INDICATIONS OF HIGH LEVELS OF INATTENTIVE AND DISTRACTED DRIVING IN SOUTH AFRICA

***VENTER, K, *LABUSCHAGNE, F.J.J., PHASHA, S., GXOWA, M., and KHOZA, S**.
*CSIR Built Environment, Transport Systems and Operations
PO Box 395, Pretoria, 0001 Tel: 012 841 3856, email: Kventer@csir.co.za.
Road Traffic Management Corporation, Research and Development Branch Private Bag 147, Pretoria, 0001 Tel: 012 999 5200, email: Deonr@rtmc.co.za.

ABSTRACT

In 2015, the Road Traffic Management Corporation undertook a pilot study to investigate how prevalent driver inattention and distraction is in South Africa. Driver inattention and distraction is the leading factor in near-crashes in for instance the United States of America where indications are that 65 per cent of near-crashes involve some form of driver inattention within three seconds before an incident. This pilot project interrogated a small sample (non-representative) of naturalistic driving data collected from four drivers over a period of six months to explore whether or not South Africans are prone to distracted driving. Preliminary indications are that inattentive and/or distracted driving, including mobile phone use, distraction by passengers and other in-vehicle behaviours are indeed prevalent. In the majority of the data analysed, all drivers showed signs of general inattention and at least one type of distracted driving behaviour. The frequency with which these behaviours occur seems to be high, leading to the question whether inattentive driving has become the norm rather than the exception for South African drivers. The findings substantiate the need for a much larger study that could explore the problem on a national level.

1. BACKGROUND

The Road Traffic Management Corporation (RTMC) as custodian of road safety in South Africa needs to align research and interventions that will reduce the number of crashes on the country's roads. Human factors are considered a leading cause of road traffic crashes, said to account for between 80 per cent and 90 per cent of fatal road traffic crashes in South Africa (Botha, 2005; Gainewe et al., 2010). Previous human factors research that relates to drivers in South Africa consisted of studies that include offences previously monitored by the RTMC on a national level (Gainewe et al., 2010) as well as research topics such as impaired driving (Meel, 2008), occupant protection (Van Hoving et al., 2014), and speeding (Bester et al., 2007; Chrisholm et al., 2012).

2. INTRODUCTION

2.1. Distracted and inattentive driving

Internationally, the role that inattention and distraction play in crashes and near-crashes has received much attention. This is partly due to in-vehicle technologies such as wireless communication, infotainment and driver assistance systems becoming more commonplace. Indications are that with these technologies, the incidence of distraction-

related crashes has escalated and more prevalent (Young et al., 2007). Other behaviours that contribute to driver inattention and distraction include eating and drinking while driving, interaction with passengers (Just et al., 2008) and passenger influences (Strayer et al., 2007; Young et al., 2007) as well as listening to music (Ünäl et al., 2012).

Inattentiveness while driving is difficult to determine due to the fact that fatigue, drowsiness and highway hypnosis are also considered as inattentive driving and difficult to observe (Young et al., 2007; Stelling et al., 2012). Inattention is associated with a lack of situational awareness, in other words, not being aware of potential risks in your traffic environment and is thus unable to appropriately respond to these risks (Young et al., 2007; Stelling et al., 2012). Driver distraction, on the other hand, is defined as a specific type of driver inattention that occurs when a triggering event induces an attentional shift away from the primary task, in this case driving (NHTSA, 2014; Horberry et al., 2006). Anything that diverts the driver's attention away from the primary task of safely navigating the vehicle is driver distraction and include multi-tasking or engaging in secondary activities while driving (Salvuci, 2002). A concern highlighted in the literature is that despite the large body of research that has emerged on inattentive and distracted driving in the last decade, there are still no universal definitions agreed upon (Regan et al., 2011).

2.2. Relationship to crashes and near-crashes

In 2011 the World Health Organisation (WHO) and the National Highway Traffic Safety Administration (NHTSA) indicated that worldwide the proportion of drivers making use of mobile phones while driving has increased from 1 per cent to 11 per cent in the last five to ten years (Burton, 2011). Driver inattention according to the NHTSA (2014) is the leading factor in most crashes and near-crashes in the United States of America (USA). Nearly 80 per cent of crashes and 65 per cent of near-crashes involved some form of driver inattention within three seconds before the event (NHTSA, 2014). Other countries also report similar statistics (table 1).

Table 1: The role of distraction in crashes in countries other than the USA

Country	Contributory factor in injury and fatal crashes
Australia	14 per cent of crashes where drivers were hospitalised but not killed in the crash were attributed to distraction (Beanland et al. 2013).
New Zealand	10 per cent of fatal crashes and 9 per cent of injury crashes caused by distraction (WHO and NHTSA, 2011).
Netherlands	8.3 per cent crashes resulting in fatalities were due to mobile phone usage (SWOV factsheet, 2012).
Spain	37 per cent of all crashes were caused by distracted driving (WHO and NHTSA, 2011).
Canada	10.7 per cent of fatal crashes caused by distracted driving (WHO and NHTSA, 2011).
Great Britain	2 per cent of crashes are attributed to driver distraction (Burton, 2011).
Columbia	9 per cent of all crashes attributed to distraction and 21 percent of crashes involving pedestrian fatalities (WHO and NHTSA, 2011).

2.3. Types of driver distraction

Sources of distraction can reside inside or outside the vehicle (DaCoTA, 2012). It can be technology- or traffic-related, self-initiated or imposed upon by the situation or circumstances (DaCoTA, 2012). Activities that impact on a driver's ability to focus on the road vary from visual distractions inside and outside the vehicle, to cognitive and physical

distractions within the vehicle (Victor et al., 2014). Pulling drivers' visual attention away from the road and the driving task, dilute the drivers' ability to maintain a safe driving position and to react to potential hazards within the road environment. Liang (2009) describes visual distraction as "eye-off-road", and cognitive distraction as "mind off-road".
Lee et al (2005) stipulates that any secondary task can have combinations of manual, visual, and cognitive components at different levels. With a visual task, the lowest level requires drivers to take their eyes off the road, the next level requires them to turn their head, and the highest level requires them to shift their entire body. On the other hand, the lowest level of a manual task requires drivers to take a hand off the wheel. Secondly, to move their entire arm while the highest level requires them to move/turn their body. The cognitive component of a task also has varying levels ranging from no thought to simply listening and comprehending to selecting a response based on incoming and recalled information (Lee et al., 2005).

2.4. Driver distraction and its influence on driver performance and safety

In-vehicle distractions include using electronic equipment while driving, talking to passengers, grooming as well as eating and drinking. Any engagement in the secondary tasks listed above influence driving performance negatively because the driver divides his attention between the driving task and the secondary activities (Stutts et al., 2003; Horberry et al., 2006). International research related to distracted driving behaviour revolve around talking on a telephone (either hand-held or hands-free) while driving (Caird et al., 2005; Peisner et al., 2011); texting (Breen, 2009; Leung et al., 2012), passenger distractions (Stutts et al., 2003; Drews et al., 2008) and grooming, eating or drinking while driving (Stutts et al., 2003). All of these activities contribute to degradation in driving performance.

2.5. Factors influencing driver distraction

Research highlights that young and novice drivers tend to engage more in distracting driving activities than experienced drivers which result in novice and young drivers being more at risk of being involved in a distracted driving related crash (Stavrinos et al., 2011; Brace et al., 2008). Experienced drivers are less likely to be involved in distracted driving crashes and but when they do engage in secondary activities their reaction times seem to be slower (Victor, 2000; Singh, 2010). Novice and young drivers on the other hand have not yet gained the experience to drive safely and distractions such as that posed by passengers (Foss et al., 2014). Research has also established that female drivers are more distracted while talking on a cell phone and make more driver errors when driving distracted, compared to male drivers that experience more distraction when there are passengers in the vehicle (Singh, 2010; Irwin, 2011).

Outside distractions include roadside advertisements (Young et al., 2007; Chattington et al., 2009); moving billboards (Roberts et al., 2013). Additional sources of external distraction include a driver dazzled due to the sun or other vehicles' headlights, checking for traffic and other road users, trying to find a location, scenery and looking at people or animals next to the road (Baird et al., 2011). Although most studies agree that distraction causes a higher risk of a crash, there seems to be little agreement about the exact size of the effect (Stelling et al., 2012). Nevertheless, distraction affects essential aspects of road users' performance (Stelling et al., 2012). Talking on a telephone while driving has been proved to significantly reduce reaction time (Breen, 2009), speed control (Burn et al, 2002; Mayhew et al., 2013) as well as maintaining lane position (Mayhew et al., 2013). Similarly, engaging in a conversation with a passenger leads to slower reaction times, increases in

following distance and difficulty in keeping the vehicle on the road (DaCota review, 2012). Stelling et al (2012) highlight that distracted drivers fail to see visual information and cues when they take their eyes or their minds of the road. Distracted drivers tend to look straight ahead for longer time periods; do not consider their immediate (peripheral) environment often enough; looks at the dashboard and in the mirrors less frequently and the drivers' reaction times increase along with displays of late and abrupt braking (Vlakveld et al., 2006).

2.6. Evidence of distracted driving in South Africa

South Africa is no exception to technology developments and according to Nielsen in southern Africa (2011); more South Africans have access to mobile phones than to drinking water. Despite MYBroadband (My Broadband 2015) reporting that 25 per cent of crashes in South Africa are related to the use of mobile phones, little formal research related to the prevalence of distracted driving has been published. Indications from the private sector are that distracted driving is probably a major problem in South Africa. Discovery Insure indicated that through its Discovery Insure Driving Challenge (DIDC) programme, the data collected shows that on average a single instance of mobile phone usage in South Africa represents approximately of 52 seconds of distracted driving (MyBroadband, 2015). The Company indicated that when driving at 60 km/h this few seconds is equivalent to driving blind and makes crashes four times more likely to occur. In addition, the research found that the worst 20 per cent of offending South African drivers use their phones for an average of three minutes per trip (My Broadband, 2015).

2.7. Methodologies

Traditionally research methods for studying inattention and driver distraction include crash database analysis (Stutts et al., 2001; Beanland et al., 2013); self-report studies (Goodwin et al., 2014) and simulator studies (Beede et al., 2006; Kun et al, 2007; Kass et al., 2007). The use of instrumented vehicles to collect behavioural data within the context of the road, the vehicle and the traffic environment are more recent attempt to study human behaviour. These methodologies are costly and extremely resource intensive (Muronga and Venter, 2014). Although there are debates regarding the reliability of the information (due to the manner in which drivers respond to the instruments in the vehicle) there seems to be some consensus that the rich contextualised data aids in a better understanding of the type of behaviours that precede a crash or near-crash (Bekarius et al., 2011; Victor et al., 2015).

3. OVERVIEW AND SCOPE OF THE STUDY

3.1. Purpose of the study

The RTMC executed a three month pilot study to determine whether inattentive and distracted driving can be quantified as part of everyday driving in South Africa. The investigation of inattentive and distracted driving is a commencement of research aimed at exploring the potential extraction of useful information from available naturalistic driving data. The results of the investigation will lead to the scoping of an expanded naturalistic driving study for research of various driver behavioural themes on a larger scale in South Africa. The purpose of this study was thus to interrogate a small sample of existing available data, specifically in search of evidence of inattentive and distracted driving practices.

3.2. Research questions

- Is there evidence of distracted driving in previously collected naturalistic driving data?
- What is the significance thereof and does it warrant further investigation into distracted driving?

3.3. Methodology

Naturalistic Driving Studies (NDS) refer to the discreet observation of driving behaviour in a natural driving setting or environment (Van Schagen et al., 2012; Bekarias, 2011). It is a novel approach to the way that road safety research can be conducted in South Africa as the methodology enables researchers to study driver behaviour in the context of the driving task and road environment as well as inform about driver actions preceding crashes or near crash events. The underlying assumption of this approach is that driver behaviour will not be significantly altered while observed over the long term and that such studies therefore reflect natural driver behaviour over time.

This study made use of NDS data previously collected from four individual drivers (two experienced and two novice drivers). The second week of driving data for each of the four drivers were selected as the reasoning was that by the second week of driving with the instrumented vehicles, the drivers should have been more comfortable with the equipment in the vehicle and their behaviour should have returned to normal. The selected imagery was transcribed and analysed in qualitative analysis software (MaxQDA©). A predefined coding scheme (based on literature review) was used for the analysis of activities related to in-vehicle distractions. This analysis was matched to the vehicle data collected for the corresponding driving periods. Approximately 7.4 hours of data were analysed. The data were analysed according to the type of driver (experienced *vs.* to novice drivers) as well as per potential distracted driving activity. Distracting activities are described in terms of the proportion of time, the frequency with which it occurs. In an attempt to contextualise "normal" in comparison to "distracted" use was the average speed was compared to the speed while engaging in the secondary activity. The findings are then compared with international trends.

3.4. Limitations of the research

The analysis made use of historical data. The findings therefore do not reflect current road and traffic behaviour or conditions. The original sample size was also too small to make any inferences to a general South African population. The ND methodology is resource intensive and due to time constraints, only a fraction of the data collected in the previous study was analysed.

4. **SUMMARY OF KEY FINDINGS**

4.1. Evidence of distracted driving practices from inside the vehicle

4.1.1. Introduction

Driver distraction is any activity that diverts the attention away from the primary driving task. Observations indicated that the drivers did engage in secondary activities while driving although the frequency and manner in which they did so differed. Multi-tasking or engagement in more than one secondary activity at one time was present in approximately a third of the data analysed. Some secondary activities were observed for all the drivers while other only for some drivers. Identifying a lack of attention is more problematic as it is

not always a visible behaviour, but could be a form of mental absenteeism. In-vehicle distractions included dining, grooming, person or object related activities, possible distractions due to controls of the vehicle as well as passengers distracting the driver. Other distractions that were observed to a lesser extend included seatbelt behaviour as well as smoking behaviour, which was only observed for one driver. In South Africa wearing of a seatbelt is compulsory. Not wearing a seatbelt is not considered a distraction but the action of adjusting the seatbelt (fasten/unfasten) could potentially be.

4.1.2. Person- or object-related distractions

Observations for 'person- or object-related' distractions were made for all the drivers. Looking down at something was the most frequent activity. International research has found a clear relationship between in-vehicle activities such as looking down or reaching for something in the vehicle and the likelihood of being in a crash. Crash risk increases significantly when eyes are diverted away from the roadway for more than 2 seconds, in this research it was found that the average time of looking down for one of the drivers was almost one minute (Klauer et al., 2006; Singh, 2010). Foss et al. (2014) states that reaching for an object in a vehicle increases risk of being involved in a crash by 1.4 times. Reaching for an object in the vehicle increases crash risk by 3 times according to the Virginia Tech Transportation Institute (Klauer et al., 2006). All drivers reached for objects in the vehicle at least once. International research has illustrated that in general reaching for something within the vehicle while driving, leads to slower speeds, larger following distances and events where the driver do not have any eyes on the road (Stelling et al., 2012). The pilot study findings indicate that two of the drivers slowed down significantly compared to their normal driving speeds, one driver drove at the same speed and the last driver drove faster than on average.

4.1.3. Dining while driving

Eating while driving was the most frequent activity coded for dining and lasted the longest. Three of the drivers took part in eating, which on average took between 3 and almost 5 minutes to complete eating. Drinking was the second most prevalent dining activity and drivers on average took between 2 and 24 seconds to complete the action. Klauer et al. (2006) considers eating as a moderate secondary task that doubles crash risk. Stutts et al. (2003) found that eating and drinking lead to greater deviations from lateral position, lower speed and more crashes and near crashes.

4.1.4. Mobile phone use while driving

Electronic device distraction is a physical as well as visual and auditory distraction (NHTSA, 2012). Talking on a mobile phone impairs a drivers' ability to maintain an appropriate speed and hampers a driver's ability to safely react to hazardous situations because a driver is distracted auditory, cognitively as well as physically (Caird et al., 2005; Strayer et al., 2007; Mayhew et al., 2013).

Only the experienced drivers conversed on their cell phones while driving. Only one of the experienced drivers spoke on a hand–held-cell phone twice, the longest duration being twelve minutes. Both experienced drivers made use of a hands-free-set. Average time talking on the hands-free set ranged between 42 and 82 seconds. The average speed while talking on a handheld cell phone was 62km/h compared to talking on a hands-free set (65 km/h). Horberry et al. (2006) indicate that talking on a cell phone while driving reduces driver performance and that this deterioration of performance increases with age.
Research however also indicates that risk related to talking on a cell phone (handheld) and using a hands-free-set are not different (Brace et al., 2007).

Texting was observed for all drivers, however one of the novice drivers engaged in the activity more frequently. The average time spent on texting by the novice driver was much less, than the time that experienced drivers spent on texting. Research related to the negative impact that texting while driving has on safety performance is well documented and include slower braking times (Leung et al., 2012), poorer vehicle control (Petzoldt, 2011) and poor hazard perception and reaction times (Hosking et al., 2009; Leung et al., 2012; Peissner et al., 2011). With the exception of the one experienced driver, all the other drivers reduced their speed while interacting with cell/mobile phones in the vehicle.

4.1.5. Passengers

For the purpose of this study coding "passengers as a distraction" included behaviour such as looking at a passenger (physical distraction) and talking (cognitive/auditory distraction) to a passenger (NHTSA, 2014; Singh, 2010). Passengers as a distraction made up the largest proportion of driving time and constituted 5.37 per cent of the total driving time. Passenger distractions are the activity that drivers allocated most of their time to, however, research has indicated that passenger distractions do not interfere with driving as much as mobile phone conversations do, because drivers are better able to synchronize the processing demands of driving with in-vehicle conversations than with cell-phone conversations (Strayer et al., 2007; Drews et al., 2008). Rather than only being a distraction, talking to a passenger is also a primary cause of driver inattention (Klauer et al., 2006; Dong et al., 2011). According to Regan et al. (2011) talking to a passenger is an example of driver-diverted attention, which implies that the driver has to deal with competing activities (driving task vs. talking). This influences driving performance negatively. Driving with passengers is an everyday occurrence and there might be a need to quantify the acceptable levels and dangerous levels of risk that passengers might hold in distracting the driver. However, when driving with passengers in the vehicle, all of the drivers drove slower than when driving on their own.

4.2. What constitute normal driving in South Africa?

"Normal driving" made up the bulk of the driving behaviour for most of the time. However, the amount of time spent on "normal" driving differed among the drivers. Currently there doesn't seem to be any guideline internationally as to what constitutes "normal driving" and the possibility exists that normal driving in South Africa might be different than "normal driving" elsewhere in the world. It is implied that normal driving as is represented in the sample of data may contain attributes to be construed as abnormal is comparison to normal driving in countries that are more road safety conscious. During the coding process it became evident that "normal driving" does co-occur with other types of secondary activities. An example would be in instances where the driver is conversing with a passenger while looking at the road and controlling the vehicle with both hands on the steering wheel. Initially it was thought that it would be possible to identify distraction based on the vehicle parameters cited in the literature (g-force events). However, after interrogating the vehicle data based on these parameters no evidence of these g-force events were found for the specific driving period. This is despite the fact that when the image material were analysed, there were evidence of secondary activities that are associated internationally with specific divergences in the vehicle parameters such as lateral deviations. This raises a question as to whether or not South African drivers are so used to driving while engaging in secondary activities that the inattentive behaviour has become the norm rather than the exception. This project, however, was not large enough to test such a hypothesis and future research should consider exploring what constitutes normal driving and possibly establish a baseline and criteria for what is considered normal driving.

5. CONCLUSIONS

The research established that secondary activities with the potential to distract attention away from the driving task were indeed present for all the drivers. However, the extent to which drivers engaged with secondary activities differed in frequency and duration. To determine the exact nature and impact of these behaviours on a South African driver population a much larger, more representative and culturally diverse sample will be needed. Internationally it has been well recognized that distracted driving practices are a primary cause of crashes and near-crashes. This study contributes to a baseline understanding of what constitutes normal as well as distracted and inattentive driving in South Africa. Currently, only mobile phone use while driving is considered as problematic in South Africa. However, from the findings it is clear that drivers do engage in other types of secondary activities while driving. The frequency with which these activities occurred as well as the amount of time spent on them could potentially be more distracting and dangerous than mobile phone use when driving. Even though this study is not representative of the general South African driving population, it has shown that it is possible to quantify driving behaviour in South Africa with the ND methodology and that a larger investigation is warranted and necessary to understand the role that distraction play in crashes and near-crashes. This study therefore represents a stepping-stone for future human factor research to curb the road safety problem in South Africa.

6. RECOMMENDATIONS

This RTMC project, as part of a larger research and development plan, aims to intensify and renew the focus behavioural research in the country. In order to make meaningful inferences about road safety topics such as distracted driving, a larger study representative of different demographics could prove valuable in making strides to understand driver behaviour in the context of South Africa. Findings from a representative study will assist in making informed decisions regarding for example law enforcement activities and could potentially inform the development of targeted road safety campaigns aimed at changing driver behaviour.

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