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FINAL PROJECT REPORT PPR886

Development and Pilot of a Business Travel Focused Intervention Addressing Close Following Driving Behaviour

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Report details

Report prepared for:	Road Safety Trust
Project/customer reference:	24398 / RST 16/1/2016
Copyright:	© TRL Limited
Report date:	01/11/18
Report status/version:	V2
Quality approval:	

	Scott Davidson		Shaun Helman
(Project Manager)		(Technical Reviewer)	

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Contents amendment record

This report has been amended and issued as follows:

Version	Date	Description	Editor	Technical Reviewer
V1	31/10/17	Final report	SD	SH
V2	01/11/18	Final published version with abstract added	SH	SH

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1   Executive summary

TRL, through funding from the Road Safety Trust, has undertaken research to test the effectiveness of a driver behaviour intervention aimed at reducing close following behaviour (CFB). This research consisted of a literature review into the key factors underpinning close following behaviour, hotspot areas for accidents, and effective components of interventions shown to change other driver behaviours. This literature review was used to identify a target area, key factors in close following behaviour to target, and ultimately to design a behavioural intervention based on best practice. This intervention was then tested with an experimental group of five businesses and 85 participants, and a comparison group of 79 participants across 48 businesses. The comparison group completed the pre and post survey but did not receive the intervention.

CFB has been selected as a target behaviour as it has been shown to be irritating (Diels, Reed & Weaver, 2009), frustrating, and cause anxiety and anger in drivers (Highways England, 2015). It has also been shown to be linked to collision risk (Evans & Wasielewski ,1983). Collision recording methods in the UK do not allow an accurate picture of its contribution to collisions in the UK, however it is believed to be one of the principle factors leading to rear-end collisions. Looking at data in other countries, 1.7 million collisions were of the rear-end type in the USA, making up 32% of all collisions, including, fatal, injury and 'property damage only' (NHTSA, 2011). Research carried out in China has estimated than 16.6% of all road traffic accidents are caused by tailgating, constituting 24.5% of all economic loss due to traffic collisions (Duan, Li & Salvendy, 2013). Despite this, up to 94.8% of drivers have been found to leave insufficient headway between their vehicle and the vehicle in front (Wang & Song, 2011).

People driving for work have been selected as the target audience as they have been found to have a higher accident risk than the general population, and be more blameworthy for those accidents (DfT, 2015; O'Dolan & Stradling, 2006).

A recent review of the literature suggested that CFB is the result of a number of factors (TRL, 2011). Key factors identified within the literature review included:

- Inexperience contributing to inattention, speed and distance judgment errors, anticipation and adaptation errors

- Personal factors such as sensation seeking, locus of control, trait and state anger and aggression levels, mental workload, confidence in driving ability, attitudes towards risky behaviour, self-identity, values and habits

- External factors such as social norms, time pressures, traffic flow pressures, platoons, road works and type of vehicle.

A full discussion and referencing of each factor is too detailed for the executive summary. For a full discussion and referencing, please refer to the literature review included in Section 2.

The literature review also identified successful features of previous behaviour change projects from both driver behaviour interventions and other behavioural interventions. This led to the design of an intervention using the following key components:

- 90 minute peer group discussion of target behaviour and underlying factors including:

    o Locus of Control group exercise

    o Speed and Distance perception group exercise

    o Adaptation techniques discussion

- - - Emotional triggers and coping techniques discussion

  - Cognitive workload and time pressure discussion

  - External factors including weather, traffic flow, platoons discussion

  - Social norms discussion.

- Social contracts

- Implementation Interventions

- Point of Choice Reminders

- Measurement and Feedback

- A minimum 8 week intervention period, with reminders to embed new habits.

For further detail on the intervention, please see the methodology section in section 3.2, page 5.

As part of the literature review TRL also reviewed accident hotspot areas, including the Bristol and Avon area as an area covering three accident hotspots. Within this area, TRL recruited five businesses and ran eight workshops, covering 85 people. These people were either volunteers, or selected by the employer as people who drove a lot for work, in a few instances individuals were selected due to recent accidents or near misses. Companies were recruited first through TRL's local network of business engagement contacts and contacts within local authorities, key individuals in each company then recruited individuals within their own companies on behalf of TRL. TRL also recruited 79 comparison group participants across a further 54 companies spread across the UK. These individuals all participated on a voluntary basis, and were recruited through TRL's network, and primarily through the EcoStars scheme. The different selection methods for the control and experimental groups were due to recruitment difficulties in reaching sample size numbers meaning the ideal approach of randomly assigning individuals selected within each company to control and experimental was not feasible.

TRL ran the intervention for over eight weeks with each group, and evaluated the impact of the intervention through both qualitative 1 hour follow up teleconferences, and quantitative surveys. The surveys consisted of a pre survey filled out before the intervention, a post survey filled out after the final teleconference and three diary surveys designed to take snapshots of behaviour through the intervention.

Survey completion rates are as follows:

- Initial Survey: 157 completed (78 experimental, 79 comparison group)

- 1st Diary Survey: 28 completed (all experimental)

- 2nd Diary Survey: 20 completed (all experimental)

- 3rd Diary Survey: 18 completed (all experimental)

- Final Survey 92 completed. (27 match to experimental pre survey responses, 30 to comparison pre survey responses).

Qualitative analysis consisted of six follow up group teleconferences of 45 minutes each covering 43 participant. Key findings included:

- Raised awareness of CFB in all participants across the entire eight week period.

- Positive attitudinal change regarding the importance of CFB, and in terms of its prevalence.

- Self-reported behavioural shift in a significant number of participants, specific to the individual, and often linked to specific context e.g. participants recall of the close following workshop is triggered by specific situations such as a person pulling out in front of them, experiencing anger, or noticing distraction through chatting with passenger. Each recall results in the participant increasing the distance to the vehicle in front – a behaviour they do not believe happened prior to the workshop.

- Clear lessons for improving the intervention.

The quantitative analysis did not show any significant results in terms of positive behaviour change. Given that the scales were taken from proven psychometric surveys and the qualitative analysis indicated what appeared to be clear results, it is possible that the quantitative and qualitative analysis were measuring slightly different effects. The quantitative measure was designed to measure "normal following distance", whereas the qualitative analysis was picking up primarily on "trigger-specific CFB" changes e.g. that the participants reported changing their CFB when it was triggered by something discussed in the workshop such as experiencing anger, another driver cutting in front or being distracted by phone or passengers..

The only significant result from the quantitative analysis was a significant shift in both control and experimental group's perception of the prevalence of close following behaviour in other drivers. In both groups this increased significantly over time, suggesting that simply completing surveys eight weeks apart on close following behaviour may have caused drivers to notice this behaviour in others more through the participation period.

Conclusions and recommendations are discussed in more detail in the conclusion section but may be summarised as:

- CFB is an important area for further research, as a highly prevalent and likely significant contributor to decreased road safety in the UK. More specifically, research distinguishing the intervention's impact on normal following distance versus what might be termed as 'trigger-specific close following behaviour', using larger samples and robust surveys, may advance our understanding of the multiple ways in which this behaviour can manifest, and ways in which it might be targeted by interventions.

- Behavioural components are a significant element of CFB, hence developing effective behavioural interventions targeting CFB is a sensible area for road safety investment.

- Qualitative analysis indicates this intervention was effective in addressing contributory factors and self-perceived behaviour, on a self-reported basis). Further research is required to investigate this in more depth.

- Employee engagement is challenging, and should not be underestimated in terms of resource required to recruit employers and employees.

- Interest in rolling this intervention out further has been expressed by two of the participating companies. Significant positive feedback on the intervention was given by participants, indicating this is welcome once initial engagement challenges are overcome.

2 Literature review

Close following has often been identified as one of the most irritating behaviours engaged in by other drivers (Diels, Reed & Weaver, 2009), as well as a behaviour leading to frustration anxiety and anger by those who are subject to it (Highways England, 2015). It has also been shown to be linked with collision risk (Evans & Wasielewski, 1983).

Close following, often referred to as tailgating, can be defined as driving too closely to the vehicle ahead, leaving insufficient distance for a driver to respond safely in the event of the vehicle having to break suddenly (TRL, 2011). However, this definition leaves much room for error as research has continuously found that a number of factors can have an impact on the reaction and breaking time of various drivers (e.g. weather, fatigue, motor and cognitive skills). Therefore, selected headway (the distance chosen by a driver at which they feel safe) can vary substantially between individuals, as differences in perception of a safe distance will have an impact on what is perceived as 'following too closely'. For this reason, road safety experts have defined close following as a driver maintaining a headway of less than two-seconds (Song & Wang, 2010). Despite this more precise definition of close following, research has consistently found that there are significant discrepancies between perceived and adopted safe distance impacting significantly on the frequency of close following behaviour (TRL, 2011).

While close following has been identified as a common behaviour, with research showing that on some road types as many as 94.8% of drivers do not leave the recommended headway (Wang & Song, 2011) the full extent to which drivers engage in such behaviour is hard to establish accurately (Hutchinson, 2008). This difficulty in measuring close following behaviour is made greater due to the large heterogeneity in close following distances adopted across the driving population. Such differences can be explained due to the multiple factors that influence both intentions to engage in, and actual close following behaviour (TRL, 2011). However, despite these variations across the general population research has shown that individual drivers seem to adopt consistent headway across a range of driving situations, suggesting that personal driver traits and attributes play an important role in close following behaviour (TRL, 2011; Huang & Ford, 2012; Castanier, Deroche & Woodman, 2013, McKenna, 2006; Muhrer & Vollrath, 2010; Adrian, Postal, Moessinger, & Charles, 2010; Foss, Martell, Goodwin, & O'Brien, 2011; Lewis-Evans, De Waard, & Brookhuis, 2010; O'Brien, Shaw, Watson & Lennon, 2012; Lu , Cheng, Lin & Wang, 2012).

A recent unpublished review of the literature (TRL, 2011) characterised close following as the 'end product of a number of processes interacting with the road environment' and put forward the error-violation dichotomy of close following. This is founded on the grounds that factors leading to close following behaviour can be either due to unintentional errors or deliberate intentional behaviour. Within each of these overarching categories a number of factors can cause the behaviour, such as inexperience or weather conditions, as well as attitudes and personality factors.

Some of the factors that have an impact on close following behaviour also include time-pressure, stress and fatigue factors that have all been identified as being particularly prominent in those driving for work (O'Dolan & Stradling, 2006). Findings from Great Britain collision data from 2014 show that there were 49,984 casualties involved in road collisions reported to the police and in which someone was known to be driving for work; of these 5,715 were killed and seriously injured (DfT, 2015). People driving for work have been found to have a higher accident risk than the general population, a trend that is maintained even after accounting for the increased road exposure of these drivers (O'Dolan & Stradling, 2006), and these drivers have a much higher blameworthiness in collisions (Clarke, Ward, Bartle & Truman, 2009). This increased accident rate can partly be explained

due to the increased pressures and reduced cognitive capacity that many drivers are faced with when driving for work.

As mentioned previously, close following behaviour is particularly hard to measure and therefore so is its real impact on collisions, casualties and congestion. Close following is often believed to be one of the principle factors leading to rear-end collisions and collision data can therefore provide us with an insight into the impact of such behaviour on collisions and casualties. In the USA 1.7 million collisions were of the rear-end type, making up 32% of all collisions, (NHTSA, 2011). Research carried out in China has estimated than 16.6% of all road traffic accidents are caused by tailgating, constituting 24.5% of all economic loss due to traffic collisions (Duan, Li & Salvendy, 2013). The figures shown here highlight the importance of understanding the factors leading to close following behaviour in order to develop the interventions required to reduce this risky driving behaviour. The relationship between close following and collisions, as well as the range of factors that can contribute to close following, especially within a high risk group such as those that drive for work, highlight the need for a more in-depth understanding of the factors and motivations leading to close following behaviour.

This report aims to identify and summarise the factors contributing to close following in order to attempt to understand why people engage in the behaviour, and consequently whether certain groups of drivers have an increased rate of engaging in close following behaviour, or whether certain driving environments can increase the likelihood of close following. In addition, in order to reduce the negative outcomes associated with this dangerous behaviour, the findings from this research were used to identify behaviour change approaches and techniques that could improve driver behaviour by reducing the occurrence of close following.

2.1   Literature review method

In order to carry out the review of the literature five research questions were established in order to define the scope of the review. These were:

- What is the impact of close following on collisions, traffic flow and congestion?

- Why do people close follow?

- Who are those people doing the most harm and what are the situations, if any that predict harm?

- How does close following behaviour by business drivers differ from the wider driving population (if at all)?

- What behaviour change approaches and techniques should be used to reduce close following?

The method used consisted of four broad stages:

1   Creation of a list of search terms and commissioning the database searches

2   Identification of potential candidate studies for inclusion based on relevance (based on abstract review)

3   Request of texts and quality assessment on full text-review

4   Shortlisting best quality literature and reporting the findings

The following sections describe these stages in more detail.

2.1.1 Identification of potential candidate studies

The review was carried out through the TRL's internal library, and literature was sourced from the Transport Research International Document (TRID) dataset, Science Direct and PubMed. As a recent review undertaken by TRL (2011) was identified, summarising the relevant literature to 2010, the search was extended back to that year. In parallel an internet search of Google Scholar was undertaken. The search terms used for this review are presented below in Table 1 below.

It is worth noting at this stage that technology based approaches to influencing behaviour were not included as this project was primarily centered around a human led intervention. The search returned 33 potentially relevant papers for review. Additional papers and background material were gathered from a Google Scholar search and from papers known to the study team and their contacts as well as through the reference section of full articles sourced from this initial search.

Table 1: Search terms

Any of	With	
'Close follow*'	Personality	Safety
OR	'Time pressure'	'Driv* skills'
Tailgat*	'Social pressure'	Emotion
OR	'Locus of control'	Skill
'Follow* too close'	Attitude*	Motiv*
OR	'Road type*'	Fatal*
'Headway choice'	'Road condition*'	Delay*
	'Safety culture'	Flow
	'Social culture'	Congest*
	Age*	Injur*
	'Driv* experienc*'	Consequenc*
	'Rid* experience*'	Impact
	Gender	Collision*
	Drink*	Profession
	Drug*	'Business driv*'
	Fatigue	'Work related driv*'
	Impairment*	'Occupational driv*'
	'Driving violat*'	'Professional driv*'
	Judg*	'van driv*'
	Perception*	HGV*
	Risk*	LGV*
	Reward*	LCV*
	Norm*	Fleet*
	Weather	Company veh*

2.1.2 Abstract review

Abstracts were evaluated based on their relevance to the research questions and whether they met quality criteria for final inclusion. Additional criteria for relevance were included regarding the interventions designed to target close following behaviour, with interventions based on infrastructure changes or technologies being excluded from the full review. Quality was assessed subjectively, but in the opinion of the author it was possible to draw formal conclusions regarding

the quality of the research based on the data presented (e.g. some effort to control bias and confounding variables). Papers were rated as either a 'yes', 'no' or 'maybe'. All papers rated as either a 'yes' or 'maybe' were included in the next stage of the review. In total 26 papers were identified to be taken forward to the full text review.

2.1.3   Full text review

Full texts were obtained for the papers that remained after the abstract review; only one of these could not be sourced by the library. After the full text reviews were undertaken, and additional relevant papers from the reference sections of these papers were retrieved a total of 39 papers were included in this report.

2.2   Findings

2.2.1   What is the impact of close following on collisions and traffic flow?

To begin with it is important to note that while close following has been identified as a common behaviour it is particularly hard to measure and therefore the extent of the behaviour is unclear. Despite this, some observational studies have attempted to measure the extent to which drivers engage in close following. Studies have suggested that on highways, as many as 90% of drivers maintain a minimum headway of less than one second, half of the recommended safe headway (Taieb & Shinar, 2001). Similarly, a study carried out in Rhode Island in the USA found that over 60% of vehicle tailgated during rush hour, with 95% of the drivers taking part in a self-reported questionnaire stating that they maintained a headway of less than 11 car lengths when driving at 60 mph, which corresponds to a two-second headway (Wang & Song, 2011). Close following is under reported in collision statistics, but nevertheless research has shown that the two main contributory factors leading to rear-end collisions are tailgating and inattention (Song & Wang, 2010), and that close following is related to collision risk (Evans & Wasielewski, 1983). However, as Hutchinson (2008) reports inattention can naturally lead to close following, often considered as error based close following, highlighting the impact that this behaviour has on collisions.

Figures from the National Centre for Statistics and Analysis in the USA reported that between 2006 and 2008 rear-end collisions were the most common collision type with 1.8 million annual cases, or 30.4% of all collisions in the USA, resulting in more than 2,200 fatalities and half a million injuries each year (Song & Wang, 2010), a figure that has remained reasonably consistent as in 2010 32% of all crashes in the USA were rear-end collisions (NHTSA, 2011). Research carried out in China suggests that between 2000 and 2005, 16.6% of all road traffic accidents were caused by tailgating, constituting approximately 24.5% of all economic loss due to traffic accidents (Duan, Li & Salvendy, 2013). Within Great Britain figures show that close following was reported as a contributory factor in 2% of fatal collisions and 7% of all accidents; however these figures should be treated with caution as research has found that close following is under-reported in contributory factors data due to the difficulty in measuring this behaviour (Hutchinson, 2008). These figures highlight the impact that close following behaviour can have on collision rates, reflecting that this risky behaviour can have a significant impact on both the KSI levels and the economic costs linked to road collisions.

Collisions have a significant impact on traffic flow; research suggests that incidents cause between 52% and 58% of total delays experienced in the USA, with non-recurrent delays (such as collisions) causing 1.5 times as much delay as recurrent delays (such as high levels of congestion during peak times) (Kabit, Charles, Ferreira & Kim, 2014).

Based on the relationship between close following and collision rates, the impact of such behaviour will be substantial on congestion and traffic flow. However, it has also been suggested that close following might have a positive impact on traffic flow; by reducing selected headway drivers may be able to increase the number of vehicles passing a reference point within a specific time frame. However, the potential improvement in traffic flow will only be sustained as long as this risky behaviour does not lead to collisions, which as previously mentioned will have a negative impact on traffic flow.

2.2.2   Why do people close follow?

A recent unpublished review of the literature has suggested that close following behaviour is the result of a number of factors ranging from personal attributes to social pressures and situational factors (TRL, 2011). The primary distinction is the error-violation dichotomy put forward within this report. This view suggests that the factors leading to close following behaviour can either be categorised as being a product of factors such as inexperience, impairment, cognitive dysfunction and perceptual errors (both in terms of visual errors or errors in the perception of risk levels), or a product of more intentional actions (such as deliberate aggression or violating) driven by attitudes, habits and values (TRL, 2011). This report will explore the factors in both of these categories as well as the situational factors that impact close following behaviour.

2.2.3   Error

Research has consistently found that young drivers are more inclined to engage in risky behaviour, partly due to inexperience, and resulting errors in perceiving and responding accordingly to risk (Foss, Martell, Goodwin & O'Brien, 2011). Inexperience has been identified as one of the causes leading to close following behaviour, due to the inability to accurately measure headway and consequently to adapt driving behaviour accordingly (Foss et al, 2011). Similarly, research has suggested that although young drivers are a group at higher risk of collision involvement, inattention and errors due to inexperience have been identified as greater contributory factors to risky behaviour and collisions than intentional risk taking behaviour (Voogt, Day & Baksheev, 2014). While young drivers have been found to maintain shorter headways than more experienced drivers, motivations for such behaviour cannot only be attributed to intentional behaviours to behave in a risky way, and the inexperience of such drivers also plays a strong contributory role (Jiang, Lu, Wu & Hu, 2011). Interestingly, although young drivers are more inclined to close follow, intended following distance seems to become slightly greater (i.e. safer) during early driving experience (Helman, Kinnear, McKenna, Allsop, & Horswill, 2013).

One of the requirements for safe driving is the ability to judge other people's speed and distance in order to be able to adapt one's behaviour accordingly. However research has consistently found that both experienced and novice drivers frequently have difficulties in accurately measuring the distance or speed of leading vehicles (TRL, 2011). These errors have a significant impact on close following behaviour, as the headway selected by a driver is based on the distance that they consider necessary in order to respond safely to changes in the behaviour of the leading vehicle, therefore making headway a product of the perceived speed and distance of the leading vehicle (Risto & Martens, 2013; Lu et al, 2012). In their study Wang and Song (2010) found that 95% of drivers thought that they were maintaining a safe headway while in fact their time headway was below the recommended two seconds, highlighting these perception errors as a cause of close following behaviour. These errors in perception consequently lead to errors in anticipation as drivers are not

able to accurately adapt their behaviour to leading vehicles, leading to collisions as a result of close following.

These errors in perception and anticipation can partly be caused by the presence, or absence of cues within the environment. Drivers base their behaviour, and consequently their chosen headway, on cues provided by other drivers; for example a driver indicating that they are slowing or using their indicators is demonstrating a change in their behaviour which could result in a reduced headway between the two vehicles, or the lead vehicle reducing their speed (Muhrer & Vollrath, 2010). However, the absence of such cues (such as the use of indicators) means that drivers are not able to adapt their behaviour accordingly.

The impact of cues on close following behaviour has also been supported by the increased instances of rear-end collisions at speed-red-light-cameras (Polders et al, 2015;). Research has found that these types of infrastructure designed to reduce speeding and red-light running have led to an increase in rear-end collision. The presumed mechanism by which this has occurred is a reduction in time headway as a result of drivers' response to the cameras. An increase in rear-end collision is often linked to an increase in sudden braking of leading vehicles, resulting in the following vehicle not being able to stop in time.

Errors in anticipation have also been linked to increased cognitive demand and mental workload (Hoogendoorn, Hoogendoorn, Brookhuis & Daamen, 2011; TRL, 2011). Research has established that drivers tend to be consistent within their own selected headway and fail to adapt their behaviour in differing driving scenarios. However this failure to adapt headway is not just limited to varying environmental environments, as drivers also fail to adapt to their own reduced capability to respond to changes in the driving environment. Driving is a complex and demanding task requiring high levels of cognitive ability. Therefore factors increasing mental workload, such as stress or adverse weather conditions, and reducing the available cognitive resources to carry out the driving task, will have a significant impact on safe driving and close following behaviour. Once the demands of the driving task exceed a certain capacity this can lead to lower levels of attention being paid to anticipating hazards on the road ahead, which can lead to increased reaction time from drivers in response to changes in behaviour of other road users, potentially increasing the occurrence of close following behaviour.

Risk perception refers to the ability to comprehend the risk posed by a driving situation that a driver faces, which has been identified by many as a skill that is acquired with experience (TRL, 2011). As defined earlier, headway is the distance chosen by a driver at which they feel safe, therefore perceptions in risk are going to have a direct impact on close following behaviour through poor adaptive behaviour. The TRL report summarised the literature around the impact of inexperience on risk perception, and how limited experience of the required braking for a given speed, poor anticipation and poor situational awareness will contribute to errors in risk perception influencing close following behaviour, especially in young drivers. It is important to note that risk perception and risk acceptance are two distinct concepts, where the latter is a result of intentional mechanisms relating directly to an individual's personal choice of risk level, a concept that will discussed in the following section.

2.2.4 Violation

The primary distinction between error and violation based close following is the level of intention in the actions. As described above error based close following is primarily unintentional. However, close following due to violations is intentional, and under conscious control. A number of factors lead to this type of close following. Close following is a result of the selected headway of each driver,

a behaviour that, while on the one hand has been found to be hugely variable across the driving population is a consistent one for each individual driver across various driving situations. This suggests that selected headway is likely to be the result of differences in individual factors such as personality and attitudes (Munigety & Mathew, 2016). A number of theories of risk acceptance have supported this by suggesting that the level of risk accepted varies according to each individual based on a number of personal factors such as sensation seeking, locus of control, trait and state anger (Huang & Ford, 2012; TRL, 2011; Taieb & Shinar, 2001).

Sensation seeking has been linked to risky driving behaviour such as speeding (Foss, 2011, TRL, 2011), but the difficulty in measuring other types of risky behaviour, such as close following, has made it more complex to establish such a link. However, research has found that individuals who are most likely to engage in speeding behaviour are also more inclined to engage in close following (McKenna, 2006).

Research carried out by Foss and colleagues (2011) examined the changes in young driver collision characteristics over the first months of driving. While the decline in most behaviours and collision types follows a trend that is consistent with a learning process certain behaviours follow a much slower decline, suggesting that they are due to more personal factors. These behaviours included close following and rear-end collisions, suggesting that they are more related to driving style than skill. Similarly, confidence in driving ability has been linked to sensation seeking and risky driving behaviour (Isler, Stanley & Steppard, 2011). Research looking into tactical compensation (adaptive regulations while driving that become apparent when situations are particularly complex and require high levels of mental or physical demands, see Michon, 1985) has found that such processes are frequently found in drivers who have lower levels of driving confidence and has been linked to coping strategies (Adrian et al, 2010). Older drivers have been found to have lower confidence in their own driving ability and decide to respond to this by adopting higher levels of avoidant coping strategies and consequently higher levels of tactical compensation such as reduced speed and greater headway. Younger drivers on the other hand have been found to have much higher levels of confidence in their driving ability and are therefore less likely to engage in such tactical compensation in high risk driving situations.

As well as sensation seeking, aggression has been identified as another personality trait that has been very closely linked to risky driving behaviour, including close following (TRL, 2011). Research has found that trait aggression is linked to the likelihood of engaging in risky driving behaviour, and research looking into the subscales of the Driver Behaviour Questionnaire (DBQ) (Reason, Manstead, Stradling, Baxter & Campbell, 1990) has found that the subscale of violation behaviour contains items relating to close following and these have been found to be associated with self-reported aggression (TRL, 2011). In addition, research has looked at the emotional and cognitive responses to scenarios differing in levels of aggressive intent and established, based on the General Aggression Model (Anderson & Bushman, 2002), that drivers were more likely to act according to their perception of on-road events, and differences in motives in the intention of an aggressive behaviour had an impact on the cognitive and emotional responses to such behaviour, therefore impacting the levels of state aggression. The research found that close following behaviour identified as hostile, or as an impulsive act with the aim of harming the target, lead to those subject to the behaviour reporting stronger negative emotions, greater levels of perceived threat and more negative attributions leading to drivers responding with both instrumental and hostile aggression (O'Brien et al, 2012). Therefore, trait aggression has been found to not only provoke risky behaviour, but also lead to further state aggression in drivers who are subject to hostile close following behaviour.

Another aspect of personality that has been found to influence risky driving behaviour is locus of control (Huang & Ford, 2012). Locus of control (Rotter, 1954) is the extent to which a person thinks they can control events affecting them and is measured on two scales. These are internality, where people perceive outcomes as dependent on their own behaviour and externality, where people perceive outcomes to be a result of external and uncontrollable influences. Therefore, locus of control is suggested to account for individual differences in perceptions of the relationship between individual actions and subsequent outcomes. People who are high in internal locus of control are more likely to engage in safer driving (such as being alert and braking in anticipation of potential danger), while those who are involved in fatal accidents score more highly on externality and lower on internality (Huang & Ford, 2012). Research investigating interventions designed to influence locus of control with the aim of influencing driver behaviour found that interventions succeeding in decreasing externality and increasing internality led to improved safe driving behaviour. While locus of control has not been found to have a direct link to close following, the link to risky behaviour is robust and due to the established relationship between close following and risky behaviour in general it is possible to assume that locus of control will influence the likelihood of engaging in close following behaviour.

Personality factors are not the only type of personal factors that influence intentional close following behaviour; other relevant factors include attitudes towards risk taking behaviour in general and close following in particular. Individuals have attitudes towards most things, and these attitudes make up part on an individual's self-identity (Verplanken & Holland, 2002). Attitudes have been shown to be a predictor of intentions to engage in a behaviour (with intentions generally agreed as being somewhat linked to behaviours themselves) (Ajzen, 1991). Indeed, attitudes towards behaviour and the outcomes of those behaviours will have a significant impact on the intention to perform the behaviour. People who have negative attitudes towards risky behaviour are less inclined to engage in such behaviour as they do not want to go against their own beliefs. Self-identity and values determine an individual's behaviour as people do not want to behave in a way that runs counter to their own identity.

As well as personal factors, social norms will have an impact on the likelihood of engaging in such behaviour. Similarly to values and self-identity, people are less likely to engage in a behaviour that is perceived as negative and dangerous by others, especially close relations (Ajzen, 1991). Research looking at the impact of the TPB components on close following found that peers' approval of a behaviour has as great an influence on the intention formation of a behaviour as attitudes (Castanier et al 2013). Similarly, family have regularly been identified as the group with the most influence over a person's intention to engage in a behaviour (Chorlton, Conner, & Jamson, 2012). Therefore, as with personal values, an individual is less likely to engage in a behaviour if it is attached to negative social consequences, such as the disapproval or disrespect of peers or loved ones (Ajzen, 1991). As well as social norms, social pressures can have an impact on the likelihood to engage in close following behaviour (TRL, 2011). These can include time pressure and pressure to keep up with the traffic. Indeed, drivers reported that when trying to maintain a two-second headway they were conscious of being tailgated themselves and chose to reduce their headways and increase their speed (Diels, Reed & Weaver, 2009).

As mentioned previously, risk acceptance is the product of a number of factors one of which is another identified with the Theory of Planned Behaviour (TPB) – perceived behavioural control (Ajzen, 1991). Perceived behavioural control refers to the perceived ease or difficulty in carrying out a behaviour. While attitudes and social norms have an impact on intentions to engage in behaviour, if an individual does not believe that they can perform the behaviour (or believes they cannot avoid it) their intention to carry out the behaviour will be reduced (or increased). Research has further

divided perceived behavioural control into two components. These are perceived autonomy, the level of perceived controllability and perceived capacity, the level of perceived difficulty (Castanier, Deroche & Woodman, 2013). In terms of close following, perceived capacity was found to have an impact on close following behaviour. This is likely to have a significant impact on increasing the likelihood of close following behaviour as drivers are prone to optimistic bias or unrealistic optimism regarding their driving behaviour (Weinstein & Klein, 1996). Indeed, drivers often tend to be over confident in their driving ability and believe that they are able to respond to unexpected events and adapt their behaviour in a much better way than they actually can. This will have an impact on the perceived levels of difficulty of a situation, and consequently the perceived level of control and their intention to engage in close following behaviour.

Risk acceptance plays a critical role in close following behaviour and this is influenced by a number of factors that vary according to each individual. However, research suggests that the consistency in selected headway could be a result of past experience (Lewis-Evans et al, 2010). Indeed, people choose to adopt a headway that is within a safety margin, or comfort zone, which is based on their past experience, whereby if a driver has consistently selected a one second headway and felt safe with this selected headway this will lead to the formation of a habit (Muhrer & Vollrath, 2010; Lu et al, 2012). This consistency and the influence of past behaviour in determining current behaviour suggest that selected headway could be a habit for many drivers. Habits have been found to override the components of the TPB, as they are a person's automatic response to a situation or behaviour (Ouellette & Wood, 1998).

2.2.5 Situational factors

While the error-violation dichotomy provides a strong theory to understand the causes behind close following behaviour there are a number of additional factors that can either lead to an increased likelihood of close following behaviour, or lead to close following behaviour but are due to the behaviour of other drivers. Indeed, observational research has found that even when instructing drivers to maintain a two second headway drivers often found themselves unable to do as other drivers took the opportunity of larger headways to overtake and join the lane in front of them (Wang & Song, 2010). In this case, drivers have no control over their immediate close following behaviour as it results from the level of risk acceptance of other drivers.

Gouy and colleagues (2012) aimed to further understand the influence of other drivers on close following by investigating the impact of platoons on a driver's selected headway. The research aimed to establish whether drivers were willing to keep a time headway smaller than their preferred one to conform to the norm established by the presence of platoons holding a short time headway. The presence of platoons led drivers to adopt a headway that was closer to their minimum acceptable headway. Indeed, the shorter the time headway of the platoon the more drivers were inclined to adopt a time headway that was closer to their minimum preferred headway.

Similarly, the type of vehicle that is being followed can have an impact on selected headway (TRL, 2011). Contrary to expected, selected headway was smaller when the lead vehicle was an HGV. Research suggests that this could be because HGV drivers are perceived as being safer and more experienced drivers and therefore their behaviour is likely to be perceived as more predictable overall. As close following is a result of perceived risk, drivers may be inclined to believe that despite the reduced visibility of the road environment the level of certainty in the leading vehicle's behaviour is much more stable than the behaviour of other drivers therefore reducing the level of perceived risk and increasing the level of perceived control over the situation (Duan, Li & Salvendy, 2013).

As well as other drivers certain driving environments, such as road works, can lead to increased close following behaviour (Yousif, Alterawi & Henson, 2014; Liu, Khattak & Zhang, 2016; Walker & Calvert, 2015). Research has found that road works can increase the likelihood of close following behaviour, both in terms of close following arising from errors and from violations. Road works can have considerable impacts on reducing roadway capacity and represent a relatively abrupt change in driving conditions, such as reduced speed and more closely bunched traffic (Yousif et al, 2014). In their review TRL (2011) identified a number of factors that had an impact on close following behaviour at road works due to the abrupt change in conditions, which included speed adaptation, distance estimation, risk perception, situation awareness, task difficulty, time pressure, risk threshold or acceptance, aggression, social deviance and attitudes. Road works have been identified as high risk areas, but recent research suggests that 71% of fatal and injury collisions in road works were a result of improper driving behaviours such as close following, improper lane change and, passing and failing to maintain proper control (Liu et al, 2016).

Weather conditions also have an impact on close following due to their impact on level of perceived risk and risk threshold (Hoogendoorn et al., 2011). Adverse weather conditions, such as heavy rain and fog, have been found to reduce road capacity by between 10% and 19%, and are generally thought to increase mental workload (due to reduced visibility for example). These changes require that drivers adapt their behaviour, but as identified previously drivers often fail to adapt their behaviour, even in cases of increased mental workload. However, while adverse weather conditions have been found to lead to some adaptive behaviour, such as reducing speed, this adaptive behaviour does not seem to extend to close following behaviour. Indeed, research seems to suggest that the presence of fog can actually lead to increased close following behaviour due to drivers seeking additional visual cues as a result of the reduced visibility (TRL, 2011).

2.2.6   Driving for work

A significant amount of road casualties are accounted for by people who drive for work, with police collision data from 2014 showing that 23% of those killed and seriously injured on roads within GB were involved in a road collision where someone was driving for work (DfT, 2015). Figures from the Health and Safety Executive (2003) show that work related driving accounts for 25-33% of all road fatalities in GB. More recent estimates are similar in magnitude (Helman, Christie, Ward, Grayson, Delmonte & Hutchins, 2014). It is also generally accepted that work-related driving is more risky than leisure driving (for a review see Grayson & Helman, 2011).

This increased risk has been attributed to the additional motives that an individual is faced with as well as the driving task, such as time pressure, stress of work, increased mental work load due to distraction, and fatigue (for a review see Grayson & Helman, 2011). This group of drivers also score lower on self-reported safety scales and breach the rules of the road more often than those who do not drive for work (O'Dolan & Stradling, 2006). The factors mentioned here have all been identified as increasing the likelihood of engaging in both error- and violation-based close following suggesting that these drivers may be more inclined to engage in this risky driving behaviour. There seems to be a strong divide in terms of the people who drive for work between those who enjoy it and those who do not, some saw it as an opportunity to spend time away from the office and used it as an opportunity to think about their work day without any distraction (O'Dolan & Stradling, 2006). The latter of these factors however suggests that when driving this group tend to be subject to an increased mental workload due to the additional tasks they are carrying out, a factor that has been identified as increasing the likelihood of tailgating due to reduced attention (Hoogendoorn et al, 2011). Similarly, those who did not like to drive for work identified stress and time pressure as two

of the contributory factors, both of which have been identified as leading to close following behaviour through an increased mental workload and more aggressive or frustrated driving.

A study carried out by Road Safety Analysis (RSA, 2014) compared the collision risk of van drivers with all other motorists, as this group (light goods vehicles) was over-represented in close following accidents. On average there were 640 van drivers who were thought to have contributed to their collision through close following each year and observation errors were recorded as the most common contributory factor in van drivers (RSA, 2014). The TRL review (2011) identified a number of factors that could lead to this increased close following rate. Similarly to others driving for work such drivers are often subject to time pressure and are most probably subject to job demands leading to higher levels of stress (e.g. meeting company or own targets). In addition, since 1994 there has been a year on year increase in the LGV population in the UK, with 2.13 million LGVs in 1994 rising to 3.28 million in 2012. Helman et al. (2014) report that the number of vans registered has increased by 24.6% between 2001 and 2011 in Great Britain. While the increased presence of these vehicles and their drivers suggest that close following behaviour may have become more common on the road, these drivers are also not subject to as much training or regulations as HGV drivers, meaning that they are equally subject to the biases faced by drivers in terms of perceived control and errors in perception and anticipation.

While there is some evidence of the direct relationship between driving for work and close following behaviour (for example insurers often state that shunt collisions are a major costs for fleets - Price, A., personal communication, 28th of July 2016), this link still has limited empirical evidence. However, the factors that have been identified as being highly correlated with close following behaviour seem to be more prominent in those driving for work, suggesting that this driver group might have a higher rate of close following behaviour.

2.2.7 Interventions

A number of factors have been identified as influencing the likelihood to engage in close following. Unfortunately while some interventions have been designed to reduce the likelihood of close following behaviour the majority of these interventions have been infrastructure based or increasingly technology based. Very few interventions have been designed and empirically tested that focus on behavioural change techniques. The review undertaken in this report aimed to identify factors that led to close following in order to allow for the development of such interventions. This section of the report will list and elaborate on the factors that should be targeted through behaviour change interventions in order to influence close following and risky behaviour overall.

As mentioned, there is little empirical research looking at interventions aiming to reduce close following behaviour therefore research from more broad behavioural change research has been included in this section of the report.

Firstly, locus of control has been found to account for individual differences in the level of control a person thinks they have over events that affect them. High internal locus of control has been linked to safer driving behaviour, and people with high externality and low internality are more reported in fatal collisions. Some interventions have aimed to increase internality and reduce externality in drivers and found that changes in locus of control could lead to safer driving.

Attitudes are closely linked to behaviour, while they are only one factor influencing intention to engage in a behaviour they have been identified as a predictor. Indeed, people with more negative attitudes towards rule violations are more likely to report safer driving. This is supported by many

behavioural models which provide evidence that drivers are less likely to engage in behaviour that they have a negative attitude towards.

As well as attitude, personality influences the likelihood of engaging in close following behaviour. Risk- and sensation-seeking have been correlated with risky driving behaviour in general, but also close following. Risk seeking has an influence on risk acceptance and risk threshold. As drivers adopt a consistent headway this suggests that they have an acceptable risk threshold and that their chosen headway will depend on this threshold. The variations in accepted risk level will depend on the level of sensation seeking and risk of each individual. Risk theories have emphasised the importance of personality traits in the risk acceptance. Indeed Risk Allostasis theory suggests that people have a feeling of risk that they prefer to maintain and take appropriate actions to do so (Munigety & Mathew, 2016).

Aggression also influences close following behaviour. Analysis of the Driver Behaviour Questionnaire (DBQ) has found that self-reported close following behaviour is associated with self-reported aggression (TRL, 2011). But state aggression can also have an impact on close following and response to close following by others, as the perceived type and level of aggression felt by drivers will have an impact on their own driving behaviour. Indeed, people respond differently to intentionally aggressive and ambiguously aggressive situations. The General Aggression Model (Anderson & Bushman, 2002) suggests that the interaction between person related emotional and cognitive processes explains aggressive behaviour and that behavioural responses to aggression are influenced by a number of factors such as state related characteristics and personal factors. Therefore interventions aiming to target close following behaviour should focus on drivers' emotional and cognitive responses to other drivers' behaviour, to minimise the likelihood of state aggression for example. Finally, frustration has been defined as 'the psychological state that occurs when a driver is blocked from making progress towards the goals of their journey' (Kinnear, Helman, Wallbank & Grayson, 2015, p229) and can be seen as a potential predictor of close following (with the purpose of overtaking). These three personality factors are the three main factors that should be targeted in order to influence close following behaviour.

Self-identity and moral norms play an important role in determining intentions to engage in a behaviour as individuals are more likely to engage in a behaviour that they consider as being in line with their own values. If an individual is known for their risk-taking and this trait is part of how they identify then they will be more inclined to engage in risky driving behaviour (Verplanken & Holland, 2002). Similarly, if a person's moral norms are such that they themselves would not engage in risk taking behaviour of any kind, then they will be less inclined to engage in risky driving. While values and moral norms can be relatively stable they can be weakened and changed if targeted appropriately and should be the focus of interventions aiming to reduce close following behaviour.

As well as moral norms and values, normative beliefs and social norms are strong predictors in intentions to engage in a specific behaviour. Others' acceptance of behaviour will have an impact on the likelihood of engaging in that behaviour. As explained in the TPB, social norms have an impact on intention formation and behaviour as people do not want to behave in a way that is considered as socially unacceptable. Social norms and normative beliefs can be the result of opinions and beliefs held by society as a whole, but are also the product of beliefs shared by peers and close family. Indeed, if a certain behaviour is considered to be unacceptable by society, but is viewed more positively among peers a person might still be inclined to engage in such behaviour (e.g. speeding among young drivers). For this reason, interventions aiming to reduce risky driving behaviour should focus on the influence of peers and family as their perception of a behaviour will have a greater impact on the intention to engage in risky behaviour.

The distinction between injunctive and descriptive norms is relevant here too. Injunctive norms refer to the broad agreement that a behaviour is or is not socially acceptable (e.g. knowing that other drivers find close following is unacceptable) while descriptive norms refer to the extent to which the behaviour is seen (e.g. seeing other drivers close follow). Cialdini (2003) has shown that for some behaviours such as littering, when injunctive norms are delivered in an environment in which the descriptive norm is aligned with the message (e.g. 'Don't Litter' signs placed in a litter-free environment) they are more effective at changing behaviour than when the descriptive norm is incongruent with the injunctive norm (e.g. 'Don't Litter' signs in a littered environment). The challenge for messaging around close following is that, as we have seen, close following is common. Finding ways to make it appear less common will be a challenge, but one worth pursuing.

Optimistic bias, or unrealistic optimism has been found to be linked to risky driving behaviour overall with drivers believing that their driving ability, and therefore ability to cope in unexpected situations, is greater than it actually is. These increased levels of self-confidence in driving skills mean that drivers do not adapt their behaviour appropriately as they feel that they do not need to compensate for increased complexity in the driving environment as they have the necessary skills to avoid collisions. This bias has often been found to be more prominent in young drivers who already have an increased likelihood of carrying out risky driving behaviour. On the other hand, older drivers tend to be less prone to such biases are more inclined to adopt avoidant coping strategies which translate into higher levels of tactical compensation such as reduced headway. Therefore coping strategies and optimistic bias should be targeted in order to influence close following behaviour.

Similarly, control beliefs play a role in the likelihood to engage in any behaviour. Individuals are less likely to engage in behaviour if they feel that they are unable to do so safely. But as mentioned above perceived control can be biased in a way that drivers think they have more control over a situation than they do. Research has broken down the components of Ajzen's perceived behavioural control into perceived autonomy (controllability) and perceived capacity (difficulty). In relation to close following behaviour perceived autonomy wasn't necessarily a predictor of close following behaviour but perceived capacity was. While perceived control should be targeted as a whole, interventions might gain from focusing more on the perceived difficulty of a situation to allow drivers to make more informed decisions of the actual difficulty of the driving situation.

Mental workload has a direct impact on driving behaviour due to the complexity and highly cognitively demanding nature of driving. An individual only has a limited amount of cognitive ability that they can use at a given time; while the cognitive demands of a task such as driving can be reduced as a person becomes more experienced, certain situations that are highly complex can increase the cognitive resources required to perform a behaviour, regardless of the amount of experience in that behaviour. In driving, when a person's mental workload exceeds their available resources this can have an impact on their attention and in turn their ability to adapt their behaviour to that of a lead vehicle. Mental workload can be influenced by factors that are unrelated to driving such as stress, time pressure, social pressures and distraction (some of which are more commonly found in those who drive for work). These pressures should be addressed within a professional setting and incorporated in interventions designed to influence close following behaviour.

Finally, it has been established that while there is significant variability in selected headway across the driving population, individuals tend to adopt a consistent headway across a range of driving situations. Indeed, drivers tend to select a headway that is within their own comfort zone as a result of past experience suggesting that selected headway could be a habit (Orbell & Verplanken, 2015). While the components of the TPB can account for over half of the variability in intentions to engage in close following behaviour (Castanier et al, 2013), habits can override these components and have

a greater influence on behaviour (Ouellette & Wood, 1998). Habits are a person's automatic responses to a certain situation and are relatively hard to change (Orbell, & Verplanken, 2015). Behavioural change models highlight that there are two approaches to behaviour: automatic and deliberate processing, where habits follow the automatic processing route and deliberate processing requires both the motivation and the cognitive capacity to act in a non-habitual way (Fazio & Towles-Schwen, 1999; Petty & Cacioppo, 1986). In a driving context reducing risky behaviour, or the possible consequences of engaging in such behaviour, might be a motivation to engage in deliberate processing but cognitive capacity can be stretched during the driving task, especially for people who drive for work making it hard to engage in this type of processing and reverting back to habits. Similarly, in situations where drivers may have been delayed due to traffic and are faced with time pressures to arrive to work appointments on time their motivation to maintain a safe headway might be reduced leading to the habitual behaviour taking over again. Some interventions have been designed to change such habits with the aim of making it easier for drivers to adopt a more deliberate processing, such as implementation intentions (Gollwitzer, 1999). These interventions use environmental and contextual cues to trigger behaviour; in the context of close following these could involve a driver paying closer attention to their selected headway each time they saw a particular sign on the motorway.

While there are few empirically tested interventions aimed at reducing risky behaviour and close following a study carried out by Gregersen, Brehmer and Moren (1996) tested four different types of interventions in a professional environment with the aim of reducing the risky driving behaviour of employees. The intervention with the highest level of effectiveness was the group discussion intervention. This consisted of drivers taking part in a number of small group discussions, with the entire intervention lasting three hours. Drivers were asked to identify issues and discuss these as a group, as well as develop how to resolve these issues. Finally the last stage required those taking part and employers to establish a plan to commit to future actions. This intervention was the one with the greatest impact in reducing risky driving and collision risk, as a 56% reduction in collision rates was observed over the two years after the measure was introduced, relative to a comparison group. While this type of intervention has rarely been used in road safety the focus on norms, attitudes and identifying concrete solutions to risky driving behaviour suggest that similar interventions might be beneficial in reducing close following behaviour.

2.2.8 Summary

There are a number of factors that have been identified through the literature that have an impact on close following behaviour. The majority of these factors can be explained through the error-violation dichotomy put forward in an earlier review of the literature (TRL, 2011). In addition to these two categories a third group of variables were identified as strong predictors of close following behaviour: situational factors. These factors have been summarised in the table below:

Table 2: Factors influencing close following behaviour

Error based factors	Violation based factors	Situational factors
Inexperience	Risk acceptance	Other driver behaviour
Errors in perception of speed and distance	Attitudes	Presence of platoons
Anticipation errors	Social norms/normative beliefs	Traffic flow
Visual and contextual cues	Perceived control	Size of leading vehicle
Mental workload	Self-identity/values	Presence of road works
Risk perception	Personality traits	Weather conditions
	Locus of control	
	Habits	
	Social pressures	
	Time pressure	

A number of these factors are common to drivers who engage in risky behaviour and risky driving in general, but are also more commonly found in those who drive for work. The relationship between close following and collision rate and the increased on-road exposure of these drivers highlights the importance of targeting the close following behaviour of these drivers in order to reduce the likelihood of them engaging in such risky driving. In order to achieve such behaviour change, this review has identified and summarised a number of strong predictors that can be targeted through the use of well-designed behavioural change techniques. These factors are:

- Locus of control
- Attitudes
- Personality traits
- Social norms, Moral norms and values (self-identity)
- Optimistic biases/unrealistic optimism
- Mental workload (stress, time pressure, social pressures)
- Habits

The complex nature of close following behaviour and the multiple predictors of engaging in this behaviour suggest that any intervention designed to reduce close following will not be a 'one-size-fits-all' solution and interventions will need to be designed with all three category of factors in mind.

Close following – driving too close to the vehicle in front or 'tailgating' – is believed to be an important contributory factor in traffic collisions, as well as having adverse effects on traffic flow. Collisions caused by close following affect drivers, the insurance industry, and the NHS and the emergency services. Despite a considerable and broad amount of road safety research globally, close following is under researched, with a limited range of potential mitigation and prevention measures available to road authorities.

There is evidence that business drivers are more likely to be in demographic groups that exhibit close following. This provided an opportunity to develop a workplace intervention to tackle close following, supporting employers' responsibilities for employee safety.

The RST therefore funded a project to develop and evaluate a behaviour change programme of engagement and messages to reduce close following. This included assessing whether 'social unacceptability' messaging is appropriate and the effectiveness of different messaging tools. The project targeted sections of road where close following was a known and frequent issue ('hotspots').

The project objectives were to:

1. Develop and pilot a behaviour change approach designed to reduce excessive close following through workplace and business engagement

2. Evaluate the impact of the pilot

3. Understand if 'social unacceptability' messaging is appropriate for use in reducing close following behaviour

4. Understand if specific behaviour tools such as regular prompts can be effective in reducing close following behaviour.

3 Method

3.1 Preparatory research

Following completion of the literature review, existing data sources were reviewed to identify the top 25 UK hotspots for incidents resulting from close following behaviour. This involved analysing STATS19[1] collisions relating to close following, to see which roads and police force areas had the highest numbers of collisions. The analysis covered all severities of collision and all types of vehicle over the period 2013-2015.

3.2 Intervention design and delivery

A delivery framework was designed, integrating this with the evaluation plan (see section 3.3). The framework identified factors contributing to close following which potentially could be influenced via an intervention with drivers. It also utilised recognised social psychological behaviour change techniques. Campaign materials were then designed, in consultation with a selected business.

> - Focus on young male drivers who undertook regular driving in light goods vehicles or cars during work, with significant mileage on motorways and major roads
> - Face to face discussion among peers in a workshop, plus a follow up group teleconference, each involving 6-8 drivers at a time
> - Broken down, practical information, delivered in an engaging, interactive manner
> - 'Implementation intentions', e.g. *'I will do x, when in situation y / experiencing emotion z'*
> - Feedback via follow up teleconferences, supplemented by evaluation throughout the trial
> - A social contract - *'We will chat again to see how you're going during and after the trial…'*
> - 'Point of choice' reminders of desired behaviour and implementation interventions at the points that influence behaviour, e.g. vehicle dashboard and desk top
> - Run for a minimum of 8 weeks to try to embed new positive habits.

Figure 1. Format of the intervention with drivers

The intervention consisted of a 90 minute workshop, an implementation intention intervention, two point of choice reminders and a follow up teleconference. Each is described in more detail below.

The participants began the workshop by completing the initial survey, followed by an initial 20 minute facilitated discussion. This began with a discussion of individual self-perceptions of driving styles, abilities, confidence and close following behaviour. This was to establish trust, an environment of honesty and openness, and engagement in the conversation. Following this introductory discussion TRL's facilitator defined the 2-second rule using an image outlining stopping distance, and a video demonstrating the 2-second rule whilst driving on the motorway at 60mph.

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[1] Road safety data about the circumstances of personal injury road accidents reported to the police and published by the Department for Transport.

This was followed by a description of when the rule is appropriate and how best to check in on the rule whilst driving. Participants then discussed social norms, social pressures, and triggers for CFB i.e. what makes each of them more likely to undertake CFB. Examples of responses included loud music, time pressure, a sunny day, an angry mood, an inconsiderate driver. These were noted for later.

Following this a judgement of speed and distance exercise was undertaken on a projector screen to establish that people, as a rule, have very poor judgement of these aspects, and have participants acknowledge this.

Participant's locus of control was then measured through an established psychometric scale (Rotter, 1966) each completed, with these data reproduced on charts for the group to see. The facilitator took the group through the scale question by question which participants noting their answers individually. Scores were then added at the end, and individual scores read out and displayed at the front of the workshop. Locus of control was then explained as a concept, and individual differences noted and discussed in terms of impact on risky behaviour and CFB specifically e.g. "*it's worth understanding if you are high or low on the locus of control, and then considering your decision making in the context of that scale. For example if you're high on the locus of control it is possible you over estimate your control in any given situation, and you may need to factor risk and those areas outside of your control more into your decision making. If you're low on the locus of control, it maybe you're more in control of situations than you think you are, and it might be worth exerting more control over driving situations such as managing risk factors like speed, CFB and other factors within your control".* The facilitator acknowledged that this isn't an exact science or as simplistic as explained, but that it could be useful in considering one's behaviour and risk management.

External factors and adaptation techniques were then discussed in the group, and finally an implementation intention part of the intervention was completed based on the trigger identified earlier e.g. if the trigger was "I'm more likely to undertake CFB if another driver upsets me", then the implementation intention would be written by the participant as, "When a driver upsets me, I will remember my family, the impacts of CFB and stay calm". This was written onto a dashboard sticky mat, so that it would act as a point of choice reminder i.e. a reminder to the person at the point they are choosing the relevant behaviour.

A further point of choice reminder was then given to all participants in the form of a vehicle shaped post-it notepad with TRL/ RST combined branding and the message, "Leave enough time. Leave with no tasks. Keep the 2 second rule". This reminder is at the point where participants can choose to reduce their cognitive workload before leaving for a journey by doing tasks before leaving, and by reducing time pressure by leaving with extra time. It also primes them to leave with the intention of driving calmly.

Following the workshop, participants were reminded of the intervention three times by text message to complete diary surveys across an eight week period. This period was chosen as it is the time identified as the minimum for a new habit, if held in routine, to be established in the place of an old habit.

Following a minimum of an eight week period, a 45-minute follow up teleconference with the same groups was then held. This acted as two elements of the intervention. One was a qualitative evaluation tool as the teleconference was run as a structured interview of the group. Secondly it acted as a "social contract". A "social contract" refers to the obligation one feels to another having agreed to something, which leads to an increased likelihood of someone undertaking a promised behaviour if they know they will be followed up with at a future date.

3.3   Participating employers and drivers

Participating employers in the experimental group included Rolls Royce (27), Bristol City Council (Parks Department, 24), Bristol City Council (Maintenance Department, 20), North Somerset County Council (7), and the Forestry Commission (7). Pilot delivery involved three levels of recruitment:

- Local authority partners for conducting the pilot, with close following hotspots targeted

- Outreach to employers, initially in collaboration with local authority partners

- Individual drivers employed at the participating workplaces.

The target was to recruit 10 employers and 80-160 drivers in total, 8-16 drivers per employer. Originally, Bristol City Council, North Somerset Council and South Gloucestershire agreed to be local authority partners for a pilot in West of England area. Due to subsequent difficulties in recruiting a sufficient number of employers / drivers in this area, the RST agreed that recruitment could be expanded to the rest of the UK. This was mainly done via contacts from local ECO Stars schemes, which promote cleaner and more efficient fleets. This resulted in recruitment targets being met.

3.4   Evaluation design

Evaluation of the intervention's effectiveness was carried out via surveys of participating drivers, comprising a survey at the start, a survey at the end and three 'diary' surveys in between.

Figure 2. Evaluation structure and timescale

Drivers were assigned to either an **intervention** or **comparison** group, with the aim of these groups being approximately the same size:

- Both groups completed the initial and final surveys

- Only the intervention group participated in the workshop and teleconference, received point of choice reminders and completed the three diaries.

Participants were asked to give informed consent for the entire trial via an appropriate consent form. The initial and final surveys asked the same questions. This main survey is in **Appendix A,** and was designed to ascertain:

- Details of the respondent's last work journey

- How demanding the respondent found the last work journey

- Attitudes towards close following and driving for work, with questions based on the theory of planned behaviour (perceived control, social norm, habit)

- The respondent's normal closest following distance, using a picture-based question (Horswill & Coster, 2001).

The three diary surveys asked the same questions. This survey in **Appendix B**, represents an abridged version of the main survey.

In order to maximise survey responses:

- The initial survey was handed out as a paper copy and completed by drivers in the intervention group during the workshop.

- Drivers in the intervention group had a choice of filling out the subsequent four surveys either online or on paper. Each of these drivers also received two text reminders to complete each of the four remaining surveys (eight texts in total per driver)

- Drivers in the comparison group had a choice of filling out the initial and final surveys either online or on paper.

- Survey arrangements were covered in driver fact sheets and at workshops and teleconferences, reinforced by a social contract.

Feedback from teleconferences was intended to complement the survey data.

4 Results

4.1 Preparatory research

4.1.1 Literature review

The literature review found that there are a number of factors that can have an impact on close following behaviour. These factors have been summarised in the Table 2 within the literature review. A number of these factors are common to drivers who engage in risky behaviour and risky driving, but are also more commonly found in those who drive for work. The relationship between close following and collision rate, and increased on-road exposure of these drivers highlights the importance of targeting their close following behaviour to reduce the likelihood of them engaging in such risky driving. The literature review also identified a number of strong predictors that can be targeted through the use of well-designed behavioural change techniques, such as:

- Locus of control

- Attitudes

- Social norms, Moral norms and values (self-identity)

- Optimistic biases/unrealistic optimism

- Mental workload (stress, time pressure, social pressures)

- Habits.

The complex nature of close following behaviour and the multiple predictors of engaging in this behaviour suggest that any intervention to reduce close following will not be a 'one-size-fits-all' solution; interventions will need to be designed taking into account all three categories of factors illustrated in Table 2. These findings helped inform design of project delivery and evaluation.

4.1.2 Accident hotspot data analysis

Table 3 shows a list of the 25 roads within police force areas which have the highest proportion of collisions relating to close following, from STATS19 data. It can be seen that all are on the Strategic Road Network. Three of the four recruited employers who provided drivers for the intervention cohort were located near the Avon & Somerset hotspot. Many of the drivers in the control cohort were based at workplaces near the Strathclyde / Central hotspots.

Table 3 UK hotspots for close following collisions: 2013-2015

Police force area	Road class	Road no.	No. of close following collisions	Total no. of collisions	Close following collisions as % of total collisions
Metropolitan	A	127	28	109	26%
South Yorkshire	A	1	15	71	21%
Cheshire	M	6	128	808	16%
Avon & Somerset	M	4	26	174	15%

Police force area	Road class	Road no.	No. of close following collisions	Total no. of collisions	Close following collisions as % of total collisions
Metropolitan	A	1153	16	124	13%
Hampshire	A	331	8	62	13%
Cheshire	M	56	54	426	13%
Warwickshire	M	42	43	343	13%
South Yorkshire	A(M)	1	22	176	13%
Strathclyde	M	8	69	565	12%
North Yorkshire	A	1	15	124	12%
Metropolitan	A	12	141	1171	12%
Central (Scotland)	A	91	10	84	12%
Metropolitan	A	233	16	136	12%
Northamptonshire	M	1	20	173	12%
Metropolitan	A	13	197	1738	11%
Metropolitan	A	220	18	161	11%
Surrey	M	23	22	197	11%
Metropolitan	M	4	51	460	11%
Metropolitan	A	1261	12	111	11%
West Yorkshire	A	1	12	111	11%
Metropolitan	A	2016	17	160	11%
Metropolitan	A	102	39	369	11%
Hampshire	M	3	69	653	11%
Cheshire	M	62	18	171	11%

4.2 Intervention Evaluation

4.2.1 *Qualitative*

Qualitative analysis consisted of six follow up 45 minute group teleconferences covering 43 participants in total. The topic guide was:

- Two minute introduction, stressing no socially desirable responding, the nature of this as an objective research study, noting that we did not wish to promote something which did not work and therefore requesting complete honesty – positive or negative.
- 10 minutes on how the intervention has been so far
  - Have participants thought about CFB?
  - Have participants thought about the intervention?
  - Have participants used any of the tools?
  - Have participants been receiving the text?
- 30 minutes – Has it affected behaviour?
  - In what way (magnitude, frequency, context)?
  - How can participant tell it's changed (perception versus reality)?
  - Which elements of the intervention does participant feel have been most effective?
  - Why?
  - Which elements of the intervention does participant feel have been least effective?
  - Why?
  - Does participant plan to continue any behaviour changes/ make any more?
  - Three mins – Thanks, wrap up and guidance on remainder of trial and final evaluation.

Notes were taken on salient points from each conversation, and the group was run in an inclusive manner ensuring all participants were prompted to get involved. Open questions were used and phrased to ensure questions were not leading, and the need for honesty was reinforced throughout the call. Key findings included:

- Awareness of CFB was raised in all participants across the entire eight week period. Participants consistently reported thinking about CFB more, being more aware of it whilst driving and in catching themselves doing it and adjusting behaviour.

- Attitudes had changed positively in terms of the importance of CFB, and in terms of its prevalence. Participants reported feelings that this was more important now when considering driving, and noticed it more on the roads than previously.

- Self-reported behaviours had shifted in over 75% of participants, but the behavioural shift was specific to the individual, and often linked to specific context. For example one participant only thought about close following behaviour when he found himself very close to someone and then backed off. Another had specifically focused his behaviour on leaving 10 minutes earlier and felt this was making a difference. Another participant noted an increased awareness of CFB when in the car with her young daughter, as she would previously get distracted chatting with her daughter but would now focus more on the road. Another participant had discussed the workshop with their partner and found themselves being reminded by their partner frequently about distance.

The following lessons for improving the intervention were identified:

  - Approximately 50% of participants did not use the dashboard sticky mat.

- Over 80% of participants cited the group discussion as the most effective and powerful factor in changing perceptions and behaviour.

- Participants found a couple of the survey questions ambiguous e.g. mothers first name was taken as "maiden name" or "Christian name", and "Day of the month born" was read by some as either the day i.e. Monday or date i.e. 1st. This led to some mismatches of survey.

- Some participants were confused by the third text message which referred to the final survey. This was intended to indicate the final diary survey, but some filled in the Post intervention survey, rather than final diary survey.

4.2.2 Quantitative

4.2.2.1 Driving distance perceptions

A mixed group factorial ANOVA was performed to examine the differences between the scores on perceived following distances before and after the intervention and between the comparison and experimental group. A mixed ANOVA compares the mean differences between groups that have been split on two "factors", where one factor is a "within-subjects" factor (pre and post here) and the other factor is a "between-subjects" factor (experimental and comparison groups here). No significant difference was found in the choices of pictures before and after the intervention, $F_{(1, 44)} = 0.21$, $p = .885$). There was a significant main effect of group, $F_{(1, 44)} = 5.42$, $p = .025$, $\eta2 = .11$ suggesting that participants from the comparison group chose different pictures than participants from the experimental group. Looking at Table 4 below, participants from the comparison group chose between picture 7 and 8, whereas participants from the experimental group chose between picture 5 and 6 (as the picture number increases the perceived following distance decreases). The interaction between time and experimental condition (Figure 1) was not significant $F_{(1, 44)} = 0.19$, $p = .662$). It is possible that the differences between the comparison group and experimental group above are due to selection method, or due to socially desirable responding (SDR). The experimental group filled the surveys in the room, with the TRL facilitator present, knowing they were about to undertake a workshop on CFB. It's possible that this skewed their responses to appear as safer drivers to the facilitator, even though no part of the workshop had started yet. Further research would be required to definitively establish what caused this difference.

Table 4: Means and standard deviations of estimated distance from the car in front before (pre) and after (post) the intervention

	Pre m(sd)	Post m(sd)
Comparison	7.6 (2.7)	7.7 (3.2)
Experimental	5.9 (2.8)	5.7 (3.1)

In short, the data from the close following picture test does not provide evidence for impact of the intervention. This measure has been used in previous studies and has been shown to be sensitive to changes in close following tendencies. For example Helman et al. (2013) showed that over the course of the period when they were learning to drive (typically around six to nine months) learner drivers showed a statistically significant drop in picture number (i.e. an increase in following distance) from 7.3 to 6.57. This difference of 0.73 was around 0.4 of a standard deviation in the data

collected by Helman et al., which according to the commonly accepted definition by Cohen (1992) is approaching a 'medium' effect size (effect size being an indicator of the practical importance of an effect). Table 4, and Figure 3 show a difference for the experimental group over time-points in picture number of around 0.2, which represents about 0.15 of a standard deviation in these data. Even if this had been a statistically significant effect that could be attributed to the intervention, it should be noted that 0.15 of a standard deviation is a very small effect size according to Cohen (1992).
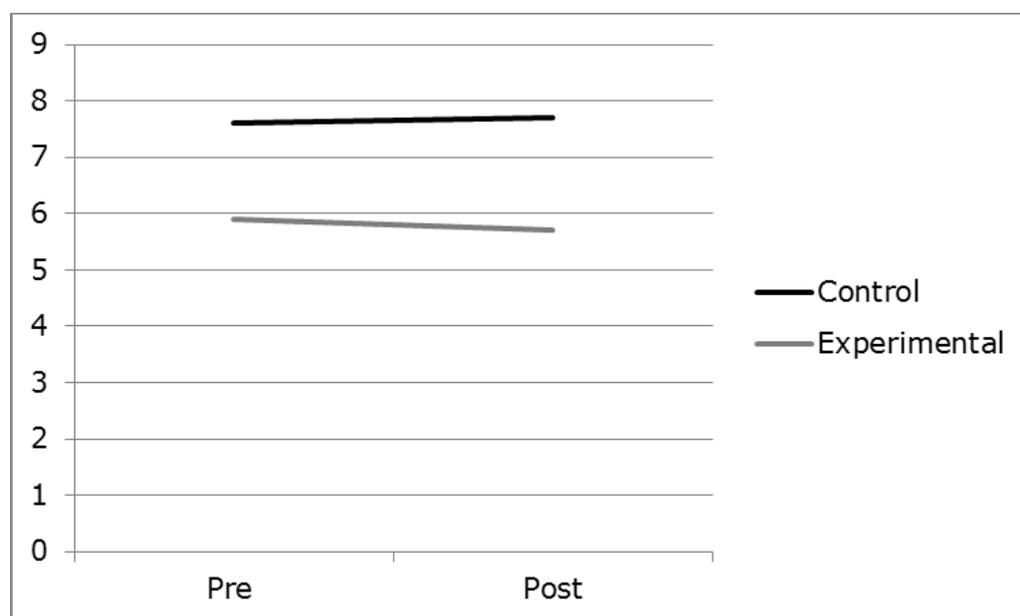
Figure 3: Score means between the control and the experimental group before and after the intervention.

4.2.2.2 Attitudes to close following

The survey contained several questions about attitudes to close following behaviours. Principle components factor analysis was used to investigate if these scales could be reduced into a small number of underlying factor scores. The assumptions for this analysis were not fully met due to sample size and the analysis was not able to produce a set of distinct factors that were robust and reliable. Due to this, all of the attitude questions were analysed individually using repeated measures ANOVAs. Repeated measures ANOVA is used to examine changes in means within subjects over 2 or more time points. Among these questions, only one repeated measures ANOVA produced significant effects between experimental conditions that were meaningful.

The following question was asked: "I think OTHER DRIVERS drive less than two seconds behind the vehicle in front ...". Participants were asked to answer the questions on a six point scale from 'never' to 'nearly all the time' (0-5).

Significant differences were found between the responses of all participants before and after the intervention. Participants perceived this behaviour as more frequent in other drivers after the intervention (m= 3.74; sd= .12) than before (m= 3.42; sd=.14) (F(1, 43)= 5.77, p = .021, η2 = .11). Also, significant differences were found between the responses of experimental and comparison groups of participants independently of the time point (before and after the intervention). Participants from the experimental group perceived the behaviour as more frequent (m=4.02; sd=.17) than the

comparison group (m=3.14; sd=.15; F(1, 43)= 14.67, p = .000, η2 = .25). No interaction effect was found between time and experimental condition, F(1, 43)= .85, p = .360. It is unlikely that the difference here can be explained by socially desirable responding (as perceiving others as more likely to be close following is not necessarily socially desirable), however it may-be possible that geographical location has played a factor between groups here. All participants within the experimental group primarily drove within the Bristol and surrounding area. This is an area characterised by high traffic density, with three heavily used motorways in close proximity (M32, M4, M5). The comparison group by comparison are likely to have been from across the UK, including areas less heavily congested than Bristol. It is possible that CFB does in reality happen less frequently in those areas. Further research would be required to establish if this is the case.

Table 5: Means and standard deviations of perceived prevalence of CFB in other drivers pre and post the intervention

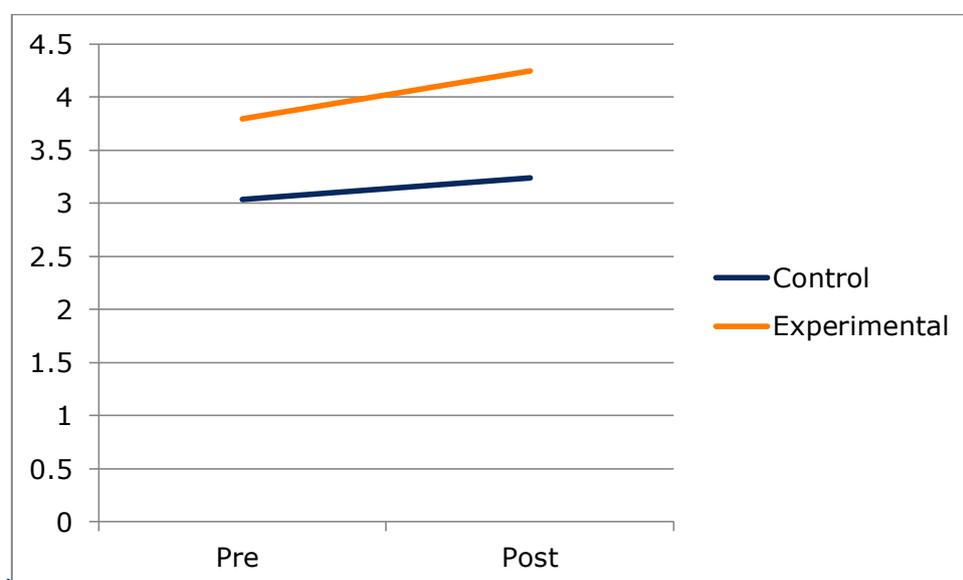|	Pre m*(sd)*	Post m*(sd)*
Control	3.04*(.18)*	3.24*(.16)*
Experimental	3.8 *(.21)*	4.25*(.18)*

Figure 4 Difference in perceptions of prevalence of CFB in other drivers pre and post the intervention.

4.2.3 Results Summary

The qualitative data suggest that self-reported 'triggered' close following behaviour may have been affected by the intervention, with people noting that they felt they had become better at avoiding close following (i.e. increasing their distance) in situations such as when they were running late, experiencing anger, or reacting to someone else cutting in front.

> *"…when I'm chatting with my daughter … I sometimes think of the workshop if I've seen something late in the traffic ahead. It makes me realise I'm distracted, and I increase my attention and maintain a safe distance better". Participant, Bristol City Council*

> *"I noticed when I someone cut me up, where previously I would have gotten angry and aggressively followed at close distance, I now recall the workshop, calm myself down and back off." Participant, Forestry Commission.*

Conversely there was no evidence of any impact of the intervention on self-reported 'usual following distance.

The only significant results from the quantitative analysis were that comparison and experimental participants all showed an increase in their perception of the prevalence of close following behaviour in other drivers between time points, and that there was a difference between the groups in perceived prevalence at both time points. The former effect may suggest that simply completing surveys on close following could increase drivers tendency to notice the behaviour in others drivers. The latter effect can probably be explained by the different geographical areas of the groups.

5 Conclusions and recommendations

The project objectives were to:

1. Develop and pilot a behaviour change approach designed to reduce excessive close following through workplace and business engagement

2. Evaluate the impact of the pilot

3. Understand if 'social unacceptability' messaging is appropriate for use in reducing close following behaviour

4. Understand if specific behaviour tools such as regular prompts can be effective in reducing close following behaviour.

In considering the four main project objectives all four were met. A behaviour change intervention was thoroughly researched, designed and piloted targeting CFB. The impact of the evaluation was evaluated through both quantitative and qualitative methods. Qualitative evaluation indicated that social unacceptability messaging is appropriate for use in reducing close following behaviour. The evaluation also indicated that specific behaviour tools including regular prompts may be effective in reducing close following behaviour relating to specific triggers such as experiencing anger, someone cutting in front of the driver, or being distracted by phone or passengers

Further analysis on the effect size of the quantitative analysis suggests that even if we achieved a significantly larger sample size, the effect based on the current survey method would still be relatively small. It is possible that this is because the survey method here looks at "normal following distance" rather than the context specific CFB highlighted by the qualitative evaluation. It is possible that the intervention is having a more significant impact on "triggered CFB" i.e. specific instances of CFB that are worse than normal, but only a small effect on "normal following distance". To be certain of this further research would be required. This is something TRL hopes to address through continuing this programme in the future and building a larger sample size for further analysis, along with adapted quantitative and qualitative research methods.

In conclusion, a well-researched intervention has been designed and tested, and results indicated that the intervention may have some promise in targeting the underlying factors in close following behaviour, and may impact actual behaviour focussed around specific triggers that are likely to increase the likelihood of CFB at any given point.

Recommendations following the delivery and evaluation of the intervention include:

- Further research into distinguishing between this intervention's impact on general CFB, compared with its impact on tackling CFB triggered by particular factors.

- Further research into the impact and prevalence of each specific trigger of CFB, and into how amenable to behavioural intervention with this type of intervention approach each trigger is.

- Further investment in the development of effective behavioural interventions targeting CFB should be an area of focus for road safety organisations.

- Consideration of survey incentives in future RST funded projects may be helpful in ensuring maximally robust evaluation results.

- Sufficient consideration of the resources required for employee engagement focused projects.

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Appendix A   Evaluation: initial /final survey

N.B. the **initial survey** is shown. The final survey is the same, except for the details in the participant information sheet being updated.

Participant Information Sheet

The Transport Research Laboratory (TRL) is undertaking a research project for the Road Safety Trust (RST). TRL is a research organisation and the RST is a national charity. As part of this project, TRL is surveying attitudes to driving for work.

To participate, we ask you to complete this survey now, and a similar one again in 8-12 weeks. Also, there will be three shorter surveys in between these times.

This survey can be completed online at www.smartsurvey.co.uk/s/RST_S1/. If you are taking part in a workshop, you will be asked to fill it in there. Otherwise, you should have received an SAE. If you want to complete paper surveys, please return them all in the SAE at the end of the project.

Your responses to the surveys will be held securely, in line with the Data Protection Act (1998), and will be anonymous. Only summary data will be included in our project report, and provided to the RST and your employer. Your employer will not see your individual responses to any of these surveys.

If you would like more information, email Samantha Jones at TRL (sjones@trl.co.uk) with the subject "RST PROJECT", or call 07776 993453 .

Consent Form

If you wish to take part, please complete this short consent form to say that you are happy to take part in the research. Please state whether you agree with the following statements:

1. I confirm that I have read and understand the background information for the study and have had the opportunity to ask questions. (Remember you can email sjones@trl.co.uk or call 01543 416416 if you have any questions.)

2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.

3. I agree to take part in the survey.

Yes, I agree with these statements (please tick and continue the survey)

No, I do not agree with these statements (please tick and end the survey)

The below questions will be used to allocate a unique code to you, which retains your anonymity but still permits us to link this survey with later ones that you complete.

1. [   ]   What is your middle initial (if you have no middle initial, write 'x')

2. [   ]   What is the initial of your mother's first name?

3. [   ]   What is the initial of your father's first name?

4. [   ]   What day of the month were you born on?

5. [   ]   How many brothers or sisters do you have?

For the purpose of the following questions, a 'journey' is defined as a period of driving from one location to another (if you had breaks on the way, treat the individual drives combined as the whole journey). A journey undertaken for 'work purposes' is a journey taken as part of your job and <u>does not</u> include commuting.

Below is a list of questions about the <u>last</u> journey you took for <u>work</u> purposes.

6. What time of day did you start your journey?

HH   MM

[   ] : [   ]

7. How long did your journey take?   ……………. hours …………… minutes

8. What road types did you drive on? Tick all that apply.

[ ] Motorway

[ ] Dual Carriageway

[ ] Single Carriageway

[ ] Other (please specify)

[   ]

9. What was the main road type you drove on? Tick one.

[ ] Motorway

[ ] Dual Carriageway

[ ] Single Carriageway

[ ] Other (please specify)

[   ]

10. What was the speed limit of the main road type you drove on? ……………… mph

Still thinking about the <u>last</u> journey you took for <u>work purposes</u>...

Please mark your answer clearly on each scale by circling the relevant point on the line.

Mental demand

    11. How mentally demanding was the journey?

Very low   Very high

Physical demand

    12. How physically demanding was the journey?

Very low   Very high

Temporal demand

    13. How hurried or rushed was the pace of the journey?

Very low   Very high

Performance

    14. How successful were you in accomplishing what you were asked to do (in terms of your driving performance)?

Very low   Very high

Effort

    15. How hard did you have to work to accomplish your level of performance?

Very low   Very high

Frustration

    16. How insecure, discouraged, irritated, stressed, and annoyed were you?

Very low   Very high

17. Describe your emotional state during this journey. Include any factors relating to your journey that affected your emotional state (for example other drivers' behaviour or the condition of the road).

18. Did you experience any near misses during your journey? If yes, please describe what happened and how you felt.

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

		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
a.	Harsher penalties should be introduced for driving too close to the vehicle in front	☐	☐	☐	☐	☐
b.	Driving too close to the vehicle in front is one of the main causes of road accidents	☐	☐	☐	☐	☐
c.	When I see another driver following my vehicle closer than recommended it makes me angry	☐	☐	☐	☐	☐
d.	I have good enough reactions to drive a little closer than recommended to the vehicle in front	☐	☐	☐	☐	☐
e.	It is quite acceptable to drive closer to the car in front than is recommended as long as you concentrate	☐	☐	☐	☐	☐

Below are some questions and statements about distance between vehicles while driving. Please indicate your answers on the scales provided.

20. How easy is it to drive at least two seconds behind the vehicle in front?

Extremely easy					Almost impossible
☐	☐	☐	☐	☐	☐
0	1	2	3	4	5

21. I think OTHER DRIVERS drive less than two seconds behind the vehicle in front …

Never					Nearly all the time
☐	☐	☐	☐	☐	☐
0	1	2	3	4	5

22. How safe or dangerous is it for a driver to drive less than two seconds behind the vehicle in front?

Extremely dangerous					Extremely safe
☐	☐	☐	☐	☐	☐
0	1	2	3	4	5

23. In your last three months of driving how often have you driven less than two seconds behind the vehicle in front?

Never					Nearly all the time
☐	☐	☐	☐	☐	☐
0	1	2	3	4	5

24. Below are some statements about driving for work. Please indicate how much you agree or disagree with each statement.

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
a. When I drive for work, I feel under pressure to reach my destination by a prescribed time	☐	☐	☐	☐	☐
b. On the journey I just took for work, I felt under pressure to reach my destination by a prescribed time	☐	☐	☐	☐	☐

25. *Imagine that you are following the car depicted below. Please circle the number that corresponds to the picture that indicates the distance from the car in front at which you would normally choose to drive. Assume that you are blocked from overtaking, and that the vehicle in front is travelling at 60mph.*

Appendix B   Evaluation: diary survey

N.B. the **first diary survey** is shown. The second and third diary surveys are the same, except for the details in the participant information sheet being updated.

Welcome to the first of three **Journey Diaries.** This is part of the driver behaviour study that you volunteered for. The diary takes the form of a short survey that should take you around 5 minutes to complete. You should already have completed a survey at the start of the project.

It would help us if you complete this survey online at www.smartsurvey.co.uk/s/RST_S2/. However, if you want to complete the paper version, you should also have received an SAE. Please return all completed paper surveys in the SAE at the end of the project.

The study is being run by the Transport Research Laboratory (TRL) and funded by the Road Safety Trust. TRL is a research organisation and the RST is a national charity. As part of this project, TRL is surveying attitudes to driving for work.

If you would like more information about this part of the study, please contact Samantha Jones at TRL (sjones@trl.co.uk) with the subject "RST PROJECT" or call 07776 993453.

The following questions will be used to allocate a unique code to you, which retains your anonymity but still permits us to link this survey with later ones that you complete.

1. [ ] What is your middle initial (if you have no middle initial, write 'x')

2. [ ] What is the initial of your mother's first name?

3. [ ] What is the initial of your father's first name?

4. [ ] What day of the month were you born on?

5. [ ] How many brothers or sisters do you have?

For the purpose of the following questions, a 'journey' is defined as a period of driving from one location to another (if you had breaks on the way, treat the individual drives combined as the whole journey). A journey undertaken for 'work purposes' is a journey taken as part of your job and underline does not include commuting.

Below is a list of questions about the <u>last</u> journey you took for <u>work purposes</u>.

6. What time of day did you start your journey?

  HH   :   MM

  ☐ : ☐

7. How long did your journey take?   ……………….. hours   ……………… minutes

8. What road types did you drive on? Tick all that apply.

☐ Motorway

☐ Dual Carriageway

☐ Single Carriageway

☐ Other (please specify)

☐

9. What was the main road type you drove on? Tick one.

☐ Motorway

☐ Dual Carriageway

☐ Single Carriageway

☐ Other (please specify)

☐

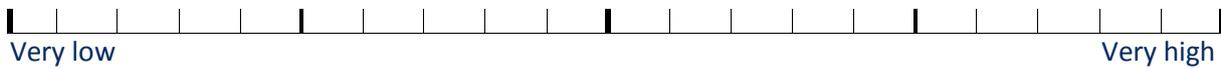**10. What was the speed limit of the main road type you drove on?**

mph

Still thinking about the <u>last</u> **journey you took for** <u>**work purposes**</u>**...**

Please mark your answers clearly on the scale by circling the relevant point on the line.

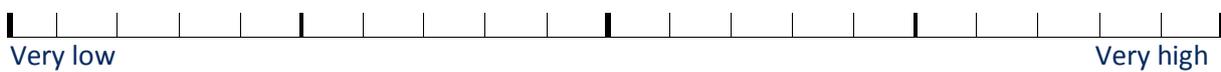**Mental demand**

11. How mentally demanding was the journey?

Very low   Very high

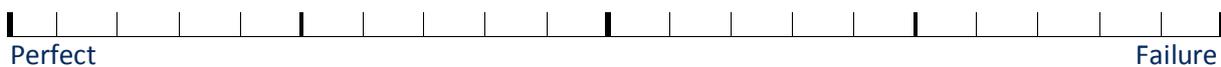**Physical demand**

12. How physically demanding was the journey?

Very low   Very high

Temporal demand

13. How hurried or rushed was the pace of the journey?

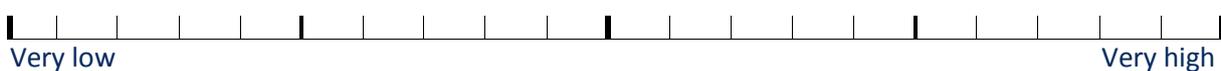Very low   Very high

Performance

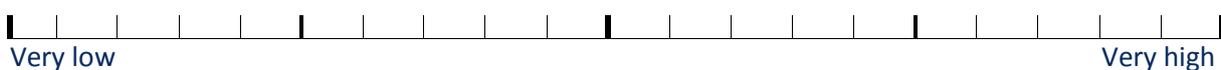14. How successful were you in accomplishing what you were asked to do (in terms of your driving performance)?

Perfect   Failure

Effort

15. How hard did you have to work to accomplish your level of performance?

Very low   Very high

Frustration

16. How insecure, discouraged, irritated, stressed, and annoyed were you?

Very low   Very high

17. Describe your emotional state during this journey. Include any factors relating to your journey that affected your emotional state (for example other drivers' behaviour or the condition of the road).

18. Did you experience any near misses during your journey? If yes, please describe what happened and how you felt.

19. Below are some statements about driving for work. Please indicate how much you agree or disagree with each statement.

		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
a.	When I drive for work, I feel under pressure to reach my destination by a prescribed time	☐	☐	☐	☐	☐
b.	On the journey I just took for work, I felt under pressure to reach my destination by a prescribed time	☐	☐	☐	☐	☐

20. For the main road type from your journey (see your answer to question 9), use the pictures below to indicate the closest distance at which you followed the vehicle in front of yours whilst traveling at speed. Please circle the number that corresponds to the picture that indicates this distance.

If the road was heavily congested, indicate the distance that you would have followed at if you were driving in free flowing traffic.
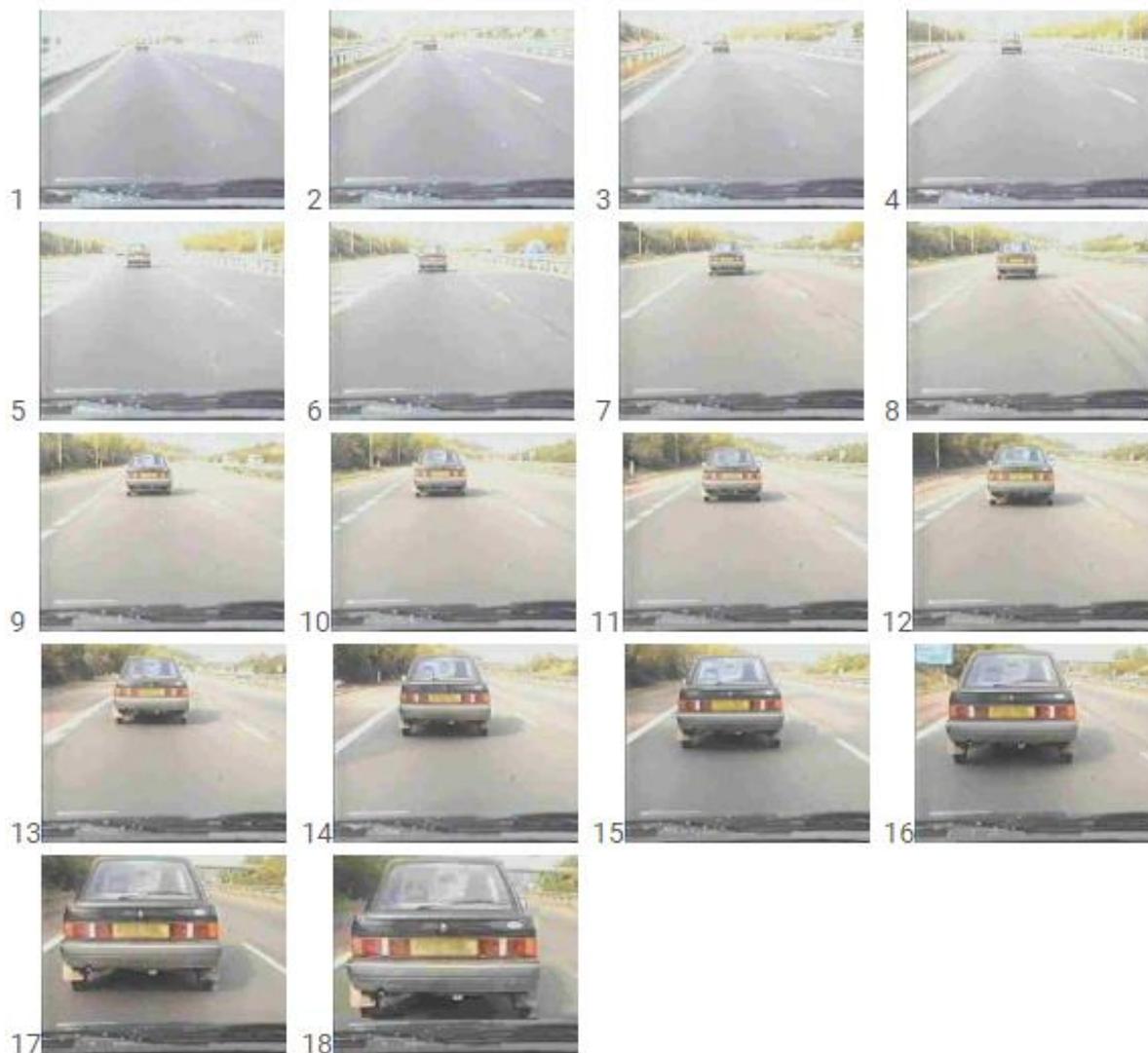
Development and Pilot of a Business Travel Focused Intervention Addressing Close Following Driving Behaviour

Close following or 'tailgating' behaviour is known to frustrate and irritate drivers, and is known to be linked to collision risk. This study undertook a literature review of the factors underlying the behaviour, and then considered ways in which it might be targeted by an intervention aimed at reducing its likelihood in those driving for work (a known high-risk group, which is also easily reached through safety briefings). An intervention was designed; this included a group discussion exercise and consideration of locus of control, speed and distance perception, adaptation, emotional triggers and coping, cognitive workload and time pressure in work-related driving, external factors such as weather, and social norms. Several specific behaviour change techniques were also used, including social contracts, implementation intentions, point of choice reminders, and measurement and feedback. 157 participants completed an initial survey measuring attitudes to close following and self-reported prevalence, and then 78 of these undertook the intervention. A survey administered after the intervention was completed by 27 of the intervention group, and 30 of the 'control' group. Qualitative data from participants showed generally a positive response to the intervention, although no statistically significant changes in attitudes or self-report could be attributed to the intervention. Both groups showed a greater awareness of close following behaviour in other drivers between the survey points, suggesting that completing the survey raised awareness of this important behaviour.