Accident Analysis and Prevention 108 (2017) 201–208

Contents lists available at ScienceDirect

Accident Analysis and Prevention

journal homepage: www.elsevier.com/locate/aap

Full length article

Is there an observational effect? An exploratory study into speed cameras and self-reported offending behaviour

J. Freeman*, S-A. Kaye, V. Truelove, J. Davey

Queensland University of Technology (QUT), Centre for Accident Research and Road Safety – Queensland(CARRS-Q), 130 Victoria Park Road, Kelvin Grove, 4059, Australia

ARTICLE INFO

Keywords:
Speed cameras
Speeding
Exposure
Deterrence and age

ABSTRACT

Fixed and mobile speed cameras are an important element of enforcement initiatives designed to create a strong deterrent effect and improve road safety. Despite the widespread use of the technology and the need to create a strong deterrent effect, research has yet to determine if there is a relationship between levels of exposure to the devices and subsequent self-reported deterrent effects. As a result, licensed motorists (N = 536; 51% female) in Queensland (Australia) were recruited to complete a questionnaire that measured exposure to speed cameras and associated offending behaviours. Data were analyzed utilising descriptive, bivariate and multivariate statistics. The key findings that emerged were: the sample reported a higher level of exposure to fixed cameras (even though there are more operational mobile cameras), younger males were most likely to speed and be observant of speed cameras and that perceived certainty of apprehension was the largest reported deterrent force. However, a positive (rather than negative) relationship was found between perceived camera exposure levels and speeding behaviours, which indicates a range of additional factors (both legal and non-legal factors as well as driving exposure levels) influence speed limit non-compliance. Furthermore, multivariate analysis revealed that higher levels of perceptual certainty were associated with general speed compliance and perceptions of the severity and swiftness of sanctions, rather than levels of self-reported camera exposure. This paper is the first to reveal that while motorists prone to speed may be more cognisant of speed camera operations, this in itself does not ensure appropriate behaviour modification.

1. Speeding behaviour

Violating speed limits has been consistently demonstrated to increase crash risk as well as the severity of injuries associated with crashes (Fleiter and Watson, 2006; Petridou and Moustaki, 2000). In essence, it remains one of the largest contributors to the Australian road toll (BITRE, 2016). Despite this, speeding behaviour remains socially acceptable among some subgroups, and as such, a sizeable proportion of drivers still continue to speed (Fleiter and Watson, 2006; Job et al., 2013). For example, the 2013 Australian community attitudes to road safety survey, revealed that while 89% of the 1500 respondents reported that a crash at 80 km/h was more severe than a crash at 70 km/h, 5%[1] reported that they always, nearly always, or mostly drive at 10 km/h over the speed limit and 65% reported that they sometimes or occasionally drive at 10 km/h above the posted speed limit (Petroulias, 2014). Similar findings were reported 10 years earlier in the 2003 Australian community attitudes to road safety survey (Pennay, 2004). These findings highlight the importance of implementing effective countermeasures to reduce speeding behaviour and reduce the significant road toll associated with such violations. Speed cameras are one such approach that have been increasingly implemented.

2. History of speed camera

Speed cameras have been adopted in many counties worldwide in a coordinated effort to identify, apprehend and deter offenders as well as promote general rule compliance. In Australia, for instance, mobile speed cameras were first trialled in Victoria in 1985, and were operational throughout the rest of Australia from the early-to-late 1990s (Delaney et al., 2005a,b; Newstead and Cameron, 2003). In Britain, mobile speed cameras were first operational in 1991 (Delaney et al., 2005a,b) and in New Zealand, mobile speed cameras were introduced in 1993 (Tay, 2000). Since this period of time, the approach has evolved to now incorporate both mobile and fixed approaches. Mobile cameras are implemented by traffic camera operators, either from inside a stationary police van or inside a stationary vehicle which is not

* Corresponding author.
E-mail addresses: je.freeman@qut.edu.au (J. Freeman), s1.kaye@qut.edu.au (S.-A. Kaye), verity.truelove@hdr.qut.edu.au (V. Truelove), j.davey@qut.edu.au (J. Davey).
[1] These figures were based on drivers who had driven within in past two years (n = 1365).

http://dx.doi.org/10.1016/j.aap.2017.08.020
Received 10 March 2017; Received in revised form 3 July 2017; Accepted 15 August 2017
Available online 12 September 2017

identified as a police van, or from a hand-held device on the side of the road. As such, mobile cameras provide an opportunity to randomise and/or tailor police enforcement initiatives to high risk locations (Cameron and Delaney, 2008; Delaney et al., 2005a,b). In contrast, fixed speed cameras are permanently installed at specific locations and were adopted by all Australian States and Territories by late 2000. Fixed cameras can be signed or unsigned, however and due to media attention and location information provided on speeding tickets, the locations for unsigned fixed cameras do not remain concealed for long. Fixed speed cameras are often located on high-risk roads such as blackspots and tunnels; (Queensland Government, 2014) and information on the specific camera sites are displayed on Government websites (e.g., see Queensland Government, 2016) in order to promote a general deterrent effect (see Section 4). Mobile and fixed speeding cameras can be operated in either an overt (e.g., visual cameras) or covert (e.g., hidden cameras) manner (Bates et al., 2012). It is noted that hidden cameras (e.g., overt) can also promote a general deterrent effect (even if unseen) simply by increasing motorists' perceptions regarding the likelihood of being apprehended (if motorists are aware that overt policing operations are undertaken in the area). In regards to speed camera operations in Queensland, speed camera enforcement operations usually involve a variety of vehicles (e.g., sedan, van and 4WD), overt and covert operations are not usually accompanied by direct signage (although general warnings about speed camera operations may be installed in an area) and portable cameras are usually installed in unmarked vehicles. It should be noted that substantial variances in operations exist between jurisdictions in Australia.

In addition to mobile and fixed cameras, point-to-point cameras were introduced in Australia in 2007 and these cameras measure a driver's average speed between two specific points on the road (Soole et al., 2013). If the driver's average speed surpasses that of the legal speed limit between the camera's start and end points, then the information of the vehicle and offence are recorded (Soole et al., 2013). Point-to-point technology is a relatively new concept and only operates at a small number of locations in Australia.[2] In the current study, point-to-point enforcement techniques are included in the "fixed camera" aspect of the current study.

3. Effectiveness of speed cameras

A number of reviews of speed camera operations have provided support for the effectiveness of the approach to reduce crashes and associated injuries and fatalities (Pilkington and Kinra, 2005; Wilson et al., 2010). For example, Pilkington and Kinra (2005) reviewed 14 studies which examined the effectiveness of fixed, mobile, and a combined of fixed/mobile speed camera. The findings from the review highlighted that speed cameras resulted in crash reductions (5–69%), reductions in injuries (12–65%), and reductions in fatalities (17–71%). In addition, Wilson et al. (2010) reviewed 35 studies which had utilised repeated measure designs to assess the potential effectiveness of mobile and fixed speed cameras. The review found that of the studies which had examined speed outcomes, all had reported a reduction in speed post-camera installation. Further, all studies had reported reductions in all types of crashes, with an average reduction of 11% (500 m from the camera site) and 13% (1 km from the camera site) for more serious crashes (e.g., those resulting in serious injuries or fatalities). In regards to the Queensland context, Newstead and Cameron (2003), examined the effectiveness of mobile speed cameras from May 1997 to June 2001 and reported fatal crash reductions of 45% and a reduction in all crashes by28% within 2 km of the mobile speed camera sites. However it should be noted that these evaluations do not take into account specific biases (such as regression to the mean) and the broader background trend in safety improvements (e.g., road infrastructure), particularly in regards to reductions in fatalities. Research has also yet to determine if fixed or mobile camera operations create the strongest general deterrent effect (briefly outlined below) nor how much exposure is required to create a lasting effect.

4. Promoting speed limit compliance with deterrence

Deterrence theory remains the foundation of many road safety countermeasures designed to improve road safety. Deterrence theory consists of two types of processes: general deterrence and specific deterrence. *General deterrence* proposes that offending behaviours will be reduced if the population consider associated penalties to be certain, severe, and swift (Davey and Freeman, 2011; Freeman and Watson, 2009; Homel, 1988; Taxman and Piquero, 1998). Mass media campaigns warning drivers' of the penalties associated with illegal behaviour (e.g., speeding behaviour) and visible law enforcement approaches are vital to maximise the effectiveness of *general deterrence* (Elvik and Christensen, 2007; Taxman and Piquero, 1998; Vingilis and Salutin, 1980). *Specific deterrence*, however, proposes that individuals who have previously been apprehended for illegal behaviour will avoid further reoffending due to previously experiencing direct punishment associated with their conviction, such as fines or licence loss (Homel, 1988).

While deterrence-based initiatives have proven extremely successful in reducing the prevalence of road rule violations, particularly within the drink driving domain (Homel, 1988; Watson et al., 2005), a number of outstanding questions remain regarding methods to enhance deterrent effects in order to maximise rule compliance. In the current case, this endeavour is particularly important given the above reviewed research that indicates: (i) a sizeable proportion of motorists continue to speed and (ii) speeding remains one of the largest (if not the largest) contributor to the road toll. Arguably of most importance is the question of how much exposure to deterrent-based enforcement (e.g., speed cameras) is needed to create a strong deterrent effect. It has long been proposed that drivers need to be constantly exposed to deterrence-based messages in order for a strong deterrent effect to be sustained (Homel, 1988). However, it remains unknown how much exposure to speed cameras actually influences: (a) perceptions of apprehension certainty and (b) subsequent compliance with posted speed limits. This may be considered a significant oversight given the tremendous amount of police resources required to maintain speed camera operations as well as the need to implement targeted and effective deterrence-based strategies to maximise the impact of speed cameras. More broadly, the sizeable body of research that has focused on models of learning and experimental psychology has demonstrated the importance of frequent exposure to stimuli in order to create behavioural change (Nagin and Pogarsky, 2001). However, this knowledge has not been transferred to the road safety domain. As a result, the current study aims to:

1. Determine the frequency of a group of urban motorists perceived exposure to fixed and mobile speed cameras;
2. Explore what level of exposure (and what personal characteristics) influences compliance with speed limits; and
3. Examine the effect such exposure has on levels of perceptual certainty of apprehension.

5. Method

5.1. Participants

South Eastern Queensland motorists (N = 536) were recruited via an online advertisement and a snowballing technique to take part in this study. The participants (51% female and 49% male) were aged

[2] In the State of Queensland, Australia, where the current study was undertaken, there are 3 point-to-point speed camera locations, 16 fixed speed camera locations (excluding combined red light and speed camera locations), and an active deployment of mobile speed cameras (Queensland Government, 2016).