Analysis of the effect of dual purpose safety cameras at signalised intersections in Adelaide

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Abstract

Several signalised intersections in South Australia are equipped with safety cameras which photograph vehicles that either travel though a red signal or exceed the posted speed limit. The registered owners of photographed vehicles are then sent an infringement notice that includes a fine and a number of demerit points. The threat of receiving an infringement is intended to reduce speeding and red signal violations with the aim of reducing the number and severity of crashes at signalised intersections. Infringement data from 21 dual purpose safety cameras at signalised intersections in metropolitan Adelaide was obtained from the South Australia Police. From this data, the change in the number of recorded disobey red light and speeding infringements for each safety camera during the first year of operation was investigated. Red light infringements declined slowly over time while speeding infringements declined rapidly during the first few months and then more gradually thereafter. The decline during the first few months was more rapid for more serious levels of speeding. Theories for these observed changes are suggested and the relationship between infringements and crash rate at signalised intersections is discussed.

Introduction

Dual purpose cameras installed at signalised intersections photograph vehicles that travel through a red traffic signal and/or vehicles that exceed the posted speed limit. Traffic expiation notices are sent to the registered owners of vehicles that are photographed. The aim is to deter red light and speeding violations and, as a consequence, reduce the number and severity of crashes at signalised intersections. Signs before the monitored approach to the intersection inform drivers that a dual purpose safety camera is in operation. In South Australia red light cameras were first installed in 1988 and the first dual purpose cameras were installed in 2003.

Many studies have looked at the effect of red light safety cameras on red signal violations at signalised intersections (Retting et al., 1999a, 1999b; Chen et al., 2001; Herbert Martinez and Porter, 2006; Wahl et al., 2010; Porter et al., 2013). Both Retting et al. (1999a, 1999b) and Chen et al. (2001) conducted studies comparing the number of red light signal violations before and after the installation of red light safety cameras at several signalised intersections in cities within the United States and Canada. It was found that the number of red signal violations after the installation of safety cameras was 40 to 69 percent lower than the number of violations prior.

The number of monthly violations at a red light camera equipped signalised intersection in New Orleans, Louisiana (United States) was investigated by Wahl et al. (2010). A rapid decline in monthly red light violations was observed over the first four months followed by a more gradual decline and eventual stabilising thereafter.

One pair of studies was able to investigate the unique situation in which red light cameras were installed and then later removed at 3 signalised intersections in Virginia (United States). Hebert Martinez and Porter (2006) monitored red signal violations at these intersections before and after the installation of red light cameras. Logistic regression analysis showed that drivers were 3.34 times less likely to violate a red signal at an intersection equipped with a safety camera. Monitoring of red signal violations at these same intersections was continued in a study by Porter et al. (2013)

during which the red light cameras were removed. It was observed that the frequency of red signal violations very rapidly returned to levels observed prior to the installation of the red light cameras.

Australia is one of the few countries that utilise dual purpose safety cameras at signalised intersections. There is little research on how these safety cameras affect red signal and speeding violations. As such, it is not yet fully understood how exactly the combination of red light and speed enforcement will effect driver behaviour. An important consideration is how the addition of speed enforcement will interact with red light enforcement. In some cases it may compliment red light enforcement by targeting drivers who avoid travelling through red signals by speeding through yellow signals. In other cases it may act independently by targeting drivers who are speeding through a green signal. An overview on general speed enforcement in South Australia can be found in Doecke and Grigo (2011) with Tables 4.9, 4.13, and 4.16 of their report specifically presenting information regarding speeding detections at fixed dual purpose camera sites. Additionally, Wilson et al. (2011) identified several studies that investigated the effect that speed cameras had on speed. In each of the identified studies it was found that, after speed camera implementation, there was an associated reduction in average speed.

One early study by Brimson and Anderson (2002) investigated the effect that 3 dual purpose safety cameras installed at signalised intersections in Canberra had on the frequency of infringements. The numbers of monthly disobey red light and speeding infringements at each intersection site was collected for the first 18 months after camera installation. The number of infringements per month varied by site but overall there was a decrease in both red signal and speeding violations. However, given the limited number of sites that were considered further research was advised.

The purpose of this study was to conduct a similar evaluation of dual purpose safety cameras at signalised intersections in South Australia. Using a greater number of safety camera equipped signalised intersection sites should enable the change in infringements over the year following the commissioning of a camera to be better quantified.

Data and method

The South Australia Police supplied data on all disobey red light and speeding infringements issued at all active safety camera sites for the period 1 January 2001 to 31 December 2008. The infringement data was de-identified and no information on vehicle registration or driver details was provided. The site, date, time, and type (disobey red light or speeding) was listed for each infringement. Additionally, for speeding infringements the vehicle travel speed was also listed.

Note that an infringement was only recorded where a violation could be identified. After a vehicle has been photographed, there are several reasons why a traffic infringement notice may not be issued. For example, the licence number of the infringing vehicle may be un-readable or obscured and any legitimate violations by emergency vehicles were disregarded.

After reviewing the data is was evident that the number of daily infringements at many sites was low. Thus to obtain reasonable numbers and to avoid day of week effects, the number of infringements per week was used as the basis of measurement.

Since 52 weeks of data was sought (for consistency across sites and to control for seasonal effects), only those dual purpose cameras commissioned before 1 January 2008 were suitable for analysis. This included some sites located in country towns that were noted as having small numbers of recorded infringements. Because of this, and to also form a more homogenous sample, these country town sites were excluded from analysis.

This left a sample of infringement data from 34 dual purpose safety cameras located at signalised intersection sites within the greater Adelaide metropolitan area. Further review of the data at these sites revealed that many had periods in which no data was being recorded, presumably due to interruptions such as road works, upgrades, or camera failures. The aim was to analyse the effect of continuous enforcement over the course of a year and so those sites with gaps in operations for three or more consecutive weeks were also excluded from the analysis.

The final 21 signalised intersection sites used in this study are listed in Table 1. The name of the road being monitored by a dual purpose safety camera, the name of the intersecting road, the suburb, and the date the camera was commissioned. The majority of the sites were busy, multi-lane, arterial roads with an average of between ten and twenty thousand vehicles passing through each day (DPTI, 2007).

Table 1. Signalised intersection sites equipped with a dual purpose safety camera (with continuous infringement data)

Monitored road	Intersecting road	Suburb	Commissioning date
Sudholz Road	North East Road	Gilles Plains	16/02/2006
Lower North East Rd	Darley Road	Paradise	17/02/2006
Regency Road	South Road	Regency Park	17/02/2006
Grenfell Street	Frome Road	Adelaide	07/03/2006
Grote Street	West Terrace	Adelaide	21/03/2006
Panalatinga Road	Pimpala Road	Woodcroft	02/05/2006
The Grove Way	Atlantis Drive	Golden Grove	05/05/2006
Main South Road	Bains Road	Morphett Vale	09/05/2006
Kensington Road	Portrush Road	Marryatville	05/10/2006
Goodwood Road	Cross Road	Cumberland Park	09/10/2006
Grand Junction Road	Addison Road	Pennington	12/10/2006
Henley Beach Road	Holbrooks Road	Underdale	06/12/2006
King William Road	War Memorial Drive	Adelaide	26/03/2007
North East Road	Ascot Avenue	Vale Park	26/03/2007
Anzac Highway	Marion Road	Plympton	27/03/2007
Main South Road	Doctors Road	Morphett Vale	27/03/2007
South Road	Cormack Road	Wingfield	30/03/2007
Diagonal Road	Oaklands Road	Glengowrie	03/04/2007
Payneham Road	Portrush Road	Marden	09/04/2007
Payneham Road	Nelson Street	Stepney	09/04/2007
Grand Junction Road	Main North Road	Enfield	12/04/2007

Results

In the figures presented below the aggregated number of infringements per week is shown for all 21 sites over the first year of operation. As explained above, some sites did show a gap in operation but the duration of such dropouts was less than three consecutive weeks. It should still be noted, however, that due to these dropouts the number of infringements recorded in one week may not be directly comparable to the number of infringements recorded in another week. Analysis of the timing of dropouts at the individual sites revealed no systematic pattern which would have significantly affected the general trend in the results presented below.

Figure 1 shows the change in weekly disobey red light infringements over the first year after commission at the 21 sites. The number of infringements was observed to decrease gradually over the analysis period.

The change in weekly speeding infringements, disaggregated by the amount by which the speed limit was exceeded, is shown in Figures 2 to 6. The lowest reported amount by which the speed

limit was exceeded was 10 km/h and the highest was 30 km/h. Speeding infringements were more frequent than disobey red light infringements and were also observed to decrease at a more rapid rate over the analysis period. As the amount by which the speed limit was exceeded increased, the rate of decline in the number of infringements was more rapid during the first few weeks.

The change in infringements over time was also examined for each individual site. All sites were found to have results consistent with the aggregated results presented here.

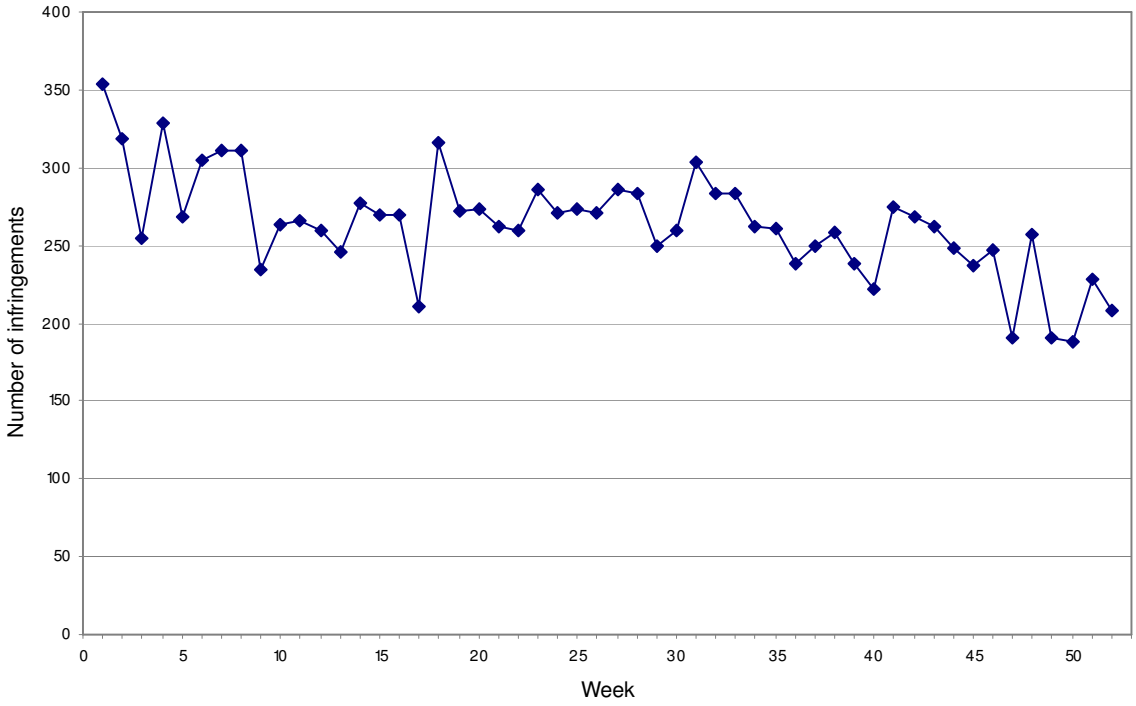

Figure 1. Total number of disobey red light infringements for each week after the commissioning date for the 21 signalised intersection sites

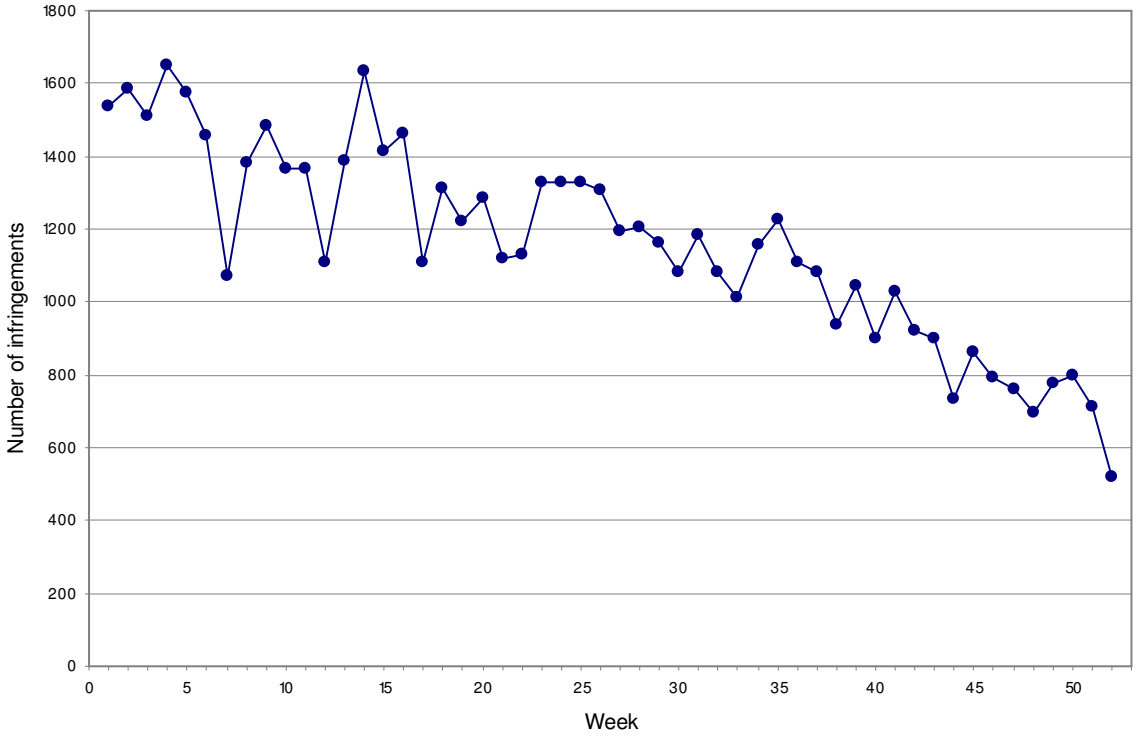

Figure 2. Total number of speeding infringements 10 km/h or more above the speed limit for each week after the commissioning date for the 21 signalised intersection sites

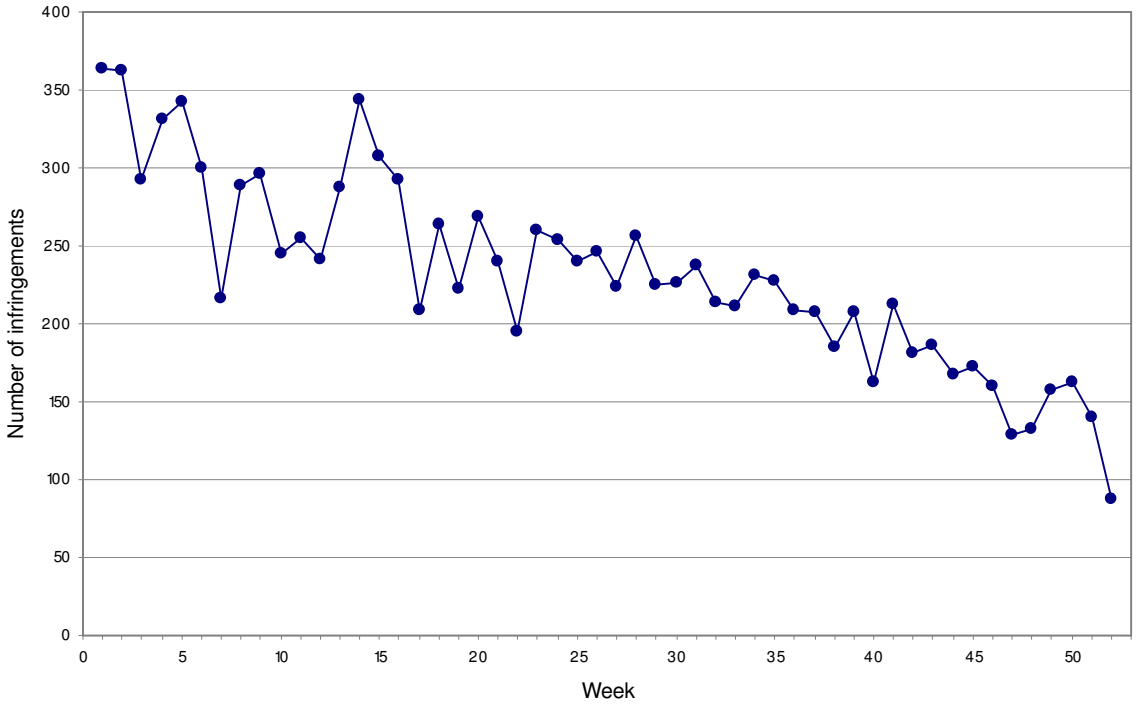

Figure 3. Total number of speeding infringements 15 km/h or more above the speed limit for each week after the commissioning date for the 21 signalised intersection sites

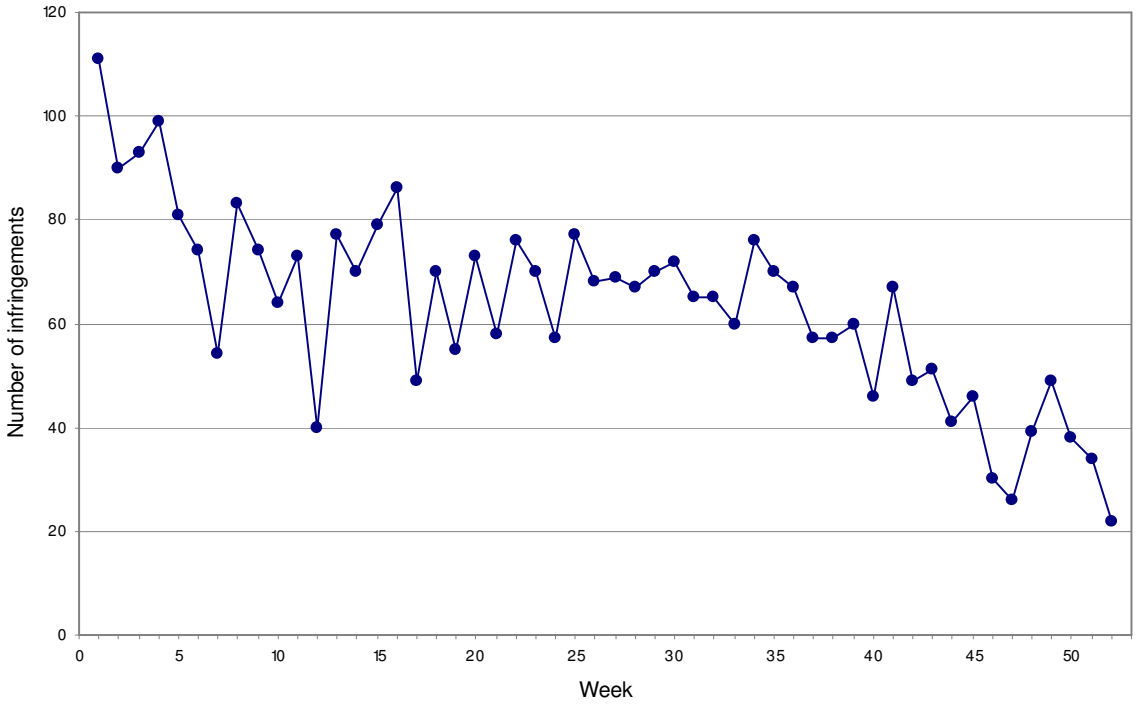

Figure 4. Total number of speeding infringements 20 km/h or more above the speed limit for each week after the commissioning date for the 21 signalised intersection sites

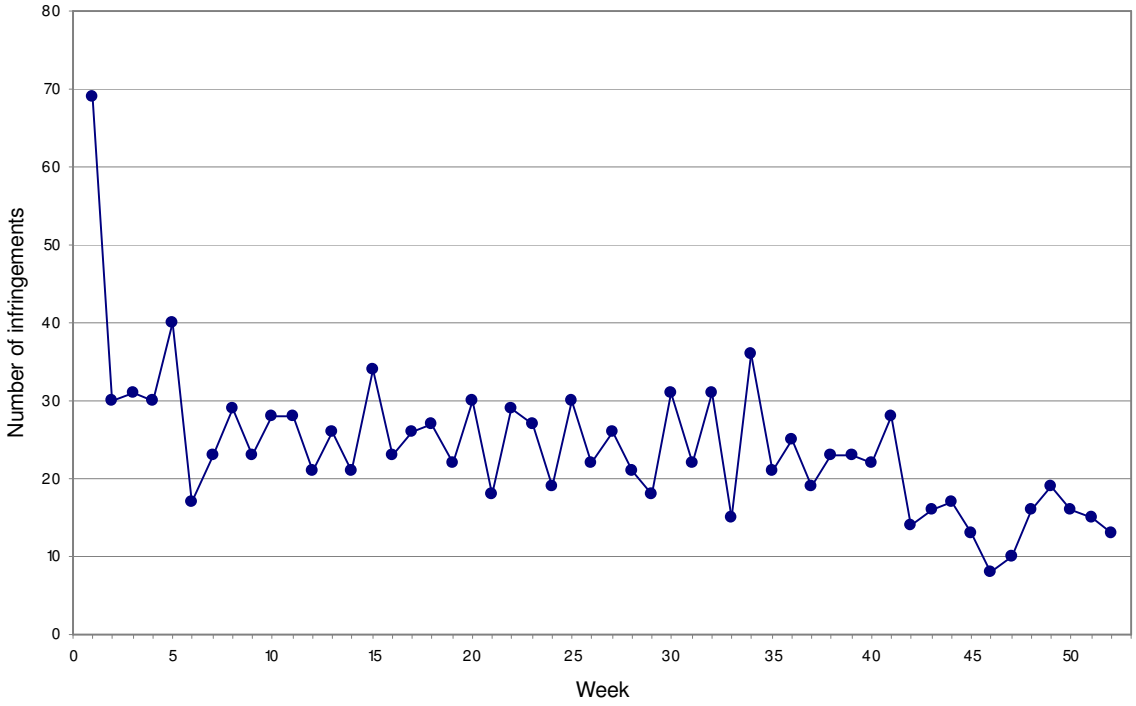

Figure 5. Total number of speeding infringements 25 km/h or more above the speed limit for each week after the commissioning date for the 21 signalised intersection sites

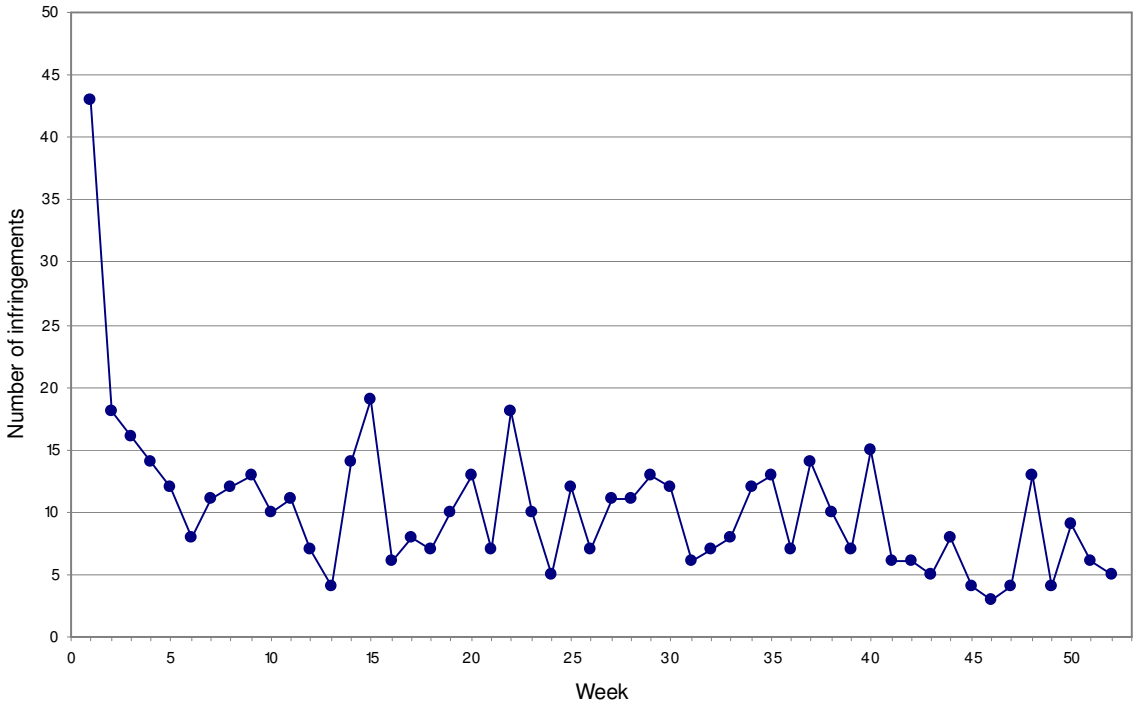

Figure 6. Total number of speeding infringements 30 km/h or more above the speed limit for each week after the commissioning date for the 21 signalised intersection sites

Discussion

From the results it is clear that the number of drivers violating red signals or speeding at signalised intersections monitored by a dual purpose safety camera declined during the first year after commissioning. Speeding infringements were affected to a greater extent than disobey red light infringements, especially for high levels of speeding.

However, there was no data on infringements prior to the introduction of the safety cameras. Consequently, it is possible that the reduction in infringements was due to a natural improvement in driver behaviour (that is, red light infringements and speeding were becoming less common). Indeed, it has been shown that from 2007 to 2008 there was a statistically significant reduction of 25 percent in the percentage of vehicles travelling 10 km/h over the speed limit on Adelaide 60 km/h arterial roads (Kloeden and Woolley, 2012). These findings were measured at midblock locations and thus may not be directly relevant to intersections but do indicate a potential reduction in speeding at the safety camera sites over the analysis period.

While some contribution of this natural reduction in speeding to the observed results cannot be completely ruled out, it seems an unlikely explanation for the total effect given the cameras were not all installed at the same time but over a period of about a year. Furthermore, the sudden and rapid decline in high level speeding infringements is not characteristic of a gradual improvement over time but of an abrupt change at each signalised intersection site.

The gradual reduction in the number of weekly infringements suggests that there may be some kind of learning by the drivers who regularly pass through the monitored intersection sites and slowly becoming aware of the presence of the cameras as more of them notice the signs on the side of the road, the boxes housing the cameras or the flashes indicating the recording of an infringement. A

number of drivers who habitually run red lights or speed through intersections may only change their behaviour at particular locations when they actually receive an infringement notice for a violation at that location. Given the generally low infringement rate, it may take some time for such drivers to be issued an infringement notice from a particular location (the average monitored intersection initially recorded 2 red light violations and 10 speeds 10 km/h or more over the speed limit per day).

The rapid drop in high level speeding offences during the first few weeks of camera operation may point to a smaller subset of drivers who habitually speed up when presented with a yellow signal in an attempt to clear the intersection before the onset of a red signal. The more severe consequences of being caught at a higher level of speeding may also play a role. For drivers with a full South Australian driver's licence, the demerit points and fines associated with the different speeding infringement levels are shown in Table 2. If 12 or more demerit points are accumulated by a driver over any three year period, that driver will be disqualified from driving for a certain amount of time as indicated in Table 3. Conversely, the relatively severe consequences for red light running (3 demerit points and a fine of $391) were not associated with a rapid drop in offences.

It is likely that there is some level of interaction between the change in speeding and red signal infringements. For example, an increase in speed compliance may lead to an increase in signal compliance as drivers have more time to recognise an amber/red light and stop their vehicle. Similarly, an increase in signal compliance may lead to an increase in speed compliance as drivers are less likely to attempt to 'beat' and red light by speeding through an intersection.

The reduction in red signal and speeding violations associated with the installation of dual purpose safety cameras at signalised intersections is considered a worthwhile improvement in driver behaviour that would be expected to result in a corresponding reduction in crashes. Indeed, this was the finding of Budd et al. (2011) who compared the number of crashes at 77 signalised intersections before and after the installation of dual purpose safety cameras in Victoria. It was revealed that, overall, crashes at intersections equipped with safety cameras had been reduced by 26 percent. For those crashes that involved a vehicle travelling through the specific intersection leg that was being monitored by a safety camera the reduction was 47 percent.

Table 2. Demerit points and fines for South Australia drivers (June 2009)

Speed infringement severity	Demerit points	Fine	Automatic disqualification period
< 15 km/h	1	$182	-
15 – 29 km/h	3	$290	-
30 – 44 km/h	4	$435	-
45 + km/h	6	$600 - $1000	6 months

Table 3. Driving disqualifications associated with accumulation of demerit points for full South Australia drivers licence holders (June 2009)

Total demerit points over a 3 year period	Automatic driving disqualification period
12 – 15	3 months
16 – 20	4 months
20 +	5 months

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