

Transport for NSW | Centre for Road Safety

Mobile speed camera operations in other Australian jurisdictions

Research Report

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Executive Summary

In October 2018, the NSW Audit Office presented a report on mobile speed cameras (Audit Office of NSW, 2018). The audit assessed whether the mobile speed camera program is effectively managed to maximise road safety benefits across the NSW road network. One of its recommendations was for a review of better practice in other jurisdictions.

Based on decades of research worldwide, it is clear that

- Speed management is crucial for the prevention of death and serious injury on our roads.
- Speed cameras are an effective tool in managing speed.

It is not possible to have speed camera operations everywhere. One practice is to use many more sites than cameras, and move the cameras from site to site. This is the advantage of the mobility of mobile speed cameras. The location of cameras is varied so that it is very difficult for a driver to anticipate where a mobile speed camera will be or when. The intention is to generate in each driver the expectation that if he or she is speeding - anywhere or anytime - detection is likely.

Evaluations of the speed camera programs in Victoria, Queensland, Western Australia and the ACT have shown that these mobile speed camera programs have substantial benefits.

The NSW mobile speed camera program uses signs to make the operations highly visible, with two warning signs before the camera vehicle and one sign after. The operation is made even more visible by using bright and distinctive markings on the camera vehicle.

Other jurisdictions do not use warning signs, although the ACT uses a sign on top of the otherwise unmarked camera van. Queensland is the only other jurisdiction to use markings on camera vehicles, but the Queensland markings are neither bright nor distinctive and up to 30% of the vehicles are unmarked.

The extent to which traffic policing should be highly visible or more covert can be considered based on whether the relevant offence is a fixed offence or a transient offence. A fixed offence is one, such as drink driving or unlicensed driving, where the offence results from the driver's physiological state or legal status, which the driver cannot change when an enforcement operation is seen. Highly visible policing is therefore suitable for fixed offences.

A transient offence is one where the driver can choose to comply when aware of an enforcement operation, and choose to offend elsewhere. Speeding is an example of a transient offence.

Even for transient offences, such as speeding, highly visible operations are suitable if the objective is to ensure compliance at a particular place (site, road section) and perhaps at a particular time, where it is a priority that safety be optimised at that place and time. For this purpose, fixed speed cameras should be highly visible.

To achieve larger scale general speed compliance across the network, mobile speed cameras should be covert. This means unmarked vehicles and no warning signs. Even if a driver cannot see a speed camera ahead, he or she should expect that there could be one.

As well as having the most visible mobile speed camera operations, the NSW mobile speed camera program is the least intense. Both Victoria and Queensland operate mobile speed

cameras for more average monthly hours. When expressed as a rate per head of population or per registered vehicle, NSW has fewer monthly hours of operation than any of the other five Australian jurisdictions considered in this report.

Queensland has benefited substantially from a 50% increase in mobile speed camera operating hours from about 5,400 per month in 2008-09 to over 8,000 per month in 2014-15. For Victoria, the ACT and Western Australia, statistical modelling indicates that these other jurisdictions would achieve substantial benefits from an increase in hours, even though they already have greater intensity than NSW.

Research indicates that jurisdictions with lower intensity should benefit more from an increase in mobile speed camera hours.

Other Australian jurisdictions use many more mobile speed camera sites than NSW. If cameras are used only at a small number of sites in limited areas, drivers will be able to learn where they can speed without fear of detection. More sites and a wider area of coverage means less predictability of enforcement and therefore a wider reduction in speeding across the network.

1 Introduction

Mobile speed cameras are an important tool in preventing death and serious injury on NSW roads.

In October 2018, the NSW Audit Office presented a report on mobile speed cameras (Audit Office of NSW, 2018). The audit assessed whether the mobile speed camera program is effectively managed to maximise road safety benefits across the NSW road network. One of its recommendations was for a review of better practice in other jurisdictions.

This review considers mobile speed camera programs in other Australian jurisdictions, and identifies differences in practice compared with NSW.

3.1. Need for speed management

Research over the last three decades - in Australia the USA, Europe and elsewhere – has clearly demonstrated the importance of speed in causing death and serious injuries. Speeding increases both the likelihood and severity of crashes. Recent reviews have continued to confirm this fact (International Transport Forum 2018) and provided more detailed understanding of the relationships between speed and risk (Elvik *et al* 2019). As speed increases, other things being equal, risk of injury increases more than proportionally. The risk of more severe injury increases more rapidly. The risk of fatal injury increases the most rapidly.

Management of speed therefore is an essential part of work to improve road safety. Speed management also has broader benefits to the environment and to quality of life, because people live and work near streets and roads.

3.2. Value of speed limit compliance

A large part of speed management relies on speed limits. Guidelines for setting speed limits (for example, Austroads 2008) stress the balance between multiple objectives. The roads exist to provide efficient transport, and the roads need to cater for a variety of users and a variety of uses, depending on the nature of the road, in accordance with the NSW Government's Movement and Place framework.

Most drivers respond reasonably to speed limits, and transport agencies work to increase understanding of the need for these limits. Nevertheless, in its most recent Statistical Statement (page 25), the NSW Centre for Road Safety reported that, in 2018, crashes which involved speeding represented at least 39 per cent of fatal crashes and 16 per cent of all casualty crashes; 2018 was not unusual in that regard. According to previous Statistical Statements, each year about 40% of fatal crashes and 16% of casualty crashes involved speeding as a factor. That is, speeding remains a major problem.

Achieving compliance with speed limits is essential for speed management, with crucial implications for prevention of deaths and serious injuries.

3.3. Value of speed cameras

Speed cameras help to improve compliance with speed limits.

The effectiveness of speed cameras has been established in many research studies. A Cochrane review (Wilson et al 2010) provided strong evidence for camera effectiveness (both fixed and mobile). Decreases in average speed, percentage of vehicles speeding, and crashes are consistently reported across studies from a range of countries. Cochrane reviews are highly respected summaries and analyses of the best available research in health-related fields (here injury prevention). Steinbach *et al* (2016) updated and extended the 2010 Cochrane review, reinforcing the results of the 2010 review.

2 Mobile speed cameras in Australian jurisdictions

Speed cameras are used in all Australian states and territories. The following pages describe the mobile speed camera programs in key Australian jurisdictions – specifically Victoria, Queensland, Western Australia, South Australia and ACT. While an outcome evaluation for the South Australian program could not be found, the other programs have been evaluated, and the evaluation reports provide a good basis for discussion of the programs and their benefits.

Clark *et al* (2019, page 15) point out that the largest jurisdictional variation in camera programs is in mobile speed camera programs. The common variations can be classified according to:

- the extent to which the mobile camera operation is overt, mainly using signage and markings on the camera vehicle
- the intensity of the operations, measured by hours of operation per month
- the number of sites
- the extent to which the focus is on improving compliance on a particular site or road section, or promoting compliance across the road network

Relative benefits of covert compared with visible operations are discussed in Section 15. Benefits of increased hours of operation are addressed in Section 16.

3.4. Victoria

Cameron and Delaney (2008) describe what a covert mobile speed camera operation means in Victoria. The camera is car-mounted. The car is one of a variety of popular makes and models and the car is unmarked. There are no warning signs. When there is enough natural light, the camera does not flash. The intention is that the driver should not notice the speed camera operation.

In Victoria, the mobile camera operating hours per month have continued to increase. D’Elia *et al* (2007) reported that the target per month had increased from 4,200 hours in August 2001 to 6,000 hours in February 2002. In 2019, mobile speed cameras operated approximately 9,300 hours per month (Department of Justice and Community Safety 2019).

The camera can detect speeding vehicles in one or both directions. And there are approximately 2,000 approved locations for mobile camera operation (Department of Justice and Community Safety 2019).

In Victoria, covert mobile speed camera operations began in 1989. Cameron *et al* (2003) briefly summarise evaluations of 1990s operations, which showed them to be very effective and included a 41% reduction in fatal crash outcome associated with very high camera activity.

From December 2000 to July 2002, Victoria introduced new speed management measures. These were:

- speed camera operations that were more covert
- a 50% increase in mobile speed camera operating hours per month

- a lower speed camera detection threshold
- a general urban speed limit of 50 km/h
- an increase in advertising targeting speeding behaviour.

D'Elia *et al* (2007) evaluated the package. Notice that this was an evaluation of the package as a whole, and was not able to analyse the effects of the separate elements. D'Elia *et al* (page 27) argued that the full force of the package was not felt until the second half of 2004. In that period, the package resulted in 27% fewer fatal crashes. There were 10% fewer casualty crashes (a casualty crash was one where a person was injured, including fatally injured).

3.5. Queensland

Queensland mobile speed camera operations started in May 1997. The mobile speed camera program originally operated only from marked vehicles. There had been signs after the vehicle to inform drivers that they had passed the camera, but since July 2015 there have been no signs. Since April 2010 Queensland has deployed up to 30% of urban operations from a variety of unmarked vehicles, without signs (Newstead *et al* 2018, p 1). There are more than 3,500 mobile speed camera sites (Queensland Government Open Data Portal) and the cameras can detect speeding in either direction (Queensland Audit Office 2015).

Figure 1 shows mobile speed camera deployment hours as reported by the Queensland Audit Office (2015). As can be seen, by 2014-15, deployment hours were more than 100,000 per year, - more than 8,000 per month. Hours were about 50% more in 2014-15 compared to 2008-09 (about 65,000 hours per year).

The Queensland Department of Transport and Main Roads and Queensland Police Service (2017 page 16) reported that they had an approved plan to increase mobile speed camera hours.

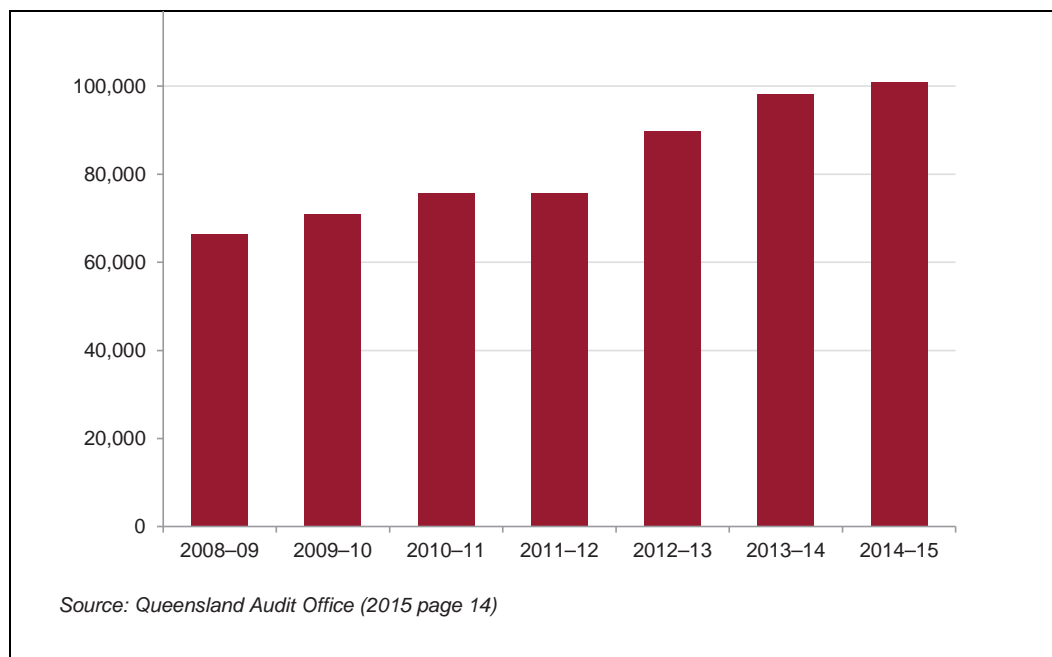


Figure 1: Mobile speed camera deployment hours by financial year, Queensland

The most recently reported evaluations of the Queensland speed camera program are those of Newstead *et al* (2017 and 2018). The 2017 evaluation relates to three years of operations:

2013, 2014 and 2015. The 2018 evaluation relates to operations in 2016. Some details were changed for the 2018 evaluation, but the evaluation framework continued to be that described by Newstead and Cameron (2013).

Using that evaluation framework, crash effects of the Queensland mobile camera program were assessed by comparing time series trends in the treatment areas with those in the corresponding comparison areas. Treatment areas were those within a 1 km radius of the centre of the speed camera zone in speed limits up to 80 km/h. Where the speed limit was higher than 80 km/h, the radius was 4 km (for the 2017 evaluation) or 5 km (for the 2018 evaluation). Comparison areas were areas outside the defined radius of the speed camera zone centres. Treatment and comparison were matched for analysis using the same broad speed zone categories and by police region of operation (Newstead and Cameron 2013).

The evaluations included other types of speed camera, and also red-light cameras. Nevertheless, the evaluations found that 98% of the savings were associated with the mobile speed camera program. Newstead et al (2017, p 68; 2018, p 49) explained that this is because mobile speed cameras cover a much greater proportion of Queensland's crash population than other types of camera.

The 2017 evaluation found that overall, the Queensland Camera Detected Offence Program was associated with an overall reduction in serious casualty crashes of between 26%-30% across 2013-2015. This represents a reduction of between 1,660 to 2,000 serious casualty crash reductions (defined as those that result in death or hospitalisation). The number of serious casualty crashes saved because of the mobile speed camera program was 1,948 in 2013, 2,001 in 2014 and 1,643 in 2015.

The most recent 2018 evaluation of camera operations in 2016 reported consistent reductions in serious casualty crashes (1,650) of which 1,636 were attributable to the mobile speed camera program.

Notice that, in the evaluations, the method of assessing benefits relates to specific camera sites. However, the intention of covert mobile camera operations is to produce general effects over the network, and so the site-specific method could perhaps underestimate the mobile cameras' benefits. Newstead and Cameron (2013 page 10) point out that it would be difficult to assess the generalised effects of covert operations.

3.6. Western Australia (WA)

Western Australia had at least 4,000 mobile camera sites by 2013 (Newstead *et al*, 2015, page 6). Most mobile camera sessions were in metropolitan areas. In 2013, the average monthly hours were 2,640 hours in metropolitan areas and 540 hours in regional areas (Newstead *et al*, 2015, page 30). Newstead (2016 page 50) reported higher target operational hours of 3,500 per month.

There had been signs to draw drivers' attention to the camera operation. The use of signs was discontinued in 2011 (Newstead *et al*, 2015, page 30). The locations of operations are published on the WA Police Force website. Rearward facing operation commenced in 2010.

The most recently reported evaluation of the WA speed camera program is Newstead *et al* (2015). This included the years 1995 to 2013.

Newstead et al (2015, page 50) related monthly variation in observed crashes at camera sites, to the monthly number of camera sessions undertaken. The evaluation reported that the "vast

majority” of camera sessions ran between 6 am and 8 pm, and so other times of the day were used as a control (page 44).

The effects were measured within 500 metres and within 1 km of the camera. The mobile speed camera program resulted in a large reduction in fatal crashes, with the average reductions over the years of between 20% and 25%.

Newstead et al (2015, p 85) pointed out that the benefits were less than they could have been if the cameras had been used more at night, because traffic is lighter at night and so speeding tends to be more prevalent.

3.7. South Australia (SA)

The SA mobile camera program uses unmarked vehicles and no signs; cameras can enforce in both directions (South Australian Police).

Maxwell (2015, page 10) indicates that mobile cameras operated for an average of 3,750 hours per month in 2014. There is no readily available information on the number of sites.

There is no apparent outcome evaluation of the South Australian mobile speed camera program.

3.8. Australian Capital Territory (ACT)

The ACT program does not use advance warning signs. The speed camera vehicle is an unmarked van with a sign on top. There are no other signs.

In 2017, mobile cameras were operated for an average of 1,200 hours per month (based on Clark *et al*, page 91).

Justice Safety and Emergency ACT list 1,184 sites where mobile cameras could be used.

The ACT mobile speed camera program was associated with an average 19.7% reduction in casualty crashes in areas within 500 m of a mobile speed camera site since program implementation (Clark et al 2019, p 61).

Clark et al (page 102) used the statistical model developed for the evaluation to estimate the likely effects of expanding different parts of the camera program. The specific expansion offering the greatest safety benefits was further increases in mobile camera deployment hours. The other options considered were fixed speed cameras, red light/speed cameras, and a point-to-point camera.

3.9. New South Wales (NSW)

In NSW mobile speed cameras are operated from highly visible vehicles. NSW uses two warning signs before the camera and one after. The speed limit is displayed on one of the advance warning signs.

NSW mobile speed cameras operate in one direction only. The cameras could operate in both directions, but the requirement for warning signs would make bi-directional operation difficult.

NSW Centre for Road Safety (2019, page 27) reports that mobile speed cameras operate for 7,000 hours per month, at 1,024 locations.

The value of mobile speed camera operations in NSW has been assessed by observing the effects when the program was stopped and then re-started. NSW stopped using mobile speed cameras at the end of 2008 and introduced new mobile speed cameras in the middle of 2010. Maxwell (2015, Page 3) pointed to the large increase in the road toll following the cameras' removal, and the large decrease following the re-introduction. BITRE (2014, page 190) also pointed out the effects of the removal and re-introduction on their model of the NSW fatality rate. NSW provides a review of speed cameras each year (for example, NSW Centre for Road Safety 2019). The reviews assess the success of the mobile camera program against the result when the program stopped for 2009. In summary, the road toll went up when the mobile speed camera stopped, and decreased when it started again.

3 Comparison between jurisdictions

Table 1 briefly compares jurisdictions in relation to the features outlined in Section 5. The numbers in Table 1 are as reported in Sections 7 to 11, above. These numbers are not necessarily completely up to date. For example, Western Australian government budget papers indicate that camera programs have expanded and will expand further, but the details are not readily available. It was pointed out in Section 7, above, that a plan to increase Queensland mobile speed camera hours had been approved.

Table 1: Summary of features of mobile speed camera programs in Australian jurisdictions

	Signs	Vehicle markings	Hours /month	Directions measured	No. of sites
NSW	2 before, 1 after	Bright and distinctive	7,000	Single	1,024
VIC	None	None	9,300	Both	2,000
QLD	None	Yes, see below	>8,000	Both	>3,500
WA	None	None	3,500	Both	4,000
SA	None	None	3,750	Both	Not known
ACT	1 on van's roof	None (sign on van roof)	1,200	Not known	1,184

The jurisdictions vary in two significant ways. The first is the extent to which the program is overt, using signage and vehicle markings. The second is the intensity of the operations, measured by hours per month.

NSW is the only jurisdiction that uses warning signs.

NSW and Queensland camera vehicles have markings, although Queensland has up to 30% unmarked vehicles. NSW vehicles are brightly and distinctively marked. Queensland vehicle markings are not bright or particularly distinctive.

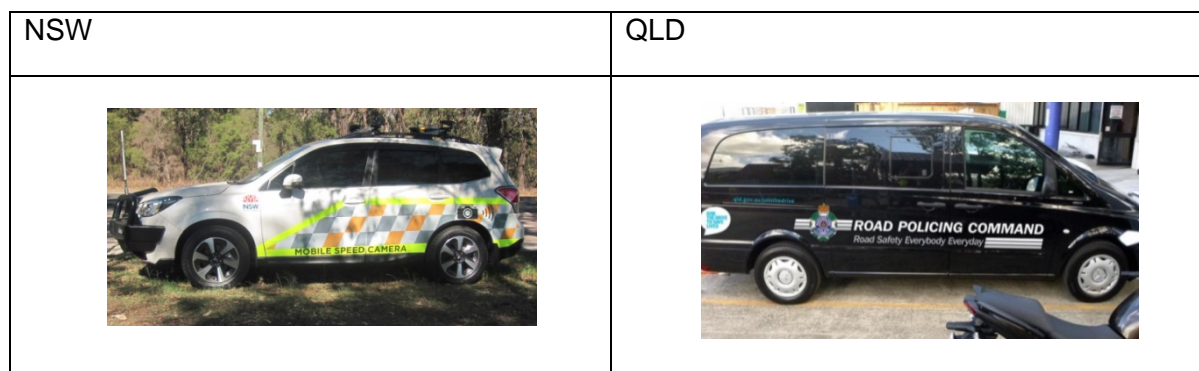


Figure 2: NSW and Qld mobile speed camera vehicles with markings

In Figure 3, the number of hours of mobile speed camera operations are expressed as hours per 10,000 registered vehicles and hours per 10,000 population, to relate the intensity to the size of the jurisdiction.

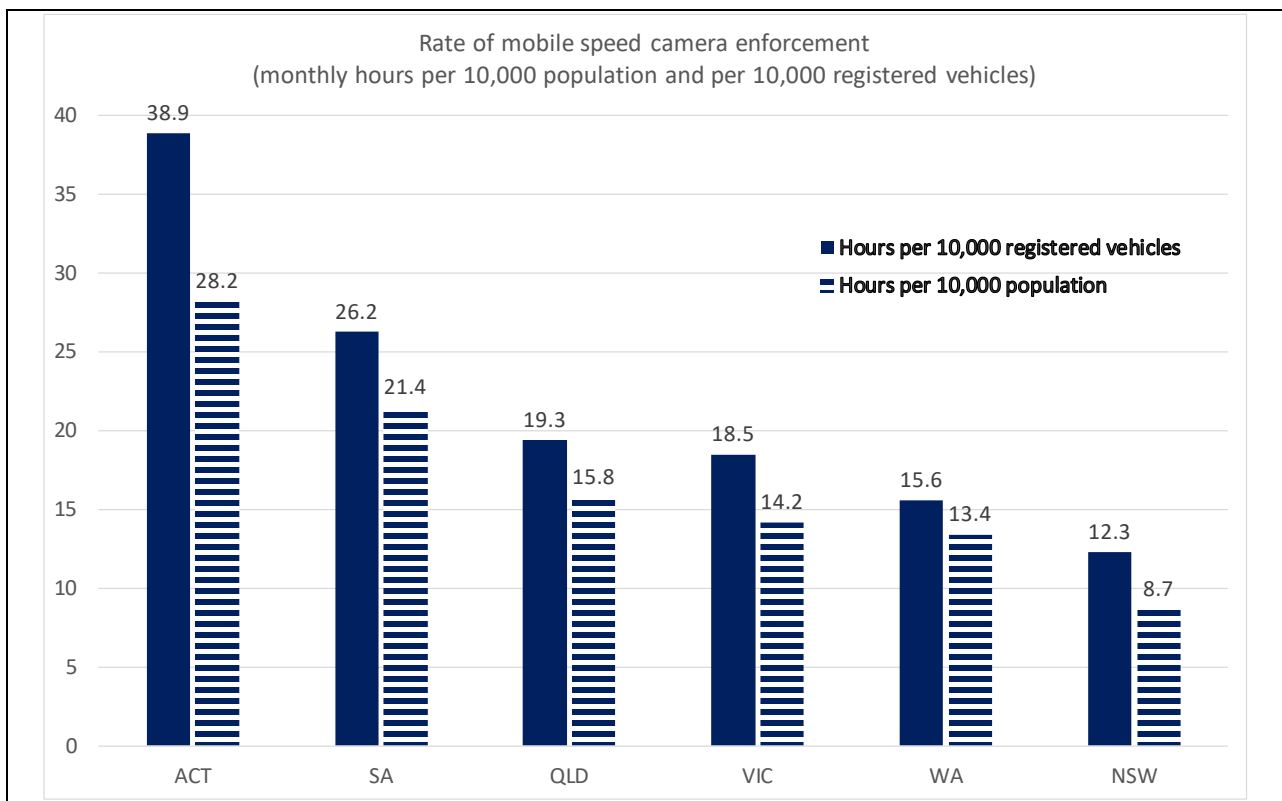


Figure 3: Comparison of monthly enforcement hours of mobile speed camera programs in Australia (Source: Hours: as per Table 1; Vehicle no. ABS Motor Vehicle Census 2019; Population: ABS Australian demographic statistics, March 2019)

NSW has the fewest mobile speed camera hours per registered vehicle and the fewest per head of population. NSW has many more vehicles and people than other jurisdictions.

NSW has the most visible operations. It has the least intense program, relative to its size.

4 Deterrence and mobile speed cameras

Exceeding the speed limit relates to a driver's motivation. Drivers will be more likely to choose to comply with the speed limit, if they perceive that they would be likely to receive a penalty for non-compliance (Zaal 1994). The aim is therefore to influence the driver's choice to comply.

Even if the penalty is appropriate, potential offenders can only be influenced by it to the extent that they expect to receive the penalty if they offend. This is the basis of deterrence.

Ideally, the best road safety benefits would result if there is deterrence at all times and in all places. All times means throughout the day and throughout the year. All places means everywhere across the road network.

However, it is not possible to have speed camera operations everywhere. One practice used to enhance the perception of enforcement at more times and in more places is to use many more sites than cameras, and move the cameras from site to site. This is the advantage of the cameras being mobile. The location of cameras at particular sites is randomised¹, so that a driver cannot anticipate where a mobile speed camera will be or when.

The intention is to generate in each driver the expectation that if he or she is speeding - anywhere or anytime - detection is likely. There should be no times or places (or as few as possible) where a driver can feel confident that speeding would not be penalised.

The following three sections consider the requirements for covert and intense mobile speed camera operations to maximise this anywhere-anytime expectation.

3.10. Number and range of sites

As pointed out, the aim of a mobile camera program is to achieve an anywhere-anytime expectation of detection, so that drivers will choose to comply with speed limits at all times and broadly across the network.

If cameras are used only at a small number of sites in limited areas, drivers will be able to learn where they can speed without fear of detection. More sites and a wider area of coverage (coupled with randomised camera operations) means less predictability of enforcement. Drivers are therefore more likely to reduce their speeds more generally, rather than at specific locations only.

There is no apparent basis for estimating the optimal number of sites. This number would be affected by the characteristics of the road network and road usage in each particular jurisdiction. Other Australian jurisdictions use many more sites than NSW, and it has been seen that the programs in these jurisdictions have been effective.

3.11. Signage and vehicle markings

The question is whether and in what circumstances mobile speed camera operations should be highly visible.

Rather than there being a clear distinction between overt and covert operations, visibility of operations varies along a continuum. NSW has highly visible mobile camera operations;

¹ This does not mean that each site has the same probability of a camera being there

Victoria's are intended not to be noticeable at all. Queensland has no signs and vehicles that have either no markings or inconspicuous markings. The visibility of Queensland operations is much less than that of NSW. On this basis, Queensland seems closer to Victoria in terms of visibility of mobile camera operations.

As Newstead and Cameron (2013 page 10) point out, it would be difficult to assess the generalised effects of covert operations. With a visible camera operation, the evaluator can measure effects at the camera site compared with elsewhere. But with a covert operation, designed so that the driver should be unaware that the camera is operating at the particular site, no site-specific effect can be expected.

Some commentators, who suggest that highly visible operations are effective, look to random breath testing as a guide. Homel (1986) is known as a champion of high visibility (and high intensity) policing to counter drink driving, as in random breath testing pioneered in NSW in the early 1980s. Therefore, it is significant that Homel (page 3) drew attention to the distinction between "fixed" offences and "transient" offences (per Cameron and Sanderson, 1982). Homel noted that

The differing requirements for effective police enforcement, depending on whether fixed or transient offences are the target, illustrate the dangers of treating traffic law enforcement as a unitary phenomenon.

In the passage quoted, Homel is pointing out that the example of random breath testing is not necessarily the best approach for all types of offences and all purposes.

A fixed offence results from the physiological or legal status of the driver; it cannot be quickly changed if the driver becomes aware of an enforcement operation. A transient offence is one where the driver can choose to comply when aware of an enforcement operation, and choose to offend elsewhere.

Cameron (2015) returned to this distinction between fixed and transient offences. Among his examples are:

- fixed offences: drink-driving, drug-driving, unlicensed driving
- transient offences: speeding, mobile phone use, red-light running.

Cameron points out that research findings indicate that different enforcement practices are suitable, depending on whether the targeted offence is fixed or transient, and whether the objective is to achieve either

- an effect at a particular location or
- a general effect across the road network.

For fixed offences, highly visible operations can achieve a broad effect, across at least a substantial part of the network. The best example is random breath testing.

Even for transient offences, such as speeding, highly visible operations are suitable if the objective is to ensure compliance at a particular place (site, road section) and perhaps at a particular time.

When targeting transient offences and aiming for network-wide compliance, highly visible operations are not optimal. Speeding is a transient offence. Cameron (2015 page 3) states:

Traditional speed enforcement operated visibly, usually at identified high risk locations, has strong “local” effects on road trauma, but no effect outside a limited range. A “general” effect on speeding across the whole road system is best achieved if there is a perceived risk of being apprehended when speeding in any place at any time. This is best achieved by covert speed enforcement that can be moved to many locations.”

As summarised in the European Road Safety Observatory (2018 page 14):

Whereas nearly every driver keeps within the speed limit when a camera is clearly visible, a small percentage of drivers may still violate the limit when they drive on a road with hidden cameras. On the other hand, clearly visible speed cameras may tempt drivers to speed up again a few hundred metres after the camera, while they may be less tempted to violate the speed limit when they are aware of the possibility of a hidden camera check.

To achieve better compliance with speed limits, using cameras, the implication is that:

- Highly visible cameras achieve compliance at specific places and times.
- Covert mobile speed cameras are necessary to achieve broad network compliance.

A covert camera program, however, cannot affect the behaviour of a driver who is unaware that covert cameras are operating. Transport agencies can raise driver awareness and expectation of mobile speed enforcement through public education and encourage drivers always to comply with speed limits.

To generate an anywhere-anytime expectation of detection, and maximise deterrence of speeding behaviour across the road network, mobile speed camera operations should not be highly visible. This means operating without warning signs, and without easily recognisable vehicles, in line with current practice in other Australian jurisdictions.

3.12. Intensity

To achieve a driver expectation of anywhere-anytime speed enforcement, a substantial enforcement intensity is necessary.

Elvik (2011) showed that there are diminishing marginal returns from increasing enforcement intensity. This means that the higher the existing intensity of enforcement, the less the benefit of increasing the intensity. Equally, it means that the lower the existing intensity, the greater the benefit of increasing intensity.

For Victoria, Cameron *et al* (2016) developed a model to estimate the crash reduction benefits of increases in several types of traffic enforcement. The model development was based on research literature from Australia and internationally. Following Elvik (2011) the model expects diminishing marginal returns. Even so, the largest benefits to be expected from an increase in enforcement in Victoria was an increase in mobile speed camera enforcement. A 50% increase in non-urban mobile speed camera hours was predicted to result in a 21.5% reduction in fatal crashes. A 50% increase in urban mobile speed camera hours was predicted to result in a reduction of 35.7% in fatal crashes.

As part of the Queensland evaluation, Newstead *et al* (2017 page 46) pointed out that the crash reductions had grown over time as a result of steady increases in the number of sites that

were actively enforced along with increases in the hours of mobile speed camera enforcement each year.

Recall from Figure 1 (page 8), that Queensland mobile camera hours increased by about 50% from 2008-09 to 2014-15. Figure 2 (page 7) indicates that the hours per month in Queensland, per head of population, are more than 50% greater than those of NSW.

The ACT has a much higher per capita intensity than NSW's, but it could still benefit substantially from an increase in mobile speed camera hours. Based on the statistical model developed for the ACT evaluation, Clark *et al* (2019 page 102) estimated the effects of an increase in ACT mobile camera hours. Clark *et al* estimated a benefit-cost ratio of 4.1 if the operating hours were to be increased by 25%.

In relation to Western Australia's program, Cameron (2008) recommended an increase in their mobile speed camera monthly hours to 12,000 (9,000 hours in Perth and 3,000 hours in regional areas). This recommendation appears to be based on modelling adapted from data from other jurisdictions. This would be nearly four times the hours reported in the Newstead *et al* (2015) evaluation.

In summary, NSW has fewer mobile camera operating hours than other jurisdictions, related to population and the number of registered vehicles. Queensland benefited substantially from a 50% increase in mobile camera operating hours. For Victoria, the ACT and Western Australia, statistical modelling indicates that these other jurisdictions would achieve substantial benefits from an increase in hours. All these jurisdictions start from a higher intensity than NSW's and therefore could expect lesser marginal returns.

5 Summary and Conclusions

Based on decades of research, it has been clear for many years that management of speed is crucial for the prevention of serious road trauma – the prevention of death and serious injury. There is strong evidence for the effectiveness of speed cameras in managing speed to prevent serious trauma.

Like many other parts of the world, all Australian jurisdictions have speed camera programs that include mobile cameras. Evaluations of the programs in Victoria, Queensland, Western Australia and the ACT (see Sections 6, 7, 8 and 10, above) have shown that mobile speed camera programs have substantial benefits. Victoria had a reduction of 27% in fatal crashes from a package that included a 50% increase in covert mobile speed camera hours. Queensland, WA and ACT benefits were measured near mobile camera sites. Queensland reduced serious casualty crashes substantially, as discussed in Section 7, above. WA reduced fatal crashes by 20% to 25%. And ACT reduced casualty crashes by 20% to 25%.

The NSW mobile speed camera program uses signs to make the operations highly visible, with two warning signs before the camera vehicle and one sign after. The operation is made even more visible by using bright and distinctive markings on the camera vehicle.

Other jurisdictions do not use warning signs, although the ACT uses a sign on top of the otherwise unmarked camera van.

As well as NSW, Queensland is the other jurisdiction to use markings on camera vehicles. But the Queensland markings are neither bright nor distinctive and up to 30% of the vehicles are unmarked.

Highly visible policing is suitable for fixed offences, such as drink driving or unlicensed driving, where the offence results from a relatively unchanging physiological state or legal status.

Even for transient offences, such as speeding, highly visible operations are suitable if the objective is to ensure compliance at a particular place (site, road section) and perhaps at a particular time, where it is a priority that safety be optimised at that place and time. For this purpose, fixed speed cameras should be highly visible.

The NSW mobile speed camera program is highly visible, and so it functions much like a highly visible fixed speed camera program rather than a randomised and unpredictable mobile speed camera program.

To achieve larger scale general speed compliance across the network, it is necessary to use covert mobile speed cameras, an approach taken in other jurisdictions through lack of warning signs and easily recognisable vehicles.

As well as having the most visible mobile speed camera operations, the NSW mobile speed camera program is the least intense. Both Victoria and Queensland operate mobile speed cameras for more average monthly hours. When expressed as a rate per head of population or per registered vehicle, NSW has fewer monthly mobile camera hours than any of the other five Australian jurisdictions considered in this report.

Queensland achieved large safety benefits from a 50% increase in mobile camera hours. Statistical modelling, for Victoria, ACT and WA, predicts large benefits from increasing hours above those noted in this report. Research has found increased marginal returns for those starting from a lower enforcement level.

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