the turn or manoeuvre itself, but that the behaviour is coupled with other disabling factors, such as being distracted and glare, for example.

Specific life course changes could be considered in relation to driving and driver safety and satisfaction with the road network. Younger people may feel more invincible but how this is played out in their satisfaction with the road network perhaps warrants further investigation. The satisfaction of vulnerable users (including the elderly), or people driving with children, is likely to be influenced by their feeling of safety, and other drivers behaviour.

3.5. Conclusion

This section has indicated that emotion may improve or compromise customer satisfaction and safety. Most research has focused on the negative influences of anger and aggression on road safety. Drivers are concerned that people driving under the influence of drugs may affect their safety, and research has concluded that drug taking can make drivers more aggressive. Boredom may be a result of a number of factors that include the driving environment, and thinking through how to reduce driver boredom might be an area for further research. Managing emotions and boredom across the life course are likely to have been researched in other domains (e.g. psychology), therefore further in depth investigation of the relevant literature may provide more information. The following section indicates how boredom can be linked with speeding.

4. Speed and Enforcement

The existing research shows that speed is a complex issue. Speed is a major factor in road safety and collision outcomes (Mitchell, 2012). Musselwhite et al. (2010) note the following issues relating to speed, behaviour and attitudes.

- people understand that speeding is wrong, but they are able to justify why they speed in certain situations
- speeding on straight, or empty roads, is more acceptable than on residential roads or near schools
- people are more likely to speed on motorways
- people who tend to speed are people who drive as part of their work
- men are more likely to speed than women
- Young men are often stereotyped as high-risk takers who are like to speed, and while there is some evidence to support this assumption, not all young men fall into this category.

These statements are supported by the IAM survey of UK drivers (2015), which also indicates that a third of people consider they drive more slowly than others do, while only 12% think they drive faster, and that men are more likely to drive fast, as are people who drive as part of their employment. Sixty-one percent of drivers consider that driving 10mph above the speed limit on motorways is acceptable, but driving 5mph above the speed limit on residential streets is less acceptable.

Mitchell (2012) proposes that the numbers of speeding offences have been falling, which in part may be attributable to GPS warning of speed cameras, but overall believes people are generally more compliant with speed limits now than in the past. Mitchell (2012) presents evidence to indicate that on British motorways, the percentage of cars exceeding the speed limit has reduced from 57% in 2003 to 49% in 2010. The percentage of cars exceeding the limit by more than 10mph fell from 20% in 2003 to 14% in 2010. Overall, average motorway speeds fell from 70 mph in 2001 to 69 mph in 2010. Mitchell argues that more than half of these reductions in speed are due to ‘real reductions in the speeds of cars in free flowing traffic’ (2012:5) rather than motorists slowing for cameras, or reducing speed due to traffic conditions. It also finds a causal relationship between cars travelling at 80mph or more with collisions that have a fatality, indicating this is an area of concern when considering raising speed limits.

4.1. Culture and Speeding

A culture of speeding can be interpreted in a number of different ways: first, the culture of speed within the identity of specific groups (e.g. young men and motorcyclists) and second, the culture of time savings.

As highlighted in Section 3 there are gender and age differences in driver behaviour and these are also important for speeding. In particular, young men are most likely to speed and this may be the result of social pressures. Musselwhite et al. (2010a) indicated that drivers are more likely to speed with passengers who are peers than parents, and driving with friends in another car may encourage risky behaviour and speeding. Rather than being influenced by a culture orientated to speed through the economic value of time, young people appear to share a culture of speed relating to pleasure and thrill-seeking related to their identity and self-presentation within their peer group.

Cestac et al. (2010) develop the ideas that individuals behave in the way that they think others are expecting them to behave. In looking at young drivers and speed through a survey in France, Cestac et al. (2010) note significant differences in men and women's intentions to speed, and that women are less likely to be affected by peer pressure to speed or thrill seeking. They suggest novice male drivers are more likely to speed in the outset because it is a novel experience, which presumably reduces an as influence over time. Hence Cestac et al. (2010) argue that there is a three-stage process to speeding that moves the debate into understanding behaviour as a dynamic process. During the first year of driving, speeding appears more influenced by sensation seeking; in the second stage, social comparison becomes more important; and in the third stage, a feeling of being in control becomes a greater motivator of speeding. Following these findings, Cestac et al. (2010) propose that speed cameras may not be a sufficient mechanism for deterring speeding.

Taking a slightly different approach, Maast et al. (2009) used a small sample of young men in a driving simulator to study the impact of hearing masculine, neutral, and feminine words while driving, and concluded that masculine words unconsciously encouraged speed. While this research approach may be questioned in terms of how masculine and feminine words are selected and defined, other social research suggests there is a link between masculine identity and driver behaviour.

As indicated above research has identified that people can gain pleasure from travelling at speed, especially young men. However, more generally drivers and motorcyclists are trying to achieve a balance between feeling bored and feeling at risk, and speed may be a way of balancing the bored-risk relationship in specific road conditions (Boughton et al., 2009). They suggest that drivers will try and maintain a certain level of difficulty in the driving task – not too difficult or easy. Risk arises when the difficulty of the task exceeds the capabilities of the driver with a

potential loss of control and subsequent collision, and this threshold seems important when looking at riding speeds of motorcyclists.

Broughton et al. (2009) compared the behaviour of motorcyclists with car drivers, and note that motorcyclists enjoy the expressive use of the vehicle including riding at speed. However, their research indicated that motorcyclists tended to conform to speed limits within urban areas, but were more likely than car drivers to exceed the speed limit elsewhere because they enjoy the sensation of speed. Yet while stress and a sense of lack of control can also be outcomes at riding at a preferred speed, riders (and car drivers) felt that travelling faster would not be difficult or put others at risk. The impact of speed cameras on motorcyclists is important, and many in this study reported riding at the legal speed while passing the camera, but those who did exceed it would do so in a dramatic way.

In contrast to speed as pleasure seeking, Musselwhite et al (2010a) indicated that speed may be linked to an underlying emphasis on travel time savings and the idea that travel time is non-productive time for those travelling in the course of business. The relationship between speeding and time savings in this context has not been explicitly researched to date with UK businesses (as far as the search could identify). Although in terms of customer satisfaction on the SRN Toombs et al (2014) have noted that drivers are time and cost sensitive, especially those in the commercial environment.

However, a survey of drivers undertaken in France by Coeugnet et al. (2013), investigated time pressures and their impact on driver behaviour, particularly noting that time pressures increase driving risks. In France, road traffic accidents when commuting constitute a work-related accident, which is different from the UK, where even work-related driving falls outside of direct workplace health and safety regulation, although guidance comes jointly from the HSE and DfT on driving for work (Stuckey et al., 2013).

Coeugnet et al. (2013) found that pleasure can be gained from being time pressured, and is associated with the types of professional roles people take on. Professionals who drive for work are more likely to be time pressured on the road. Coeugnet et al. propose: ‘The driving setting is repeatedly associated with professional hurry and becomes a conditioned stimulus that elicits a time-pressure response’ (2013:48). More generally, they note that time-pressures decrease with age, but they also confirm that women are more likely to be time pressured if they are managing the dual roles of working and parenting.

For the SRN customer satisfaction Toombs et al. (2014) also consider the impact of unexpected delay and extended journey times on customer satisfaction. Here, going slower has a negative impact, especially where the reason for the delay was not clear (see also Jain et al 2015).

4.2. Speed cameras

Fixed speed cameras are not popular amongst some of the motoring public and such attitudes were confirmed by Musselwhite et al. (2010a, 2010b). Wells (2008) and Wells and Wills (2012) sought to find out why the general public are resistant to this form of monitoring using focus groups, interviews, observations and analysis of internet-based discussions. Wells (2008) considers the speed camera as an object discussed on internet forums, whereas Wells and Wills, (2012) focus on individual identity in how people respond to speed cameras.

The fact that fixed speed cameras only record an action and do not have the interpretation of the situation creates a sense of injustice for some people. Wells (2008) notes those prosecuted for being caught speeding by a camera feel that the camera does not take into consideration the road conditions or weather. This finding supports earlier evidence, and the idea that drivers feel that judging an appropriate speed is dependent on the context. Wells (2008) proposes people want flexible speed limits with cameras that are more responsive to the contextual conditions, and argues that talking about speed cameras makes people indicate a preference for traffic police who are able to make a more 'human' judgement of the circumstances.

Wells and Wills (2012) note that people talk about fixed speed cameras in three specific ways:

- Sceptical. This set of people include people who question the scientific evidence that justifies a speed camera, or those who think speed cameras are there for financial rather than safety reasons.

- I'm law abiding. Despite being caught speeding, these drivers view themselves as law abiding. The response to speed cameras is often emotional, and the individual right is being over ruled by unnecessary legislative intervention.

- Focus on real criminals. People consider there should be greater focus on other deviant drivers, and real criminals, not (mostly) law-abiding motorists.

The introduction of 'average speed enforcement', which measures an average speed between two cameras on a stretch of road, seems to be more acceptable than single fixed cameras and produces good outcomes in terms of average speed reductions at the enforcement location. Soole et al (2013) conducted a review of evidence from around the world on average speed enforcement. However, they have noted that there is a paucity of rigorous evaluation, with few comparison or control studies by independent researchers (as opposed to the research conducted by the system manufacturers). Despite this caveat, they provide some key insights into the potential impacts associated with driver behaviour, acceptability, and cost benefit analysis. A key finding is average speed enforcement improves traffic flow along the monitored stretch of road by removing speed variations. In practice this mean

vehicles are all moving at a similar speed just below the threshold. Reducing speed variability between vehicles reduces the likelihood of crashes and the numbers of KSI. Other ancillary benefits include a reduction in CO_2. The social cost savings due to the reduction in KSIs are significant. Soole et al. (2013) also note that there appears to be greater support for this system compared to fixed cameras, as people believe it to be fairer than a snapshot of speed. They present evidence for support of this system in the UK in a 20mph residential setting, which might suggest there is the potential for support more broadly on the SRN. However, Soole et al. (2013) do suggest that further research is required to understand the wider impacts of such technology, i.e. does it encourage safer speeds more generally, or only at the enforcement locations.

Potentially, it seems that average speed cameras will have more support and greater compliance than fixed speed cameras, but still further research is required to look at the wider impact on speeds outside of monitored zones.

4.3. Driver Training and Campaigns

Various authors have suggested that driver training needs to give novice drivers, in particular, improved knowledge of the issues around driver behaviour and safety. There is also interest from Transport Focus as to drivers' awareness of the impact of speed, for instance on safety. There are a number of studies that have looked at how information can be presented to drivers, and the success of educational campaigns around driving behaviours have had a mixed response as to their effectiveness (Musselwhite, 2010a, 2010b).

Elliot and Armitage (2009) experimented to see if information given to drivers about speeding could influence underlying cognition and thus change behaviour. Their ideas were based on the processes identified in the 'theory of planned behaviour' (see Figure 1 earlier) The assumption being that if an element is changed in the way people form their attitudes then their behaviour will change. In this experiment 258 participants completed a questionnaire and were then given a booklet explaining the risks of speeding and messages aimed at changing 'specific behavioural, normative and control beliefs.' Participants had to self-report speeds driven.

Elliot and Armitage (2009) considered the small reductions of speeding following the intervention potentially to have important results at a larger population scale. However, the booklet format for the intervention could be considered a less effective method for conveying messages compared to other media. However, what the research illustrates is how a theoretical model of behaviour can help shape how a message is targeted.

A very different approach was taken in Melbourne, Australia, where a smartphone app (CityGT) was developed and tested as an educational tool to make young

drivers more aware of safety issues. Tierney (2011) reports on the response to this tool amongst 18-25-year olds:-

- the game's message was seen to be serious and important
- the game was a good way of showing the consequences of talking on the phone while driving
- It would be fun to use the game to 'trick' their friends, thus creating a campaign that was viral in nature. This was positive as users of the game would effectively be spreading the research team's safety messages amongst their peers.
- communicating in this way to young people was valid and a positive initiative for VicRoads
- Most importantly, CityGT would bring the safety issue to mind while they were driving, and may make them think about safer ways of using a phone.

Tierney notes that the aim of social marketing and consumer campaigns such as this is to support more direct road safety initiatives (such as police enforcement) through encouraging behaviour change and shifting attitudes, and as such campaigns of this type are not judged by their effects on accidents, but rather through their reach and people's self-reported changes in attitude/behaviour.

Particularly significant are the findings that:

(i) the app brought safety to mind whilst the person was actually driving, presumably by creating a link between the experience of driving and receiving a phone call in the game, to the next time this happened whilst driving an actual vehicle;

(ii), the campaign had a 'viral' nature, tapping into this element of social media to spread the message to a user's social group, and potentially increase the social or cultural impact; and

(iii), the app approach reflected well on the roads authority, suggesting that they are in touch with younger drivers, by whom these types of authority can be viewed as remote.

This second piece of research indicates there are a number of innovative ways of engaging younger people, which is a result of thinking more actively about social marketing strategies. Musselwhite et al (2010a) had suggested the 'nudge' approach that was popular at the time of the review, but not taken forward in the context of road safety in so far as the research for this report could identify.

4.4. Conclusions

While some research indicates that culture shapes attitudes and behaviours towards speed and speeding, this area warrants further investigation. In particular, the relationship between work cultures and work pressures and the values of time present an opportunity for understanding the time constraints and employer expectations in the context of health and safety policies and practices at work. This element could be compared more actively against the management of truck (lorry) and other professional drivers who are more rigorously monitored (e.g. with tachometers, etc).

The cultural element in relation to identity and social norms is important in understanding behaviour and speeding. A more extensive literature review is recommended in this area before perusing further research. However, this aspect may be important for developing campaigns and social marketing messages. As the research above suggests there are new opportunities for tapping in to cultural activities (social media, gaming, etc) that draws on such ideas as identity and social norms.

5. Personal and In-Vehicle Technology

Digital technology has significantly changed since 2008, which was the cut off point for the literature reviewed by Musselwhite et al. (2010a). Many people now own a smartphone, with OFCOM (2015) indicating significant market penetration for those under the age of 35 in 2015 (16-24 years 90% 25-34 years 87%, 35-55 years 80%, 54-65 years 50%, and over 65 years 18%). From a safety perspective, it is important to note that people can now use the internet as well as make phone calls and text while travelling. Some cars have the internet integrated into the dashboard. The IAM survey (2015) indicates that drivers are very concerned with other people driving while using mobile phones to text or check social media, yet 50% view that talking on the phone is acceptable. People who drive as part of their jobs are less supportive of measures to stop texting, use of mobile phones or other technologies.

Vehicle technology is also changing. Some aspects of automation in driving have already arrived, and fully automated (driverless) vehicles are under development. For example, many heavy goods vehicles are fitted with cruise control, and have speed limiters. The earlier evidence suggests that many people do not like the idea of speed limiters – they want to be in control so they can make context-dependent decisions about their driving behaviour, and they feel that automation might de-skill drivers. The design of automated vehicles presents some critical ethical decisions about road safety, as well as public acceptability of technology.

This section presents research evidence around personal technology use and the move towards automated vehicles. The summary section identifies the knowledge gaps in this area.

5.1. Mobile phone to Smartphone

Despite the growth in smartphone use, there is less evidence to date about the impact of smartphones on driver behaviour or driver attitudes towards using a smartphone for internet-based activities on the move compared to phoning and texting on a mobile phone. It is likely that the rapid change in technology has meant that relevant research is particularly lacking on this theme.

Section 2 highlighted that the literature review for the DfT said very little about mobile phones, despite UK legislation banning hand-held mobile phone use while driving. Collet et al. (2010) undertook a comprehensive review of epidemiological, psychological, behavioural, and physiological research to evaluate the impact of a mobile (cell) phone while driving. Overall, the evidence points to the negative impacts of using of a mobile phone on driving performance. The impact is on cognitive attention and the phone call creating a distraction from driving. Collet et al. (2010) provide some evidence to show that experienced drivers are more likely to drive in a more automated mode so their brain is able to take on the additional

processing of holding a conversation while driving. However, the research by Collet el al. (2010) may not be as relevant as when it was published as technology has changed, not only due to the profusion of smartphones but also other in-vehicle technology which might create different, more 'invasive' forms of driver distraction.

Many of the studies reported below use a driving simulator to examine the impact of mobile phones on driver behaviour and performance, focusing on distraction from the phone ringing, making and taking calls, texting and using social media while driving. Earlier the report noted that driver distraction can cause driver errors (Young and Salmon, 2012). These studies mostly use the 'theory of planned behaviour' to frame interpretation.

First, the impact of a phone ringing appears to have a negative impact on driving performance in a simulator context. Holland et al. (2013) set up a driving simulator experiment with a small sample (n = 27) of young drivers (18-29 years) who were regular mobile phone users.

The mobile phone ringing in the car caused a statistically significant increase in distraction, which in turn caused greater numbers of accidents, speed exceedances, and centre line crossings than when there was no mobile phone ringing. The simulator test also found that drivers who were distracted by the ringing of their mobile phones were more likely to hit pedestrians than when they were not distracted. No drivers collided with a pedestrian in the simulator under conditions of no distraction, however 41% collided with the pedestrian when they were distracted. Those who wanted to answer the phone, even if they did not answer it, were more likely to make a driver error than those people who did not intend to answer the phone. These results show that for some people the distraction influence of a mobile phone goes beyond simply the distraction of the noise, and is related to the psychology of their intention to answer the phone and the challenge that not answering it poses. However, the effects recorded were related to the more cognitively demanding components of driving such as hazard avoidance and speed control, whilst the more automatic control skills (steering) were not significantly affected by a ringing mobile phone.

The study by Holland et al. (2013) raises a number of important questions in relation to the proliferation of advanced mobile technologies, and particularly in relation to our apparently increasing psychological dependence on them. One of the most interesting findings is that *merely the intention* to answer the phone has a detrimental impact on driving attention. In the context of smartphones which have a whole range of different audible notifications for different types of communications (emails, messages, calls, social media notifications, etc.), there are even more distractions now for people who have a high intention to interact with these communications while driving.

Moving from the phone ringing to actually using a phone is the next concern for road user safety. The second paper reviewed here considers the differences between hands-free and hand-held phones. White et al. (2010) specifically investigated the difference between the two on driver attitudes and behaviour in Australia. The study employed a quantitative survey using open-ended questions developed using the Theory of Planned Behaviour to assess people's beliefs around using mobile phones and hands free devices while driving. They recruited study participants at large service stations and obtained 796 valid responses. More than 70% of participants reported mobile phone use while driving in this study. (This figure is consistent with some other self-report studies, but other studies suggest that proportions of people using their phones regularly are lower.) Participants reported most frequently the use of their mobile phone to answer calls, followed by making calls, reading text messages and sending text messages, while driving. The majority of participants did not own a hands-free kit and, of those who did, approximately half did not use it most of the time. Therefore, most of the participants in the sample used a hand-held mobile phone whilst driving.

Drivers who used a hands-free kit had a higher frequency of answering and making calls compared to drivers who did not own a hands-free kit (White et al. 2010). This finding suggests either the people who are using their phones the most feel the greatest need to buy a hands-free kit, or that having a hands-free kit induces people to use their phones more while driving. White et al (2010) note that other studies propose that using a hands-free is not any safer than using a hand-held mobile phone. Hence high levels of use with a hands-free may impact on road safety, and might be problematic as drivers are likely to believe that the risk of doing so is relatively low.

Social approval was found to strongly influence hands-free use – with closer social connections (i.e. family and friends as opposed to police/other drivers) having the strongest influence. White et al. (2010) note that media campaigns focussed on the (dis)approval of significant others might be effective in combatting phone use whilst driving. Time efficiency was a big factor reported in hand-held mobile phone use. People who believed the mobile phone would use their time effectively for receiving information were more likely to use it. Frequent hand-held phone users were more aware of the risks than infrequent users (distraction, police fines, etc.), but yet continued to use their phone frequently despite this. Frequent hand-held users were more likely to report approval from significant and similar others than infrequent users. Thus campaigns aimed at this group may need messages that change this perception of approval by significant others to be effective for this group (with White et al giving the example message - "Your friends don't want you to be dying to talk to them"). The research questions whether hand-held mobile phone use is, similarly to speeding, not seen as a "real crime" and suggests further research into this issue.

The impact of text messaging on safety is the third areas of concern for road safety. Reed et al. (2008) specifically consider this activity in a driving simulation study.

Here they set up a motorway driving experience and participants took an undistracted drive and one where they had to read an incoming message and compose and send a response. Participants completed before and after questionnaires; and the time it took to text during the experiment was measured.

Participants' driving was impaired by a concurrent text message task, with writing text messages creating significantly more distraction and impairment than reading text messages. Reaction times (RT) tended to be significantly slower when reading or writing a text message, and indeed, participants often missed hazard stimuli entirely in the simulator. The authors discuss the safety aspects of this: the failure to detect hazards, increased response times to hazards, and exposure time to that risk have clear implications for safety. At motorway speeds (as were present in the visual RT task), a driver would travel more than one mile whilst completing the text message and the increase in mean reaction time would result in an increased stopping distance of 12.5m (approximately three car-lengths). This could easily make the difference between causing and avoiding an accident or between a fatal and non-fatal collision.

Reed et al. (2008) found that drivers engage in countermeasures whilst texting – for example reducing their speed. This is suggested to be because the drivers know that there is a greater risk involved and so try to mitigate this through changes in driving behaviour. Despite these measures, participants were unable to maintain a consistent distance from a lead vehicle and were more likely to make lane deviations.

The study notes gender differences in texting and driving, with female participants performing worse than male drivers whilst texting. However, men were nevertheless significantly impaired, and the higher likelihood of male drivers texting compared to female drivers (identified in other studies) is suggested to equalise this gender imbalance making the total extent of impairment across the sexes relatively even.

Reed et al. (2008) note that participants' responses to the questionnaires indicated that they were confused about the legality of texting and driving. The authors conclude by noting that the combination of increased mental workload required to write a text message, the control impairment caused by the physical act of holding the phone, and the visual impairment caused by continually shifting visual orientation between the phone display and the road ahead resulted in significantly impaired ability to maintain safe road position. Participants' reduction in speed indicated their awareness of the impairment caused by texting whilst driving. However, this attempt to mitigate risk cannot fully compensate for their deterioration in performance when attempting to text and drive.

Given that a ringing phone is a distraction as noted by Holland and Rathod (2013) it is surprising that receiving a text message but not answering it did not create distraction. Conceivably, it might be the case that, in this study participants were not

distracted by the text message as they knew it would not contain a communication for them, and was merely a part of the test. It would be interesting to know more about the impacts of ignoring real communications in an actual driving situation – particularly in the context of smartphones, which have the ability to deliver notifications for a wide range of different communication services. Also Reed et al. (2008) found that participants did not know if texting while driving was legal or not.

He et al. (2013) again used a driving simulator experimental approach to explore speech-based texting. The research indicated that both handheld and speech-based texting significantly affect driving performance in relation to the control tests. Handheld texting increased brake response time, increased variation in headway distance and lane position.

Drivers who texted using a handheld smartphone had greater following distances and drove further towards the left lane boundary. He et al. (2013) suggest these behaviours may represent a compensatory strategy to help mitigate the perceived risk of the texting task.

Driving whilst performing the speech-based texting task resulted in a less adverse impact on performance, however speech-based texting nevertheless impacted negatively on driving performance in relation to driving without performing the task, causing more variation in both speed and lane deviation. The study supports previous research, which found that drivers who engage in texting had a longer brake response time, impaired lane keeping, and longer headway distance.

Despite speech-based texting causing some adverse impact on performance, it was nonetheless preferable to handheld texting, and this supports the findings from other studies that manual and visual distractions hinder performance (i.e. holding the phone to text and looking down at the phone to read what one is texting). The speech-based texting was suggested to remove these forms of distraction (because a driver can text hands-free just by talking, and can continue to look at the road during the task), and that the detrimental impact was therefore primarily to do with the cognitive demands of the task.

The study also recorded the ways in which drivers adopt strategies to offset the negative impacts of texting, including: increasing headway distance, reducing speed, and anticipating the behaviours of lead vehicles and pedestrians.

He et al. (2013) suggest that a practical application of the findings is for car makers in designing in-vehicle systems – where they suggest a speech-recognition based texting option would be better than a hand-held option. However, they also note that speech-based texting is nonetheless still distracting, and the ideal scenario for driver behaviour is to simply not text and drive.

A significant and important limitation in this study is that the speech-based texting task was not performed using actual speech-based texting technology. Therefore, it is limited in representing in a real-world scenario with current technology.

He et al. (2013) give an insight to the debate around ergonomics and the usability of in-vehicle systems – be these a driver's personal mobile devices or an in-vehicle system designed by the manufacturer. They suggests that a purpose-designed in-vehicle system design could help to reduce distraction from using technology in comparison to simply using a handheld device, however at the same time caution that currently performing any secondary task such as texting causes distraction to a greater or lesser degree.

As indicated in the introduction the rise of the smartphone has enabled people to conduct a range of tasks on the move that go beyond phoning and texting, of which using social media is a popular activity. The fourth paper review considers reading and responding to social media messaging is an extension of the issues raised by texting above. There is research that used a driving simulator to understand how using a smartphone affects driving performance. Basacik et al. (2012) tested 28 young people (men and women) once without a distraction and once with the distraction of using a smartphone to interact with a social networking site. They had to read and write a message and update their status.

In comparisons with previous studies, using a smartphone for social networking resulted in greater impairment to reaction times than alcohol, cannabis, hands-free mobile phone conversations and texting, but less than hand-held mobile phone conversations, which is suggested to be the most distracting act in terms of reaction times.

The main findings in comparison to driving without a smartphone were:

- participants were more likely to miss the reaction time stimuli while using their smartphone for interacting on social media
- when they did respond, reaction times to visual and auditory stimuli were found to increase by approximately 30% when using a smartphone for social media messaging
- they were unable to maintain central lane position resulting in unintentional lane departures
- they were unable to respond as quickly to a lead vehicle gradually changing speed, leading to a more variable headway
- they spent between 40% and 60% of their time looking down while using a smartphone compared to 10% during the control drive
- The study notes that with all results taken together, participants' driving was impaired when they were using a smartphone to send and receive messages on a

social networking site. This reduction in driving performance is likely to have been the result of three different types of distraction:

- cognitive distraction – having to concentrate on the smartphone task
- manual distraction – having to hold the smartphone device
- visual distraction – significant increase in the amount of time spent looking at the phone in order to interact with it.

One area which has not been considered is the links to the levels of distraction experienced by people's intention to answer and levels of perceived behavioural control in relation to answering – as discussed in Holland and Rathod (2013).

It is clear that smartphones are equally as distracting as normal mobile phones, and indeed, the task that the participants were conducting was more distracting than hands-free conversations and texting on conventional mobile phones.

The really important point here, however, is related to the continued development and expansion of mobile ICTs. Smartphones offer a much broader array of communication services than conventional phones, and so it is likely that smartphone users have a higher number of notifications and communications to distract them whilst driving when compared to conventional phone users, who can only receive phone calls and send text messages. This looks set only to increase as the use of these services continues to rise, and while much is known about the quality of the distraction from these devices, less is known about the quantity of driver distractions that might be occurring with smartphones. For example, how many communication notifications does the average smartphone user receive (and thus have to ignore or respond to) in a single journey as compared to a standard mobile phone user – for example, emails, texts, phone calls, social media messages/posts? What are the implications of this? The use of smartphones on driver behaviour therefore needs further research.

5.2. Technology and automation in vehicles

Technology is being introduced into the car in a variety of ways. Some are delivering information such as GPS navigation systems, others are connecting the driver to the internet. There is also a future vision of increased automation in vehicles, with some vehicles already having automated features. One of the challenges facing the road industry is public attitudes towards greater automation in the future with a view to moving towards driverless vehicles. There are also questions around how much a driver will have to concentrate on driving in the future, and that issue of distractions from ringing phones will become meaningless to safety.

In September 2015 the RAC Foundation commissioned an Ipsos MORI survey of 2,175 members of the general public in Great Britain aged 17-75 to understand the usage of and attitudes towards so-called 'connected technologies' in vehicles (Rigby

et al. 2015). The study explores people's attitudes towards in-vehicle technologies which can facilitate greater connection and the delivery of relevant information for a range of purposes: practical, experiential and social.

The main types of connecting technology explored by Rigby et al (2015) were in-vehicle systems to monitor performance, satellite navigation, smart journey information (traffic jam avoidance, etc.), speed camera warnings, Bluetooth connectivity, in-car hands-free technology, and in-car entertainment (music, video, gaming).

The study found that there is a high interest in connected driving features for those considering buying a new car – particularly systems which provide drivers with more information about their vehicle and their journey. In terms of the technologies people already have, reasonably high proportions make use of in-vehicle information and entertainment systems.

In terms of current usage, almost two thirds (64%) of current drivers who have at least one vehicle in their household have at least one connected driving feature in their vehicle. The most prevalent features are satellite navigation systems – either built into the vehicle or brought in from the outside using external devices – (owned by 38% of current drivers), 'smart' journey information and Bluetooth connectivity (both at 33%), the ability to take calls (28%), and information about the condition of the vehicle (25%). Along with in-car music streaming services (owned by 8% of current drivers), the last four of these features (i.e. excluding satellite navigation) are also the features likely to be used the most frequently (i.e. at least once a week). Far fewer have the following features in their main vehicle: online gaming, telematics insurance, the ability to locate car park spaces using software, specialist apps for news and sports, and the ability to send emails (all mentioned by 5% or fewer of these drivers).

The study explored who was more likely to be interested in in-vehicle technology, and identified that those groups with the highest interest were: men, people in work, those from higher socioeconomic classes and/or higher earners (generally defined as those earning over £35,000 a year), and also those with children in the household. Rigby et al. (2015) note that these groups are similar to the demographic who say they are interested in technology more generally.

In terms of the impacts of these in-vehicle technologies, people were quite split as to whether information provided while driving could be distracting or not (for example information about fuel usage etc.). A sizeable proportion of respondents simply "didn't know". This result is more clear cut for connecting technologies such as mobile phones and other communication devices, with 69% of people agreeing that this has the potential to distract. There is a strong interest in "anti-distraction" features such as "driving safe mode", which could be activated by the driver and stop their personal technologies for distracting them whilst driving.

Rigby et al (2015) also note that whilst connected technology use is reasonably high considering how new some of these devices and services are, these features are less important when choosing a new car. In-vehicle technology ranks eleventh out of 13 in the list of factors when considering buying a car (Rigby et al., 2015). Of those vehicle drivers who already use connected driving features, almost exactly half felt that they improved the driving experience.

Rigby et al (2015) report presents a useful vison of the future of in-car technology, and the driving experience. They suggests that uptake of some of the newer in-car technologies is relatively low, but as these are all relatively new technologies the picture could be different within the next five years. However, those who might be more interested in such technologies may create a future "technological divide" along demographic lines, which may impact on driver attitudes, behaviours and experiences.

Looking at such technological enhancements in the context of automated vehicles (AV), it is interesting to consider how the demand for in-car technology might change as the driver becomes able use travel time for non-driving tasks. People's perceptions regarding what is acceptable and unacceptable in safety terms might also change as these new technologies make their way onto the roads. For example, currently half of the respondents that have some form of connected technology said it improved their experience. Would this change if people felt they had had more time to safely engage with entertainment and communications technology whilst driving?

The only other in-vehicle technologies found by this report is that of speed limiters, which is an aspect of automation that focuses on safety. Musselwhite et al. (2010a) suggested that people did not like to have their driving controlled by speed limiters. Trials of 'Intelligent Speed Adaption' (ISA) have been undertaken in a number of countries. Intelligent Speed Adaptation (ISA) denotes intelligent transport systems that limit the speed of a vehicle. These can range from providing speed limit information to controlling the speed of the vehicle.

Chorlton and Conner (2014) looked at the longer-term behaviour change of this technology with private and professional drivers. The study was UK based, and half of it was carried out on trunk roads, feeder roads and motorways, increasing its relevance to the UK SRN. The trial involved driving for 28 days without the technology, 112 days with it, and a further 28 days without. The data suggested that introduction of ISA lessened drivers' intention to speed and reduced their actual speeding. It also decreased drivers' beliefs that speeding would enable them to get to their destination more quickly and that speeding was a function of 'being in a hurry' (2014:49). However, these changes in intentions and beliefs did not lead to changed behaviour.

Following ISA exposure, participants were more likely to believe that speeding would make them feel good. They were also less likely 'to believe that the police would

disapprove of their speeding and were significantly less motivated to comply with the wishes of other road users.' (Chorlton and Conner, 2014: 52).

There were differences between genders. Males travelled greater distances over the speed limits and had a more favourable view of speeding. In general these differences seem to predispose males to speed more than females; one exception was that males expressed a stronger motivation to comply with family or spouse. Differences between drivers of different age groups were less pronounced. Whilst there were general differences between genders in relation to speeding, this did not change the effect of ISA upon the driver.

A survey in Sweden also looked at the impact of ISA on longer term speed reductions using a similar style trial (Warner and Aberg, 2008). Like the study by Chorlton and Conner, participants initially reduced their speeds with the ISA, but the effect lessened over time, with the percentage of speeding incidents slowly rising over a two year period. However, given that the ISA only indicates when the speed limit is being exceeded, it has little effect on the mean speed.

The evidence here shows some indication that such in-vehicle technology can be useful in changing behaviour, but given there is the potential for it to be ignored over time then further technological solutions need to be sought to deal with this issue.

Linking into the ISA discussions Transport Focus were interested in how lorries (trucks) utilize in-vehicle technologies such as cruise control to manage their driving speeds in particular environments such as through roadworks. While the search did not find any research specifically in this area, the following research from America gives some insights into the response of professional drivers to technologies that monitor their speed and other driving behaviour.

According to Huang et al. (2005), in America trucks are more likely to be involved in crashes than other vehicles; mostly as a consequence of driver error, heart failure or falling asleep. They argue that black box technology supports improving driver behaviour, and can aid reconstructing the causes of a fatality (e.g. if the driver has fallen asleep). Technology offers a feedback system in a unique work relationship, as truck drivers work alone. Information gathered from monitoring behaviour can improve the technology.

The survey reported by Huang et al (2005: 291) indicated the three most important safe driving behaviours of importance to truck drivers:

- ''Looking well ahead of my vehicle to adjust to what is happening in front of me'', selected by 74% of the drivers
- ''Expecting other drivers to make driving mistakes and being ready to avoid them—expect the unexpected'' was selected by 55% of the drivers

- ‘‘Using turn signals to give other drivers plenty of warning when changing lanes or making turns’’ was selected by 49% of the drivers.

The survey conducted by Huang et al.(2005) indicated that drivers are positive about receiving feedback about their driving behaviour. They want feedback to help defend themselves if involved in a crash, and to reduce stress. However, around two thirds of drivers were concerned about privacy and the security of the data. The survey also investigated how feedback should be delivered – most respondents preferred a visual display on the dashboard, followed by a print out at the end of the day, with a computerised voice being the least popular. About half the respondents wanted feedback at their request, but 43% also agreed with receiving feedback at regular intervals. Drilling down into feedback by technology, the survey indicated just over half wanted feedback immediately. However, mostly drivers wanted feedback from a member of their organisation or a customer.

It is interesting to consider how feedback is received while driving, given the issue of driver distraction raised in relation to other technologies such as ringing phones or social media.

5.3. Conclusions

Technology is both a challenge and an opportunity for road safety. Currently, there is an implication for road safety where people are being distracted by mobile technologies. However, these technologies are socially desirable and their use while driving increasingly acceptable, especially with younger people or those who drive as part of their work. This attitude potentially poses an issue for customer satisfaction, especially where boredom may invoke a negative response, and using technology may alleviate that state (see Section 4). While a lot of work has considered safety, more work perhaps needs to focus on understanding why, where and for what purpose people use their mobile technologies when driving (e.g. maintaining contact with work, or idling time in a traffic jam).

Where mobile technology is part of work related driving, similar issues arise as for speeding and cultures of time and time keeping. There is a need to understand the wider realm of working on the move and vehicles, technology and time. Likewise monitoring and other automated technologies related to professional driving need further investigation.

Future automated vehicles (AVs) present a new way of looking at in-vehicle technologies. Where the driving task is removed, what opportunities will there be for other activities, and how will people respond to this change? Such questions remain open for the foreseeable future.

6. Conclusions

Transport Focus is concerned with customer satisfaction on the SRN as well as safety and fatality reduction. Generally, research into driver behaviour and attitudes has focused on safety issues, with the underlying intention of reduced road causalities, rather than increase satisfaction. The two come together because road users want safe roads, and if they feel unsafe then levels of road user satisfaction may be affected.

The challenge lies with the roads being used by many different types of driver as well as vehicle. The report has not been able to go into great depth about how different vehicles (e.g. lorries and cars) and driving expectations (e.g. slower and faster drivers) can be managed by the design or organisation of the highway to improve perceptions of safety. However, it does show that different people want to use the roads in different ways. For example, those who want to travel at higher speeds may impact on other road users through normalising the higher speed, but creating a sense of higher risk for others. Such different needs make road management a complex task.

However, specifically looking at driving speeds has created some questions about its future trend, as there are some indications that drivers are choosing to travel at slightly lower speeds on the SRN than before. Yet younger drivers (especially young men) are still problematic in being attracted to travelling at high speeds, although the specifics of this group's behaviour on the SRN itself has not been isolated, and more likely to be the cause of fatal accidents. Attention has focused on driver training to shape novice driver behaviour, which may include specifics around using the motorway network. The report was unable to find appropriate research around the issue of retraining speeding offenders and subsequent outcomes.

The idea of a culture of speed shaping behaviour was considered in the report. It identified speed as part of the youth driving culture and identity, but little evidence was revealed about wider cultural issues of time values and the need to minimize travel time between locations especially in the course of work related travel. French research suggests that particular types of people are attracted to being part of a time pressured image that generates the need to travel at speed. Further evidence is required to understand how employees manage their driving schedules in relation to work targets in the UK.

Overall, evidence points towards speeding being culturally acceptable in some instances (e.g. on the motorway), and that people like to feel they have a choice over their speed based on the context (e.g. weather). In this respect speed cameras at odds with such contextual decision making, which is one of the reasons they are less popular compared to the human judgement of traffic police. Average speed monitoring between fixed cameras has greater potential for managing traffic flows at

a constant level between fixed points. How speed is controlled therefore may have another contributory factor on the driving experience and satisfaction.

In looking at driving behaviour, the report considered the issue of emotion and boredom on the driving experience. It revealed that research has mainly focused on anger and aggression and its impact on the driving experience of other road users and distraction. Boredom is another area where drivers have the potential to drift in their attention from the task, and to counteract boredom they may engage with risky driving behaviours (e.g. go faster, or use a mobile phone). While aggression and boredom may lead to more negative customer satisfaction, there do not seem to be any studies around what triggers more positive emotional response when driving. One study demonstrates that music may impact on driver behaviour but further evidence needs to support this finding, especially in terms of creating a more positive experience.

Driving under the influence of drugs may increase driver aggression, and there is wide spread concern by road users about it. However, there appears to be little evidence from the UK as to how it is being managed and the issue of peer attitudes from the initial scoping research. Clearly, while drink and drug driving are seen as socially unacceptable, there is some tolerance of drink driving within peer groups, and drug driving like speeding is associate with younger drivers. Thus, looking at social influence may be useful here for behavioural change.

Musselwhite et al. (2010a) suggested further research into understanding how driver behaviour and attitudes change across the life course. The research indicates that there is a significant amount of knowledge about the problems of young (male) drivers and increasingly the challenges of driving when elderly. There is less discussion about the middle group of people and how changes to attitudes evolve. Likewise, this is likely to be relevant to changes in levels of customer satisfaction across the life course.

Technology is having a major impact on the driving experience and safety, and technology is evolving and diffusing faster than research on it. Hence, it is only very recently that research into the broader set of smartphone and in-vehicle technologies has started to be published. Technologies are desirable to travellers, and having a technologically-equipped car may increase satisfaction, and many people want to use their phone while driving. However, the social concern of safety and driver distraction implies there is concern when others are using it. Thus, increasing automation of vehicles add a further layer of what is expected from a driver and the potential for seeking other forms of activity if the need to concentrate on the road is reduced. Future changes with increased automation may change the balance with what is deemed currently distracting drivers to occupying them while being effectively driven.

To conclude the report's remit, the report was unable to find evidence for a number of points raised at the initial discussions with Transport Focus. These remain areas for future research and include:

- cultural differences in road users attitudes between UK and non-UK drivers
- evidence around HGV accidents and cruise control technologies
- how and where do road users want more enforcement of traffic laws
- specific attitudes relating to driver behaviour on different parts of the SRN (although this may arise through the ARUSS)
- how desires for different levels of speeds can be managed on the network (e.g. people who want to travel slower than others)
- greater understanding of social marketing and social influence in road campaigns, especially in the context of social media, in the UK
- disabled drivers.

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Apendix A: Research process

The research process:

- discussion of aims and objectives with Transport Focus
- review of Musselwhite et al (2010a, 2010b)
- searches using a number of data bases using terms such as ‘mobile phone AND attitudes OR behaviour AND safety’
- long list of potential items from searches
- selection of items for review

For the item review the researcher had to complete the pro forma:

Item Review: Transport Focus Driver Attitudes and Behaviour Lit review
Name of reviewer:
Topic number(s):
Full Harvard reference:
Abstract
Summary of methodology (Approach, Sample size, Location etc, Noted limitations)
Summary of key findings
Reviewer’s interpretation about what it adds to the topic (customer satisfaction/safety).