



Transport
for NSW

Centre for Road Safety

Annual NSW Speed Camera Performance Review 2015

Acknowledgements

Transport for NSW wishes to thank the following:

- NSW Ministry of Health for providing access to information in the NSW Admitted Patient Data Collection, NSW Emergency Department Data Collection and the NSW Registry of Births, Deaths and Marriages – Death registrations.
- Centre for Health Record Linkage for conducting the record linkage.
- Aboriginal Health & Medical Research Council for supporting the ongoing data linkage project.
- Dr Mike Bambach, from Transport and Road Safety (TARS) Research, University of NSW, for analyses of serious injuries not matched to police reports.
- Independent Hospital Pricing Authority for providing the International Classification of Diseases, 10th Revision, Australian Modification (ICD-10-AM) electronic code lists.
- The State Insurance Regulatory Authority (SIRA) and icare (Lifetime Care) for providing data on Compulsory Third Party insurance claims and Lifetime Care participants.
- ACT Health Directorate for providing access to information in the ACT Admitted Patient Care and ACT Emergency Department Information System data collections.

This serious injury research forms part of the routine monitoring activity undertaken by Transport for NSW to improve road safety for the community. It was approved by the following ethics committees:

- Approved by the NSW Population & Health Services Research Ethics Committee on 19th December 2013.
- Approved by the Aboriginal Health & Medical Research Council Ethics Committee on 24th January 2014.
- Approved by the ACT Health Human Research Ethics Committee on 13th November 2013.

Author:	Centre for Road Safety
Date:	December 2015
Version:	1
Division:	Freight, Strategy and Planning

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1 Executive summary

The purpose of the Annual NSW Speed Camera Performance Review is to systematically monitor speed cameras in NSW to ensure they are having a positive road safety effect. The NSW Centre for Road Safety (CRS) has reviewed all NSW speed cameras against the criteria outlined in the NSW Speed Camera Strategy 2012, culminating in this report.

This series of annual reports addresses the recommendation from the 2011 NSW Auditor-General's audit of speed cameras, to provide the community with information about the road safety impact of speed cameras.

If a camera is found not to have a positive road safety effect, CRS will consider alternative road safety measures at the same location. The findings from this annual review will also guide future speed enforcement priorities and operations.

1.1 How we review speed cameras

The review criteria for each camera type outlined in the Strategy has been determined by CRS based on the road safety benefit that is expected to be achieved from each program. Broadly speaking, review recommendations are measured by two key criteria:

- the reduction in casualty crashes and casualties, caused by the speed camera slowing drivers down, and
- the reduction in infringement rates, caused by the speed camera slowing drivers down.

Typically at least five years of crash and casualty data are required to make an assessment of a camera's safety benefit. The red-light speed camera and point-to-point enforcement programs are in their early stages, with most locations only operational for four years or less. Given the infancy of these programs, the data analysed in this annual review is generally not sufficient to assess reliably the safety benefit of individual camera locations. Where there is sufficient data, we indicate a recommendation to either retain or review the camera.

Because mobile speed cameras are designed to generally deter speeding across the road network, and because they move regularly, these annual reviews examine crash and speed data for the entire state, rather than individual mobile speed camera locations.

1.2 Key findings

This annual review analyses data relating to crashes that occurred between 1 January 2014 and 31 December 2014.

1.2.1 Mobile speed camera program

Program size as at 31 December 2014: 7,000 hours of enforcement per month at 640 locations

Overall, the trend in road fatalities and annual speed surveys indicate that the mobile speed camera program continues to deliver positive road safety benefits, compared with results prior to the reintroduction of the mobile speed camera program in 2010. Over 99 per cent of vehicles passing mobile speed cameras are not infringed for

speeding. This high rate of compliance has remained consistent since 2010 when the program was reintroduced.

The 2014 road toll of 307 fatalities on NSW roads is the lowest annual figure since 1923. This is also 32 per cent lower than in 2009 (with 453 fatalities), before the reintroduction of the mobile speed camera in 2010.

There has also been a 39 per cent reduction in speed related fatalities from 2009 to 2014, and results from the 2014 speed surveys show speeding remains below the level observed in 2009.

The percentage of light vehicles exceeding the speed limit by more than 10km/h in 2014 has reduced in all speed zones compared to 2013, which builds on impressive results from previous years. In 2014 fewer light vehicles were exceeding the speed limit by more than 10km/h compared to all years from 2009 to 2013.

The percentage of heavy vehicles exceeding the speed limit by up to 10km/h has increased in some speed zones compared to 2013; however, the results still compare favourably compared to previous years. Significant reductions in heavy vehicles exceeding the speed limit by over 10 km/h continued into in 2014, achieving the lowest percentages over the entire five year period in 40km/h, 50km/h, 60km/h and 90km/h zones and maintaining low levels in 100km/h zones.

1.2.2 Red-light speed camera program

Program size as at 31 December 2014: 164 cameras at 145 intersections

Preliminary analysis of the red-light speed camera program show encouraging results in changing driver behaviour.

Overall, when comparing the five years before red-light speed cameras were installed to the post installation period for each camera location there has been a:

- 34 per cent reduction in casualty crashes
- 39 per cent reduction in total casualties at these locations including:
 - 55 per cent reduction in fatalities
 - 32 per cent reduction in serious injuries
 - 45 per cent reduction in moderate injuries
 - 36 per cent reduction in minor/other injuries
 - 44 per cent reduction in pedestrian casualties

These reductions in casualties represent a total saving of \$95.1 million to the community.

One red-light speed camera has been operating for more than five years as at 31 December 2014, Cumberland Highway, Cabramatta at St Johns Road. Since the camera was installed there has been a 16 per cent reduction in casualty crashes and a 37 per cent reduction in casualties at this location.

The 10 highest infringing red-light speed cameras all had high compliance rates with more than 99 per cent of drivers passing the cameras without being infringed for red-light running or speeding. Where cameras have been operating for longer than two years, infringements have generally decreased over time.

1.2.3 Fixed speed camera program

Program size as at 31 December 2014: 132 cameras at 107 locations¹

Overall, when comparing the five years before the fixed speed cameras were installed to the most recent five years there has been a:

- 38 per cent reduction in the number of casualty crashes
- 91 per cent reduction in fatalities
- 42 per cent reduction in injuries at these camera locations

These reductions in total casualties represent a saving of \$526.1 million to the community.

Of the 94 fixed speed camera locations, 86 were found to offer continued safety benefits. One location – Hartley, Great Western Highway was identified last year for review, and this will occur once road works at the location is completed. One location has been recommended to be removed because it is no longer providing road safety benefits and is recommended to be relocated to a higher priority location and the remaining six were identified for further review. The locations to be reviewed or removed are:

- Bonville, Pine Creek Way – Remove
- Bomaderry, Bolong Road – Review
- Brogo, Princes Highway – Review
- Burringbar, Tweed Valley Way – Review
- North Narrabeen, Pittwater Road – Review
- Queanbeyan, Lanyon Drive – Review
- Rydalmere, Victoria Road – Review
- Hartley, Great Western Highway – Review following road works

Cameras at three further locations have been removed due to major road works and will be reviewed once these road works have been completed. These locations are:

- Berry, Princes Highway – Review following road works
- Foxground, Princes Highway – Review following road works
- Terrigal, Terrigal Drive – Review following road works

The 10 highest infringing fixed speed cameras were all found to reduce crashes and casualties. All had high compliance rates with more than 99 per cent of drivers passing the cameras without being infringed for speeding.

1.2.4 Point-to-point speed camera program

Program size as at 31 December 2014: 24 lengths

Preliminary analysis of point-to-point speed enforcement lengths shows that there has been a low number of heavy vehicle crashes since camera operation. Infringement data for average speed offences in point-to-point enforcement lengths show a high level of compliance and a low number of infringements.

¹ Of the 107 fixed speed camera locations, seven locations operate in warning mode and five locations are 'high risk' that are located in tunnels. These locations were not included in the fixed speed camera analysis.

2 Introduction

In response to the Auditor-General's recommendation, the NSW Government announced the *NSW Speed Camera Strategy* on 1 June 2012. The strategy provides an integrated framework for speed enforcement in NSW and aims to improve the transparency and understanding of the use of speed cameras in NSW through increased community engagement and education. The strategy was developed in consultation with the NSW Police Force and NRMA Motoring and Services, and reinforces the Government's commitment to reducing fatalities and serious injuries on NSW roads.

One of the key actions outlined in the *NSW Speed Camera Strategy* is the annual publication of camera performance against criteria outlined in the Strategy. This action also meets the NSW Auditor-General's recommendation to provide the community with information about the road safety impact of speed cameras.

The purpose of the *Annual NSW Speed Camera Performance Review* is to present the results of performance monitoring carried out on each of the speed camera programs in NSW. The Auditor-General found that the right speed camera in the right place can save lives. Cameras not delivering the expected road safety benefits will be monitored and reviewed and, potentially recommended for removal. The findings from this report will guide future speed enforcement operations.

This report also addresses the NRMA Motoring & Services' request for an assessment of all high infringing speed camera locations across NSW.

2.1 The speeding problem

Speeding, which encompasses excessive speed (driving above the speed limit) or inappropriate speed (driving too fast for the prevailing conditions), is unquestionably recognised as a major contributing factor in both the number and severity of traffic crashes in NSW.

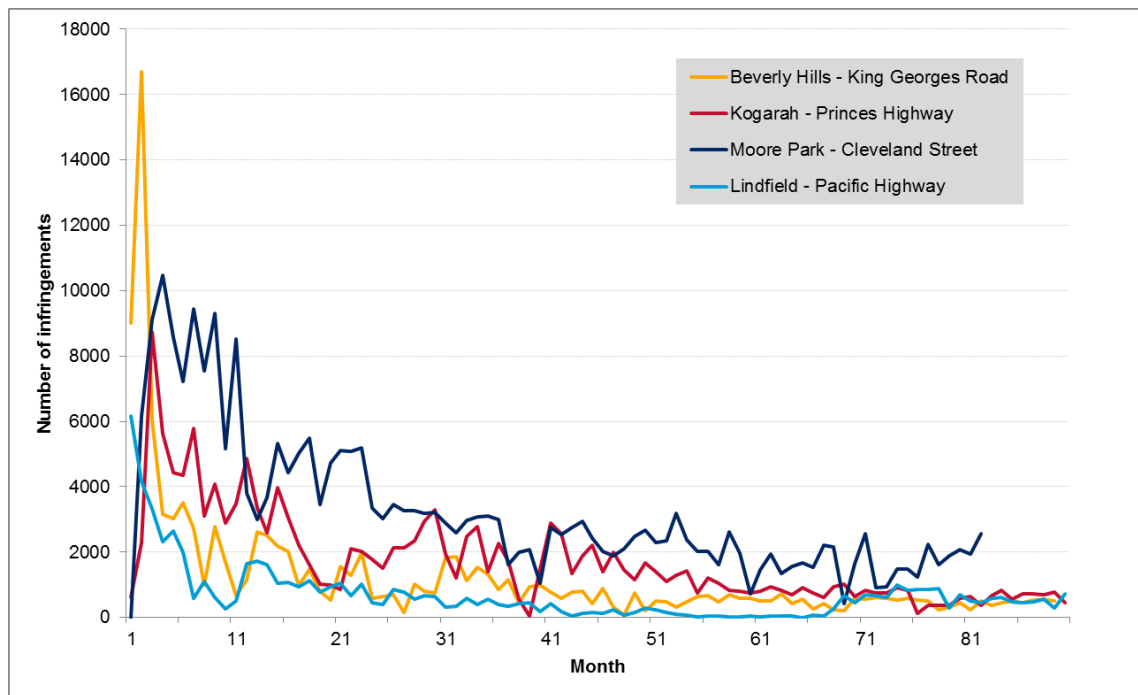
Speeding increases the risk of having a crash, and increases the risk of serious injury or death in the event of a crash. Studies of survival and impact speed show that small increases in travel speed can result in large increases in braking distances and impact speed, resulting in both an increased risk of a crash and a more severe outcome. This is especially the case for crashes with less protected road users such as pedestrians and cyclists.

2.2 Safety benefits of camera enforcement

Speed camera enforcement is an important road safety initiative with proven road safety benefits, and is a commonly employed method of speed enforcement in many best practice road safety jurisdictions worldwide. Speed enforcement helps to reduce the incidences of speeding on our roads, which in turn reduces the risk of crashes and reduces the likelihood of death or serious injuries in the event of a crash.

Speed enforcement activities aim to reduce speeding by increasing the perceived likelihood of being caught and punished. For an example of how we can see speed cameras changing driver behaviour, Figure 1 depicts the number of infringements per month since the commencement of enforcement at three of the highest infringing fixed speed camera locations.

Figure 1: Example of trend in speed camera infringements over time



This pattern shows an initial high number of infringements followed by a rapid and sustained decrease in infringements as drivers modify their behaviour. This is also reflected by a reduction in crashes over that time.

Appendix C contains this type of graph for every fixed speed camera location in NSW.

2.2.1 Data table trends in speed camera infringements over time

Month	Beverly Hills - King Georges Road	Kogarah - Princes Highway	Moore Park - Cleveland Street	Lindfield - Pacific Highway
1	9009	599	1	6161
2	16685	2296	6176	4155
3	6040	8724	9110	3332
4	3158	5630	10479	2319
5	3017	4425	8573	2640
6	3521	4346	7232	2001
7	2714	5791	9448	588
8	982	3107	7535	1109
9	2768	4091	9313	609
10	1692	2886	5164	269
11	672	3487	8532	505
12	1157	4873	3804	1642
13	2610	3346	2991	1724
14	2497	2599	3678	1624
15	2192	3966	5314	1056
16	2024	3057	4430	1080
17	967	2216	5019	925
18	1468	1612	5486	1121
19	813	1029	3442	772
20	519	989	4734	941
21	1553	852	5114	1054
22	1281	2114	5071	664
23	1957	2008	5186	1006
24	579	1770	3334	441
25	648	1502	3015	398
26	685	2124	3464	846
27	157	2130	3263	776
28	1014	2340	3268	554
29	812	2950	3172	653
30	756	3304	3203	646
31	1838	1946	2873	317
32	1854	1203	2601	353
33	1127	2491	2964	589
34	1531	2789	3071	408
35	1315	1388	3111	548
36	857	2253	3006	395
37	1166	1728	1610	352
38	443	550	2002	431
39	923	31	2069	440
40	980	1465	1055	191

Month	Beverly Hills - King Georges Road	Kogarah - Princes Highway	Moore Park - Cleveland Street	Lindfield - Pacific Highway
41	778	2888	2751	413
42	572	2554	2533	166
43	767	1330	2757	40
44	791	1876	2931	122
45	434	2197	2421	156
46	878	1395	2029	113
47	303	1997	1873	245
48	77	1463	2101	59
49	737	1156	2488	152
50	212	1659	2672	300
51	499	1393	2294	233
52	483	1093	2336	156
53	326	1298	3188	96
54	482	1411	2384	59
55	633	758	2025	29
56	669	1202	2007	48
57	485	1040	1614	42
58	698	816	2623	27
59	592	803	1956	27
60	572	747	731	38
61	505	804	1441	5
62	502	948	1934	37
63	713	834	1331	33
64	413	704	1550	32
65	569	917	1665	1
66	269	735	1528	66
67	424	602	2199	55
68	222	936	2159	255
69	212	1016	417	654
70	592	638	1639	453
71	567	817	2556	701
72	607	760	920	677
73	577	746	946	625
74	538	899	1467	993
75	578	824	1484	821
76	535	137	1228	846
77	510	358	2237	857
78	236	360	1627	894
79	312	370	1874	280
80	459	595	2083	695
81	230	643	1935	503
82	495	365	2559	444
83	360	673		587
84	461	829		614
85	492	555		466
86	444	729		440
87	534	711		478
88	553	684		553
89	506	783		280
90		455		728

2.3 How can I tell if a location has a speed camera?

All speed cameras in NSW are signposted and mobile speed camera vehicles are clearly marked.

The NSW Centre for Road Safety website also lists all speed camera locations in NSW. The website allows any member of the public to find the positions of all mobile, fixed, red-light speed cameras, and the positions of all point-to-point speed zones.

2.4 Where does speed camera revenue go?

All fines from speed and red light cameras are paid into the Community Road Safety Fund. This fund goes towards numerous community road safety initiatives, including road safety engineering works, enhanced enforcement by the NSW Police Force and public education campaigns. Note this does not include fines issued by police.

3 Types of speed camera programs in NSW

Speed cameras are speed enforcement tools that supplement enforcement conducted by the NSW Police Force. The NSW Police Force routinely nominates locations to be considered for automated speed enforcement, as they can also operate in locations that are difficult for police to enforce.

Table 1 shows the four types of speed cameras used in NSW.

Table 1: Types of speed camera enforcement in NSW

Speed cameras used in NSW			
Camera Type	Main purpose	Introduced	Size of NSW program as at 31 December 2014
Mobile	General network deterrence	First introduced in 1991. Ceased operation in December 2008 and re-introduced in 2010	640 locations 7,000 hours of enforcement per month
Red-light speed	Location specific (To address high risk intersections)	2009	164 cameras at 145 intersections
Fixed speed	Location specific (To address black spot/high risk)	1997	132 cameras at 107 locations ²
Point-to-point	Route enforcement (For heavy vehicles only)	2010	24 lengths

3.1 Mobile speed cameras

Mobile speed cameras are moved around the road network at various times and locations. This means drivers are less able to predict where enforcement will occur, and so are more likely to comply with the speed limit more often. Therefore the benefit of mobile speed cameras in reducing speeding is not limited to mobile speed camera locations or for the time the camera is located there; they produce a sustained change in driver behaviour by increasing the real and perceived likelihood that speeding can be enforced anywhere at any time.

3.2 Red-light speed cameras

Red-light speed cameras are installed at specific signalised intersections where drivers are vulnerable to right angle crashes and there is an elevated risk of a pedestrian crash. These cameras detect and deter both speeding and red-light running, both of which can result in severe injuries even in lower speed crashes. By reducing the incidence of speeding and red-light running at enforced intersections, red-light speed cameras are also expected to change driver behaviour at

² Of the 107 fixed speed camera locations, seven locations operate in warning mode and five locations are 'high risk' locations (typically located in tunnels). These locations were not included in the fixed speed camera analysis.

intersections more broadly, reducing speeding and red-light running across the network.

3.3 Fixed speed cameras

Fixed speed cameras are located at specified road lengths where there is a high crash risk or a demonstrated crash history. These cameras detect and deter speeding at a specific location on the road network.

3.4 Point-to-point speed cameras

Point-to-point enforcement addresses heavy vehicle speeding along travel routes with a demonstrated history of heavy vehicle crashes and/or speeding. Point-to-point enforcement in NSW targets heavy vehicles as they are over-represented in crashes on known heavy vehicle routes. Point-to-point enforcement works by measuring the amount of time it takes a heavy vehicle to travel between two points and then calculating the average speed of the vehicle. If the vehicle's average speed is faster than the speed limit for the length of road, the driver will be infringed for speeding.

4 Criteria for reviewing speed cameras

The ultimate indicator of performance for all speed cameras in NSW is a reduction in people killed and injured in crashes. The following tables outline the criteria that have guided the review of speed camera performance in NSW as well as the overall performance of the *NSW Speed Camera Strategy*.

Table 2: Criteria for measuring camera performance

Camera Type	Performance data	Measure of performance
Mobile	Annual speed surveys	Reduction in vehicles exceeding speed limit across the road network, by testing a random sample of locations
	Compliance data	Increase in compliance rates and/or reduction in infringement rates
	Crash data	Reduction in crashes and casualties across NSW
Red-light speed	Speeds	Reduction in vehicles exceeding speed limit at intersection
	Compliance data	Increase in compliance at intersection and/or reduction in infringement rates
	Crash data	Reduction in casualties and crashes at intersection
Fixed speed	Speeds	Reduction in vehicles speeding within 500 metres of the camera
	Compliance data	Increase in compliance at camera location and/or Reduction in infringement rates
	Crash data	Reduction in casualties and crashes within 500 metres of the camera
	Risk	Reduction in risk at the location (for example low level of speeding and/or crashes in tunnels)
Point-to-point	Speeds	Reduction in heavy vehicle speeding within enforcement length
	Compliance data	Increase in compliance within the enforcement length and/or reduction in infringement rates
	Crash data	Reduction in crashes within enforcement length

Table 3: Criteria for measuring overall performance of enforcement programs

Program	Outcome
Mobile	Reduction in road trauma, speed-related crashes and speeding across the entire road network
Red-light speed	Reduction in frequency and severity of crashes at enforced intersections (and at all signalised intersections due to deterrent effect across the network)
Fixed speed	Reduction in vehicles speeding and the frequency or severity of crashes at fixed speed camera locations
Point-to-point	Reduction in speeding and the frequency and severity of crashes on point-to-point enforcement lengths

5 Review methodology

5.1 2014 road crash data

The crash data used in this annual review include crashes which occurred between 1 January 2014 and 31 December 2014. Data for this time period were finalised at the time of writing the report, however injury severity data presented in this report for July to December 2014 is preliminary and should be treated with caution. The matched hospital admission and emergency presentation data for this time period were incomplete at the time of writing this report so results may under-represent the true number of injuries for this time period.

The crash statistics recorded by Transport for NSW in the CRS crash recording database, CrashLink, were confined to those crashes which conform to the national guidelines for reporting and classifying road vehicle crashes³, based on the following criteria:

- The crash was reported to the Police
- The crash occurred on a road open to the public
- The crash involved at least one moving road vehicle
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away

5.2 Injury severity

Crash data was presented by severity of injury. The severities are defined as follows:

- **Fatality:** a person who dies within thirty days from injuries received in a road traffic crash
- **Serious injury:** a person identified in CrashLink (casualty or traffic unit controller) who is matched to hospital admission record on the same day or on the day after a crash and did not die within 30 days of the crash
- **Moderate injury:** a person identified in CrashLink (casualty or traffic unit controller) who is matched to emergency department presentation record on the same day or on the day after a crash (but not subsequently admitted to hospital)
- **Minor / Other injury:** a person identified as an injury in CrashLink who is not matched to a hospital admission record or emergency department presentation record within two days of the crash
- **Injury– Severity uncategoryed:** a person identified as an injury in CrashLink prior to 2005
- **Casualty:** any person killed or injured because of a crash
- **Casualty crash:** a crash that results in at least one person killed or injured

³ More information about how crash data is processed in NSW is available online at www.roadsafety.transport.nsw.gov.au.

5.3 Important notes on crash data and injury severity

This annual review of speed cameras includes changes to crash data reported. The method of reporting tow away crash data changed in October 2014. The tow away crash data from this date is no longer comparable to the before period, and for this reason results exclude tow away crashes. Furthermore, the annual review now includes more detail about the severity of injuries for data from 2005 onwards. This improvement to the data has occurred because crash data has been matched to hospital admissions or emergency department presentations from this date onwards. Further detail is provided below.

5.3.1 Additional information on tow away crash data

The crash statistics reported in this annual review excluded tow away crashes (where no people were killed or injured in the crash). Previous reviews included tow away crashes, however in October 2014 the reporting process for tow away crashes changed, which resulted in significant reductions to the number of those crashes reported and the level of detail contained in the data. This means that tow away crashes reported prior to October 2014 were not comparable to data reported after this date, and therefore were not suitable for before-and-after comparison of speed cameras.

5.3.2 Additional information on injury severity

Crash data reported from 2005 onwards includes additional detail regarding injury severity, and are categorised as Serious Injury, Moderate Injury or Minor / Other Injury. Prior to 2005, crash data was not matched to hospital admissions or emergency department presentations so all non fatal injuries prior to 2005 were uncategorised with respect to the severity of injury.

Crash data for 2014 was incomplete with respect to linkage to hospital admission and emergency department presentation records and was considered preliminary. Updates to linkage of 2014 crash data to hospital admissions and emergency department presentations will occur in 2016, so the data presented in this report was preliminary and subject to change.

An important outcome to note from the data linkage matching process was the inclusion of motor vehicle traffic controllers who were not identified as “injured” in the NSW Police reports, but who were matched to a hospital record. This resulted in the identification of additional injuries.

Crash data results for injuries for the six quarters from July 2010 to the end of 2011 were over-estimated due to a coding practice change in the injury recording process. The coding practice change resulted in an over enumeration of around nine per cent for this period, mostly amongst vehicle occupants, and may influence the results of casualties and injuries for the review period across the speed camera programs. Where a camera appeared not to be performing, CRS reviewed the crash data to determine if the camera was affected by the coding practice change.

5.4 Speed camera crash data

Crash data was examined at individual speed camera locations for fixed, red-light speed and point-to-point cameras to ascertain performance at camera locations. For mobile speed cameras, the annual review examined crash data for the entire state rather than individual locations due to the mobility of mobile speed cameras and their purpose of creating a general deterrence effect across the road network.

Typically at least five years of crash and casualty data are required to make an assessment of a camera's performance.⁴ Since red-light speed cameras and point-to-point enforcement programs have been operational for less than five years (with the exception of one red-light speed camera location), the data provided in the annual review were not sufficient to reliably assess the performance of individual camera locations and only preliminary observations are made.

5.4.1 Red-light speed cameras

Preliminary analysis of the red-light speed camera program was conducted by intersection, rather than by camera. At the end of 2014, there were 164 red-light speed cameras in total, operating at 145 intersections around Sydney, Newcastle and Wollongong. 18 intersections had two or more cameras.

Crash data were examined at each intersection with a red-light speed camera for all crashes that occurred within 10 metres of the intersection.

- **Pre installation period:** crash data for the five years up to 91 days before the commencement date of the camera, because this was the period in which the camera was under construction. There are two locations where the camera was installed, but enforcement did not commence for some time, and a longer period than 91 days was used at these locations. This is indicated in the report.
- **Post installation period:** crash data from the commencement date of the camera to the end of 2014.

Note: Red-light speed cameras operate in warning mode for a period prior to issuing infringements.

In addition to total casualties at each location, pedestrian casualties were specifically examined given the greater exposure of pedestrians at signalised intersections and the higher likelihood of severe casualty outcomes for this group due to their lack of protection in a crash.

Data was also provided for adjacent, right through and rear-end crashes before and after camera installation as these are the crash types that typically occur at intersections. Adjacent and right-through crashes are often more severe as drivers and passengers are not as protected from side impact crashes, with low-speed side impact crashes potentially resulting in severe injuries. The frequency and severity of these crash types are expected to reduce at intersections enforced by red-light speed cameras.

Rear-end crashes were included in the preliminary analysis, as it has been reported that red-light cameras can lead to an increase in rear-end crashes due to drivers suddenly stopping on an amber light.⁵ Red-light speed cameras are intended to counteract the potential increase in rear-end crashes by also enforcing speed, as it is easier for drivers to brake in time to avoid a rear-end collision when they are driving at lower speeds.

Individual camera locations were not assessed because very few locations have been in operation for a long enough time period to appropriately measure their performance.

⁴ Austroads (2009). *Guide to Road Safety Part 8: Treatment of Crash Locations*. Publication No. AGRS08/09.

⁵Budd, L., Scully, J. & Newstead, S.. (2011). *Evaluation of the Crash Effects of Victoria's Fixed Digital Speed and Red-light Cameras*, Report No. 307, Monash University Accident Research Centre., Publicly available from: <http://www.monash.edu.au/miri/research/reports/muarc307.pdf>.

Additional technical notes for the analysis of red-light speed cameras

1. To identify crashes at each intersection, CRS initially examined crashes geo-coded as within 90 metres of the Traffic Control System (TCS) feature and that occurred at the intersection. Crashes were then assigned to the enforced intersection if they occurred within, or up to 10 metres from, the intersection.
2. These were viewed and attributed to the intersection under analysis taking into account the geo-coding as well as the values in the street name, the ID feature, and the intersection-type fields.
3. Where unclear, the correct location of the crash was confirmed or inferred from the original police report.
4. The commencement of the warning letter period was listed for each camera. For the analysis of intersections with two cameras, the post installation period began with the earlier commencement date.
5. Data for each crash type (adjacent, right- and rear-end) was reported based on Road User Movement (RUM) codes. RUM codes describe the first impact that occurred during the crash. Adjacent crashes are indicated by RUM code 10; Right-crashes are coded 21 and rear-end crashes are coded 30. More information on RUM codes can be found in the Definition and notes to support road crash data at <http://roadsafety.transport.nsw.gov.au/downloads/definitions-notes.pdf>
6. The improvement rates for crashes and casualties were based on the annual averages in crashes and casualties at each location before and after the cameras were installed. This allowed an approximate comparison to be made between the five year pre installation period and the available data for the post installation period until December 2014 (currently less than five years for nearly all red-light speed camera locations).
7. The estimated casualty cost saving for the program was calculated comparing the post installation to the pre installation data using the willingness to pay methodology which reflects the accumulated value the NSW community is willing to pay or forgo in exchange for a reduction in the probability of crash related injuries and road crash deaths on NSW roads. The casualty costs used were \$6,785,013 per fatality, \$244,770 per serious injury and \$51,534 per moderate or minor/other injury, based on the costs for urban fatal and injury reductions.
8. Data for the crash analysis were not ranked and were presented alphabetically by suburb of the camera location.

5.4.2 Fixed speed cameras

Analysis of the fixed speed camera program was conducted by fixed speed camera location, rather than by camera. While there are currently 107 fixed speed camera locations across NSW, 94 fixed speed camera locations were analysed in this report. Of the 107 locations, the following were excluded from this performance review:

- Seven locations operate in warning mode following the 2011 audit of speed camera programs. These cameras were not reviewed as part of the performance review, but each annual report includes information on crashes and infringements at these locations.
- Five locations are located in tunnels (and were sometimes referred to in the review as “high risk” locations). These were generally installed when the tunnel was constructed, therefore no pre-installation data are available.

- One location (Sandgate, Pacific Highway) which was identified for removal following the 2013 annual review, and is due to be switched off and removed once safety works have been completed at the location.

For each of the 94 locations included in the analysis, typically crash data within 500 metres either side of the fixed speed camera was examined. For cameras located within a school zone, crash data was examined from patch-to-patch (i.e. the length of road designated as a school zone, as identified by the start and end patches marked on the road). For locations with more than one camera in operation (where cameras are less than 100 metres apart), the crash analysis length was for 500 metres either side of the mid-point of the two cameras.

One fixed speed camera location - the M1 Princes Motorway (formerly the F6, Southern Freeway) Gwynneville - had two cameras operating approximately 1,000 metres apart and infringing in different directions. In this report, these two cameras were listed as separate locations in the directions they enforce. However, crash and infringement data for these locations are included in each annual report.

Fixed speed camera performance was measured through analysis of crash data from the “before” period (pre installation) and the “after” period (post installation). In most cases, the analysis provided crash data for the five year before period, ending three months directly before the commencement date (as this was the period in which warning letters are issued). The after period was the most recent five calendar year period (2010 - 2014) to assess the current performance of the speed camera.

Based on the before and after period crash analysis, and along with other relevant site specific information, for each fixed speed camera location, the report made a recommendation of either:

- Retain
- Recommended for review, or
- Reviewed in the past five years and not considered for review this year

Fixed speed camera locations were recommended for review when:

- The number of casualty crashes in the last five years had increased compared to the before period.
- The number of casualties in the last five years had increased compared to the before period.
- There was a low road safety risk at the location based on the crash history and there was a low level of speeding based on the infringement data at the location.
- Major road works such as curve re-alignment or highway duplication had significantly improved safety at the location.

Where a fixed speed camera location was identified for review based on the above criteria, a further desktop review of the location was conducted, to determine the appropriateness of the recommendation. This analysis considered the trend in casualty crashes, the circumstances of fatal crashes at the location, the specific types of crashes that occurred at the location and any other known site-specific details that assist in making a recommendation. Where there was additional information which supported the retention of the camera, this is indicated in the report and the camera is recommended to be retained.

Additional technical notes for the analysis of fixed speed cameras

1. The commencement date listed for each location refers to the date that the fixed speed camera commenced infringement at that location. For locations where more than one fixed speed camera is in operation, the date listed refers to the date that the *first camera* started infringing at that location unless specified otherwise.
2. For each location, the pre and post installation periods vary depending on the date the camera commenced infringement, and excluded the three month period directly before the commencement date. For each location, the pre installation period was defined as the five year period up to three months prior to the commencement date of camera infringements. The post installation period was defined as the most recent five year calendar period.
3. In instances when there was less than five years of pre installation data, the pre installation period was adjusted so that it represented an equivalent five year period.
4. The percentage reduction for crashes and casualties are based on the annual averages in crashes and casualties at each location before and after the cameras were installed. This allows an approximate comparison to be made between the five year pre installation period and the most recent five calendar year post installation period (2010 - 2014).
5. The estimated casualty cost for the pre installation and the most recent five calendar year post installation was calculated using the willingness to pay methodology which reflects the accumulated value the NSW community is willing to pay or forgo in exchange for a reduction in the probability of crash related injuries and road crash deaths on NSW roads. The casualty costs used were \$7,090,792 per fatality, \$291,817 per serious injury, \$59,871 per moderate or minor/other injury and \$138,713 per uncategorised injury, based on the costs for weighted average of urban and non-urban fatal and injury reductions.
6. For each fixed speed camera location a test of significance of the change in casualty crashes was conducted using the conditional method⁶ comparing the number of casualty crashes in the after period with the conditional distribution of the casualty crashes in the after period given the total casualty crashes in both the before and after period to determine if there was a significant increase or decrease.
7. Data for the crash analysis have not been ranked and are presented alphabetically on the location description of the camera location.

5.4.3 Point-to-point speed cameras

At the end of 2014, there were 24 point-to-point enforcement lengths: two lengths were installed in 2010; 13 lengths were installed in 2011; four lengths were installed in 2012; two lengths were installed in 2013; three lengths were installed in 2014. The remaining point-to-point length was installed in early 2015. There were eight lengths that enforced for the entire 2012 - 2014 review periods; however this was still a period of four years or less and was insufficient to assess the performance of individual enforcement lengths.

The report provided heavy vehicle crash data for the five year period prior to the length commencing enforcement and available data for the period after the length was activated in warning period.

⁶ Przyborowski, J., Wilenski, H., 1940. Homogeneity of results in testing samples from Poisson series. *Biometrika* 31, 313–323.

5.5 Speed survey data

Vehicle speeds were assessed state-wide through the CRS annual speed survey program. In 2014 annual speed surveys were conducted at 175 locations across NSW.

Each year, CRS conducts speed surveys across NSW on a range of roads with a range of speed limits to gather current information about speeding behaviour of both light vehicles and heavy vehicles. The surveys measure free travel speeds, with a headway of four seconds. That is, only the speeds of vehicles that are unimpeded by other traffic are measured. Therefore the survey provides a measure of the speed that drivers choose to travel rather than a measure of traffic congestion.

Speed surveys are not undertaken at specific speed camera enforcement locations, therefore at camera locations infringement data is used as a proxy for speed data in this review. Speed surveys are undertaken at a sample of speed camera enforcement locations so that speeding behaviour can be assessed for these programs.

5.6 Infringement data

Recent infringement data were used as a proxy measure of speeding behaviour at camera locations. Infringement data analysed in this report included penalty notices detected by Roads and Maritime Services speed cameras from July 2002 onwards (no earlier infringement data was available).

All fines from speed cameras are directed to the Community Road Safety Fund to pay for road safety programs across the state. Infringement data for red-light speed cameras, fixed speed cameras and mobile speed cameras are publicly available through the NSW Office of State Revenue (<http://www.osr.nsw.gov.au/info/statistics>).

6 What happens after cameras are reviewed?

6.1 Monitoring the speed cameras that are delivering safety benefits

Fixed speed cameras remain in place when they are found to be delivering road safety benefits. All such cameras continue to be reviewed each year as part of the annual speed camera performance review.

6.2 Identifying cameras that require a safety review

Safety reviews involve a comprehensive examination of crash history, traffic volumes, road conditions, land use and high risk user behaviour near the fixed speed camera location. Safety reviews also involve the consideration of road safety issues raised by the community in regard to the locations.

If the review determines that the camera is not delivering the expected safety benefits at the location, it will be recommended for removal and possible relocation, and alternative road safety treatments will be considered to address any identified road safety issues. Alternative treatments may involve improved signage, road works, traffic facilities, speed zoning reviews and targeted communications.

6.3 Decommissioning the speed cameras that are not improving safety

In July 2011, the NSW Auditor-General released an audit report on the statewide speed camera program. The report identified 38 speed cameras that were not delivering the expected road safety benefit. Consequently, the Minister for Roads, Maritime and Freight directed that these 38 cameras be deactivated; however, cameras at seven of these locations remain in warning mode following safety concerns expressed by the community.

Since the Auditor-General's report, annual speed camera performance reviews report on the road safety performance of speed cameras across the state. Where speed cameras are required to be deactivated and removed because they are not delivering expected road safety benefits, Transport for NSW consults with key stakeholders to develop alternative road safety treatments to address existing road safety risks at each location. These key stakeholders include local communities, councils, nearby schools (if the camera is located in a school zone), NRMA Motoring and Services, the NSW Police Force.

As at 31 December 2014 speed cameras had been removed from 25 locations. At the remaining locations that have been identified for decommissioning, a program of alternative safety works has commenced. At each site, when the alternative safety works have been completed, the speed cameras and signage will be removed. The exception is the speed camera location at Pacific Highway, Sandgate; these cameras remain in operation and will be switched off and removed once safety works are completed.

6.4 Results of last year's review

The 2014 Annual NSW Speed Camera Performance Review identified two fixed speed camera locations for comprehensive review: Richmond Road, Berkshire Park; and Great Western Highway, Hartley.

- **Richmond Road, Berkshire Park:** The review of Richmond Road, Berkshire Park was conducted in November 2014, and recommended that the speed camera be retained as it continues to provide road safety benefits.

- **Great Western Highway, Hartley:** The speed camera on the Great Western Highway, Hartley has not yet been reviewed due to planned road works at this location. Because the change in the road environment is likely to affect the performance of the camera, it will be reviewed following the completion of the road works in 2016.

7 Results and discussion

This review has found that across the four programs, speed cameras are continuing to improve road safety in NSW. Early results from the red-light speed, mobile speed and point-to-point camera programs show that drivers are changing their behaviour, which overall is resulting in a reduction in crashes and casualties at camera locations and across the road network. However, with less than five years of operation, it is still too early to assess the longer term safety benefit of these new programs. CRS will continue to monitor the performance of these programs annually.

7.1 Mobile speed cameras

The analysis of the mobile speed camera program is available at **Appendix A**.

In August 2011, a review of the NSW mobile speed camera program found that in the first year of operation (19 July 2010 to 18 July 2011) the program contributed to a 19 per cent statistically significant reduction in fatalities throughout NSW. This represents a saving of 89 lives and an estimated community saving of around \$575 million.

The immediate impact of the reintroduced mobile speed cameras is evident. The significant reduction in fatalities (and speed-related fatalities) in 2010, the first year of the program, can be attributed to the effect of enforcement as well as the deterrence effect, which produced broader speed limit compliance due to the less predictable enforcement of mobile speed cameras.

The ongoing impact of the mobile speed camera program is reflected in the 2014 road toll. The 2014 road toll of 307 fatalities on NSW roads is the lowest annual figure since 1923 (with 231 fatalities). This is also 32 per cent lower than in 2009 (with 453 fatalities), before the reintroduction of the mobile speed camera in 2010. Speed-related fatalities over 2009 to 2014 have also gradually decreased over this period, with the number of speed-related fatalities of 127 in 2014 being the lowest number ever recorded and representing a 39 per cent reduction compared to 2009 levels.

Results from the 2014 speed surveys show speeding continues to remain below the level observed in 2009, prior to the reintroduction of the mobile speed camera program in 2010.

The percentage of light vehicles exceeding the speed limit by more than 10km/h in 2014 has reduced in all speed zones compared to 2013, which builds on impressive results from previous years. The results show that in 2014 fewer light vehicles were exceeding the speed limit by more than 10km/h compared to all years from 2009 to 2013. As a percentage, this figure has remained lower than 2009 to 2011 figures.

The percentage of heavy vehicles exceeding the speed limit by up to 10km/h has increased in some speed zones compared to the previous year. While some of the reductions in heavy vehicle speeding by up to 10km/h have been lost, the 2014 results still compare favourably compared to previous years. Significant gains in reducing heavy vehicles exceeding the speed limit by more than 10 km/h have been maintained in 2014, achieving the lowest percentages over the entire five year period in 40km/h, 50km/h, 60km/h and 90km/h zones and maintaining a low level of speeding at this level in 100km/h zones.

Overall, the trend in road fatalities and annual speed surveys demonstrates that the mobile speed camera program continues to deliver positive road safety benefits, compared with results prior to the reintroduction of the mobile speed camera program. The general decrease in speeding observed in the annual speed surveys,

over the past five years, provides evidence that mobile speed cameras provide a general deterrence to drivers.

In 2014 the mobile speed camera program increased from around 930 hours of enforcement to the full program size of 7,000 hours of enforcement per month. With this larger program, there is a greater coverage of the road network at various times and locations and, like police enforcement, this mobility increases the deterrence effect due to the unpredictability of the exact location of speed enforcement.

In 2014 there were a total of 55,467 infringements resulting in \$10.54 million in fines from mobile speed camera enforcement. The cost of conducting the mobile speed camera program in 2014 was \$17.4 million.

From June 2012, there was a decrease in infringements that can be attributed to the enhanced visibility of mobile speed camera vehicles as well as additional signage being placed before a mobile speed camera to ensure drivers see and recognise the enforcement activity. At the same time, mobile speed cameras also switched from enforcing in both directions to single direction enforcement, further contributing to the lower volume of infringements. In 2014, the number of infringements issued increased in line with the increased level of enforcement by month, although there appears to be a downward trend towards the latter half of 2014. This trend indicates that driver behaviour has changed with to the higher level of mobile speed camera enforcement.

Since the program was reintroduced in 2010, the compliance rate of vehicles passing a mobile speed camera that are not infringed for speeding remains high. In 2014, 99.79 per cent of vehicles passing mobile cameras were not infringed for speeding.

CRS has developed and implemented a speed camera public education campaign that has supported the rollout of the mobile speed camera program. CRS evidence shows that enforcement and strong public education campaigns change driver behaviour and help prevent speed-related crashes and trauma through awareness of enforcement.

CRS has identified 26 of the 640 approved mobile speed camera locations that were previously used by the Police but are no longer operationally useful because no suitable enforcement sites have been identified. Therefore these enforcement locations are not providing a road safety benefit because there is no enforcement at these locations. These locations are listed in the table below and will be decommissioned.

Table 4: Mobile speed camera locations to be decommissioned

Suburb/Town	Road
Annandale, Camperdown, Leichhardt, Petersham, Stanmore	Parramatta Road
Ashfield, Haberfield, Summer Hill	Parramatta Road
Auburn, Clyde, Granville, Harris Park	M4 Motorway
Beaumont Hills, Kellyville, Kellyville Ridge, Stanhope Gardens	Windsor Road
Belford, Branxton, East Branxton, Lower Belford	New England Highway
Beresfield	John Renshaw Drive
Burwood, Concord, Croydon, Five Dock	Parramatta Road
Burwood, Concord, Homebush, North Strathfield, Strathfield	Parramatta Road
Camperdown, Chippendale, Forest Lodge, Glebe, Ultimo	Parramatta Road
Capertree, Round Swamp	Castlereagh Highway
Cartwright, Hinchinbrook, Hoxton Park, Miller, Prestons	Hoxton Park Road
Cassilis, Uarbry	Golden Highway
Centennial Park, Woollahra	Oxford Street
Coffs Harbour, Korora, Moonee Beach, Sapphire Beach	Pacific Highway
Corowa	Redlands Road

Suburb/Town	Road
Cremorne, Mosman, Neutral Bay	Military Road
Dean Park, Doonside, Glendenning, Oakhurst, Quakers Hill	Richmond Road
Dumaresq Island, Glenthorne, Pampoolah	Pacific Highway
East Gosford, Point Frederick	York Street
East Maitland, Maitland, South Maitland	New England Highway
Finley, Tocumwal	Newell Highway
Gateshead	Pacific Highway
Hartley, South Bowenfels	Great Western Hwy
Kingsvale, Wombat, Young	Back Creek Road
Marchmont, Murrumbateman	Barton Highway
Monak	Sturt Highway

7.2 Red-light speed cameras

The analysis of red-light speed camera locations is available at **Appendix B**.

Overall, there has been a 34 per cent reduction in casualty crashes and a 39 per cent reduction in total casualties at the 145 red-light speed camera locations since the cameras were installed compared with the five year period prior to installation. Of the total casualties, there has been a 55 per cent reduction in fatalities, 32 per cent reduction in serious injuries, 45 per cent reduction in moderate injuries and a 36 per cent reduction in minor/other injuries. This reduction in casualties represents a saving of \$94.8 million to the community.

There was a 44 per cent reduction in pedestrian casualties at red-light speed camera locations. There has also been a reduction in the three main intersection crash types with a 49 per cent reduction in adjacent crashes; a 36 per cent reduction in right-through crashes; and a 22 per cent reduction in rear-end crashes. The reduction in rear-end crashes is a positive result for the combination of red-light and speed enforcement because previous research has found that while red-light cameras reduce more severe right-angle crashes, rear-end crashes can sometimes increase. The addition of speed enforcement to red-light cameras is a countermeasure that assists in addressing the small increase in rear-end crashes at red-light speed camera locations. As can be seen from the results, it also reduces pedestrian casualties due to a decrease in vehicle speeds.

In 2014 there were a total of 281,546 infringements resulting in total fines of \$91.91 million at red-light speed camera intersections. In NSW, the penalty for running a red-light is higher than most speeding penalties because the consequences of this behaviour pose a greater risk. Red-light running can lead to severe T-bone and pedestrian crashes where the front of a car impacts with a pedestrian or the less protected side of a car. Generally, around 60 per cent of offences and 80 per cent of fines at red light speed camera locations are attributed to running a red light. Of the total red-light speed camera infringements for 2014: 164,636 (58 per cent) infringements and \$71.41 million in fines were for red-light offences; and 116,910 (42 per cent) infringements and \$20.50 million in fines were for speeding offences.

One red-light speed camera has been operating for more than five years as at 31 December 2014, Cumberland Highway, Cabramatta at St Johns Road. Since the camera was installed there has been a 16 per cent reduction in casualty crashes and a 37 per cent reduction in casualties at this location.

In next year's annual review a further 57 red-light speed camera locations will have a full five years of crash data following installation, at this time a decision will be made whether to retain the cameras or conduct comprehensive reviews of their performance.

As part of the *NSW Speed Camera Strategy*, the number of intersections with red-light speed cameras will expand to 200. As the red-light speed camera program continues to roll out, an increase in the volume of infringements is anticipated. However, following the program increase the number of infringements is expected to stabilise and return to a downward trend as driver behaviour changes.

At this stage, red-light speed cameras have not been in operation for long enough for there to be a meaningful trend in infringements. However, it is expected that red-light running and speeding at red-light speed camera intersections will decrease over time, thereby reducing the number of infringements and fines at these locations. While red-light running decreased slowly over time, speeding decreased more rapidly. This demonstrates an improvement in driver behaviour as a result of red-light speed cameras.

Early results for the NSW program also indicate that the expected road safety benefits are being achieved when compared with the evaluation of a similar program in Victoria⁷. While these early results are encouraging, it is too early to conclusively determine the safety benefit of individual locations and therefore no recommendations for review are proposed in this report. Typically at least five years of crash and casualty data are required to make an assessment of a camera's performance.

The 2013 review identified the below four locations where there has been a fatality since camera operation:

- Griffiths Road and Turton Road, Lambton
- O'Riordan Street and Gardeners Road, Mascot
- Anzac Parade and Lang Road, Moore Park
- Corrimal Street and Burelli Street, Wollongong

These fatalities occurred in 2012. No fatalities were identified in 2013 or in the current review period (2014 calendar year). While the cameras at these locations will not be considered for removal, the Centre for Road Safety conducted an initial investigation into the nature of these fatal crashes, with site investigations conducted at Griffiths and Turton Road, Lambton, and Corrimal Street and Burelli Street, Wollongong.

The investigation at O'Riordan Street and Gardeners Road, Mascot identified no safety deficiencies, and revealed the intersection will be upgraded in the near future as part of re-development work associated with Green Square. No safety deficiencies were also identified at the intersection at Anzac Parade and Lang Road, Moore Park.

Following the site investigation at Griffiths Road and Turton Road, Lambton, the traffic light display for eastbound motorists was upgraded. A mast arm has been installed which slightly overhangs the kerbside lane to improve the visibility of traffic lights to oncoming vehicles. A speed review was conducted at this location in 2014.

Following the site investigation at Corrimal Street and Burelli Street, Wollongong, additional pedestrian protection was provided by installing red arrows to control vehicles waiting to turn into adjacent streets. An upgrade to the line marking on Corrimal Street was also completed.

The review identified the 10 red-light speed camera locations with the highest number of infringements detected in 2014. The list is shown at the end of **Appendix B**. Most of the 10 speed camera locations are on main roads with high traffic volumes. As the red-light speed camera program has not been in operation for five years, it is too early

⁷Budd, L., Scully, J. & Newstead, S.. (2011). *Evaluation of the Crash Effects of Victoria's Fixed Digital Speed and Red-light Cameras*, Report No. 307, Monash University Accident Research Centre., Publicly available from: <http://www.monash.edu.au/miri/research/reports/muarc307.pdf>.

to assess the performance of these cameras. However, all had high compliance rates with more than 99 per cent of drivers passing the cameras without being infringed for red-light running and/or speeding.

7.3 Fixed speed cameras

The analysis of fixed speed camera locations is available at **Appendix C**.

Overall, when comparing the five years before the fixed speed cameras were installed to the current five year analysis period, there has been a 38 per cent reduction in the number of casualty crashes, a 91 per cent reduction in fatalities and a 42 per cent reduction in injuries at camera locations. In the five years before the cameras were installed there were 1,648 casualty crashes, resulting in 55 fatalities and 2,235 injuries. In the current five year analysis period there were 1,040 casualty crashes resulting in 5 fatalities and 1,315 injuries. This reduction in casualties represents a savings of \$526.1 million to the community. In 2014 a total of 296,059 infringements were issued resulting in total fines of \$60.87 million at fixed speed camera locations.

The majority of fixed speed cameras were found to be providing road safety benefits. The top 10 performing speed cameras based on a statistical analysis of the change in casualty crashes are listed in the table below.

Table 5: Top performing fixed speed cameras

Location	% Change in casualty crashes	% Change in casualties
Canterbury Road, Canterbury	↓62%	↓62%
Parramatta Road, Auburn	↓67%	↓75%
Terrigal Drive, Terrigal	↓84%	↓88%
Pacific Highway, Ewingsdale	↓93%	↓96%
Hume Highway, Lansvale	↓51%	↓52%
King Georges Road, Beverly Hills	↓38%	↓39%
Bexley Road, Bexley North	↓57%	↓66%
Pennant Hills Road, Carlingford	↓45%	↓49%
M1 Princes Motorway, Gwynneville (northbound)	↓73%	↓84%
James Ruse Drive, Camellia	↓44%	↓53%

Based on the analysis of 94 fixed speed camera locations, 8 locations were identified for a preliminary desktop review based on meeting at least one of the crash analysis criteria outlined in the review methodology section. These locations were:

- Bomaderry, Bolong Road
- Bonnyrigg, Elizabeth Drive
- Bonville, Pine Creek Way
- Burringbar, Tweed Valley Way
- Brogo, Princes Highway
- North Narrabeen, Pittwater Road
- Queanbeyan, Lanyon Drive

- Rydalmere, Victoria Road

Preliminary reviews of these locations were undertaken to gain an understanding of exactly what had occurred at each location.

The camera at one location, Bonnyrigg, Elizabeth Drive, was retained following the preliminary review.

The camera at Bonville was identified as no longer providing road safety benefits following the preliminary review, and is recommended to be removed. This fixed speed camera is located on Pine Creek Way, a former section of the Pacific Highway that has been bypassed, has a recent crash history that shows few casualties, a low level of speeding infringements and has had community representations requesting its removal. Due to the low number of recent crashes, and that there is a low level of road safety risk at this location due to the Pacific Highway duplication works, it was determined that a comprehensive review was not required and the camera should be switched off immediately and removed and relocated to another high priority location.

The remaining six locations were identified for comprehensive safety reviews to be undertaken by CRS. These locations are:

- Bomaderry, Bolong Road
- Brogo, Princes Highway
- Burringbar, Tweed Valley Way
- North Narrabeen, Pittwater Road
- Queanbeyan, Lanyon Drive
- Rydalmere, Victoria Road

Additionally, one fixed speed camera location – Hartley, Great Western Highway – was identified for review in last years' annual review. This comprehensive review will be conducted following the road works that are being conducted at this location.

In total, 86 fixed speed camera locations found to offer continued safety benefits and will be retained. Three of these locations were removed in 2014 or 2015 due to major safety works. These locations will be assessed for whether there is still a need for ongoing speed enforcement following the road works at these locations. These locations are:

- Berry, Princes Highway
- Foxground, Princes Highway
- Terrigal, Terrigal Drive

The review also identified the 10 fixed speed camera locations with the highest number of infringements detected in 2014, excluding cameras located in high-risk locations, such as tunnels. The list is shown at the end of **Appendix C**.

Most of the 10 speed camera locations are on main roads with high traffic volumes. All of these locations were identified to be retained in the annual review, delivering crash and casualty reductions. All had high compliance rates with more than 99 per cent of drivers passing the cameras without being infringed for speeding.

The seven locations with fixed speed cameras in warning mode are not included in the fixed speed camera analysis. However a report on crash and infringement results since the camera locations began operating under the '3 strikes' warning letter program is available at **Appendix D**.

7.3.1 Point-to-point speed cameras

The analysis of the point-to-point speed camera program is available at **Appendix E**.

There were 24 lengths of the point-to-point enforcement program rolled out by the end of 2014. However, it is too early to assess the performance of individual point-to-point enforcement lengths as two lengths were installed in 2010, 13 in 2011, five in 2012, two in 2013 and three installed in 2014. Only one point-to-point length, Great Western Highway between Meadow Flat and Raglan, has enforced for a full four year period (2011 - 2013).

A total of 1,581 speeding infringements were issued resulting in total fines of \$0.69 million at point-to-point lengths in 2014. Infringement data for average speed offences in point-to-point enforcement lengths shows a high level of compliance within the enforcement lengths and a low number of infringements. This is consistent with results in other point-to-point programs. Numerous studies have shown that point-to-point enforcement is typically associated with very high rates of compliance with posted speed limits even when traffic volume is high⁸. For example, rates of infringement associated with point-to-point enforcement (light and heavy vehicles) on the Hume Highway, Victoria have been reported at 1-2 per cent.⁹

7.3.2 Future of NSW speed camera programs

The NSW CRS will continue to annually review all individual speed cameras as well as the overall performance of speed camera programs as set out in the *NSW Speed Camera Strategy*. These reviews will be annually published to ensure that the programs remain transparent to the community.

The fixed speed camera program continues to provide positive road safety benefits to the locations where they are installed, and will be annually assessed to ensure they continue delivering a positive road safety benefit. The NSW CRS will review locations that do not show crash and/or casualty reductions, and will remove cameras at locations that are found to not deliver clear road safety benefits.

While it is too early to assess the safety benefit of the red-light speed, mobile speed and point-to-point speed camera programs, the early results from these programs are encouraging, with evidence of changes in driver behaviour. This is also reflected in an improvement in the road toll for 2014.

⁸ Soole, D. W., Fleiter, J. and Watson, B. (2011) *Point-to-point speed enforcement: A technological overview, review of the empirical evidence and recommendations for better practice*, Draft final report for Austroads Steering Committee, Austroads, Sydney, Australia.

⁹ Soole, D. W., Fleiter, J. and Watson, B. (2012). *Point-to-point speed enforcement*. Austroads Research Report, AP-R415-12.