EVALUATION OF ANPR TRIALS FOR TRAFFIC POLICING IN QUEENSLAND

Report to the Queensland Police Service,
State Traffic Support Branch

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1 EXECUTIVE SUMMARY

In response to the Travelsafe Committee Report No. 51 – report on the inquiry into Automatic Number Plate Recognition Technology – it was recommended that the Queensland Police Service continue to trial the deployment of ANPR technology for traffic enforcement work and to evaluate the road safety impacts and operational effectiveness of the technology. As such, the purpose of this report is to provide an independent evaluation of a trial of ANPR that was conducted by a project team within the State Traffic Support Branch of the Queensland Police Service (QPS) and provide recommendations as to the applicability and usability of the technology for use throughout Queensland.

ANPR technology is increasingly being used in other jurisdictions to target illegal behaviours such as unlicensed driving, unregistered and uninsured driving and traffic fine defaulting. In addition, the Travelsafe Committee (2007) identified the potential for ANPR to target speeding, fatigue offences among heavy vehicle drivers, and the non-compliance of provisional drivers with relevant restrictions. In the current trial of ANPR, four offences were targeted. They included unlicensed drivers, unregistered vehicles, stolen number plates and stolen vehicles. These four behaviours were chosen as per Recommendation 2 of the Parliamentary Travelsafe Committee Report No. 51. Specifically, the scope of the current trial was "The Queensland Police Service will conduct traffic enforcement trials of this technology, using the Department of Transport and Main Roads' database of unregistered vehicles and the Queensland Police Service's Vehicle of Interest database of stolen vehicles, wanted vehicles and vehicles used by or registered to wanted or missing persons" (Department of Transport and Main Roads, 2009).

The current report contains both a process and an outcome evaluation. The process evaluation of ANPR technology for this report was undertaken through two methods. The first was through direct observation of the operation of the ANPR system used during the trial deployments. The second was though the use of a survey distributed to the police officers in each district that participated in the ANPR trial. The outcome evaluation focused on the data collected during the deployments as well as a study of the characteristics from a random sample of the offenders detected during the operation.

The evaluation of the ANPR trial deployments has demonstrated that ANPR technology is of benefit for use in road traffic policing operations. The ANPR technology proved useful in targeting offences that are considered to be detrimental to road safety in Queensland, for which the current countermeasures are less than ideal. The benefits of the ANPR technology can be summarised into two categories; i) detection of offences and ii) deterrence of offending behaviours.

From the evaluations undertaken in this report from data provided by the ANPR Project team, it is recommended that *ANPR technology be introduced for traffic policing operations in Queensland.* The ANPR system affords substantial improvements over the current technology for detecting unlicensed drivers, both in terms of the detection ability and the operational efficiency and the deterrence value of the technology has the potential to positively impact on road safety.

It is recommended that the operating procedures, site selection and staffing resources for ANPR operations ensure that punishment avoidance episodes are minimised. The procedures

must adequately address the situations where potential offenders are able to drive thorough high visibility operations without being intercepted.

It is recommended that ANPR operations should not take away resources from existing effective traffic policing strategies, such as RBT. Rather ANPR is another technology that can be undertaken in conjunction with other traffic policing operations. ANPR is just one tool in the toolbox for traffic policing operations, with each tool having specific applications for detection and deterrence or specific offending behaviours.

It is recommended that the issues of data security management and privacy safeguards, as raised by the Travelsafe Committee (2008), are adequately addressed and the legislation governing/relating to the use of ANPR should be the subject of further consideration. It is important that operating procedures confirm to the requirements of the existing legislation.

It is recommended that methods for reducing licence plate theft and licence plate cloning be investigated. The introduction of ANPR technology in Queensland has the potential to increase the frequency of these offences, as was the case in the UK after the introduction of ANPR (Travelsafe Committee, 2008).

It is recommended that further consideration be given to the introduction of compulsory carriage of licence for open licence holders in Queensland, to facilitate more routine licence checking. The lack of compulsory carriage of licence is seen as a potential issue which may limit the effectiveness of the ANPR technology for the detection and deterrence of unlicensed driving.

It is recommended that ANPR be supported by an on-going public education campaign in order to maximise the likely general deterrence effect.

Finally, it is recommended that on-going evaluation be undertaken in order to:

- identify the appropriate level of resources to be devoted to ANPR relative to other enforcement operations; and
- to fine tune ANPR practices.

2 REPORT BACKGROUND AND OBJECTIVES

In response to the Travelsafe Committee Report No. 51 – report on the inquiry into Automatic Number Plate Recognition Technology – it was recommended that the Queensland Police Service continue to trial the deployment of ANPR technology for traffic enforcement work and to evaluate the road safety impacts and operational effectiveness of the technology. As such, the purpose of this report is to provide an independent evaluation of a trial of ANPR that was conducted by a project team within the State Traffic Support Branch of the Queensland Police Service (QPS) and provide recommendations as to the applicability and usability of the technology for use throughout Queensland.

While it is acknowledged that ANPR can be used to detect and prevent a wide range of criminal behaviour, the purpose of the current report is to evaluate a recent trial using the technology by QPS. As such, this report will primarily be limited to the road safety applications of this technology as applied in the trial. This focus is in keeping with the research interests and expertise of the authors.

2.1 What is ANPR?

Automatic Number Plate Recognition (ANPR) or Automatic Licence Plate Recognition (ALPR) technology employs a camera and Optical Character Recognition (OCR) software to capture an image of a vehicle's number plate and convert it to a text string of letters and numbers. ANPR technology works best with digital images and, as Constant (2003) states, to ensure the maximum utilisation of the ANPR technology, an infrared camera should be used, so that number plate images can be captured in low light, and at night time. Once the number plate has been 'read' the string is logged and cross-referenced against a relevant database in order to determine whether the number plate appears within that database. Information such as whether the vehicle is registered, insured, stolen, or is registered to an unlicensed driver can be stored within the database.

2.2 The Role of ANPR in Road Safety

In order to establish the likely road safety benefits of ANPR it is important to consider the role of traffic law enforcement and how its effectiveness may be enhanced by the use of the technology. Over recent decades, a growing body of literature has emerged indicating that traffic policing programs, particularly in conjunction with publicity campaigns, can prove very cost-effective in reducing road trauma. Indeed, Australia has attracted international attention for the success of policing programs such as:

- Random Breath Testing (RBT) (eg. Homel, 1988; Watson, Fraine & Mitchell, 1994; Henstridge, Homel & Mackay, 1997);
- red light cameras (eg. Queensland Transport, 1995);
- speed cameras (eg. Cameron, Cavallo & Gilbert, 1992; Delaney, Diamantopoulou & Cameron, 2003); and
- randomly scheduled traffic policing (eg. Newstead, Cameron & Leggett, 2001).

A key feature of successful traffic policing programs is their capacity to increase the population's perceived risk of being apprehended for breaking the road rules (Homel, 1986, 1988; Zaal, 1994). In this regard, South (1998, p.76) has argued that the: "reduction in the road toll . . . has arguably been the most successful example of public action to minimise a social problem in Australia, and there is solid evidence that general deterrence programs have played a major role."

Drawing on the work of Homel (1993), it has been argued that traffic law enforcement operations are most effective when they are:

- unpredictable in their timing and location;
- deployed in a widespread (ubiquitous) manner to ensure a broad coverage of the road network; and
- difficult for drivers to avoid when encountered (Watson et al., 1994, 1996).

While it is beyond the scope of the current report to review a number of theoretical issues that assist in understanding the influence of these programs on driver behaviour, a detailed review of deterrence theory and hallmarks of successful traffic law enforcement operations can be found elsewhere (see Watson & Walsh, 2008).

ANPR technology is increasingly being used in other jurisdictions to target illegal behaviours such as unlicensed driving, unregistered and uninsured driving and traffic fine defaulting. In addition, the Travelsafe Committee (2007) identified the potential for ANPR to target speeding, fatigue offences among heavy vehicle drivers, and the non-compliance of provisional drivers with relevant restrictions. In the current trial of ANPR, four offences were targeted. They included unlicensed drivers, unregistered vehicles, stolen number plates and stolen vehicles. These four behaviours were chosen as per Recommendation 2 of the Parliamentary Travelsafe Committee Report No. 51. Specifically, the scope of the current trial was "The Queensland Police Service will conduct traffic enforcement trials of this technology, using the Department of Transport and Main Roads' database of unregistered vehicles and the Queensland Police Service's Vehicle of Interest database of stolen vehicles, wanted vehicles and vehicles used by or registered to wanted or missing persons" (Department of Transport and Main Roads, 2009).

3 THE CURRENT EVALUATION

3.1 Process Evaluation

The process evaluation of ANPR technology for this report was undertaken through two methods. The first was through direct observation (by the first and second authors) of the operation of the ANPR system used during the trial deployments. The second was though the use of a survey distributed to the police officers in each district that participated in the ANPR trial. The survey was developed by the ANPR Project team for the purposes of the ANPR trial evaluation.

3.1.1 Equipment Used

During the ANPR trial, the following equipment was used:

- Aspect AutoKit, comprising the ANPR software (OCR software) and a Panasonic Toughbook Laptop computer (a water and dust resistant laptop with a magnesium alloy case and mechanical shock protection)

- PIPS Technology P362 Camera, surrounded by an illuminator consisting of a ring of infra-red LEDs, and housed within a metal shroud. The P362 actually comprises two cameras; one black and white and one infrared. The camera has a 25mm focal length ensuring high infra-red sensitivity with both lenses configured to read number plates. The camera includes a patented filter combined with flash techniques which can suppress headlights, bright sunlight and other variable light conditions

- RAPID ANPR software

The RAPID end-user interface was obtained from the Australian Federal Police via an inter-service agreement for the duration of the project. There are many different end-user interface versions available, all of which can be altered to meet specific needs of the user. However RAPID was selected as it met the needs of the ANPR trial in terms of ease of use and statistical data collection abilities. During the trial it was used in conjunction with the Aspect AutoKit ANPR software.

3.1.2 Equipment Setup

All the trial deployments were conducted with the camera mounted on a three-way tripod head and placed either on a tripod beside an unmarked vehicle, or mounted onto the vehicle with a suction-cup mount. The three-way head has separate locking controls and rotational movement on each axis allowing precise adjustment. The camera was connected to the Toughbook laptop computer with a cable. The ANPR operators were located inside the unmarked vehicle, with one operator monitoring the computer and the other observing passing traffic and communicating with the intercepting officers.

A Site Safety/Suitability checklist was developed by the ANPR Project team to record details relating to the setup of the ANPR system. The checklist also recorded the location of each deployment and the OH&S controls that were put in place at each deployment site. The camera was setup and the ANPR operators evaluated the positioning by the accuracy of the character matching being achieved by the system. The ANPR operators used their own judgement to determine if the system was not achieving a reasonable degree of accuracy, and adjusted the setup if required to improve the character matching accuracy. This was done in conjunction with the capabilities of the ANPR software when determining appropriate angles. For example, when setting up the equipment it has a capability of being able to preview reads of number plates. From this, the angle can be altered / corrected to ensure that the camera is at the optimum position to allow for accurate reads.

Constant (2003) stresses the importance of both investing in good quality technology and in taking the time and effort to ensure that the entire system is configured for optimal image capture. These factors include, but are not limited to, assessing the level of illumination, the camera angle, and the shutter speed. Constant (2003) claims that he has experienced instances where number plate recognition rates have leapt from 30%-40% to nearly 100% when the camera angle has been adjusted. When developing standard operating procedures

for widespread ANPR deployment in Queensland, the importance of correct camera setup must be addressed in order to ensure that the system is as accurate as possible in the character matching process. An optimal camera setup will reduce the workload on the ANPR operators by minimising the frequency of inaccurate character matching which requires manual intervention by the operator to correct.

3.1.3 Sites Chosen

The physical sites chosen for the ANPR trial were selected from a list of sites that were already deemed suitable for other operations, such as RBT or speed camera operations or other static site interception operations. While many of the sites were pre-approved, some were specifically selected for ANPR. The sites were selected in consultation with the officers in each district that participated in the trial. The Site Safety/Suitability checklist, developed by the ANPR Project team, was used at each deployment and the OH&S controls in place at each deployment site were recorded.

Whilst undertaking the deployments it was found that some of the sites were not suitable for ANPR operations. One of the reasons was the OH&S issues with regard to stopping traffic on a dual lane carriage way. Another issue experienced at some deployments was that after a period of operation of the ANPR system, and the subsequent vehicle intercepts from the ANPR 'hits', it was found there was not sufficient room to stop vehicles, simply because of the number of vehicles were already parked on the side of the road due to enforcement action. Some of the comments from the officers in relation to this point were:

> *"... the 2 times I was involved in ANPR, we more or less ended up with a used car yard, where offenders were pulled off the road and vehicles were being parked up and down the street, due to unlicensed, unreg and uninsured."*
>
> *"It would be great if we had a big enough area and enough staff to do a combined operation, but logistically it would be a nightmare. There would be cars everywhere."*
>
> *"There were a lot of good sites, that we use for other operations, that weren't suitable due to the traffic being multiple lanes ..."*

ANPR technology brings with it some unique requirements in terms of site characteristics. While the technology is capable of capturing the number plates of vehicles in multiple lanes of traffic, similar to speed cameras, intercepting vehicles in multiple lanes increases the OH&S risks for the intercepting officers. As noted above, ANPR operations have the potential to result in a large number of vehicles being intercepted and removed from the road, and future ANPR sites would have to take this factor into account. Alternately, the duration of the ANPR operations could be reduced, so that no one particular site becomes overcrowded. This would allow officers to target several sites for shorter durations, which may eliminate the overcrowding experienced when deployments occur over several hours at the same site. It is considered that these issues be addressed when developing standard operating procedures for widespread ANPR deployment in Queensland.

3.1.4 Data fields formally captured and stored

The data fields that were captured during the ANPR trial were as follows:

- Photograph of the vehicle licence plate
- OCR 'read' of the vehicle licence plate from the photo
- Time and Date of the 'read'
- The category of alarm associated with the ANPR 'hit' (e.g. unregistered vehicle or primary/secondary owner unlicensed).

No identifiable information in relation to the registered owner/s of vehicles was displayed or recorded after an ANPR 'read'. This was done for privacy and security of data reasons. The first time a police officer was aware of the identity of the driver and/or registered owner/s of a vehicle was when the vehicle was intercepted and investigations commenced.

The way in which the ANPR camera was setup resulted in the capture of images in a very specific target area. The camera was setup to focus on the area of vehicles were the licence plates would typically be located. This had implications when licence plates were in a non-standard position, such as high up on the rear of four wheel drives and for accessory licence plates (such as bike carriers). The ANPR camera did not record a full image of the target vehicle and the driver of the vehicle could not be identified from the recorded images.

3.1.5 Format in which the data is captured

The data was captured in an electronic format on a 'Toughbook' laptop computer. All the data fields that were captured through the RAPID end-user interface were stored in the software's database. The data file format was a proprietary file type specific to the ANPR system software. This proprietary file type could not be opened and read by commonly available programs, such as word processing or spreadsheet applications, thereby further restricting access to the data.

3.1.6 System Protocols

3.1.6.1 Security of Data

The database used for the trial was a combination of data from the Department of Transport and Main Roads (DTMR) database of unregistered vehicles and the Queensland Police Service Vehicle of Interest database. During the early stages of the trial, the encrypted and password protected database was physically collected from the DTMR MINDA Unit two to three times a week and then uploaded onto the ANPR Laptop. This process was eventually fine-tuned so that the database was transferred from the DTMR to QPS secure fileserver on a daily basis. The latest available database file could then be retrieved by the ANPR Project officers daily, anywhere in the state, before the commencement of a deployment. The ANPR Project officers had authorisation to access the data and could decrypt and open the database file. The database file/s were transferred to the Toughbook laptop computer used for the trial and imported into the Aspect AutoKit and RAPID ANPR software. The Toughbook Laptop and database access was restricted to the ANPR Project officers directly involved in the ANPR trial deployments. Access to the laptop was secured through logon credentials and a password protected screen saver/lock.

3.1.6.2 Capture of Images

It was possible to transfer captured images from the Toughbook laptop to a secure fileserver when necessary, for example for evidentiary purposes. Access to the secure fileserver was restricted to authorised persons only; in this case ANPR Project Officers. The ANPPR laptop was not able to be connected to the QPS network, and therefore captured images could not be accessed other than via the ANPR laptop or the secure fileserver (both of which are access limited), in order to minimise the possibility of security breaches.

3.1.7 Readability and accessibility of the data

In the RAPID ANPR system software, the data was arranged in a table format with the image of the vehicle licence plate and the OCR 'read' alpha numeric characters from the image. If an ANPR 'hit' was detected from the OCR characters, then these characters (the vehicle licence plate number) were displayed in red to distinguish this ANPR read from others in the table.

Captured data consisted of a picture of the front of the vehicle and a digitalised image of the number plate (known as a 'patch' plate image). It is important to note that that the image capture was focused licence plate and NOT on the occupants of the vehicle. Included on the picture of the vehicle was information pertaining to the vehicle and type of ANPR 'hit' or 'alarm' and therefore the potential offence category, as well as the time and date-essential information should the image be subsequently required for evidentiary purposes. Again, it is important to note that NO identifying information, such as names, address etc were included.

The captured data was only able to be subsequently opened and read by the ANPR system software. There was no transmission of the captured data from the laptop computer which was utilised during the trial. Further the laptop configuration prevented connection to the QPS network. Access to the laptop computer used during the trial was restricted to the officers from the ANPR Project team whom were directly involved in the supervision of the ANPR trial.

3.1.8 Resources utilised at the deployments

The deployments typically involved the inclusion of two officers from the ANPR Project team in conjunction with a number of district officers. The number of district officers involved varied at each deployment due to resourcing and timing issues of the ANPR trial. In order to maximise the use of the district officers, RBT was also performed at the majority of deployments. This was undertaken, in order to maximise the use of available resources at any one time. Additionally, on a small number of deployments, LIDAR based speed enforcement was also conducted at the interception sites; again to maximise the use of available resources.

The results from the survey of police officers involved with the trial indicated that the actual operation of the ANPR system required minimal staffing. The vast majority (91%) of the participants believed that the staffing numbers required to operate the ANPR technology were an effective use of resources. Some of the officer's comments on this theme were:

> *"Provides an immediate traffic response with minimal staffing resources."*
>
> *"It helps in the more efficient use of finite resources and maximises the detection of offenders moving around on the road network."*

> *"ANPR acts as a filter to identify unlicensed disqualified drivers and unregistered vehicles. Studies have shown that recidivist traffic offenders often fall into this category and are often involved in traffic crashes. ANPR affords the opportunity to identify these offenders using affordable technology in a recourse effective manner."*

By design, the ANPR technology requires very little human intervention during operation, with the bulk of the work performed by the system. A maximum of two officers are required to operate the system, with one supervising the results generated by the software matching process, and correcting manually if necessary, and the second officer performing the communication with the intercepting officers and recording information where necessary. The additional resources required to undertake an ANPR operation were in the majority considered to be an acceptable use of resources by the officers that participated in the trials.

While the actual operation of the ANPR system requires few resources, the interception operations may require a considerable number. The potential for offenders who register a 'hit' to drive through an ANPR operation and not be intercepted is of particular concern. Watson (2004), in his survey of unlicensed driving offenders, found that punishment avoidance was positively associated with the frequency of unlicensed driving and the intention to drive unlicensed in the future. If the intercepting officers at an ANPR operating site are all busy and an offender is not intercepted, the resulting punishment avoidance experience can potentially result in *increasing* the frequency of that offender's illegal behaviour. This is a factor that must be considered when establishing ANPR operating procedures and staffing resources for ANPR operations. This is considered to be especially important during the initial stages of formal ANPR operations, as it is expected that a considerable numbers of drivers will be intercepted due to ANPR 'hits' when the system is initially introduced. However, staffing could reasonably be expected to reduce as the deterrent effects of widespread ANPR operations start to have an effect on the frequency of drivers offending behaviours. For further information see Watson and Walsh (2008).

3.1.9 Difference between ANPR specific vs joint operations

Prior to the commencement of the trials, a vehicle was fitted with an ANPR system to allow trials of the technology in the vehicle mounted mobile mode. However due to other operational constraints there were no mobile deployments undertaken during the ANPR trial. As this method of deployment was not undertaken during the trial it is not evaluated in this report. The evaluation of ANPR technology in this report is therefore limited to an evaluation of ANPR technology used in a static mode.

It proved to be very difficult to have formal joint operations undertaken (i.e. in conjunction with an RBT Booze Bus Operation with appropriate site selection and resourcing *and* the necessary ANPR resourcing needed) due to resourcing and timing issues associated with the trial. This could very well be a different situation if a particular work unit has permanent access to ANPR. Whilst all deployments during the trial were considered stand-alone, car-based RBT was also performed at the majority of deployments. As mentioned previously, this is common practice whenever there are static interceptions undertaken, in order to maximise the use of available resources at any one time. As a result in some deployments all vehicles passing through the site were intercepted by police and RBT performed, with the ANPR system being used to alert the intercepting officers of any ANPR alarms on a particular vehicle allowing them to follow this up while the vehicle was pulled over.

The responses from the survey of police officers involved with the trial generally supported the combined use with other operations, such as Booze Bus, RDT and LIDAR/Digicam, as the most effective way to deploy the ANPR technology. However it was also considered by more than half of the participants that there are situations in which stand-alone ANPR operations would be the most effective way to deploy the technology. The comments in support of stand-alone operations generally revolved around either i) having specific times or locations for stand-alone ANPR operations, or ii) that the area required to undertake combined operations is potentially significant, thus limiting the locations in which combined operations could be undertaken. Some of the officer's comments on this theme were:

> *"Stand alone operations would be best and more productive during peak hours (07:30-09:30, 12:00-14:00 and 16:30-18:30 hours). During other times of the day it would be best to use ANPR in conjunction with other strategies such as our intersection operations."*
>
> *"I think there's an opportunity for this in both of the aforementioned* [stand alone and combined ANPR], *provided that sufficient staffing can be sourced so as not to compromise the efficiencies available to any of the activities. As an OIC I'd love to have an ANPR unit at approach to my RBT, RDT line or Digicam site to detect other offences."*
>
> *"I think stand alone would be best as the 2 times I was involved in ANPR, we more or less ended up with a used car yard, where offenders were pulled off the road and vehicles were being parked up and down the street, due to unlicensed, unreg and uninsured. Being combined with a booze bus operation, would need a lot more space and more officers."*
>
> *"It would be great if we had a big enough area and enough staff to do a combined operation, but logistically it would be a nightmare. There would be cars everywhere."*

It is considered that the use of ANPR in both stand-alone operations *and* the use of ANPR combined with other high intensity traffic work are both effective ways to utilise ANPR technology. As mentioned previously there is concern however if the staffing of combined operations are inadequate, resulting in offenders who register an ANPR 'hit' driving through without being intercepted. The resulting punishment avoidance experience can potentially *increase* the frequency of that offender's illegal behaviour (for further information see Watson & Walsh, 2008).

It is also considered that stand-alone ANPR operations have the advantage of being relatively mobile, with minimal time required for setup of the system. Therefore stand-alone ANPR operations can quickly move from one location to the next, several times over a day or shift. This is important as evidence suggests that the randomised deployment of policing resources serves to establish and maintain the perception among drivers that a police vehicle could be located somewhere along a road at any time, whilst maintaining uncertainty about the exact location (Newstead, Cameron, & Leggett, 2001; Watson et al., 1996). In effect, drivers exposed to such enforcement will become vigilant and alert, even if they don't see a police vehicle, in the expectancy that the police could be 'just around the corner' (Leggett, 1988). Hence, the deployment of operations according to a random scheduling methodology offers a means of increasing the perceived unpredictability and ubiquity of traffic policing.

3.1.10 Survey of Traffic Officers

A survey of police officers that participated in the ANPR trials was undertaken to gain feedback on their experience working with the ANPR system. The survey was developed by the ANPR Project Officers for the purposes of the ANPR trial evaluation. The survey also asked the officers for their opinions on the effectiveness of the technology, and on the best way to utilise the technology for traffic enforcement. The survey also asked for feedback from the officers on the suitability of the database for operational deployment of ANPR technology.

3.1.10.1 Method

Participants

The participants were operational Queensland police officers that had experienced firsthand the operation of the ANPR system during the trials conducted during 2009. The participants came from all nine police regions across the state. A total of 44 participants completed the survey.

Materials

A paper based survey questionnaire was utilised containing nine questions, with four questions capturing qualitative data. For an example copy of the survey refer to the Appendix of this report.

Procedure

The surveys were distributed to the Officer in Charge of Traffic Branches in each district where deployments were conducted, with a request that the offices that had participated in the trials complete the survey. The completed surveys were returned to the ANPR Project team in Brisbane. From a total of 247 potential respondents, 44 completed survey questionnaires were returned to the ANPR Project team, representing a response rate of 18%.

Data Analysis

The returned paper surveys were compiled into an electronic form by the ANPR Project Officers. The electronic file was then analysed by CARRS-Q staff to identify both qualitative and quantitative trends. The qualitative data was analysed using thematic analysis to identify any common themes among the participant responses.

3.1.10.2 Results

While the 18% response rate for the surveys was relatively low, it is in the normal response rate range for mail out surveys. The survey response rate varied by operational region, with the majority of responses coming from the Southern Region (25%) and the North Coast Region (23%). The minimum number of responses (5%) was received from both the Central Region and the Metropolitan South Region, with only two completed surveys returned from each of these regions. All the participants had participated in an ANPR trial on at least one occasion, with 39% participating twice, 16% participating on 3 occasions, and 5% participated on more than three occasions.

To the question on whether ANPR is effective in the detection of targeted traffic offences. 52% of participants responded that it was *very effective*, and 41% responded that it was *effective*. None of the participants thought that ANPR was *not effective*; however a small

number (7%) felt that it was only *marginally effective* in the detection of targeted traffic offences.

The participants were asked whether they believed that the staffing numbers required to effectively undertake ANPR deployment is an effective use of resources. The vast majority (91%) of participants believed that the staffing numbers required were an effective use of resources, while 5% responded that they were not an effective use of resources, and 5% were not sure either way.

3.1.10.3 Qualitative

On the question of *"whether ANPR technology has a role in traffic enforcement"*, all participants responded that it does, and all the additional comments provided were positive. Four main themes were identified in the participant's responses, which are detailed below.

ANPR allows checking of a high volume of vehicles easily. The ANPR technology enables 100% of the vehicles passing the site to be checked, which is substantially higher than other methods. Some of the participant's comments on this theme were:

> *"It provides the ability to check a high volume of vehicle registrations and Driver's Licence status of registered owners in an instance. The only thing we currently have to do this now is MINDA which does not allow to perform high volume checks in a short period of time."*
>
> *"Current MINDA input is manual and only allows approximately 10% of passing vehicles to be checked/enforced. ANPR allows 100% of passing vehicles to be checked and will ensure a greater compliance/targeting of offences."*
>
> *"In the modern technology era – the use of ANPR allows for multiple vehicle checks and select offender targeting. During trails it has resulted in a high level of detections from within heavy traffic areas no easily targeted by conventional methods."*
>
> *"It speeds up the MINDA process and seems to have as accurate and more relevant data / hits than we have now with MINDA."*
>
> *".... being computerised it's a lot faster then human checking via MINDA."*

These comments reflect the speed and efficiency of the ANPR technology in checking vehicle licence plates in a stream of moving traffic. This is seen as a significant benefit of the ANPR technology over current methods for checking vehicle registration plates. This was also demonstrated previously in the statistics from the deployments, during which an average of 7.2 vehicle plates where checked per minute of deployment.

Reduces biases associated with the use of MINDA for the checking of vehicles. These comments related to the perceived bias that can be shown when checking vehicles using the MINDA system. Some of the participant's comments in relation to this theme were:

> *"Further to this MINDA usage at the moment is hit and miss, in that you target certain vehicles to check particulars, ANPR allows to blanket check all vehicles and assist in the detection of the target offences."*
>
> *"The success rate, especially with unlicensed drivers is quite high. Rego label often give away rego offences, but unlicensed drivers in newer non-hoon cars often go*

unchecked. The ANPR in not discriminatory in which vehicle it checks, unlike police officers who usually check vehicles of interest."

It was recognised that ANPR is non-discriminatory in its nature; it will not just check vehicles that look suspicious to an officer. This eliminates any bias is the checking of vehicles for registration or unlicensed driving offences that may normally occur due to common perception about "typical" vehicles that may be associated with these types of offences.

Beneficial in detecting unlicensed and unregistered vehicles. During the ANPR trials the participants noted that the ANPR system was very useful in detecting unlicensed drivers and unregistered vehicles, and was extremely effective in identifying vehicles for follow up enquiries by the intercepting officers. Some of the comments along this theme were:

"ANPR is very effective as it is a useful tool in pin pointing unlicensed and unreg and uninsured vehicles. It is a fast process whereby the offender is weeded out effectively from traffic where, officers are not waiting for either MINDA results(which are usually slow) or waiting for an opportunity to try hopefully get onto the enquires channel to get a result(which usually takes longer)."

"It is always good to have another tool to combat traffic offences. Especially licencing offences which tend to be more difficult to discover as opposed to speeding offences etc. This system seems to be good at detecting these types of offences."

"Beneficial in detecting Unreg, Uninsured and licence offences."

"ANPR acts as a filter to identify unlicensed/disqualified drivers and unregistered vehicles. Studies have shown that recidivist traffic offenders often fall into this category and are often involved in traffic crashes. ANPR affords the opportunity to identify these offenders using affordable technology in a recourse effective manner."

The participant's comments on this theme indicate that the ANPR system proved very effective during the trials at detecting the target offences of unregistered vehicles and unlicensed drivers. It was observed during the trials that the ANPR system is a very effective means for screening large volumes of traffic to identify potential unregistered vehicle and unlicensed driver offences.

Staffing ease for ANPR operations. The participants commented that during the trial the ANPR system required minimal staffing. As was noted previously the vast majority (91%) of the participants believed that the staffing numbers required were an effective use of resources. Some of the participant comments on this theme were:

"Provides an immediate traffic response with minimal staffing resources."

"It helps in the more efficient use of finite resources and maximises the detection of offenders moving around on the road network."

"ANPR acts as a filter to identify unlicensed/disqualified drivers and unregistered vehicles. Studies have shown that recidivist traffic offenders often fall into this category and are often involved in traffic crashes. ANPR affords the opportunity to identify these offenders using affordable technology in a recourse effective manner."

The participants were asked what they *"thought the most effective way to deploy the ANPR technology would be"*. The majority of support (43%) was for Combined ANPR with other strategies (e.g. Booze Bus, LIDAR/Digicam, Random Drug Testing etc.) as the most effective way to deploy ANPR technology. Some of the comments from the participants in support of the combined method were:

> *"ANPR is another tool of traffic enforcement and to assist with other types of Traffic enforcement."*
>
> *"A complete saturation of motorists in high volume traffic areas general has a profound effect. By maximising resources like the Booze Bus, Lidar, ANPR Digicam this is an extremely effective way of targeting offences."*
>
> *"It allows more effective use of resources. If we have staff at a site carrying out enforcement it makes sense to have ANPR technology working for us as well. It is just as easy to pull someone in for an ANPR detected offence as it is for speeding etc and they all get breathtested".*

However almost one third (30%) of the participants responded that Stand-alone ANPR and Combined ANPR would be the most effective way to deploy ANPR. The comments in support of this generally revolve around utilising ANPR in a standalone configuration during certain times, or in specific locations, but they also note that in high intensity traffic work it would be very useful to have ANPR at the site. Some of the comments along this line were:

> *"Stand alone operations would be best and more productive during peak hours (07:30-09:30, 12:00-14:00 and 16:30-18:30 hours). During other times of the day it would be best to use ANPR in conjunction with other strategies such as our intersection operations."*
>
> *"The manner of use for the ANPR equipment, in the detection of offences, depends on the location and method of deployment to determine effectiveness. Several means of deployment, including the above examples, exist to effectively utilise this equipment, and this is dependent upon the number of staff, and priorities, for each Regional requirement. The data collected on locations of offences also assists with gathering intelligence of types of offences and times to enable effective use of resources."*
>
> *"I think there's an opportunity for this in both of the aforementioned* [stand alone and combined ANPR], *provided that sufficient staffing can be sourced so as not to compromise the efficiencies available to any of the activities. As an OIC I'd love to have an ANPR unit at approach to my RBT, RDT line or Digicam site to detect other offences."*

A further 25% of the participants indicated they felt that stand-alone ANPR would be the most effective way to deploy the technology. Some of the comments in support of using ANPR technology in stand-alone configuration were:

> *"I think stand alone would be best as the 2 times I was involved in ANPR, we more or less ended up with a used car yard, where offenders were pulled off the road and vehicles were being parked up and down the street, due to unlicensed, unreg and uninsured. Being combined with a booze bus operation, would need a lot more space and more officers."*
>
> *"The site should not be overcrowded with offenders for other offences."*

> *"It would be great if we had a big enough area and enough staff to do a combined operation, but logistically it would be a nightmare. There would be cars everywhere."*

The responses on the question of the most effective way to deploy the ANPR technology generally support combined use with other strategies, such as Booze Bus, RDT and LIDAR/Digicam. However it was also considered by more than half of the participants that there are situations in which stand-alone ANPR operations would be the most effective way to deploy the technology. The comments in support of stand-alone operations generally revolved around either i) having specific times or locations for stand-alone ANPR operations, or ii) that the area required to undertake combined operations is potentially significant, limiting the locations in which combined operations could be undertaken.

The comments concerning high interception rate making the site overcrowded and unsafe is of particular concern. There are two issues here which are i) the OH&S issues of site overcrowding for the police officers and ii) the potential for offenders to experience punishment avoidance in the event they fail to be intercepted. The OH&S issues highlight a potential need for the development of a specific list of ANPR sites for each district. In addition to the regular OH&S issues, the specific ANPR sites should take into account that ANPR operations have the potential to result in a large number of vehicles being intercepted and removed from the road. The specific ANPR sites would have to take this factor into account. Alternately, the duration of the ANPR operations could be reduced, so that no one particular site becomes overcrowded. This would allow officers to target several sites for shorter durations, which may eliminate the overcrowding experienced when deployments occur over several hours at the same site.

The potential for offenders who register a 'hit' to drive through an ANPR operation and not be intercepted is of particular concern. ANPR technology has the potential to significantly reduce the driving of unregistered vehicles and unlicensed driving through the general deterrent effect of the ANPR technology. In a similar process to the deterrent effect of RBT on a driver's decision to drink and drive (Homel, 1986), the ANPR technology has the potential to significantly increase the perceived risk of apprehension for licence and registrations offences. Studies into unlicensed driving have shown that the perceived risk of apprehension for unlicensed driving is significantly lower than it is for drink driving or speeding (Watson, 2005). However Watson (2004) also found that punishment avoidance was positively associated with the frequency of unlicensed driving and the intention to drive unlicensed in the future among the group of unlicensed driving offenders surveyed.

As previously noted, the impact of experiencing punishment avoidance as a result of offenders failing to be intercepted because an ANPR operating site has become overcrowded can potentially result in actually *increasing* the frequency of those offenders illegal behaviour. This is a factor that must be considered when establishing ANPR operating procedures and ANPR deployment sites. This is considered to be especially important during the initial stages of formal ANPR operations, as it is expected that a considerable numbers of drivers will be intercepted due to ANPR 'hits' when the system is initially introduced. However the problems associated with site overcrowding could reasonably be expected to reduce as the deterrent effects of widespread ANPR operations start to have an effect on the frequency of drivers offending behaviours.

On the question *"whether the accuracy of the ANPR database used during the trials was sufficient to allow operational deployment"*, 82% of the participants responded that it was

sufficient. The participant comments also generally supported that it is working well in the current form. However a theme that was noted in the participant responses, which was that online checks should still be done when a vehicle is flagged by the ANPR system, to ensure accurate results. Some of the participant responses along this theme were:

> *"The off line database is sufficient if no more than a couple of days old. After all the ANPR is only a screening device – no affirmative action should be taken without thorough investigation and live checks of QPrime and other necessary systems. Having the database on line would be better but it is not critical so long as timely updates can be provided – suggest once per day before use."*
>
> *"Although the system works great with an off-line check, perhaps ONLY the vehicles that produced a 'hit' could then be checked on-line similar to MINDA to ensure accurate results."*
>
> *"Yes it is capable in its current form but with online checks conducted of all VOI/DL hits intercepting officers could have up to date info immediately."*

The participants were asked *"in what way they felt that the deployment of the ANPR technology could be improved"*. Two themes were identified in the participant's responses, which were to i) utilise the technology in a mobile mode and ii) to allow each region/area to develop their own best practice use of the technology based on local conditions. Some of the responses from the participants on these themes were:

> *"As stated above I believe mobile mode is the best option to allow all traffic crews to utilise the technology."*
>
> *"The 2009 QPS ANPR trial and the similar 2004 QPS ANPR trial did in that using ANPR in stationary tripod mode is effective, efficient, useful and long overdue, but ANPR is capable of much more than being used for out of vehicle tripod mounted with a team of interceptors waiting further up the road and as expected QPS has failed to even explore this method during the current trial. ANPR is perfectly suited to mobile use and, as NSW Police have proved with their investment in over 100 mobile units for mounting on their Highway Patrol cars, there is no reason why QLD Police should not make the most of this technology. It goes hand in hand with political and agency rhetoric on detecting, deterring and punishing repeat offenders."*
>
> *"Fitment to patrol vehicles for mobile enforcement."*
>
> *"Different areas need to develop their own best practices after careful consideration of all issues. It is imperative that static sites be run by at least one senior and competent traffic branch officer. Less experienced officers can suffice as interviewing / action officers. My experiences in FNR led me to develop certain operational procedures that helped ensure excellent enforcement results when we deployed the equipment here."*
>
> *"If these units were available to each Region they would be more effective in being deployed for specific events within the Regions in line with QPS and Regional requirements based on intelligence databases to reduce the recidivism rates through ongoing enforcement actions."*

3.1.10.4 Summary

The results from the survey show that all the participants believe that ANPR technology has a role to play in traffic enforcement operations. The participants identified four main themes as to why they believed that ANPR technology should be utilised for traffic operations. These were:

1. ANPR allows checking of a high volume of vehicles easily;
2. ANPR reduces biases associated with the use of MINDA for the checking of vehicles;
3. ANPR is beneficial in detecting unlicensed and unregistered vehicles; and
4. Staffing ease for ANPR operations.

More than two thirds of the participants indicated that they believed Combined ANPR operations (with other high intensity traffic work) would be the most effective way to deploy the ANPR technology. However over half of the participants also indicated that there are also situations where the use of standalone ANPR would be more effective. This includes during peak traffic times, and in locations where there is insufficient physical area in which to set up a combined operation.

The majority of the participants indicated that the ANPR database utilised during the trials appeared to be working well it the current format, and was sufficient for operational deployment. However a theme noted was that the details of vehicles flagged by the ANPR system should be checked on-line (using MINDA or other means) during the follow up investigations to ensure accurate results.

After participating in the trials the officers indicated that there were two main areas that the deployment of ANPR technology could be improved. These were the introduction of mobile ANPR units for fitment into patrol cars and the development of regional best practice guidelines for the use of ANPR to take into account local conditions.

3.2 *Outcome Evaluation*

3.2.1 Review of the Deployment Statistics

3.2.1.1 Method

Procedure

Data from the ANPR trial deployments can be exported from the RAPID end-user software into a form that is able to be interrogated for necessary purposes, including the cross checking. Data captured during the trial in paper form was entered manually into the Excel spreadsheet by the ANPR Project officers. Additional clarifying comments about the categories of offence types and alarm types were provided. The data was screened by the ANPR Project Officers to remove all identifying information from the trial deployment data, and subsequently no identifying information was recorded in the Excel spreadsheet.

Data Analysis

The Excel spreadsheet containing the data from the trial deployments was provided in an electronic form to CARRS-Q. The electronic file was then analysed by CARRS-Q staff to identify the qualitative indicators and trends from the data.

3.2.1.2 Results

A total of 115 deployments were undertaken over a four month period from August to December 2009. The locations of these deployments were spread throughout the State in all eight Police Regions, in both major metropolitan and regional areas. Table 1 below gives a summary of the statistics for the ANPR trial.

Table 1: Overall summary of the deployments statistics

Number of Deployments	Total Operating Time (h)	Total Licence Plate 'reads'	Total ANPR Alarms	Percentage of 'Hits'	Total Vehicles Intercepted	Total Offences Detected* includes non ANPR detected offences
115	188	81541	1422	1.74 %	7492	988

The first statistic of note from the deployments is the number of plates read by the ANPR system in the operating time. This demonstrates the efficiency of ANPR compared to the current methods for checking of drivers licence status and unregistered vehicles. The ANPR system allowed for screening of a high volume of vehicles in a continuous traffic flow. During the trials the ANPR system checked an average of 434 vehicle plates per hour (or 7.2 plates per minute) of deployment. This is a substantial improvement over the current MINDA or MAVERICK system/s. With an average response time for MINDA of 15 seconds per enquiry, and allowing for the manual entry of a vehicles plate details into the system, it is considered that the ANPR system would result in more than a doubling of the number of vehicles that can be checked per hour of deployment. Research conducted in the UK has revealed that ANPR systems are capable of checking up to 3,600 plates per hour under the right circumstances (see Travelsafe Committee, 2007, *Inquiry into Automatic Number Plate Recognition Technology*, Issues Paper No. 12).

Of the total number of vehicles checked during the trial, 1.7% recorded an ANPR 'hit', and this ranged from 0.8% to 3.6% across all operations. The percentage of passing vehicles that recorded an ANPR 'hit' in each police region is shown below in Figure 1. It can be seen from Figure 1 that while the proportion of 'hits' during the trial did not vary greatly by region, the percentage of 'hits' for two regions, Metropolitan South and South Eastern, were slightly higher than the other regions.

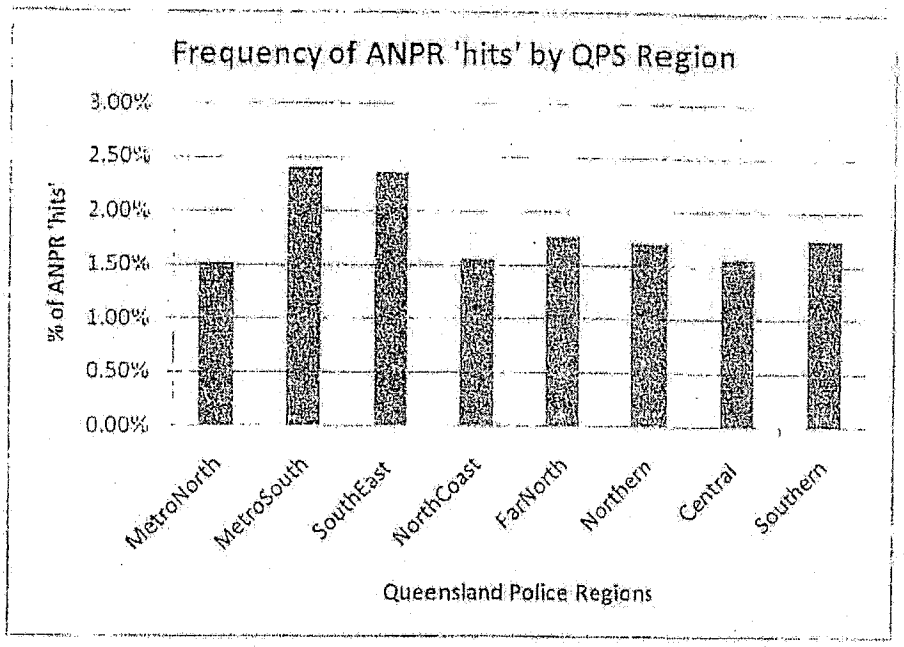

Figure 1 – The frequency of ANPR 'hits' recorded in each Queensland police region

Analysis of the percentage of 'hits' showed that while both the Metropolitan South and South Eastern regions were slightly higher, only the difference in the percentage of 'hits' for the latter was statistically significant, $t(4) = 4.01$, $p < .05$.

Of the 'hits' recorded during the trial, 80% related to licensing offences recorded against one (or more) of the registered owners of the vehicle. Unregistered vehicles accounted for 18 % of the 'hits' while stolen vehicles and stolen plates accounted for only 2% of the 'hits' recorded during the trial.

The total number of offences detected in Table 1 includes offences that were not detected by the ANPR system. Table 2 gives the breakdown for how the offences were detected during the trial deployments. The offences in the 'ANPR Only' column are those target offences that were detected as a result of the ANPR system flagging a 'hit' and the ANPR operators relaying the vehicle details to the intercepting officers. These offences demonstrate the effectiveness of the ANPR system in a stand-alone deployment configuration. The ANPR system alone detected an average of 47% of the total offences detected during the trials, with the percentage ranging from 8% to 100% across all the deployments. This range in the proportion of offences detected is extremely large and is due to differences in enforcement opportunities at different deployments. While in some deployments, all vehicles passing the location were pulled over to perform a range of traffic policing strategies (i.e. RBT), allowing intercepting officers the opportunity to focus on other non ANPR enforcement opportunities, whereas at other locations where traffic flow and the detection rate of ANPR type offences were such that only those vehicles that flagged an ANPR 'hit' were pulled over.

Table 2: Method of the detection of offences during the ANPR deployments

Vehicle Intercepts		Offences Detected				
Total Vehicle Intercepts	ANPR Vehicle Intercepts	Total Offences Detected	ANPR System Only	ANPR Intercepting Officers	ANPR Operator Observation	Non-ANPR Offences
7492	1317	988	461	66	145	316

Overall the average ANPR detected offences resulting from an ANPR flagged intercept was 35%. Of these offences detected by the ANPR system, 33% were licence offences. Unregistered and uninsured offences accounted for 56% of the offences, while cancelled plates accounted for the remaining 11% of the offences detected by the ANPR system. No stolen vehicle or stolen plate offences were detected during the trials.

Analysis of the deployment statistics shows that of all the 'hits' that occurred due to licensing issues, only 14% resulted in an offence being recorded. While this does not appear high, it does demonstrate the potential for the system to detect unlicensed drivers. It was noted during the deployments that many ANPR 'hits' did not result in enforcement action due to another person driving the particular vehicle when intercepted and/or that there was insufficient evidence to proceed against the driver-for example SPER related licensing suspensions (Senior Sergeant R. Maltby, personal communication, December 11, 2009).

Of the total offences detected during the trial, 15% were detected by the ANPR operators identifying additional potential offences, such as mobile phone use and failure to wear seatbelts, as the target vehicle passed the ANPR system. This was considered an advantage of having two ANPR operators manning the system during the trials.

In addition to the offences detected by the ANPR system, an additional 66 ANPR type offences (7% of the total offences) were detected by the intercepting officers. These were ANPR type offences that the system did not detect. Of these 66 offences, 48% were licensing offences and 44% were unregistered and uninsured offences. This situation where ANPR type offences are detected by the intercepting officers can be due to the way in which the ANPR software was configured. Each record in the database is matched to a vehicle licence plate. If there are a number of records in the database for the same vehicle, such as licence disqualification and an unregistered vehicle, then the offences are prioritised. The prioritisation of alarms is a configurable item in the ANPR software which allows them to be altered to meet specific requirements at each deployment. When the ANPR system flags a 'hit' for a passing vehicle, only the priority offence is displayed on the end-user interface screen. However any additional offences which are lower priority in the system, such as registration offences, will be picked up by the officers after the vehicle is intercepted.

Another potential situation where ANPR type offences are detected by the intercepting officers is if a vehicle was intercepted for another purpose (i.e. RBT) and in the course of inquiries an ANPR type offence was discovered. This could also be the case where an unlicensed offender is driving a vehicle not registered in their name, such as a work vehicle or a family member's vehicle. In these situations the ANPR system cannot detect the potential unlicensed offenders, as there is nothing linking the vehicle they are driving to their drivers licence.

During the trial there were 83 vehicles that registered an ANPR 'hit' but were not intercepted. This represents 6% of the total ANPR 'hits' recorded during the trial. Vehicles were not intercepted for a variety of reasons during the trial, but predominantly it was due to the intercepting police being otherwise engaged. There were also some occasions during the trial when vehicles flagged by the ANPR system could not be intercepted because of the risk to the intercepting officers. This was generally limited to situations when the flagged vehicle was travelling on an inner lane of a multiple lane roadway.

3.2.1.3 Discussion

There is currently no system in use in Queensland that allows for the *large scale* checking of vehicle licence plates. The MINDA system (Mobile Integrated Network Data Access) was introduced in 1996 by Queensland Transport and the Queensland Police Service as a way of improving the identification of drivers who are unlicensed (Travelsafe Committee, 1999). The MINDA device is a hand-held unit, connected to Queensland Transport's licensing and registration databases, which allows for the rapid checking of vehicle and driver details. The units connect to the databases via the mobile phone network, which limits their effectiveness in remote areas of Queensland where the network reception is poor or non-existent.

The introduction of the MINDA units resulted in a fourfold increase in the level of detection of unlicensed driving, unregistered vehicles and outstanding warrants (Travelsafe Committee, 1999). The units reduced the time required to undertake a licensing and registration check from an average of 15 minutes using radio communications, to approximately 15 seconds. On the success of the MINDA units, a larger system designed for the installation in patrol vehicles was developed. The units were called MAVERICK and did not rely solely on access to the mobile phone network. MAVERICK units had back-up versions of the databases on their hard drives which the system could utilise when out of mobile phone range. These back-up versions of the databases on the MAVERICK hard drive can be refreshed daily when the vehicle is returned to base, to ensure that the information is always up-to-date.

While the introduction of the MINDA (and subsequent introduction of similar MAVERICK units) resulted in an increase in the level of detection of unlicensed driving (Travelsafe Committee, 1999), these systems are still very labour intensive. These systems require an operator to visually observe a vehicle licence plate and then manually enter those details into the system interface. In a continuous stream of moving traffic an operator could only check a select number of vehicles as they pass. Not only does this allow vehicles to move past unchecked, but where a vehicle is checked, the manual entry and the time required for the system to respond results in a significant time delay, during which the target vehicle has moved much further along the roadway, making interception of a vehicle more difficult. This is considered to be a significant limitation of these systems for use in high intensity traffic work for licence and registration checking operations.

By contrast the ANPR system proved very efficient in checking vehicles as they passed in a stream of moving traffic, with an average of 7.2 vehicles checked per minute during the trial. The speed of checking was also much faster than the MINDA devices, as the ANPR system uses a database on the laptop hard drive rather than communicating with a central database via the mobile phone network. This reduced the response time for the ANPR system, and image capture, OCR processing and scanning the database for potential matches was all performed in around one to two seconds. This increased efficiency has the potential for a much greater number of vehicle checks to be performed each year.

The overwhelming majority of 'hits' during the trial was for licensing offences. This demonstrates that the system has enormous potential to detect unlicensed drivers on the roads, when they are driving a vehicle which is registered to them. If an unlicensed driver is driving a vehicle not registered to them, such as a work vehicle or a family member's vehicle, the ANPR system cannot detect them. However Watson (2004) found in a study of unlicensed driving offenders, that almost two thirds reported that they owned the vehicle which they were driving at the time they were detected.

While only 14% of the ANPR 'hits' for licensing resulted in an offence being recorded, the interception of a vehicle for unlicensed driving is considered to have significant benefits for road safety. ANPR technology has the potential to significantly reduce the driving of unregistered vehicles and unlicensed driving through the general deterrent effect of the ANPR technology. Studies into unlicensed driving have shown that the perceived risk of apprehension for unlicensed driving is significantly lower than it is for drink driving or speeding (Watson, 2005). In a similar process to the deterrent effect of RBT on a driver's decision to drink and drive (Homel, 1986), the ANPR technology has the potential to significantly increase the perceived risk of apprehension for licence and registrations offences, particularly if the operations are conducted in a highly visible manner and supported by public education campaigns.

The ANPR type offences that were not detected by the ANPR system demonstrates that ANPR does not provide a total solution for traffic policing operations. Rather, ANPR is simply an additional tool to add to the other currently utilised tools for traffic enforcement operations. While ANPR technology provides an increased level of detection and vastly improved efficiency over the current countermeasures available for checking vehicle licence plates, its application for traffic policing has limitations. This is especially the case for unlicensed driving, where the ANPR system is limited to detecting unlicensed drivers where their drivers licence is matched to a vehicle licence plate record in a database.

Although there were only 6% of vehicles that recorded an ANPR 'hit' but were not intercepted, this is still an area that should be addressed when establishing ANPR operating procedures and staffing for ANPR operations. Watson (2004) has found that punishment avoidance is positively associated with both the frequency of unlicensed driving and the intention to drive unlicensed in the future. If the intercepting officers at an ANPR operating site are all busy and an offender is not intercepted, the resulting punishment avoidance experience can potentially result in actually *increasing* the frequency of that offender's illegal behaviour. This is more likely to be the case where the ANPR operations are more widespread and, thus, recognisable.

3.2.2 Review of traffic histories

3.2.2.1 Method

Participants

To further explore the impact of the ANPR technology, a study was undertaken to explore the characteristics of the offenders detected by the operation. The participants were a sample of the drivers detected committing an offence during the ANPR trial deployments conducted in 2009. The age of the participants ranged from 18 to 67 years old, with a mean age of 36.65 years old (SD = 12.53). There were a total of 98 participants and 63% were male and 36% female. The gender of one participant was not recorded.

Procedure

The ANPR Project team selected participants from each trial deployment such that the sample was representative of all the regions across the state, and of each deployment undertaken during the trial. The traffic histories of the sample of drivers were then de-identified by the ANPR Project team before being supplied to CARRS-Q. A total of 99 traffic histories were supplied to CARRS-Q.

Data Analysis

The de-identified traffic histories were screened by CARRS-Q, and one was dropped from the review due to discrepancies with the recorded offences and the age of the driver. The remaining 98 traffic histories were then reviewed and the offences on the traffic history were grouped into categories. The categories were as follows:

- number of disqualifications
- number of driving while disqualified offences
- number of unlicensed driving offences
- number of unregistered vehicle offences
- number of speeding offences
- number of drink driving convictions (< 0.15 BAC)
- number of high-range drink driving convictions (=/> 0.15 BAC)
- number of SPER suspensions
- other offences.

The number of disqualifications on each traffic history was recorded, along with the number of offences for driving while disqualified. It is considered that driving while disqualified is one of the more serious offences recorded in the traffic histories. The number of disqualifications is most often linked with the number of convictions for drink-driving, and in most cases the number of each is the same. In addition, previous research in Queensland has estimated that disqualified and suspended drivers are three times more likely to be involved in a crash than licenced drivers (Watson, 2004).

The number of convictions for unlicensed driving included;

- drivers that had not yet obtained a driving licence,
- drivers that were driving while suspended for demerit point loss or SPER infringement,
- drivers that did not have the correct licence for the vehicle being operated, and
- drivers that had an expired licence.

Unregistered vehicles often attract multiple offences when the driver is detected. In addition to the *use/permit use of an unregistered vehicle* offence the driver is often charged with two additional offences; i) *having a plate/label attached that is recorded as cancelled/lost/stolen/destroyed* and ii) *driving an uninsured vehicle*. For purposes of the classification of unregistered offences for the data analysis, these offences were counted as one single offence, where all occurred on the same date. This was considered necessary so as not to artificially inflate the frequency of offences for driving of unregistered vehicles.

The SPER offences includes SPER suspensions (such as from failure to pay a fine) along with suspensions and cancellations due to demerit point accumulation. This category also includes suspensions for high range speeding offences.

The offences recorded in the 'Other' category were all those not already covered by the previous categories. These ranged from minor offences, such as a bicycle rider not wearing a helmet, through to serious offences such as careless driving/driving without due care and attention. While some of these 'Other' offences were serious in nature, they were not classified into separate categories. It was considered the nature of the ANPR system (which relies on vehicle licence plates) is such that it will not lead to an appreciable increase in the detection or deterrence of these offences.

3.2.2.2 Results

The mean number of *disqualifications* was 0.83 (SD = 1.26), with 57% of the participants having never recorded a disqualification. The percentage of participants that had recorded three or more disqualifications was 9% and the maximum number of disqualifications was six.

The number of convictions for *driving while disqualified* was found to be low with a mean of 0.16 (SD = 0.62) with 8% of the participants having one or more convictions for driving while disqualified. The maximum number of convictions for this offence was four, with 2% of the participants having three or more convictions for driving while disqualified.

The mean number of *unlicensed driving* offences was 0.56 (SD = 0.85), and the maximum was four. The participants with no unlicensed driving offences were 60%, while 3% of the participants had three or more unlicensed driving offences on their traffic history.

The mean number of *unregistered* vehicle offences among the participants was 0.84 (SD = 0.87), with 41% of the participants having never recorded an unregistered vehicle offence. The percentage of participants that had recorded three or more unregistered offences was 3% and the maximum number of unregistered offences was four. In four cases (4.08%) the *only* offence on the participant's traffic history was for an unregistered vehicle, which was picked up by the ANPR system during the trials.

Of the ANPR type offences targeted during the trials, the driving of unregistered vehicles was the one which appears to be occurring most frequently, with 59% of the participants having one or more unregistered offences. However, caution must be advised when interpreting this statistic. The use of the ANPR system in the trials may have actually significantly increased the detection of this offence, which is reflected in the number of participants with an unregistered offence in their traffic history. As shown from the deployment statistics in Section 3.2.1.2, unregistered and uninsured offences accounted for 56% of the offences detected by the ANPR system during the trail deployments. In other words, the results are partly a function of the enforcement activity, rather than the prevalence of the offences relative to other offences.

The drink driving offences were separated into low and high range offences, which is reflective of both the seriousness of high range drink driving and the current enforcement differences for high range offences. The mean number of *drink driving* offences was 0.34 (SD = 0.69), with 77% of the participants having never recorded a drink driving offence. The percentage of participants that had recorded three or more drink driving offences was 2% and the maximum number of drink driving offences was three. The mean number of *high-range*

drink driving offences was very low at 0.11 (SD = 0.69), with 92% of the participants having never recorded a high-range drink driving offence. None of the participants had recorded three or more high-range drink driving offences and the maximum number of high-range drink driving offences recorded was two.

The *speeding* category recorded the most number of offences among the participants, with only 18% having no speeding offences. This is reflective of the high levels of detection for this offence. The current countermeasures available for detection of speeding offences are numerous and they are generally very effective in detecting speeding vehicles. The mean number of speeding offences was 3.60 (SD = 3.65), with 82% of the participants having one or more speeding offences on their traffic history. The percentage of participants that had recorded three or more speeding offences was 50% and the maximum number of speeding offences was nineteen.

The *SPER* category includes suspensions for non-payment of fines. While fine evasion is not generally considered a behaviour directly affecting road safety, it is considered that these SPER suspensions give an indication of an overall disregard for road safety by some of the participants. Therefore care must be taken when interpreting the SPER category, as the SPER offences includes demerit point, high speed and SPER (non-payment of fine) suspensions. The mean number of SPER offences was 1.31 (SD = 1.65), and the maximum was seven. The percentage of participants with no SPER offences was 46%, while 18% of the participants had three or more SPER offences on their traffic history.

3.2.2.3 Discussion

For all categories of offences the standard deviations (SD) were quite large. This is due to the skewing of the data by a small number of participants that have recorded a high number of a particular offence (or in a small number of cases a range of offences) within their traffic history. In the disqualified, driving while disqualified, unlicensed driving and drink driving categories, the majority of participants had *none* of these offence types in their traffic history.

On the traffic histories of the participants, the low percentage of both driving while disqualified and driving while unlicensed offences is likely due to the lack of detection for these offences using the current countermeasures available. This is consistent with the results of Watson's (2005) study of unlicensed driving offenders, which found that the perceived risk of apprehension for unlicensed driving was significantly lower than for drink driving or speeding.

The speeding category recorded the most number of offences among the participants, with 82% of the participants having one or more speeding offences in their traffic history. This is reflective of the current countermeasures available which results in high levels of detection for this offence.

The results of the review of traffic histories for the offenders detected by the ANPR system reveal that the ANPR technology is targeting those drivers that engage in unlicensed driving and the driving of unregistered vehicles. The review of the deployment statistics showed the overwhelming majority of 'hits' during the trial was for licensing offences. This demonstrates that the system has enormous potential to detect unlicensed drivers and the driving of unregistered vehicles on the roads. While only 14% of the ANPR 'hits' for licensing resulted in an offence being recorded, every interception of a vehicle for unlicensed driving will contribute to an increase the general deterrent effect of the ANPR technology, and increase

the perceived risk of apprehension for unlicensed driving. This will also apply to the driving of unregistered vehicles.

3.3 Conclusion

3.3.1 Advantages of ANPR

The evaluation of the ANPR trial deployments has demonstrated that ANPR technology is of benefit for use in road traffic policing operations. The ANPR technology proved useful in targeting offences that are considered to be detrimental to road safety in Queensland, for which the current countermeasures are less than ideal. The benefits of the ANPR technology can be summarised into two categories; i) detection of offences and ii) deterrence of offending behaviours.

3.3.1.1 Detection

In a study of unlicensed driving offenders, Watson (2003) found that 8.1% of those surveyed had been driving unlicensed for more than ten years without detection. The overwhelming majority of 'hits' during the trial was for licensing offences. This demonstrates that the system has enormous potential to detect unlicensed drivers, when they are driving a vehicle which is registered to them.

Compared to the MINDA (and vehicle mounted MAVERICK) devices currently being utilised, the ANPR technology was much more efficient in checking vehicles as they pass in a stream of moving traffic. During the trials the ANPR system checked an average of 7.2 vehicles per minute of operation, with almost 100% of vehicles passing the system checked. The ANPR system performed image capture, OCR processing and scanning of the database for potential matches in around one to two seconds, which is considerably faster than the MINDA system. The increased efficiency has the potential for a much greater number of vehicle checks to be performed each year, increasing the detection of target offences.

As ANPR does not rely on human input methods it performs the checking of vehicles in a non-discriminatory nature; that is, it will not just check vehicles that look suspicious to an officer. This eliminates any bias is the checking of vehicles for registration or unlicensed driving offences that may normally occur due to common perception about "typical" vehicles that may be associated with these types of offences.

ANPR technology could be utilised in conjunction with other high intensity traffic operations, and can act as a screening tool, flagging vehicles for further follow up due to an ANPR 'hit' on that vehicle. The ANPR system can easily check the licence and registration of every vehicle as it approaches a Booze-Bus or RDT operation. As the vehicle is already intercepted, directing it into an area out of the traffic flow for follow up enquiries would be relatively easy (compared to having to intercept a moving vehicle).

ANPR also allows for increased detection of recidivist offenders driving on the roads. The addition to the database of vehicles registered to drivers with multiple offences for high risk traffic behaviours (such as high-range drink driving or driving while disqualified) can increase the detection of these offenders on the roads.

3.3.1.2 Deterrence

Deterrence theory is central to criminology and criminal justice policy (Andenaes, 1974; Babor et al., 2003; Cavaiola & Wuth, 2002; Piquero & Pogarsky, 2002) and has been used in Australia and other countries to guide the development of many road safety countermeasures. Deterrence theory proposes that individuals will avoid offending behaviour(s) if they fear the perceived consequences of the act (Homel, 1988; Von Hirsch, Bottoms, Burney & Wikstrom, 1999).

ANPR technology has the potential to significantly reduce the driving of unregistered vehicles and unlicensed driving through the general deterrent effect of the ANPR technology, and the system could, in all probability, be justified in the long term on the general deterrent effect alone. The experience with RBT has shown that technology and related enforcement practices, which can increase the detection of an offence, is extremely effective in increasing the perceived risk of apprehension for drink-driving. Studies into unlicensed driving have shown that the perceived risk of apprehension for unlicensed driving is significantly lower than it is for drink driving or speeding (Watson, 2005). ANPR technology, when utilised in high visibility deployments, and in conjunction with a publicity campaign, has the potential to significantly increase the perceived risk of apprehension for licence and registrations offences. In a similar process to the deterrent effect of RBT on a driver's decision to drink and drive (Homel, 1986), the ANPR technology has the potential to significantly deter drivers from engaging in offending behaviours through vicarious experiences of punishment (Watson & Walsh, 2008).

Further, ANPR technology has the potential to increase specific deterrence aimed at recidivist offenders. The addition to the database of vehicles registered to drivers with multiple offences for high risk traffic behaviours (such as high-range drink driving or driving while disqualified) can increase the detection of these offenders on the roads. When combined with an effective publicity campaign, ANPR may provide another method of specific deterrence for these offenders.

3.3.2 Limitations of ANPR

While ANPR is a considered a robust tool for detecting unregistered vehicles and unlicensed drivers, it is not a total solution to the unlicensed driving problem, as the system is limited to searching based on a number plate of a vehicle. The ANPR technology therefore cannot distinguish whether an unlicensed person is driving or not at the time, and therefore requires the interception of the flagged vehicle by police officers to determine further details. While ANPR will not detect unlicensed drivers when they are driving a vehicle which is not registered to them, Watson (2004) found in a study of unlicensed driving offenders, that almost two thirds reported driving a vehicle they owned at the time they were detected.

Because the system relies on the licence plate of a vehicle to perform its searching function, it is unlikely to be effective in detecting drivers that are driving a work or company vehicle. Only where a registered owner of a vehicle is flagged as unlicensed will the vehicle be flagged for unlicensed driving, when checked by the ANPR system. This allows for the possible exclusion of a large number of vehicles from the potential reach of ANPR for unlicensed driving detection and enforcement. Given that a major motivator for driving unlicensed is the requirement to drive for work purposes (Watson, 2004) it must be acknowledged that ANPR is not a panacea for the detection of unlicensed drivers. It is merely one tool in the available 'toolkit' for traffic policing.

Another concern with the use of ANPR technology is the potential for punishment avoidance. The potential for offenders who register a 'hit' to drive through an ANPR operation and not be intercepted is of particular concern. Watson (2004) found that punishment avoidance was positively associated with the frequency of unlicensed driving and the intention to drive unlicensed in the future. If the intercepting officers at an ANPR operating site are all busy and an offender is not intercepted, the resulting punishment avoidance experience can potentially result in actually *increasing* the frequency of that offender's illegal behaviour. This is a factor that must be considered when establishing ANPR operating procedures and staffing for ANPR operations. This is considered to be especially important during the initial stages of formal ANPR operations.

It is arguable that the introduction of ANPR technology in Queensland has the potential to increase the frequency of licence plate theft and licence plate cloning, as was the case in the UK after the introduction of ANPR (Travelsafe Committee, 2008). The widespread use of ANPR may increase these offences as some offenders attempt to avoid punishment for unlicensed driving and registration offences. While intercept operations and 'live' checking of existing databases would prevent the use of stolen plates as a means of avoiding detection, the use of cloned plates may not. It is also considered that successful episodes of punishment avoidance by utilising cloned plates would likely serve to increase the frequency of the offending behaviours.

Watson (2004) found that many offenders reduced their overall amount of driving in order to evade detection, although this did not necessarily equate to safer driving. To this end, unlicensed drivers may modify their behaviour to reduce their perceived risk of detection, which may result in them driving only small distances from their residence, or driving at times when they perceive the risk of detection to be low (such as when police resources are typically lower). ANPR operations therefore would need to be carefully planned so that they are random, difficult to avoid and occur at all times of day and night. ANPR operations that are unpredictable and ubiquitous will be very effective in increasing the perceived risk of detection for unlicensed driving and unregistered vehicle use.

The way in which ANPR technology operates creates specific issues for data security management and privacy safeguards, as raised by the Travelsafe Committee (2008). In order to gain public acceptance, the widespread use of ANPR technology would require procedures to be put in place to protect the privacy of the public, the majority of who are not committing unlicensed or unregistered vehicle traffic offences. Many of the potential privacy problems are overcome when only intercept operations are utilised, as 'live' checking of existing databases could be performed after a vehicle is intercepted, which would prevent the need for recording details of all passing vehicles (Watson & Walsh, 2008).

4 RECOMMENDATIONS

From the evaluations undertaken in this report from data provided by the ANPR Project team, it is recommended that *ANPR technology be introduced for traffic policing operations in Queensland.* The ANPR system affords substantial improvements over the current technology for detecting unlicensed drivers, both in terms of the detection ability and the operational efficiency and the deterrence value of the technology has the potential to positively impact on road safety. It is recommended that the operating procedures, site selection and staffing resources for ANPR operations ensure that punishment avoidance

episodes are minimised. The procedures must adequately address the situations where potential offenders are able to drive thorough high visibility operations without being intercepted.

It is recommended that ANPR operations should not take away resources from existing effective traffic policing strategies, such as RBT. Rather ANPR is another technology that can be undertaken in conjunction with other traffic policing operations. ANPR is just one tool in the toolbox for traffic policing operations, with each tool having specific applications for detection and deterrence or specific offending behaviours.

It is recommended that the issues of data security management and privacy safeguards, as raised by the Travelsafe Committee (2008), are adequately addressed and the legislation governing/relating to the use of ANPR should be the subject of further consideration. It is important that operating procedures conform to the requirements of the existing legislation.

It is recommended that methods for reducing licence plate theft and licence plate cloning be investigated. The introduction of ANPR technology in Queensland has the potential to increase the frequency of these offences, as was the case in the UK after the introduction of ANPR (Travelsafe Committee, 2008).

It is recommended that further consideration be given to the introduction of compulsory carriage of licence for open licence holders in Queensland, to facilitate more routine licence checking. The lack of compulsory carriage of licence is seen as a potential issue which may limit the effectiveness of the ANPR technology for the detection and deterrence of unlicensed driving.

It is recommended that ANPR be supported by an on-going public education campaign in order to maximise the likely general deterrence effect.

Finally, it is recommended that on-going evaluation be undertaken in order to:

- identify the appropriate level of resources to be devoted to ANPR relative to other enforcement operations; and
- to fine tune ANPR practices.

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APPENDIX

SURVEY OF TRAFFIC OFFICERS

Please select your desired response and make comment where appropriate.

ANPR Survey

1. Location: FNR NR CR NCR SR SER MSR MNR OSC

2. On how many occasions have you participated in an ANPR Operation?

1 2 3 More than 3

3. How effective is ANPR in the detection of targeted traffic offences?

Very effective *Effective* *Marginally effective* *Not effective*

4. Do you believe ANPR technology has a role to play in traffic enforcement?

YES *NO* *NOT SURE*

Why?

5. Do you believe that the staffing numbers required to effectively undertake ANPR deployment/operations is an effective use of resources?

YES *NO* *NOT SURE*

6. What would be the most effective way to deploy the ANPR technology?

(a) Stand-alone ANPR Operations

(b) Combined ANPR with other strategies (ie. Booze Bus, Lidar/Digicam, Random Drug Testing etc.)

(c) Other

Why?

7. Is the accuracy of the current ANPR database sufficient to allow effective operational deployment of ANPR technology ?

YES *NO* *NOT SURE*

8. What improvements should be made to the database?

9. How can the deployment of ANPR be improved? Please use the manner in which ANPR was deployed during the operational trials as the point of reference for this question.