Centre for Automotive Safety Research

Mobile phone detection cameras in South Australia

CASR225

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Report documentation

REPORT NO.	DATE	PAGES	ISBN	ISSN
CASR225	January 2024	26	978-1-925971-58-3	1449-2237

Title

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Performing Organisation

Centre for Automotive Safety Research
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Funding

This research was funded via a deed with the South Australian Government

Available From

Centre for Automotive Safety Research; http://casr.adelaide.edu.au/publications/list

Abstract

Mobile phone detection cameras (MPDC) capable of detecting mobile phone use by drivers have been adopted in some Australian jurisdictions and are being considered for use in South Australia in 2023. This project provides background information on the best practice use and effectiveness of such cameras and makes recommendations about the optimal locations for their placement. This report provides a brief literature review on the effectiveness of MPDC, discusses the experiences from other Australian jurisdictions that have previously introduced mobile phone detection cameras, and makes recommendations regarding the placement of the proposed fixed cameras in South Australia. These recommendations take into consideration the research literature, experiences in other Australian jurisdictions and practical issues in South Australia. To increase the effectiveness of the MPDC program in South Australia and align with other jurisdictions, future projects should aim to increase the number of cameras and include relocatable cameras placed at multiple locations across the wider road network to increase the perceived risk of detection.

Keywords

Mobile phone, safety camera, detection, driver behaviour

Summary

BACKGROUND

Driver distraction is a significant contributing factor in road crashes. In particular, mobile phone use has been shown to greatly increase the likelihood of a driver being involved in a crash. Despite the risks associated with mobile phone use while driving, and public messaging informing road users of those risks, there remains a high prevalence of phone use while driving. The increasing ubiquity of smart phones, along with their expanding functionality, mean that their use in vehicles (and resultant crashes) are likely to increase without new interventions.

Mobile phone detection cameras (MPDC) capable of detecting mobile phone use by drivers have been adopted in some Australian jurisdictions and are being considered for use in South Australia in 2023. To inform and support the implementation of MPDCs in South Australia, the current project provides background information on the best practice use and effectiveness of such cameras and makes recommendations about the optimal locations for their placement. Specifically, this report:

- Provides a brief literature review on the effectiveness of mobile phone detection cameras.
- Discusses the experiences of other Australian jurisdictions that have previously introduced mobile phone detection cameras.
- Makes recommendations about the optimal placement of the cameras, taking into consideration the research literature, experiences in other Australian jurisdictions and practical considerations.
- Suggests data to be collected to facilitate future evaluation of the MPDC program.

EFFECTIVENESS OF MPDC'S

The small number of Australian and European jurisdictions that have implemented MPDCs are still generally in the early stages of the process and, as a result, there are no formal evaluations of the programs available. In their absence, consultations were undertaken with representatives of government agencies that have implemented MPDC programs in New South Wales and Queensland (Victoria and Western Australia are currently undertaking trials). Evidence from New South Wales, the first state in Australia to introduce a state-wide MPDC program, shows non-compliance rates have steadily declined over time since their implementation in 2019.

Current programs in Australian jurisdictions use both fixed and relocatable MPDCs. Fixed cameras prioritise safety and compliance at specific locations while relocatable cameras promote larger scale compliance by providing a wider coverage of the road network. The MPDC programs in New South Wales and Queensland have sought to strengthen a perception by the public that they can be detected for mobile phone use while driving anywhere and at any time. This is achieved through the randomised and unpredictable placement of relocatable cameras without warning signs, and it maximises the general deterrence effect.

The potential effectiveness of MPDC programs in Australian jurisdictions has been estimated through statistical modelling. In New South Wales it was estimated that a widespread MPDC program using both fixed and mobile cameras that reached 99.5% of the NSW driving population and achieved 30% to 40% deterrence could prevent approximately 95 to 126 fatal and serious injury crashes over five years, equating to savings of approximately $126 to $168 million. In Queensland, modelling predicted that after five years of the combined mobile phone and seatbelt detection

camera program, assuming there was full compliance (i.e., the best results that could be expected) the cameras could reduce fatalities by 12.6% and hospitalisations by 5.3%. In Victoria, it was estimated that if a widespread MPDC program was implemented using cameras at any location within the road network, that reaches all drivers, it could prevent 95 casualty crashes per year (0.77% decrease in annual crashes) with an annual savings of $21 million.

INCREASING COMMUNITY SUPPORT

Consultation with Australian jurisdictions highlighted that it is important to ensure that the funds generated from the fines for non-compliant drivers are directed into road safety-focussed programs, to ensure ongoing community support. It is also important to educate the public that, while artificial intelligence is used to initially identify potential instances of mobile phone use, the final decision involves a human review and verification stage. The public should also be assured that the privacy of the data is carefully managed.

OPTIMAL LOCATIONS FOR MPDC'S

Based on the review of research evidence available thus far, the following principles should be considered best practice for the installation of MPDCs in general and should be used to inform the implementation of the program in South Australia:

- MPDCs should be installed at locations where crashes involving mobile phone distraction are more likely (i.e., free-flowing traffic on multi-lane roads in commercial areas) as well as locations where mobile phone use is more common (i.e., metropolitan intersections with traffic lights, with high volumes of traffic, if practical). Targeting locations with high mobile use will detect the most drivers using phones and should, therefore, provide increased general deterrence, while targeting locations with high frequency of crashes related to mobile phone distraction should provide the best chance of preventing these crashes.
- Both fixed and relocatable MPDCs should be deployed to provide a balance of compliance at specific locations and a geographic spread across the network. Fixed cameras can be visible and located on metropolitan arterial roads with multiple lanes and high traffic volume. Relocatable cameras should be covert and moved regularly, and without warning, to locations that are randomised and unpredictable, and the locations should provide the best practicable geographical coverage of the road network.
- Locations for the relocatable cameras are best identified through consultation with stakeholders with consideration of crash analyses and practical issues (e.g., site access). The consultation process can be used to identify locations with a history of relevant crashes (crash types relevant to mobile phone distraction or crashes in which mobile phone distraction was proven to be a contributing factor), as well as locations where mobile phone use by drivers has been regularly observed.
- For a new program, high traffic volume metropolitan and suburban roads, with multiple lanes, lower speed limits (i.e., 50-60km/h speed limits), and sites near commercial areas should be the prioritised locations for cameras (fixed and relocatable) but other roads (e.g., regional, high-speed highways) should also be included in the coverage to improve compliance in all areas.

While these recommendations are based on the research evidence and should be considered best practice, there are also practical and funding constraints that limit their viability, particularly in relation to camera type (e.g., fixed and relocatable) and location (e.g., mid-block and intersections, high traffic metropolitan roads and regional roads). The proposed program in South Australia is commencing on a smaller scale than existing programs in other Australian jurisdictions. The South Australian program involves installing seven fixed cameras at three sites in metropolitan Adelaide, with yearly rotation of the fixed cameras to alternative sites. Given the constraints (i.e. practical considerations), the present report supports a proposed strategy of targeting high volume major roads with existing overhead gantry in variable messaging sign infrastructure at midblock locations, as it is reasonable in terms of balancing deterrence of the behaviour with cost effectiveness.

The potential effectiveness of the smaller scale proposed program in South Australia cannot be expected to reach the estimated road safety benefits forecast in other jurisdictions which are based on widespread rollouts using fixed and mobile cameras. For larger scale general compliance across the road network, future enhancement of the MPDC program should consider increasing the number of cameras and including regional roads in its geographical coverage. In addition to fixed cameras, covert transportable mobile phone detection cameras placed at locations that are randomised and unpredictable will increase the perceived risk of being detected in any place and at any time. It is acknowledged, however, that such an expansion of the MPDC program in South Australia would require additional operational resources and funding.

DATA COLLECTION FOR FUTURE EVALUATION

Any new MPDC program should undergo evaluation to ensure it is operating effectively and to determine whether the cameras are succeeding in reducing mobile phone use. Appropriate data from the MPDC’s should be recorded and retained from the start of deployment, as well as from any trials or activities before issuing infringements, to facilitate effective evaluation.

CONCLUSION

Given the constraints that the current MPDC program in South Australia is commencing on a smaller scale than existing programs in other Australian jurisdictions and consists of only fixed cameras, the proposed strategy appears to be an appropriate solution in terms of balancing deterrence with cost effectiveness. To increase the effectiveness of the MPDC program in South Australia and align with other jurisdictions, future projects should aim to increase the number of cameras and include relocatable cameras placed at locations that are unpredictable and randomised to increase the perceived risk of detection across the wider road network. Additional resources and funding should be allocated to achieve wider compliance and potentially greater crash reductions associated with such an expansion.

Note that this report was substantially completed in October 2022 and does not consider developments after that date.

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1. Background

1.1. Introduction

Driver distraction is a significant contributing factor in road crashes. In particular, mobile phone use has been shown to greatly increase the likelihood of a driver being involved in a crash. The increasing ubiquity of smart phones, along with their expanding capabilities and functionality, mean that their use in vehicles (and the resultant crashes) are likely to increase without new interventions.

Legislation exists around Australia that prohibit the use of mobile devices while driving (with the exception of specific functions). However, there are challenges for police enforcing these laws at scale. As a result, driver-monitoring technologies, such as road-based cameras that detect the use of mobile phones by drivers are increasingly being adopted around Australia. Cameras capable of detecting mobile phone use by drivers are being considered for use in South Australia in 2023. This project provides background information on the use of such mobile phone detection cameras (MPDC), makes recommendations about their placement and describes their potential benefits.

Specifically, the current project:

- Describes the likely camera rollout program in South Australia
- Provides a brief literature review on the effectiveness of mobile phone detection cameras
- Discusses the experiences of other Australian States that have previously introduced mobile phone detection cameras
- Makes recommendations about the optimal placement of the cameras, taking into consideration the research literature, experiences in other Australian jurisdictions and practical considerations.
- Suggests data to be collected to facilitate future evaluation of the MPDC program once it has been in operation for some time.

The following sections of the report provide a brief background of the extent of the road safety problem associated with mobile phone use while driving, a description of the proposed South Australian MPDC program, a review of available information relating to the effectiveness of MPDCs (i.e., detection rates of illegal mobile phone use while driving, estimated reductions in phone use-related crashes), and a discussion of the optimal locations for camera installation. Recommendations for MPDC camera locations are provided, taking into consideration the research literature, experiences in other Australian jurisdictions and practical considerations in South Australia.

1.2. Driver distraction and mobile phone use

Mobile phone use while driving is a significant road safety problem. Mobile phone use affects driving performance by placing substantial cognitive demands on the driver and diverting attentional resources away from the driving task (Klauer, Guo, Simons-Morton, Ouimet, Lee, & Dingus, 2014; Oviedo-Trespalacios, Haque, King, & Washington, 2016). This affects the driver’s reaction time and stimulus detection performance (Caird, Simmons, Wiley, Johnston, & Horrey, 2018; Caird, Willness, Steel, & Scialfa, 2008; Horrey & Wickens, 2006). Therefore, the driver distraction that results from mobile phone use increases the risk of motor vehicle crashes (Caird et al., 2018; Dingus et al., 2016;

Elvik, 2011; Klauer et al., 2014; McEvoy et al., 2005; Papantoniou, Antoniou, Yannis, & Pavlou, 2019; Wundersitz, 2019).

In one of the most cited Australian studies on mobile phone distraction and crash risk, McEvoy et al. (2005) examined the mobile phone records of crash-involved drivers and demonstrated that a driver is four times more likely to have a crash resulting in injury when using a mobile phone. In a meta-analysis of studies examining crash risk and phone use, Elvik (2011) provided a point estimate of the increased risk of a crash when using a mobile phone of 2.9, despite methodological issues that had resulted in heterogeneous results. More recently, Dingus et al. (2016) examined 905 crashes from a naturalistic driving study in the US and found that drivers who interact with a hand-held phone had a 3.6 times (95% confidence limits of 2.9 to 4.5) higher crash risk. A meta-analysis examining naturalistic driving studies reported that crash risk not only increased for hand-held phone use (2.7 times the risk), but increased significantly for other phone activities including answering a phone (3.6 times the risk), dialling on a hand-held phone (4.0 times the risk), and texting, browsing or emailing (10.3 times the risk) (Simmons, Hicks & Caird, 2016).

The prevalence of mobile phone use in crashes is difficult to ascertain as it is hard for police to prove a phone was used at the exact time of the crash and drivers are unlikely to admit use out of fear of legal sanctions. For these reasons, it is widely accepted that phone use in crashes is under-reported. Nevertheless, Wundersitz (2019) examined 160 fatal and injury crashes in South Australia and found that distraction from mobile phone use was involved in 2.5% of the crashes. In Victoria, investigations by the Monash University Accident Research Centre (Fitzharris et al., 2020) of 393 crashes involving a hospitalisation found that 3.8% of crashes involved confirmed physical handling and concurrent use of a mobile phone, including dialling, texting, talking, looking at the screen and/or passing the phone to a passenger. The percentage of mobile phone use increased to 4.3% in higher severity crashes. These Australian figures are consistent with research from in-depth investigations of fatal crashes in Norway by Sundfør, Sagberg, and Høye (2019) which found that between 2 and 4% of the fatal crashes were associated with mobile phone use.

Observational surveys provide another valuable indication of the prevalence of driver mobile phone use on road networks. A recent study by Ponte, Edwards and Wundersitz (2021) used elevated covert video cameras to record in-vehicle distracted driver behaviour in moving traffic at four locations within South Australia. The study found that 2.5% of drivers were using phones and this was the most frequently observed distracted driving behaviour. Findings also confirmed that drivers who used their phone illegally did so in a concealed manner that would not have been easily detected without the sophisticated camera technology employed in the study. An older roadside observational survey of 5,813 drivers in Victoria by Young, Rudin-Brown, and Lenné (2010) found that 3.4% were using hand-held phones.

Despite the risks associated with mobile phone use while driving, there remains a high prevalence of self-reported engagement in phone use while driving. An online survey of 401 South Australians aged 16 years and over found 38% reported using a mobile phone (any function) while driving, even though 64% of respondents strongly agreed that it was dangerous to do so (New Focus, 2018). In New South Wales, Waddell and Wiener (2014) surveyed 181 drivers aged 18 to 66 years and found that 29% reported making a call on a hand-held mobile, 28% had sent a text message, 44% had answered a call on a hand-held mobile, and 57% had read a text message while driving. In Victoria, Young and Lenné (2010) conducted an online survey of 287 drivers aged 18 to 83 years and found that 59% self-reported using their phone while driving. Of the drivers who used their phone, 35%

engaged in hand-held conversations, 64% read text messages, and 55% sent text messages. Another survey of Australian drivers aged 17 to 74 by White, Hyde, Walsh, and Watson (2010) found that, irrespective of handset type (hands-free or hand-held), 43% reported answering calls while driving on a daily basis, 36% reported making calls, 27% reading texts, and 18% sending text messages.

The most common response to the increased crash risk associated with mobile phone use has been to ban hand-held phone use while driving, which has occurred in every state and territory in Australia as well as in many jurisdictions around the world. The most common method to enforce bans and reduce the prevalence of phone use while driving is to positively identify drivers using their phones and either warn them that they should stop or penalise them for it. In South Australia, it is illegal to use a hand-held mobile phone while driving (i.e., not mounted in the vehicle or using Bluetooth connection), and drivers found doing so incur a fine of $534 (plus $60 victims of crime levy) and three demerit points.

Enforcement of illegal mobile phone while driving has usually relied on visual inspection by police. However, it is difficult to detect (Truelove, Oviedo-Trespalacios, Freeman, & Davey, 2021), with factors such as window tinting and low light at night-time reducing visibility, and it can be challenging for police to prove that they have witnessed a driver using their phone (Jessop, 2008; Rudisill, Baus, & Jarrett, 2019). Phone use can also be difficult to detect as drivers actively try to conceal their behaviour under the level of the window to avoid detection (Gauld et al., 2014; Oviedo-Trespalacios et al., 2017; Ponte et al., 2021). There are also limited numbers of police patrols to cover road systems in their entirety and these officers often have other duties to perform. Automated techniques to identify in-vehicle mobile phone use are increasingly becoming available. Ideally, mobile phone use monitoring and detection could be built into driver-focussed technology that could eventually be installed in all vehicles. For example, as part of advanced driver assistance systems that also include fatigue detection and warning. This technology is not currently available in the car market and there are potential privacy issues related to its installation in all vehicles. Research has suggested that in-vehicle monitoring of mobile phone use (such as from naturalistic driving studies) could have an accuracy of detection of up to 91.2% (Wang, Xu, Zhang, Zhuang, & Wang, 2022). Another option to reduce mobile phone use while driving is through ‘blocking’ technologies that reduce the communication functionality of phones while the vehicle is being driven. However, this technology requires driver opt-in to be effective and research that examined the effectiveness and acceptability of two types of this technology – a mobile phone software application and an external hardware device that paired with phone through Bluetooth – found that drivers did not view it as reliable (Ponte, Baldock, & Thompson, 2016). It was also easy to circumvent the technology, so complete compliance would be difficult to achieve (Ponte & Baldock, 2016).

Cameras capable of detecting illegal mobile phone use by drivers through artificial intelligence software are now available and provide a more viable, immediate, and efficient option. These mobile phone detection cameras (MPDCs) can be deployed into the road system as either fixed or mobile solutions. MPDCs log the details of all vehicles that drive through them and record visual evidence from multiple camera angles (high resolution images showing the front cabin space of a vehicle through the windscreen). A computer algorithm is then used to process the images and identify drivers who are using their mobile phones (photographs of compliant drivers are deleted). Photographs of drivers positively identified by the algorithm as using their phones are validated through human inspection and the relevant information (e.g., registration details) is sent to police or road authorities to issue fines and demerit points to the registered vehicle owners. As well as the penalties that would result from detections of mobile phone use by these cameras, they also provide a visible deterrent and increase the perceived certainty by drivers that they will be caught; both of which are important for deterrence (Truelove, Oviedo-Trespalacios et al., 2021; Truelove, Watson-Brown, Parker, Freeman, & Davey, 2021). Given their elevated installation and, therefore, superior view into vehicles, MPDCs are also likely to be effective at identifying concealed phone use (Ponte et al., 2021).

1.3. MPDC program in South Australia

MPDCs are currently being considered for installation and use in South Australia in 2023. CASR understands that the current project involves deploying seven new cameras to be installed at three fixed sites to cover seven lanes of traffic. While the cameras have the potential to detect other behaviours (i.e., seat belt non-use, speeding, unlicensed driving), they will only be focussed on mobile phone usage. To maintain a deterrent effect, it is intended that additional sites to the initial three would also be selected and prepared to enable annual rotation of fixed camera locations.

In terms of the location of the cameras within South Australia, it has been indicated that the intention of this initial project is to have a balanced spread of fixed camera sites across the Adelaide metropolitan area to improve the visibility of the project.

To facilitate the optimal implementation and effective functioning of these cameras in South Australia, the next section reviews existing information regarding the effectiveness of such cameras in other jurisdictions.

2. Effectiveness of mobile phone detection cameras

The national and international jurisdictions that have implemented MPDCs are still generally in the early stages of the process and, as a result, there are no formal evaluations of the programs available to draw information from. However, the present section discusses information (e.g., MPDC detection rates) released by various jurisdictions and published in the media, as well as information obtained from consultations with representatives of the government agencies that have implemented the MPDC programs in New South Wales and Queensland.

New South Wales was the first state in Australia to implement a state-wide MPDC program and it was reported that this introduction of automated camera technology was a world-first (National Road Safety Partnership Program, 2020; Warner, Stephan, Newstead, Stephens, Willoughby, & Shearer, 2021). A six-month trial of fixed cameras started in January 2019 in two locations, with no penalties issued during this period for phone use detections (Transport for NSW, 2019a). Victorian company Acusensus was contracted to provide the technology (Willoughby et al., 2021). During the trial, 8.5 million vehicles were checked, and a 1.2% non-compliance rate of mobile phone use (more than 100,000 detections) was reported (Transport for NSW, 2019a). The cameras proved to be highly reliable in all traffic and weather conditions (Willoughby et al., 2021).

Permanent implementation occurred in December 2019, through both fixed and relocatable trailer-mounted cameras. For the first three months of the permanent program, offending drivers (registered operators of a vehicle) received a warning letter. During the first three months, nine million vehicles had been checked and more than 30,000 warning letters had been issued to offending drivers, representing a non-compliance rate of around 0.3%. After this initial three months, drivers were issued a fine of $344, or $457 in a school zone, and received five demerit points. During the first week of the permanent implementation, 3,303 drivers were detected using a mobile phone out of 773,532 vehicle checks (Transport for NSW, 2019b). The non-compliance rate of 0.4% was a two-thirds reduction from the 1.2% rate from the initial trial period (Transport for NSW, 2019b). Data between 1 March 2020 and 30 June 2022 shows that the non-compliance rate has fallen further to 0.2% (over 194,900,000 vehicles checked and around 393,000 infringements issued) (Transport for NSW, personal communication, July 2022). This suggests that the non-compliance rate had steadily declined since the MPDC installation commenced. It was forecast that the MPDC program would expand to perform 135 million vehicles checks each year by 2023 (Transport for NSW, 2019b), with around 45 cameras required to achieve this (Willoughby et al., 2021).

At the time of the permanent implementation, modelling undertaken by the Monash University Accident Research Centre suggested that a widespread MPDC program using fixed and mobile cameras that reached 99.5% of the NSW driving population and achieved 30% to 40% deterrence could prevent approximately 95 (30% deterrence) to 126 (40% deterrence) fatal and serious injury crashes over five years, equating to savings of approximately $126 million (30% deterrence) to $168 million (40% deterrence) (Warner et al., 2021). It was also announced in November 2020 that warning signs for these cameras would be removed over the following 12 months (Transport for NSW, 2020a).

MPDCs have also been installed in Queensland and have been operating since July 2021 (following a six-month trial that began in July 2020) (Drive, 2021). Warning letters were issued to detected drivers (registered operators of a vehicle) instead of fines for the first three months of the program, and then fines were issued from the start of November 2021. The technology also detects non-use of seatbelts by vehicle occupants in the front row of seats. There are both fixed (n=12) and portable cameras (n=5) in use (Queensland Government, 2021). During the trial, 4.8 million vehicles were checked, and more than 15,000 mobile phone offences were detected (non-compliance rate of 0.3%) (Drive, 2021). Early figures since the program has been issuing penalties show a 0.6% non-compliance rate (2,433 detections out of 405,820 vehicles checked). Queensland has a penalty of four demerit points and a fine of $1,078 for using a mobile phone while driving, which is the highest monetary penalty in Australia for such an offence. A formal evaluation of the MPDC program in Queensland will be undertaken in November 2022, which is twelve months after the penalties started to be issued to detected drivers (Department of Transport and Main Roads – Queensland, personal communication, June 2022). An evaluation framework was developed by the Centre for Automotive Safety Research at the University of Adelaide (Baldock, Kloeden, & Ponte, unpublished report) prior to the commencement of the program to ensure that all relevant data were being collected to undertake the evaluation. The evaluation framework incorporates an impact evaluation (the extent to which the program has directly affected driver and vehicle occupant behaviour), an outcome evaluation (the extent to which the program has produced a road safety benefit), and a cost-benefit analysis (whether the benefits of the program outweigh the costs of implementing and maintaining it). The evaluation framework also included modelling that predicted that after five years of the program, assuming no additional cameras would be introduced after 1 December 2021, the combined mobile phone and seatbelt detection cameras would reduce fatalities in Queensland by 12.6% and hospitalisations by 5.3% if there was full compliance (i.e., the best results that could be expected).

Truelove, Watson-Brown et al. (2021) examined self-reported mobile phone use while driving amongst samples of drivers in Queensland during periods when restrictions were imposed for the COVID-19 pandemic and when the restrictions were later eased (both periods in 2020). It was found that, overall, mobile phone use was significantly lower during restrictions as well as after restrictions were eased compared with prior to the pandemic. Furthermore, there was an additional significant decrease after restrictions were eased compared to during the restrictions. It was noted that this further decrease in mobile phone use may have, at least in part, been due to the coinciding introduction of roadside MPDCs in Queensland.

A trial of MPDCs in Victoria began in July 2020 and ended after three months (Drive, 2021). During the trial, 679,438 vehicles were checked, with one in every 42 drivers detected for illegal mobile phone use while driving (non-compliance rate of 2.4%) (CarExpert, 2021b). Unpublished research conducted by the Monash University Accident Research Centre estimated that a widespread MPDC program using cameras at any location throughout the road network that reaches all drivers could prevent 95 casualty crashes per year (approximately a 0.77% decrease in annual crashes) with an annual savings of $21 million (Stephens, Stephan & Newstead, 2019). Authorities in Victoria have committed to a permanent implementation of MPDCs by 2023. Victoria currently has a penalty of four demerit points and a $545 fine for illegal mobile phone use while driving.

An initial testing period of one fixed camera at one location in the Australian Capital Territory started in 2022 (CBR City News, 2022). The testing period is being undertaken to ensure that the technology worked as intended. No fines, infringements or warning notices will be issued during the testing period. More cameras are planned to be implemented later in 2022, with the first three months planned to be a warning period. The fine for using a hand-held device to make or receive calls in the

ACT is $487 and three demerit points. For messaging, social networking, accessing apps or the internet, the fine is $589 and four demerit points.

Western Australia has undertaken a three month trial of transportable MPDCs and experimented with other camera capabilities (i.e. seat belt detection, speed, licence plate recognition). However, there are no current plans to issue a fine or warning notice resulting from MPDCs (CarExpert, 2021a). Western Australia has a penalty of three demerit points and a $500 fine for touching a mobile phone whilst stopped at traffic lights or holding the phone while taking a call. However, the penalty for texting, emailing, using social media, watching videos or accessing the internet while driving is $1,000 and four demerit points.

The Tasmanian Government has also indicated that it will consider implementing similar transportable technology in the near future (CarExpert, 2021a). Tasmania has a penalty of three demerit points and a $336 fine for illegal mobile phone use while driving.

Information from internet media suggests that, internationally, Europe is the only other location to implement MPDCs. In the Netherlands, fines have been issued from such cameras since November 2020 (CarExpert, 2021a). The United Kingdom has also implemented the technology since 2019 using cameras that detect a range of offences. Unfortunately, information on these European MPDC programs was limited and no further details were available to determine their effectiveness.

3. Identification of optimal locations for MPDCs

In order for MPDC programs to be as effective as possible, the identification of optimal locations for the cameras is critical. Firstly, it seems logical to suggest that the cameras are placed in locations with high traffic volume so that the highest number of vehicles can be checked. Inner-city or suburban arterial roads would be ideal for high traffic volume. Secondly, the best locations to install MPDCs could be based on identifying locations where mobile phone use is more common or the risk of a crash due to mobile phone use is highest.

3.1. Evidence from research literature

There is some literature on where mobile phone use while driving commonly occurs that might inform the location of MPDCs. A study using naturalistic driving data from mobile application users on highways in Texas, United States, by Iio, Guo, and Lord (2021), found that the mean posted speed limit was lower when phone handling events were recorded compared to driving without recorded phone handling. This is consistent with research by Ponte et al. (2021) which examined the prevalence of in-vehicle driver distraction in moving traffic in South Australia and found that higher speed zones were associated with a lower proportion of distracted driving behaviour compared to lower speed zones. This suggests that drivers use their phones more often when they are travelling at comparatively slower speeds. It has also been suggested by Ponte et al. (2021) that roads with lower speed limits offer more opportunities to commence a distracted behaviour when stationary in traffic and then continue that behaviour while moving, compared to roads with higher speed limits where there are fewer opportunities to commence a distracted behaviour while stationary. Indeed, Young et al. (2019) suggest that drivers make strategic decisions about when to engage in secondary tasks and are more likely to initiate these while stationary compared to moving but do not necessarily stop the secondary task once they resume moving.

A systematic review of roadside observational studies of secondary task engagement (predominantly mobile phone use) while driving by Huemer, Schumacher, Mennecke, and Vollrath (2018) found that there were higher rates of secondary task engagement in city areas than surrounding regions. Phone use was higher in stationary vehicles compared to moving vehicles. It was also found that roundabouts had lower rates of phone use compared to intersections and straight sections of road. Differences in phone use by road type were examined but results varied, with some studies suggesting that phone use was higher on motorways and some suggesting it was higher on minor roads. Some studies suggested that phone use was higher on roads with two lanes compared to roads with one lane.

Ismaeel, Hibberd, Carsten, and Jamson (2020) used naturalistic driving data from five countries (the UK, Germany, France, Poland and the Netherlands) to examine engagement in secondary tasks while driving through intersections. It was found that drivers were less likely to engage in secondary tasks when their vehicle was moving compared with when it was stationary. Additionally, drivers engaged in secondary tasks less frequently at intersections controlled by traffic signs compared to those controlled by traffic lights, and when they did not have priority compared to when they had priority. Similarly, Huth, Sanchez, and Brusque (2015) examined the use of mobile phones by drivers while stopped at red traffic lights in a roadside observational study in Lyon, France and identified strategic use for visual-manual interactions compared to voice-based phone calls. Visual-manual interactions were more commonly initiated while stationary at red traffic lights and were usually stopped before the vehicle started moving. These studies suggest that there is a degree of self-regulation by drivers of visual manual secondary tasks and that they strategically engage in these tasks in locations and situations that they perceive as less risky (Oviedo-Trespalacios, King, Haque, & Washington, 2017; Ponte et al., 2021). Research from South Australia (Ponte et al., 2021), however, has shown that mobile phone use by drivers is not simply a behaviour that occurs in stationary or slower moving traffic but also occurs in vehicles moving freely on roads with speed limits between 50 km/h and 100 km/h.

In terms of locations with high mobile phone-related crash risk, an analysis of naturalistic driving data by Owens, Dingus, Guo, Fang, Perez, and McClafferty (2018) found that visual-manual interaction with a phone was associated with significantly increased crash involvement and that this increase in crash involvement was higher for crashes in free-flow traffic conditions (odds ratio = 2.46).

Research by Wu, Song, and Meng (2021) examined the frequency of driver inattention-related crashes on rural and urban road segments of North Carolina in the United States. It was demonstrated that presence of commercial areas (in both rural and urban regions) increased the probability and frequency of driver inattention-related crashes. Certain roadway characteristics were also associated with increased driver inattention crash counts, including non-freeways, segments with multiple lanes, and traffic signals. In comparison, state secondary routes (i.e., lower hierarchy roads) and roads with speed limits higher than 35 miles per hour (equivalent to 60 kilometres per hour) were associated with fewer driver inattention crashes.

3.2. Experiences in Australian jurisdictions

Information about the best locations for MPDCs can also be drawn from the experiences of jurisdictions that have already implemented them. The MPDC program in NSW uses locations for cameras based on consideration of the prevalence of crashes (particularly crash types relevant to mobile phone distraction) and advice from NSW Police and stakeholders on locations where crashes have occurred, where phone use has been observed, or that may be difficult to enforce using existing police resources (NSW Centre for Road Safety, 2022; Transport for NSW, personal communication, July 2022). The program is also designed to ensure geographical spread of deterrence (Transport for NSW, personal communication, July 2022). In consultations with representatives of Transport for NSW it was noted that the program is aimed at covering almost 100 percent of the driving population in NSW through deployment of the cameras in a mix of metropolitan and regional areas. It was explained that, generally, it makes most sense to place fixed cameras on roads with high traffic volume and then move the transportable cameras around regularly. However, there are practical considerations for suitable sites for the transportable cameras, such as whether the sites have areas to park the trailer-mounted cameras and whether there are any overhanging electricity lines. Detailed site assessments are conducted before a camera is deployed. It was also noted that they try to deploy the cameras to a mix of road types and speed limits, including intersections (where vehicles are often stopped, and drivers may be more likely to use their phones).

Online information about the MPDC program in Queensland states that the locations of its cameras are based on where road crash injuries or fatalities, in which mobile phone use was a contributing factor, have occurred (Queensland Government, 2021). It is also stated that mobile phone enforcement occurs anywhere and anytime on Queensland roads (presumably referring to transportable cameras and the ability of mobile traffic police units to identify illegal mobile phone use while driving). Representatives of the Department of Transport and Main Roads, Queensland confirmed that locations where mobile phone-related crashes commonly occur were their priority for site selection. They explained that, at the beginning of the program, Queensland was divided up into five-kilometre squared sectors and distraction-type crashes were mapped across the sectors (Department of Transport and Main Roads, Queensland, personal communication, June 2022). Suitable sites for cameras were then identified in the sectors that had the highest crash rates. They noted that roads with high traffic volumes and multiple lanes are selected for the fixed camera sites. Their objective was to achieve a wide geographical spread over Queensland with the locations selected for the transportable cameras (including regional and rural areas), although, as with NSW, there are some practical limitations such as locations with overhanging power lines, locations with limited access, and residential streets with limited traffic. Detailed site inspections are conducted before a camera is deployed. They also consider advice from police and other stakeholders. Intersections are not selected as a location for either camera type.

The project team for implementation of the MPDC program in the ACT engaged the Centre for Automotive Safety Research to conduct a review to identify the best locations for fixed and transportable cameras. The best locations from a road safety perspective were identified, with an analysis of crash data in the ACT used to pinpoint locations with a high prevalence of specific types of crashes (e.g., involving distraction). Additionally, consultations with stakeholders identified locations where vulnerable road users were at high risk, mobile phone use had been identified previously, or enforcement through existing police resources had been difficult. Through a weightings system applied to the crash data (based on factors such as injury severity) and with consideration of the stakeholder consultations, 100 possible locations in the ACT where MPDCs could be deployed for maximum road safety benefit were highlighted. Most locations were at intersections, as the highest density of crashes were found to have occurred there. However, the review also highlighted alternative sites without consideration of intersection crashes in case midblock sites were preferred or there were technical/operational difficulties in installing cameras at intersections.

3.3. Driver awareness and deterrence

The issue of driver awareness of MPDCs also needs to be considered. Driver awareness has been discussed in relation to best practice enforcement operations for speed compliance but is also applicable to the implementation of MPDCs. Highly visible operations are appropriate if the intention is to prioritise safety and compliance at a specific location, or, in other words, to achieve a localised effect (Transport for NSW, 2020b). For this result, fixed speed cameras should be highly visible and warning signs may also be used. To achieve general deterrence, that is, larger-scale compliance across the network, covert operations are best, and their location should be unpredictable, randomised and without warning signs (Transport for NSW, 2020b). This increases the perceived likelihood of being detected in any place and at any time (Cameron, 2015). Both Transport for NSW and the Department of Transport and Main Roads Queensland noted in consultations that they have sought to strengthen a perception by the public that they can be detected for mobile while driving anywhere and at any time. They have a adopted a covert strategy for their MPDC programs, in which their cameras (both fixed and transportable) are not marked or sign-posted in any way, and the placement of their transportable cameras is randomised and unpredictable. However, they both suggested that drivers are likely to quickly become aware of the locations of the fixed cameras (Department of Transport and Main Roads – Queensland, personal communication, June 2022; Transport for NSW, personal communication, July 2022).

3.4. Summary of optimal locations for MPDCs

In summary, the evidence suggests that drivers self-regulate the locations and situations in which they use their phones illegally. They engage in mobile phone use when perceived driving demand is reduced. Roadway demand and contextual factors are also important to their decision (Kidd, Tison, Chaudhary, McCartt, & Casanova-Powell, 2016; Ismaeel et al., 2020; Oviedo-Trespalacios, Haque, King, & Washington, 2019). Specifically, drivers are more likely to use their phones:

- In areas with lower speed limits (and, therefore, at lower travelling speeds) compared to areas with higher speed limits.
- In city areas compared to surrounding regions.
- When their vehicle is stationary compared to when it is moving.
- At intersections and straight sections of road (but less likely at roundabouts).
- At intersections controlled by traffic lights compared to traffic signs.
- When they are stationary at a red traffic light compared to when they are moving through the traffic light.
- On roads with multiple lanes compared to roads with one lane.

The locations and situations in which drivers more commonly crash because of mobile phone distraction are slightly different, they include:

- Free-flowing traffic conditions.
- Commercial areas (both rural and urban regions).
- Roads that are not freeways.
- Roads with multiple lanes.
- Roads with lower speed limits.

Other jurisdictions with MPDCs already operating have considered the following when deciding on locations for cameras:

- Locations with high crash frequency, particularly crash types that are relevant to mobile phone distraction or crashes in which mobile phone use was a contributing factor.
- Advice from police and stakeholders, particularly relating to locations where crashes have occurred, where phone use has been observed, or that may be difficult to enforce using existing police resources.
- Geographical spread of deterrence, particularly by deploying the cameras in a mix of metropolitan and regional areas.

Other jurisdictions have favoured the use of both fixed and relocatable MPDCs. The locations of fixed cameras become well-known over time by drivers and, therefore, prioritise safety and compliance at specific locations (a localised effect). Relocatable cameras prioritise more general, larger-scale compliance by providing a wide coverage of the road network. They are generally covert, and their location should be unpredictable, randomised and without warning signs so that drivers perceive that they can be detected for illegal mobile phone use anywhere and at any time.

Based on this review of literature, the following principles should be considered for locating MPDCs:

- MPDCs should be installed at locations where crashes involving mobile phone distraction are more likely (i.e., free-flowing traffic on multi-lane roads in commercial areas) as well as locations where mobile phone use is more common (i.e., metropolitan intersections with traffic lights, at which high volumes of traffic are regularly stationary in multiple lanes, if practical). Targeting locations with high mobile use will detect the most drivers using their phones and should, therefore, provide increased general deterrence, while targeting locations with high frequency of crashes related to mobile phone distraction should provide the best chance of preventing these crashes.
- Both fixed and relocatable MPDCs should be deployed to provide a balance of compliance at specific locations and more generally across the network. Fixed cameras can be visible and located in metropolitan arterial roads with multiple lanes and high traffic volume. Relocatable cameras should be covert (no warning signs or markings) and moved regularly without warning to locations that are unpredictable and randomised, and the locations should provide the best practicable geographical coverage of the road network.
- Locations for the relocatable cameras should be identified through consultation with Police and other stakeholders (e.g., road authorities) with consideration of crash analyses and practical issues (e.g., site access). The consultation process can be used to identify locations with a history of relevant crashes (crash types relevant to mobile phone distraction or crashes in which mobile phone distraction was proven to be a contributing factor), as well as locations where mobile phone use by drivers has been regularly observed.
- Metropolitan and suburban roads with multiple lanes, 50 or 60 km/h speed limits, near commercial areas and with high traffic volumes can be prioritised locations for cameras (fixed and relocatable) but other roads (e.g., rural/regional, high-speed highways/freeways) should also be included in the coverage to improve compliance in all areas.

While these recommendations are based on the research evidence, there may also be practical constraints that limit the viability of some types of locations. Practical considerations within the South Australian context are discussed in the next section.

4. MPDCs in South Australia

4.1. Practical considerations in South Australia

In South Australia, the proposed initial program will be using fixed cameras which have some technical requirements that need consideration. Camera providers have indicated that the fixed cameras work more effectively in free-flowing traffic and require around 50 metres of relatively straight road with no changes to the number of lanes leading up to the site. This means that locations that are midblock, rather than at intersections, are preferable to meet this requirement. Fixed cameras are also suited to operate on up to two or three lane roads (in one direction). Another practical consideration is the location of cameras in a position where they can safely be maintained.

Given there is an intention to prepare numerous additional sites to permit the rotation of cameras each year, there is a strong preference to use existing infrastructure on high volume roads to match the capabilities of the cameras and to minimise installation costs. Locating MPDCs on existing infrastructure such as variable messaging sign (VMS) structures and bridges (as has been done in other jurisdictions) would reduce costs, diminish visual pollution, and minimise the need for isolated structures of limited long-term usage. The VMS structures are particularly suitable as they are located at midblock locations and already have safe walkways to facilitate maintenance without disrupting traffic. It is also possible that drivers will associate MPDC with VMS sites (of which there are currently 60-70 around Adelaide) and therefore spread the potential deterrent effect across greater Adelaide (regardless of whether a camera has been installed).

4.2. Proposed locations of MPDCs in South Australia

Given the practical consideration listed above, a subcommittee of the MPDC working group suggested the following MPDC location criteria for consideration in South Australia:

1. Represents a balanced spread across the Adelaide metropolitan area.
2. Two or three lane roads.
3. 50 metres of free-flowing traffic.
4. Cameras need to be sited at ‘midblock’ locations away from intersections.
5. Cameras need to be located where they can safely be maintained.
6. Cameras need to be located after considering road crash statistics and traffic volumes. They need to be located along, or near, the top twenty corridors in the metropolitan area as informed by historical road data.
7. Preference is given to locating cameras on existing infrastructure such as the VMS structures and bridges as in other States, thereby reducing costs, visual pollution and minimising the need for isolated structures of limited long-term usage.
8. Cameras need to be rotated/moved to alternate sites as driver behaviour changes significantly (annually).

Following these criteria, of the top 20 proposed roads identified from the data analysis (see point 6 above), seven roads were identified as having VMS that are potentially feasible for MPDC installation (and a potential eighth site pending VMS installation). These locations are spread around Adelaide with at least two potential locations in each of the three sectors (North, South, Central). If more sites are desired, VMS could be installed at additional strategic locations on high volume roads. Alternatively, wayfinding sign sites could be modified to mount cameras. However, these sites have no gantry so traffic may be disrupted for maintenance. Three of the top 20 proposed roads have large wayfinding signs that could be modified.

4.3. Comments on MPDC locations in South Australia

For a new program, MPDC should be concentrated on high volume roads (to check as many drivers as possible for general deterrence), at locations where mobile phone use is more likely to occur (to obtain a better detection rate), and at locations where mobile phone distraction crashes are more likely to occur (to maximise the potential road safety benefit). The potential effectiveness of the smaller scale proposed program in South Australia cannot be expected to reach the estimated road safety benefits forecast in other jurisdictions which are based on widespread rollouts using fixed and transportable cameras. Given the constraints that the current program in South Australia is commencing on a smaller scale than existing programs in other Australian jurisdictions and consists of only fixed cameras, a proposed strategy of targeting high volume major roads with existing VMS infrastructure at midblock locations appears sensible in terms of balancing deterrence of the desired behaviour with cost effectiveness.

An additional consideration for general deterrence is avoiding the public perception that enforcement only occurs at a few locations or at particular location types. In an effort to promote deterrence, it is intended that fixed cameras will be moved on an annual basis, although this could be done more frequently. For larger scale general compliance across the road network and to align with other jurisdictions, future enhancement of the MPDC program should involve increasing the number of cameras and including regional roads in its geographical coverage. In addition to fixed cameras, transportable mobile phone detection cameras placed at locations that are unpredictable and randomised will increase the perceived risk of being detected in any place and at any time. The requirements of transportable detection equipment may however limit covert operation. Modelling could be undertaken by CASR in the future to determine locations for transportable cameras from a road safety perspective incorporating analyses of crash locations. Such an expansion of the MPDC program in South Australia would require additional operational resources and funding.

4.4. Experiences of program implementation by other jurisdictions

Consultations were undertaken with representatives of the government agencies that have implemented the MPDC programs in New South Wales (Transport for New South Wales) and Queensland (Department of Transport and Main Roads, Queensland). A number of issues were raised by the representatives of the government agencies in these consultations that are important to consider for any jurisdiction implementing a new MPDC program. It was highlighted that ongoing community support for a new MPDC program is crucial to its success. It is important to ensure that the funds generated from fines for non-compliant drivers are directed into road safety-focussed programs to maintain community support. It is also important to educate the public that, while artificial intelligence is used to initially identify potential instances of mobile phone use, the final decision involves a human review and verification stage. The public should also be assured that the privacy of the data is managed very carefully.

It was noted that any jurisdictions intending to implement MPDCs should prepare for a lot of correspondence from drivers through both online and postal mail sources. Jurisdictions indicated that, in their experience, a large proportion of this correspondence came from drivers who have received infringements and specifically those who received an infringement for having their mobile phone on their lap. To counteract this, they suggest providing messaging early in the MPDC program reminding road users that it is an offence for a driver to use their mobile phone while it is in their lap. A considerable number of staff will be required to respond to high levels of correspondence.

4.5. Data collection for future evaluation

Any implemented MPDC program should undergo evaluation to ensure it is operating effectively and to determine whether the cameras are succeeding in reducing mobile phone use. The cameras have the capability to collect the appropriate data to enable evaluation. However, it is important that the right data is recorded and retained from the start of deployment to facilitate future evaluations of the program. Optimally, data should also be obtained during any trials and before issuing infringements to examine any changes in detection rates.

Minimum data to be collected from each camera should include:

- Location of the camera
- Date and hour of operation
- Total number of vehicles checked each hour
- Number of mobile device use detections each hour.

4.6. Conclusion

Given the constraints that the current MPDC program in South Australia is commencing on a smaller scale than existing programs in other Australian jurisdictions and consists of only fixed cameras, the proposed strategy appears to be an appropriate solution in terms of balancing deterrence with cost effectiveness. To increase the effectiveness of the MPDC program in South Australia and align with other jurisdictions, future projects should aim to increase the number of cameras and include relocatable cameras placed at locations that are unpredictable and randomised to increase the perceived risk of detection across the wider road network. Additional resources and funding should be allocated to achieve wider compliance and potentially greater crash reductions associated with such an expansion of the program.

Acknowledgements

This research was funded via a deed with the South Australian Government.

The authors would like to acknowledge the valuable input from South Australia Police and insightful contributions made by the stakeholders from Transport for New South Wales and Department of Transport and Main Roads, Queensland, during the consultations.

Special thanks to Craig Kloeden, Jamie Mackenzie, Matthew Baldock and Jeremy Woolley for providing advice and reviewing the report.

The views expressed in this report are those of the authors and do not necessarily represent those of the University of Adelaide or the funding organisations.

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