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Analysis of infringement data from fixed red light and speed cameras at signalised intersections in South Australia

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ABSTRACT

Safety cameras are installed at some signalised intersections in South Australia. They photograph vehicles that enter the intersection after the signal has changed to red, or that exceed the speed limit by more than a selected amount. Infringement data at 21 safety camera sites in metropolitan Adelaide was used to track how disobey red light and speeding infringements changed during the first year of operation. It was found that both speeding and red light running decreased over time after the installation of a safety camera. Red light running decreased slowly over time, while speeding fell more rapidly. For the more serious levels of speeding, there was a more rapid fall in infringements during the first few weeks and a slower decline thereafter. Based on this, safety cameras appear to generate a worthwhile improvement in driver behaviour. The fact that continued reductions are seen during the first year of operation suggests that some learning on the part of drivers is occurring.

KEYWORDS

Red light camera, Speed camera, Law enforcement, Speeding, Traffic offences

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Summary

Safety cameras are installed at some signalised intersections in South Australia. They photograph vehicles that enter the intersection after the signal has changed to red, or that exceed the speed limit by more than a selected amount.

Infringement data at 21 safety camera sites in metropolitan Adelaide was used to track how disobey red light and speeding infringements changed during the first year of operation.

It was found that both speeding and red light running decreased over time after the installation of a safety camera. Red light running decreased slowly over time, while speeding fell more rapidly. For the more serious levels of speeding, there was a more rapid fall in infringements during the first few weeks and a slower decline thereafter. Based on this, safety cameras appear to generate a worthwhile improvement in driver behaviour.

The fact that continued reductions are seen during the first year of operation suggests that some learning on the part of drivers is occurring.

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1 Introduction

Red light cameras are installed at signalised intersections or signalised pedestrian crossings in order to photograph vehicles that enter the intersection or crossing after the traffic signal has changed to red. Dual purpose cameras operate the same way as red light cameras but also photograph vehicles that exceed the speed limit by more than a selected amount. Traffic expiation notices are sent to the registered owners of vehicles that are photographed. The aim is to deter red light running and speeding and, as a consequence, reduce the number and severity of crashes at intersections and crossings. Signs before the monitored approach to the intersection inform drivers that red light or dual purpose safety cameras are in operation.

In South Australia red light cameras were first installed in 1988. The first dual purpose cameras were installed in 2003. As of June 2009, there were 81 safety camera installations available for operation in South Australia.

Doecke and Grigo (2011) provide an overview about general speed enforcement in South Australia. Specifically, Tables 4.9, 4.13, and 4.16 of their report present information on speeding detections at fixed dual purpose camera sites.

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.

The purpose of this study was to conduct an evaluation of fixed red light and speed cameras at signalised intersections in South Australia. This was achieved by analysing the change in the number of infringements over the year following the commissioning of a camera.

2 Safety camera installations in South Australia

Through consultation with the South Australian Department of Planning, Transport and Infrastructure (DPTI), a total of 106 safety camera installations were identified in South Australia between 1988 and June 2009. Note that this number counts multiple cameras at the same intersection separately and considers a reinstallation at a site that was previously decommissioned as being an additional installation.

There were four cases where two safety cameras were located at the same intersection. In two of these cases the safety cameras were monitoring different approaches to the same intersection. In the remaining two cases, the safety cameras were monitoring different lanes of the same approach to an intersection with multiple lanes.

Prior to 2006, all safety camera sites consisted of housings for wet film cameras. In 2006, it became standard practice to fit all new safety camera sites with digital cameras.

2.1 Red light camera sites in 1988

In July 1988, fifteen signalised intersections around Adelaide were fitted with red light camera housings and flash units, with five active wet film camera internals being rotated among the sites (see Table 2.1). All of the sites were decommissioned in later years. The specific dates of commissioning and decommissioning could not be found for any of the sites. Some of the sites had safety cameras reintroduced (under a new site listing) in later years.

Table 2.1
Red light camera intersection sites introduced in 1988

Road name	Intersecting road name	Suburb
Franklin Street	Morphett Street	Adelaide
Fullarton Road	The Parade	Kent Town
Goodwood Road	Springbank Road	Daw Park
Hampstead Road	Taunton Road	Manningham
Main North Road	Elizabeth Way	Elizabeth
Melbourne Street	Mann Terrace	North Adelaide
North East Road	Ascot Avenue	Vale Park
North East Road	Sudholz Road	Gilles Plains
Oaklands Road	Diagonal Road	Warradale North
Payneham Road	Portrush Road	Payneham
Pirie Street/Bartels Road	Hutt Street	Adelaide
Port Road	South Road	Croydon
South Road	George Street	Thebarton
South Road	Richmond Road	Keswick
West Lakes Boulevard	Frederick Road	West Lakes

2.2 Red light camera sites in 1997

During 1997, four red light camera sites were installed at two signalised intersections in the country town of Port Augusta, with one active wet film camera internal being rotated among the sites (see Table 2.2). The specific dates of commissioning and decommissioning could not be found for either of the sites. However, it is known that these sites were decommissioned after only a short time in operation.

Table 2.2
Red light camera intersection sites introduced in 1997

Road name	Intersecting road name	Town
Eyre Highway - Southeast	Burgoyne Street	Port Augusta
Eyre Highway - Northwest	Burgoyne Street	Port Augusta
Victoria Parade - Southeast	Carlton Parade	Port Augusta
Victoria Parade - Northwest	Carlton Parade	Port Augusta

2.3 Red light camera sites in 2001

During 2001, 26 red light wet film cameras were installed at signalised intersections around Adelaide (see Table 2.3). From late 2003 to early 2005 the majority of sites were upgraded to dual red light and speed, wet film cameras.

Five of the sites were decommissioned but the specific dates could not be determined. The remaining sites were still in operation in June 2009, with 13 wet film camera internals being rotated among them.

Table 2.3
Red light camera intersection sites introduced in 2001
and upgraded to dual purpose camera sites during 2003-2005

Road name	Intersecting road name	Suburb	Commissioning date	Upgrade date
Findon Road	Balcombe Avenue/Crittenden Road	Findon	20/04/2001	not upgraded
King William Street*	North Terrace	Adelaide	25/04/2001	01/03/2004
South Road	Daws Road	Melrose Park	25/04/2001	01/03/2004
Dyson Road	Beach Road	Christies Beach	07/05/2001	12/07/2004
Main South Road	Flaxmill Road/Wheatsheaf Road	Morphett Vale	07/05/2001	10/03/2005
North Terrace*	Frome Road	Adelaide	07/05/2001	23/12/2004
Fitzroy Terrace	Prospect Road	Fitzroy	08/05/2001	30/12/2003
Marion Road	Cross Road	Plympton Park	08/05/2001	27/02/2004
South Road	Torrens Road	Renown Park	08/05/2001	29/12/2003
Brighton Road	Sturt Road	Brighton	09/05/2001	05/03/2004
Cross Road	Goodwood Road	Westbourne Park	09/05/2001	12/01/2004
Marion Road*	Sturt Road	Mitchell Park	09/05/2001	22/12/2003
South Road*	Grange Road/Manton Street	Hindmarsh	14/05/2001	30/04/2004
Montacute Road	St Bernards Road	Rostrevor	04/06/2001	18/02/2005
Golden Grove Road	Milne Road	Modbury Heights	06/06/2001	23/01/2004
North East Road	Reservoir Road	Modbury	12/06/2001	23/01/2004
Glyburn Road	The Parade	Kensington Park	25/06/2001	20/07/2004
Lower North East Road	Gorge Road	Paradise	28/06/2001	23/12/2003
Main North Road	Regency Road	Enfield	29/06/2001	25/02/2004
The Golden Way	The Grove Way	Golden Grove	06/07/2001	06/01/2004
Wakefield Street*	Pulteney Street	Adelaide	09/07/2001	not upgraded
Kings Road	Salisbury Highway	Salisbury Downs	17/07/2001	26/02/2004
West Terrace	South Terrace/Anzac Hwy	Adelaide	04/10/2001	02/08/2004
West Terrace	South Terrace/Goodwood Road	Adelaide	04/10/2001	07/07/2004
Montacute Road	Glyburn Road/Payneham Road	Hectorville	19/11/2001	not upgraded
Portrush Road	Magill Road	Norwood	19/11/2001	19/04/2004

*Sites that were later decommissioned

2.4 Pedestrian crossing sites from 2003 to 2005

During the period of 2003 to 2005, four dual purpose cameras were installed at pedestrian crossings (see Table 2.4). These were still in operation in June 2009.

Table 2.4
Dual purpose camera pedestrian crossing sites introduced during 2003-2005

Road name	General position	Suburb	Commissioning date
Park Terrace	Western side of the Salisbury Railway Station	Salisbury	25/03/2003
Park Terrace	Eastern side of the Salisbury Railway Station	Salisbury	25/03/2003
Portrush Road	Near Phillips Street	Kensington	23/02/2004
Portrush Road	Near Watson Avenue	Toorak Gardens	21/12/2005

2.5 Dual purpose camera sites from 2006 to June 2009

From 2006 until June 2009, 57 dual purpose digital cameras were installed at signalised intersections in Adelaide and several country towns (see Table 2.5). The country towns where safety cameras were installed were Murray Bridge, Littlehampton, Whyalla, Port Augusta and Mount Gambier.

Table 2.5
Dual purpose camera intersection sites introduced from 2006 to June 2009

Road name	Intersecting road name	Suburb/Town	Commissioning date
Sudholz Road	North East Road	Gilles Plains	16/02/2006
Lower North East Road	Darley Road	Paradise	17/02/2006
Regency Road	South Road	Regency Park	17/02/2006
Grenfell Street	Frome Street	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/Aeolian Drive	Golden Grove	05/05/2006
Main South Road	Bains Road	Morphett Vale	09/05/2006
South Road	Grand Junction Road	Wingfield	10/05/2006
Grand Junction Road	Walkleys Road	Walkley Heights	05/10/2006
Henley Beach Road	Tapleys Hill Road	Fulham	05/10/2006
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
North East Road	Sudholz Road	Gilles Plains	12/10/2006
Henley Beach Road	Holbrooks Road	Underdale	06/12/2006
Greenhill Road	Hutt Road	Adelaide	26/03/2007
King William Road	Sir Edwin Smith Ave./War Memorial Drv.	Adelaide	26/03/2007
North East Road	Ascot Avenue	Vale Park	26/03/2007
Adelaide Road	Maurice Road	Murray Bridge	27/03/2007
Anzac Highway	Marion Road	Plympton	27/03/2007
Commercial Street East	Crouch Street South	Mount Gambier	27/03/2007
Main South Road	Doctors Road/Beach Road	Morphett Vale	27/03/2007
Sturt Street	Bay Road	Mount Gambier	27/03/2007
Adelaide Road	Mannum Road/Swanport Road	Murray Bridge	28/03/2007
Playford Avenue	Elliot Street	Whyalla	29/03/2007
Tapleys Hill Road	West Lakes Boulevard	Seaton	29/03/2007
Main North Road	Yorktown Road/Philip Highway (kerb)	Elizabeth Park	30/03/2007
Main North Road	Yorktown Road/Philip Highway (median)	Elizabeth Park	30/03/2007
South Road	Cormack Road	Wingfield	30/03/2007
Diagonal Road	Oaklands Road	Glengowrie	03/04/2007
South Road	Ashwin Parade/West Thebarton Road	Torrensville	03/04/2007
Payneham Road	Lower Portrush Road/Portrush Road	Marden	09/04/2007
Payneham Road	Nelson Street/Stephen Terrace	Stepney	09/04/2007
Grand Junction Road	Hanson Road	Ottoway	12/04/2007
Grand Junction Road	Main North Road	Enfield	12/04/2007
Norrie Avenue	Nicolson Avenue	Whyalla	12/04/2007
Victoria Parade	Carlton Parade	Port Augusta	12/04/2007
Victoria Parade	Flinders Terrace	Port Augusta	13/04/2007
Commercial Street West	Wehl Street South	Mount Gambier	09/05/2007
Adelaide Road	South Eastern Freeway Access Ramps	Littlehampton	28/07/2007
West Terrace	Hindley Street	Adelaide	22/09/2007
South Road	Richmond Road	Mile End South	19/12/2007
Sir Donald Bradman Drive	Brooker Terrace	Hilton	08/07/2008
Main North Road	Fairfield Road	Elizabeth Grove	28/08/2008
Churchill Road	Regency Road	Prospect	11/09/2008
South Road	Regency Road	Regency Park	16/09/2008
Waterloo Corner Road	Bagster Road	Salisbury North	25/09/2008
Main South Road	Black Road	O'Halloran Hill	30/09/2008
Commercial Road	Grand Junction Road	Port Adelaide	02/10/2008
Bridge Road	Montague Road	Ingle Farm	23/10/2008
Glover Avenue	West Terrace	Adelaide	20/11/2008
Anzac Highway	Cross Road	Plympton	24/11/2008
Marion Road	Sturt Road	Mitchell Park	16/01/2009
Montefiore Road	War Memorial Drive	North Adelaide	20/01/2009
North Terrace	Frome Road	Adelaide	11/03/2009
Glyburn Road	Kensington Road	Kensington Gardens	18/03/2009

3 Selection of safety camera sites for analysis

All disobey red light and speeding infringements issued at all active safety camera sites for the period 1 January 2001 to 31 December 2008 were obtained from the South Australia Police. The infringement data was de-identified and no information on vehicle registration or driver details was provided. The following information was included for each infringement:

- Site location
- Date of infringement
- Time of infringement
- Infringement type (disobey red light, speeding, or both)
- Speed limit at site
- Speed of infringing vehicle

For many of the sites there were very few infringements on a given day. To obtain reasonable numbers and to avoid day of week effects, the number of infringements per week was used as the basis of measurement.

The goal was to track infringements issued at each site for one year after each site was commissioned. Since the wet film camera sites did not always have a camera operating, only the digital camera sites were suitable for tracking (the 57 dual purpose camera sites commissioned from 2006 to June 2009). As 52 weeks of data was required, only those sites commissioned before 1 January 2008 were suitable for tracking (43 sites remaining). Few infringements were recorded at sites outside of Adelaide. For this reason, and to form a more homogenous sample, the country sites were excluded leaving 34 sites.

Even for the chosen sites, continuous infringement data was not available for 52 weeks due to interruptions such as road works and camera failures. Those sites with missing infringement data for three or more consecutive weeks were removed from the sample. This resulted in the analysis sample consisting of 21 sites.

Table 3.1 lists the location of the 21 sites, the commissioning date, the speed limit of the monitored approach to the intersection, the number of lanes monitored and the Annual Average Daily Traffic (AADT) through the monitored approach to the intersection. The AADT data was sourced from DPTI traffic maps and the values should be considered as estimates (DPTI, 2007). It can be seen in Table 3.1 that the majority of the sites are busy, multi-lane, arterial roads. It was beyond the scope of this study to review the history of each of the selected sites for modifications such as road works, the introduction of turn arrows, periods of high flow and major events.

Table 3.1
Safety camera intersection sites with continuous infringement data

Road name	Intersecting road name	Suburb	Commissioning date	Speed limit	No. of lanes	AADT
Sudholz Road	North East Road	Gilles Plains	16/02/2006	60	3	16750
Lower North East Road	Darley Road	Paradise	17/02/2006	60	3	14775
Regency Road	South Road	Regency Park	17/02/2006	60	3	12800
Grenfell Street	Frome Street	Adelaide	07/03/2006	50	3	Unknown
Grote Street	West Terrace	Adelaide	21/03/2006	50	3	Unknown
Panalatinga Road	Pimpala Road	Woodcroft	02/05/2006	80	3	10750
The Grove Way	Atlantis Drive/Aeolian Drive	Golden Grove	05/05/2006	60	3	Unknown
Main South Road	Bains Road	Morphett Vale	09/05/2006	60	3	15625
Kensington Road	Portrush Road	Marryatville	05/10/2006	60	3	10225
Goodwood Road	Cross Road	Cumberland Park	09/10/2006	60	2	15375
Grand Junction Road	Addison Road	Pennington	12/10/2006	60	2	14650
Henley Beach Road	Holbrooks Road	Underdale	06/12/2006	60	2	16800
King William Road	Sir Edwin Smith Ave./War Memorial Drv.	Adelaide	26/03/2007	50	3	Unknown
North East Road	Ascot Avenue	Vale Park	26/03/2007	60	3	Unknown
Anzac Highway	Marion Road	Plympton	27/03/2007	60	4	15400
Main South Road	Doctors Road/Beach Road	Morphett Vale	27/03/2007	60	4	12250
South Road	Cormack Road	Wingfield	30/03/2007	70	3	17675
Diagonal Road	Oaklands Road	Glengowrie	03/04/2007	60	3	11550
Payneham Road	Lower Portrush Road/Portrush Road	Marden	09/04/2007	60	3	20325
Payneham Road	Nelson Street/Stephen Terrace	Stepney	09/04/2007	60	3	16550
Grand Junction Road	Main North Road	Enfield	12/04/2007	60	3	16200

4 Results

The graphs presented in this Section show the number of infringements per week in total for the 21 selected sites during the first year of each site's operation. Some of the sites did experience short dropouts (less than 3 consecutive weeks) of infringement data. Consequently, the infringements recorded for any one week may not be exactly comparable with those recorded for the previous or following week, as different sites may have dropped out. If dropouts occurred with increasing frequency over time, infringements would fall simply because of this. A minor effect of this type cannot be ruled out, but the general picture reported below (one of decline in infringements with time) is confirmed by considering the numbers of infringements at individual sites.

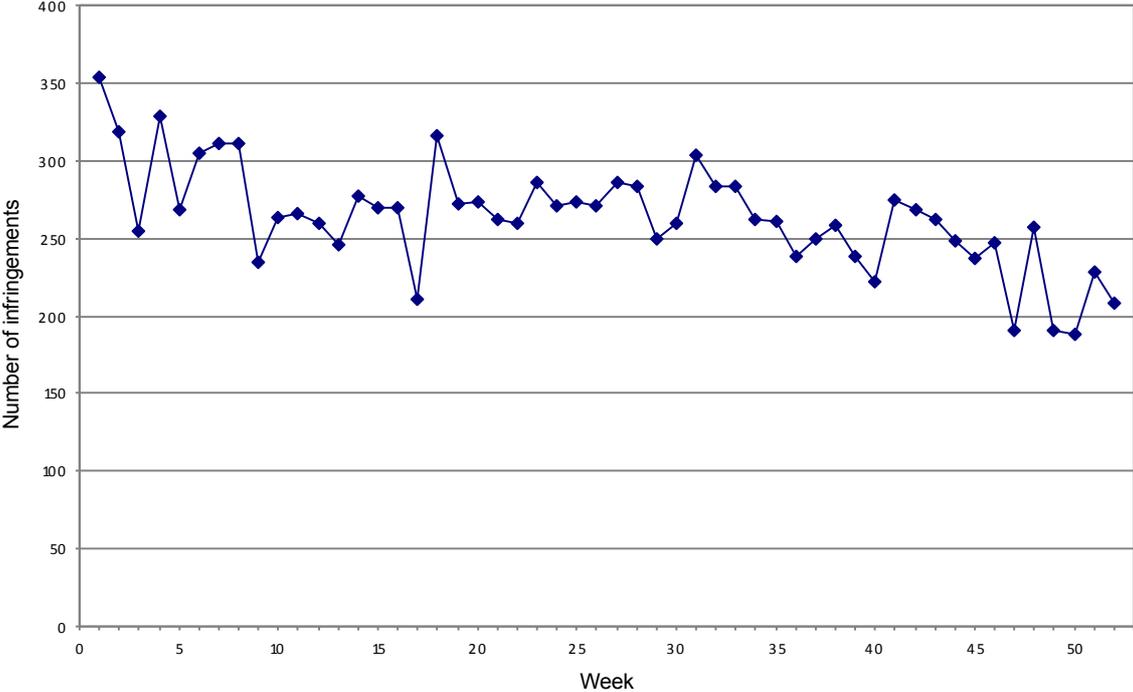
The pattern of infringements over time was also examined for sites with missing infringement data for three or more consecutive weeks that were removed from the sample. These sites were found to have results consistent with those presented here.

It should be noted that infringement data is an underestimate of the actual number of vehicles which are photographed by a safety camera in the act of disobeying a red light or speeding through an intersection. 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.

4.1 Disobey red light infringements

The total number of disobey red light infringements issued for the selected sample of 21 sites was observed to decrease gradually during the first year after infringements started being issued at each site (Figure 4.1).

Figure 4.1
Total number of disobey red light infringements for each week after the commissioning date for the selected sample of 21 sites



4.2 Speeding infringements

Speeding infringements were more numerous than disobey red light infringements. The number of speeding infringements that involved exceeding the speed limit by 10 km/h or more fell over time (Figure 4.2). Speeding infringements fell more rapidly than disobey red light infringements over the course of the 52 weeks.

The number of speeding infringements issued for exceeding the speed limit by 15 km/h or more, 20 km/h or more, 25 km/h or more and 30 km/h or more are shown in Figures 4.3-4.6. All showed a general decline over the course of the 52 weeks. For high level speeding, a rapid fall in speeding infringements was observed during the first few weeks with a slower continued decline thereafter.

Figure 4.2
 Total number of speeding infringements 10 km/h or more above the speed limit
 for each week after the commissioning date for the selected sample of 21 sites

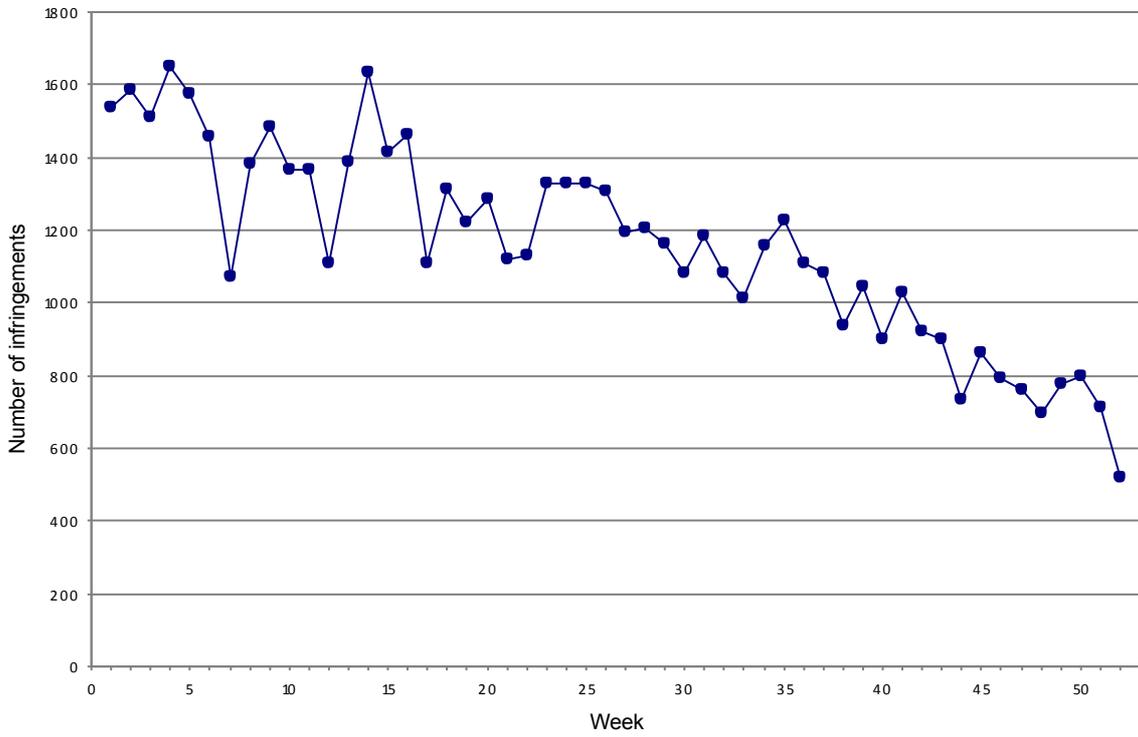


Figure 4.3
 Total number of speeding infringements 15 km/h or more above the speed limit
 for each week after the commissioning date for the selected sample of 21 sites

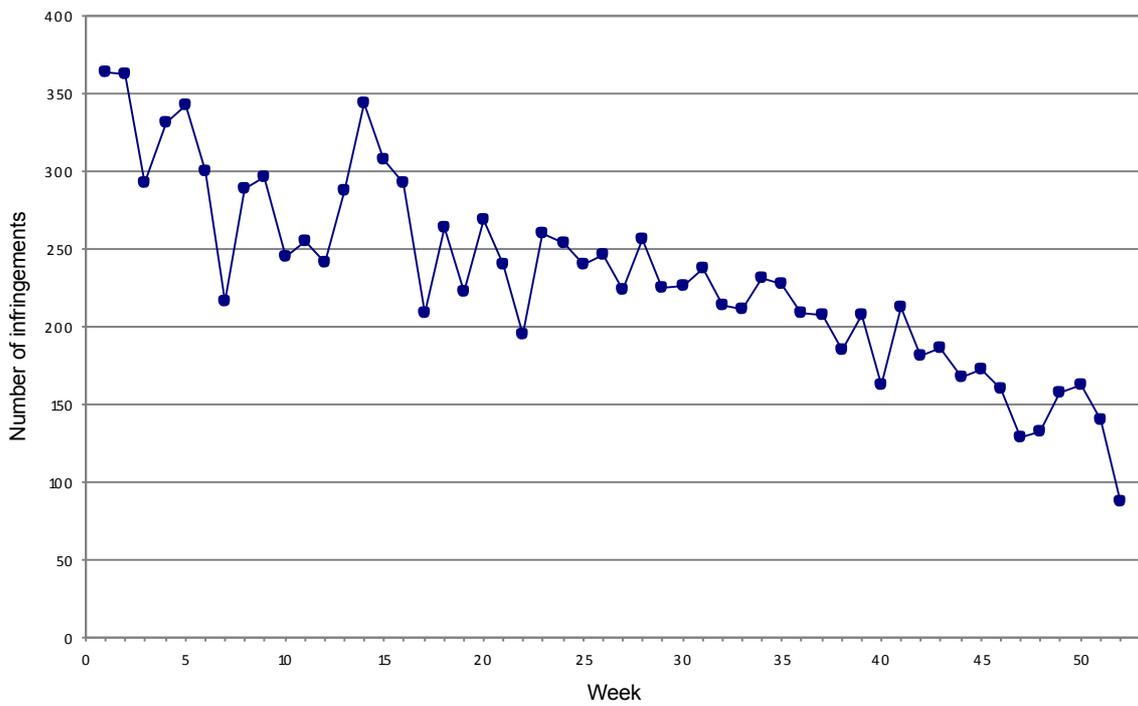


Figure 4.4
 Total number of speeding infringements 20 km/h or more above the speed limit
 for each week after the commissioning date for the selected sample of 21 sites

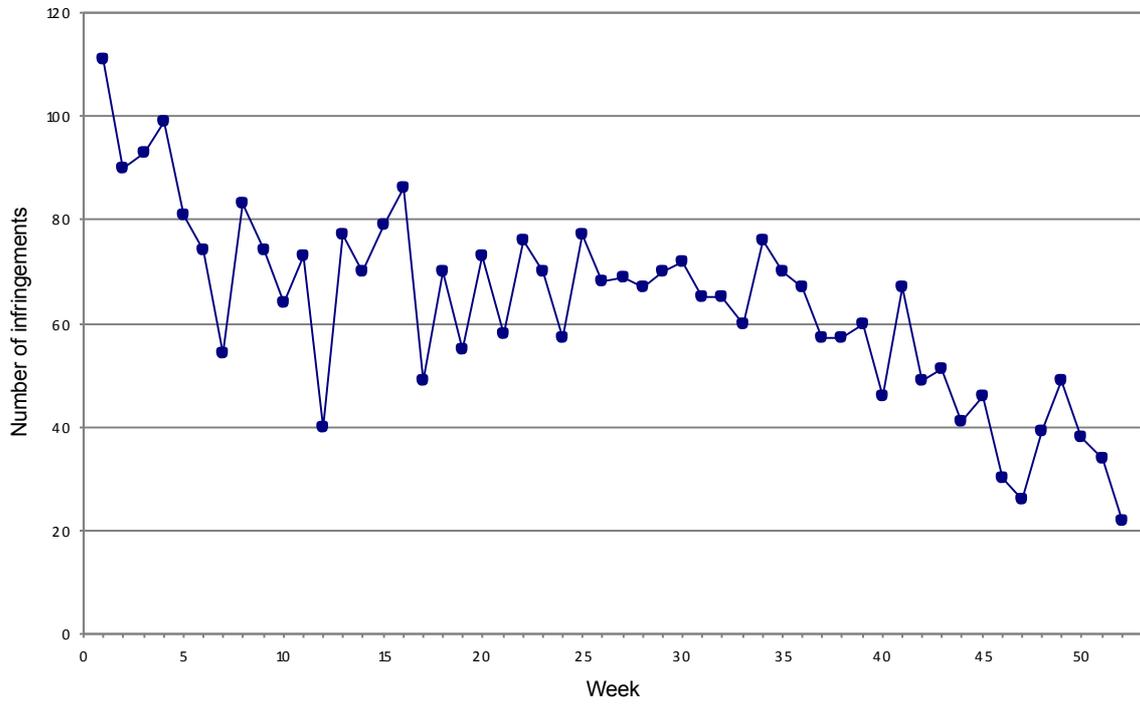


Figure 4.5
 Total number of speeding infringements 25 km/h or more above the speed limit
 for each week after the commissioning date for the selected sample of 21 sites

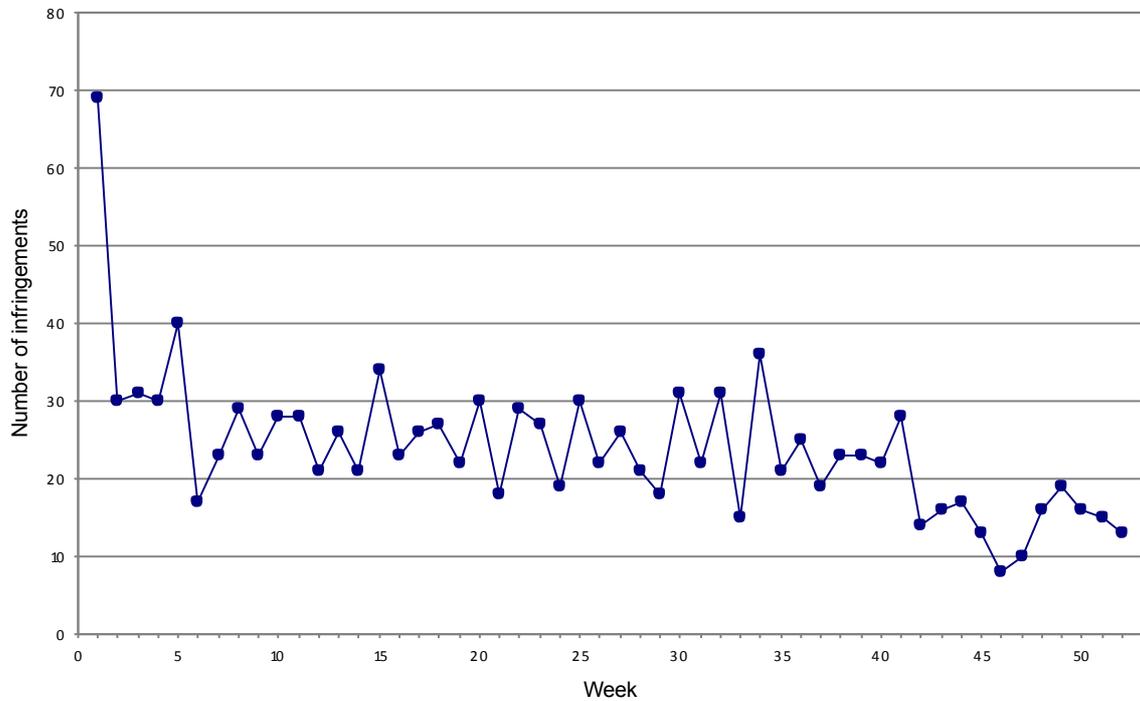
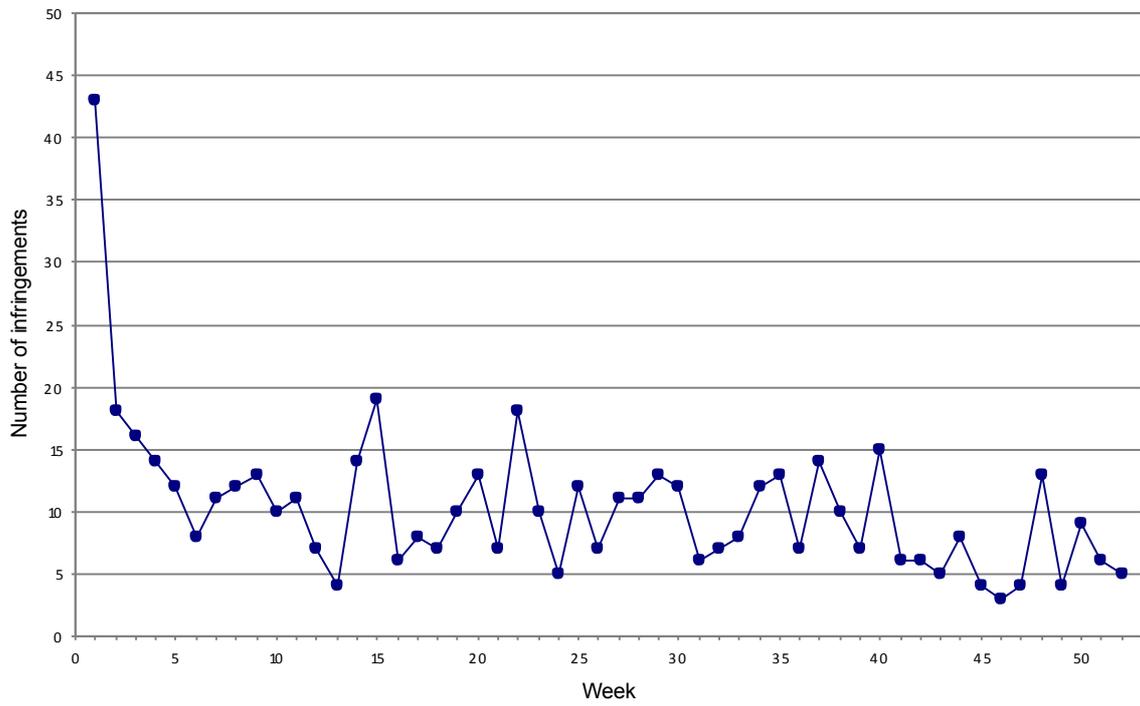


Figure 4.6
Total number of speeding infringements 30 km/h or more above the speed limit
for each week after the commissioning date for the selected sample of 21 sites



5 Discussion

Installing signs indicating that an intersection or crossing is being monitored for red light running violations or red light running and speeding violations would be expected to reduce the frequency of red light running and illegal speeds. Unfortunately, no pre-installation data is available to determine the size of this effect since the cameras themselves were used for data collection.

It is clear from the results presented here that the number of drivers disobeying a red light or exceeding the speed limit continued to decline for at least the first year after the installation of a camera and warning signs. In this sense safety cameras appear to generate a worthwhile improvement in driver behaviour. The slow improvement over time suggests some kind of learning by the population of drivers passing through the camera sites.

One possibility is that a small group of regular users of the road who habitually run red lights or speed through intersections only change their behaviour at particular locations when they actually receive an infringement notice for a violation at that location. Since the opportunities to run a red light or speed through a monitored intersection are low 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 per day and 10 speeds 10 km/h or more over the speed limit per day).

While the relative size of such an effect cannot be determined given the data that is available, the differences between the results for red light running and various levels of speeding do provide some insights.

Red light running and low level speeding rates decrease nearly linearly over the first year of operation. This is suggestive of a general ongoing raising of awareness of the safety cameras and a slow change of behaviour consistent with the majority of drivers 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. Since these kinds of offences can be due to a failure of attention rather than a voluntary choice, drivers paying more attention could be expected to lead to slight and ongoing reductions.

The rapid drop in high level speeding offences during the first few weeks of camera operation is more suggestive of a small group of drivers who habitually speed, are caught at a particular intersection, and then adjust their speeding behaviour for that intersection immediately.

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 5.1. 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 5.2. However, 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.

Table 5.1
Demerit points and fines for South Australian drivers (June 2009)

Speed infringement severity	Demerit points	Fine	Automatic driving 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

* A subsequent speeding infringement of 45+ km/h incurs a fine of \$700 - \$1200 and an automatic driving disqualification of 2 years

Table 5.2
Driving disqualifications associated with accumulation of demerit points for full South Australian 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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The views expressed in this report are those of the authors and do not necessarily represent those of the University of Adelaide or the funding organisations.

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