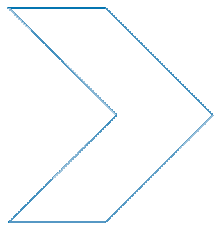


# ➤ Centre for Automotive Safety Research



## Vehicle speeds in South Australia 2007

CN Kloeden, JE Woolley

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## ABSTRACT

A program designed to monitor the speed behaviour of motorists commenced at 132 sites in South Australia in 2007. The sites selected included sites with historical measurements supplemented by new sites to give a broad range of road types. Speed data was collected for one week at each of the sites and summary volume and speed statistics and speed distributions are given for each of the road types surveyed. Limited historical surveys on a set of roads in built up areas indicated that travelling speeds on those roads fell in 2003 (after the introduction of the default 50 km/h speed limit in March 2003) compared to 2002 and fell again in 2005. However, travelling speeds on those roads increased in 2007 compared to 2005 by a statistically significant amount at least on Adelaide local roads affected by the 50 km/h limit. Analysis of previously collected data for a limited subset of rural roads indicated no statistically significant change in vehicle speeds on those roads between 2006 to 2007 although there was a general upward trend in speeds on most road types. Various sampling issues encountered in the collection and analysis of the 2007 data are discussed.

## KEYWORDS

Vehicle speed, Speed limit, Driver behaviour, Urban road, Rural road, Statistics.

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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.

## Summary

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A systematic and ongoing method of measuring vehicle speeds has been introduced in South Australia to assess the effects of speed reduction countermeasures and to monitor the speed behaviour of South Australian motorists over time.

This report documents the initial collection of speed data at 132 sites in South Australia in 2007. The sites selected included sites with historical measurements supplemented by new sites to give a broad range of road types.

Speed data was collected for one week at each of the sites and summary volume and speed statistics and speed distributions are given for each of the road types surveyed.

Limited historical surveys on a set of roads in built up areas indicated that travelling speeds on those roads fell in 2003 (after the introduction of the default 50 km/h speed limit in March 2003) compared to 2002 and fell again in 2005. However, travelling speeds on those roads increased in 2007 compared to 2005 by a statistically significant amount at least on Adelaide local roads affected by the 50 km/h limit.

Analysis of previously collected data for a limited subset of rural roads indicated no statistically significant change in vehicle speeds on those roads between 2006 to 2007 although there was a general upward trend in speeds on most road types.

Various sampling issues encountered in the collection and analysis of the 2007 data are discussed with the aim of ensuring future valid and meaningful speed surveys.

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# 1 Introduction

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Speed is an important determinant of crash incidence and outcome and numerous initiatives are being implemented in South Australia with the aim of reducing the speeds of vehicles.

A systematic and ongoing method of measuring vehicle speeds in South Australia has been introduced to assess the effects of speed reduction countermeasures and to monitor the speed behaviour of motorists over time.

The Department for Transport, Energy and Infrastructure contracted CASR to identify a selection of sites in South Australia at which speed measurements will be taken at on a yearly basis. The sites selected included sites with historical measurements supplemented by new sites to give a broad range of road types. The process of selection can be found in the following reports (Woolley, 2008; Woolley and Kloeden, 2008).

This Report summarises the data collected at the selected sites in 2007 which forms the baseline for future surveys. Some comparisons are also made with previous years for sites with previously collected survey data.

## 2 Methodology

### 2.1 Site selection

The full process of site selection can be found in Woolley (2008) and Woolley and Kloeden (2008). Note that some of the sites mentioned in those reports were dropped from the current study due to placement near a change in speed limit or misidentification of a speed limit zone.

Table 2.1 lists the origin of the 132 sites that formed the final set of survey sites. The individual site locations are listed in Appendix A.

**Table 2.1**  
Speed survey sites by road type and survey source

Road type (speed limit)	Auslink site	Harwood site*	Default 50 site	New measured site	Total
Adelaide local (50)			18		18
Adelaide collector (50)			11		11
Adelaide arterial two way no median (60)			3	3	6
Adelaide arterial two way with median (60)			1	5	6
Adelaide arterial multi-lane no median (60)			2	4	6
Adelaide arterial multi-lane with median (60)			4	5	9
Adelaide arterial (80)				6	6
Rural local (50)		2	12		14
Rural arterial (60)		4			4
Rural hills arterial (80)				4	4
Rural arterial (100)	4	6			10
Rural arterial (110)	31	4			35
Outback arterial (110)	1	2			3
<b>Total</b>	<b>36</b>	<b>18</b>	<b>51</b>	<b>27</b>	<b>132</b>

\* named after Colin Harwood who initiated data collection at these sites

The Auslink sites are DTEI controlled permanent measurement sites that record the speed of all passing vehicles throughout the year with data downloads being performed manually at about 4 weekly intervals. The data for August 2007 was requested for each of the sites and a week of data at each site was selected for analysis. The last week of August was selected except where equipment malfunctions required an earlier week in August to be used. August was chosen as the month that best represents average traffic flows on these roads.

The Harwood sites represent a selection of sites that DTEI has for some years been conducting speed measurements at for a one week period in August. Note that three of the listed Auslink sites are also Harwood sites and the Auslink data for 2007 was used for analysis. The 2006 speed data for all 21 Harwood sites was also obtained for comparison purposes.

The default 50 sites were those used in the evaluation of the introduction of the default 50 km/h speed limit. One of the original 52 sites was dropped as it was found to be a collector road with a 60 km/h speed limit. These sites were surveyed by a contractor for one day each in 2002, 2003 and 2005 in November or December and this data is used for comparison purposes. These sites were surveyed by a contractor again in 2007 for a full week mostly in November or December. Some sites had to be remeasured in early 2008 due to equipment malfunction.

The new measured sites were additional sites surveyed by the same contractor collecting the default 50 data during the same time period in November and December 2007. They were selected to bolster the number of sites in the different road types, mainly

concentrating on metropolitan arterial roads. The rural hills arterial sites consisted of six sites with 80 km/h speed limits where infrequent DTEI speed measurements were made in the past. However, two of these were dropped: one was actually a 100 km/h speed zone; and one was very close to a 100 km/h speed limit zone.

## 2.2 Data collected

The data was collected in most cases using a standard traffic counter box and tubes that were set up by either a contactor or DTEI personnel. At some sites, in-ground detectors were used for measurements. The following information was recorded for each vehicle that passed during the survey period:

- date
- time (to nearest second)
- direction of travel
- speed (to nearest 0.1 km/h)
- wheelbase (to nearest 0.1 m)
- headway (to nearest 0.1 second)
- gap (to nearest 0.1 second)
- number of axles
- class of vehicle (based on number of axles and wheel bases)

The aim was to capture data at each site for a continuous one week period either in August 2007 or November 2007 depending on the site.

Due to equipment malfunctions, some of the time periods had to be extended but a full week of data was collected at each of the 132 sites.

Due to limitations of the equipment, multilane arterial roads with medians had their median lanes measured and multilane arterial roads without medians had their kerbside lanes measured.

## 3 Traffic volumes and speeds in 2007

This Section presents summary traffic volume and speed statistics for each road type for a full week of data collection at each of the sites listed in Appendix A.

### 3.1 All vehicles

The traffic volume and summary speed statistics for all vehicles passing the measured sites over a one week period are presented in Table 3.1 grouped by road type.

Table 3.1  
Traffic volumes and speed statistics for each road type in 2007

Road type (speed limit)	Number of sites	Vehicle count	Mean speed	Median speed	85th percentile speed	%exceeding speed limit	%exceeding speed limit by more than 10 km/h
Adelaide local (50)	18	118909	45.06	46.3	55.7	34.49	6.58
Adelaide collector (50)	11	249345	49.77	50.1	57.4	50.32	8.94
Adelaide arterial two way no median (60)	6	707978	56.00	57.1	62.4	28.77	1.42
Adelaide arterial two way with median (60)	6	713186	54.81	55.9	60.9	19.75	0.81
Adelaide arterial multi-lane no median (60)	6	523467	54.85	56.2	61.6	23.03	1.19
Adelaide arterial multi-lane with median (60)	9	822287	59.34	60.0	64.9	49.90	3.09
Adelaide arterial (80)	6	657753	74.77	75.7	82.6	26.66	2.02
Rural local (50)	14	110898	51.87	53.6	61.6	65.35	20.75
Rural arterial (60)	4	72254	57.60	58.2	64.6	37.79	4.77
Rural hills arterial (80)	4	92616	76.61	76.2	85.4	32.21	7.58
Rural arterial (100)	10	119126	92.11	92.7	103.8	25.66	5.64
Rural arterial (110)	35	390931	102.12	103.3	113.5	25.82	3.88
Outback arterial (110)	3	7174	105.97	107.2	120.3	42.50	15.49



Figures 3.1 - 3.8 present the speed distributions of the various road types.

Figure 3.1  
Speed distributions for 50 km/h Adelaide local roads and Adelaide collector roads in 2007

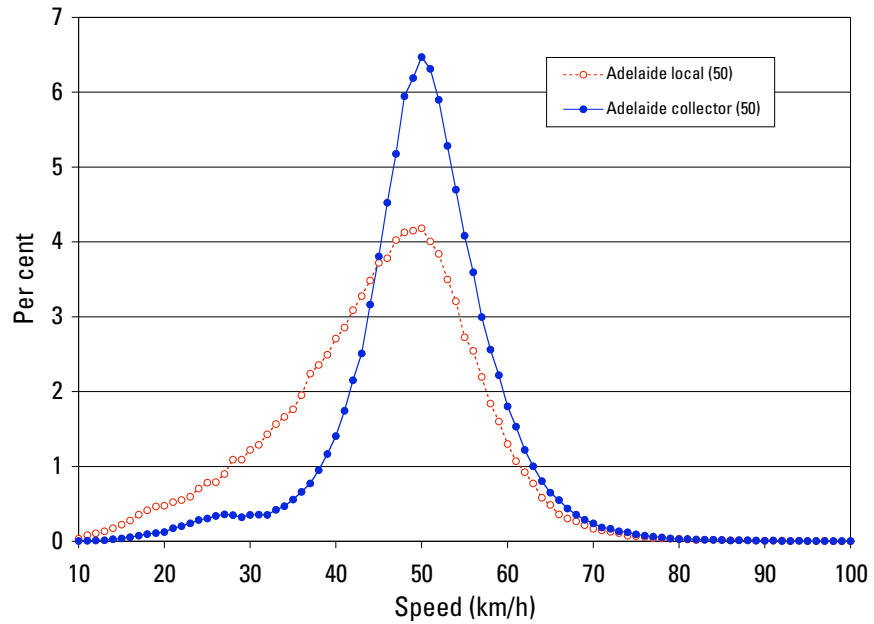


Figure 3.2  
Speed distributions for 50 km/h Adelaide local roads and rural local roads in 2007

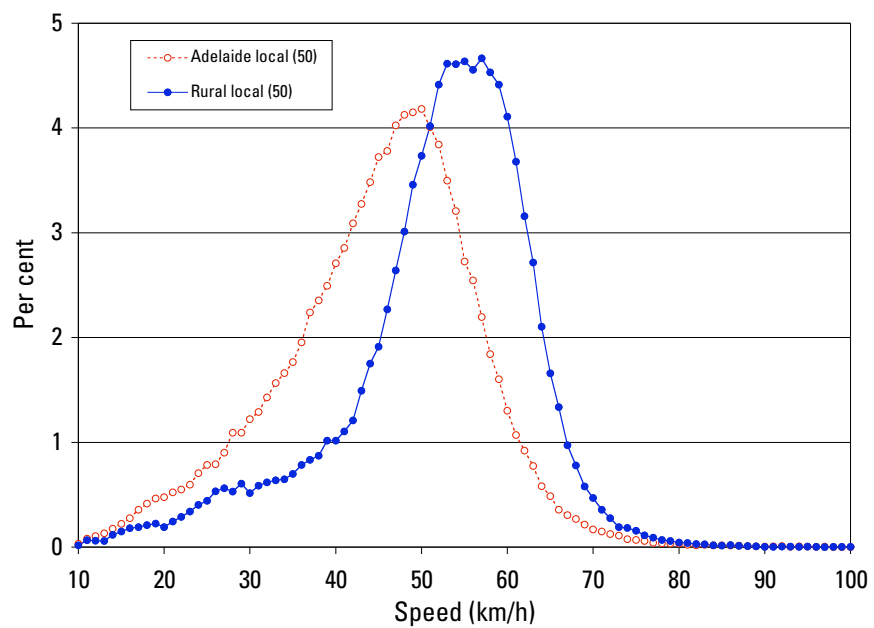


Figure 3.3  
Speed distributions for 60 km/h Adelaide arterial two way roads by presence of a median in 2007

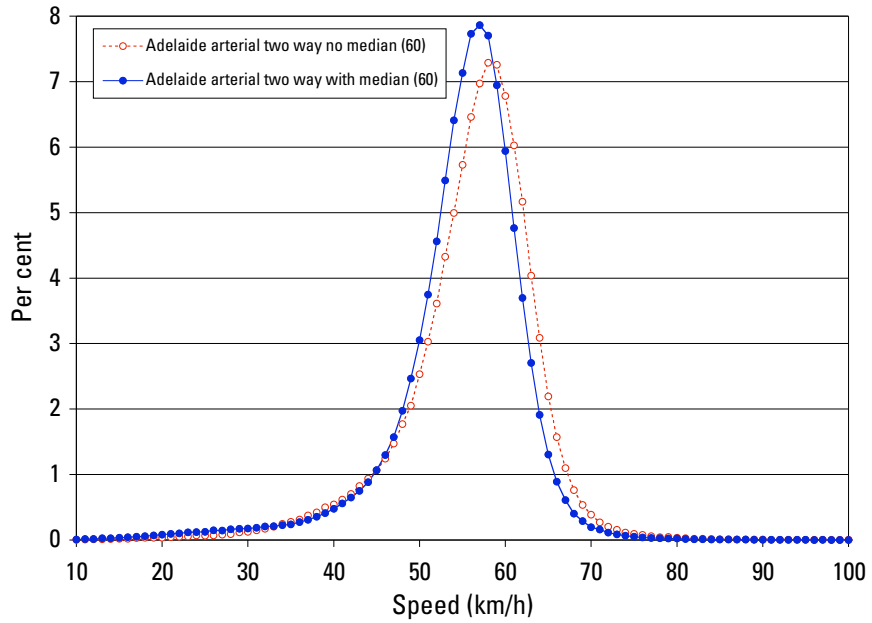


Figure 3.4  
Speed distributions for 60 km/h Adelaide arterial two way roads by presence of a median in 2007

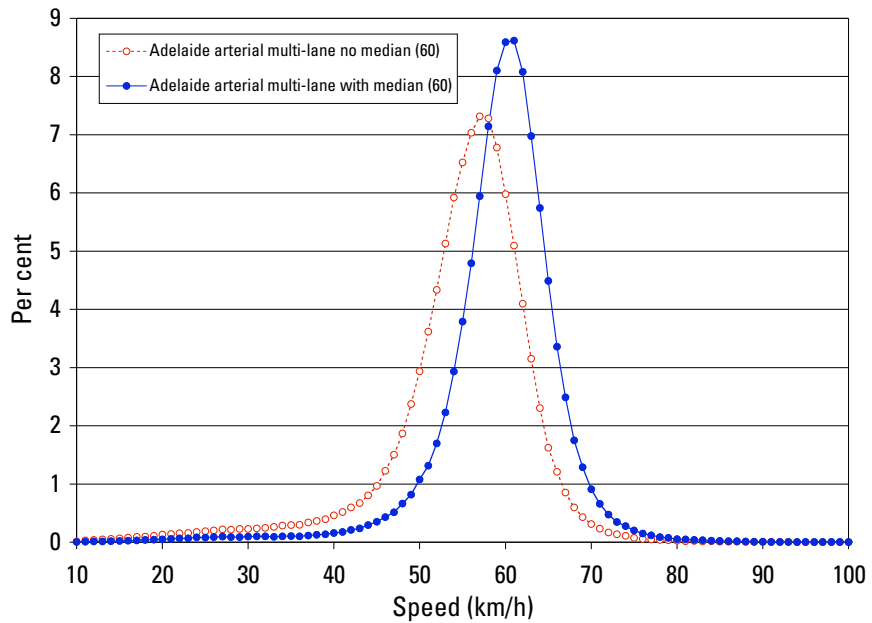


Figure 3.5  
Speed distributions for 80 km/h Adelaide arterial roads and rural hills arterial roads in 2007

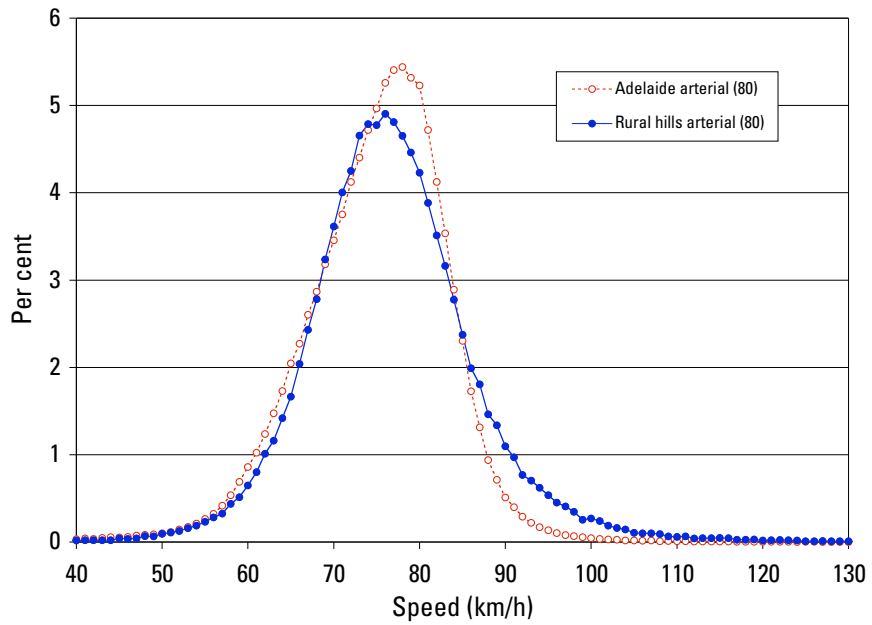


Figure 3.6  
Speed distributions for 50 km/h rural local roads and 60 km/h rural arterial roads in 2007

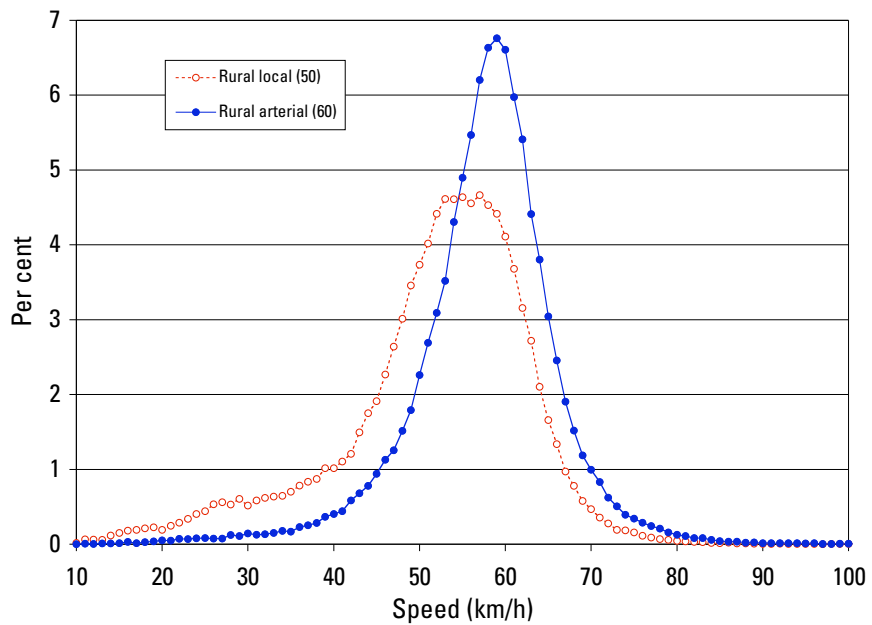


Figure 3.7  
Speed distributions for 100 km/h rural arterial roads and 110 km/h rural arterial roads in 2007

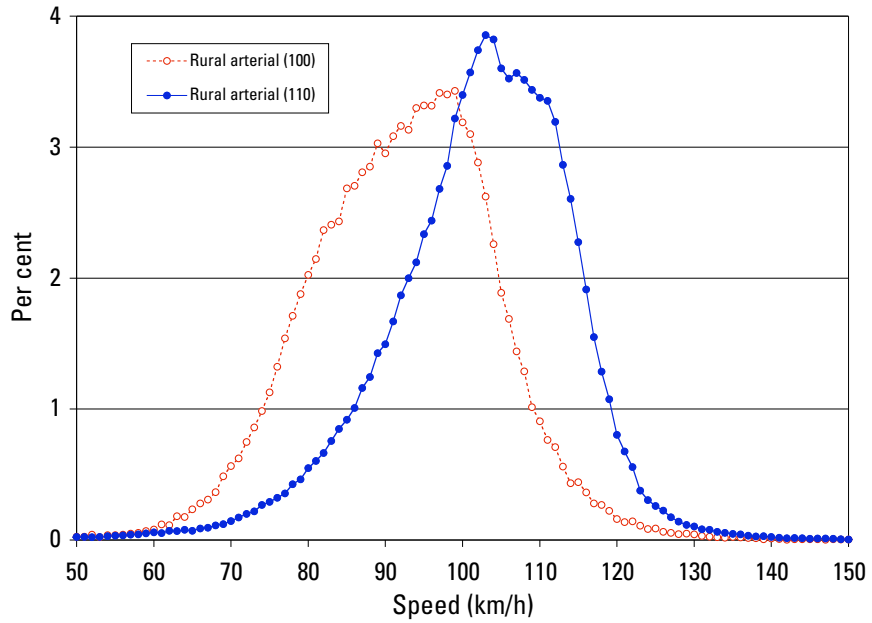
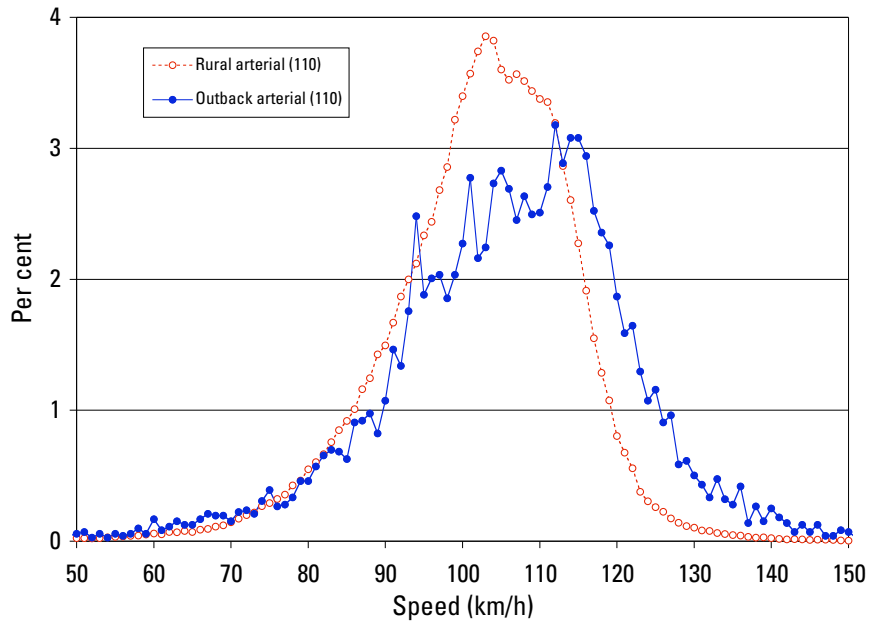


Figure 3.8  
Speed distributions for 110 km/h rural arterial roads and outback arterial roads in 2007



## 3.2 Free speed vehicles

Free speed vehicles were defined as those that had at least a four second headway gap to the vehicle in front of them (ie the time between the front wheels of the two vehicles passing the measurement site was at least four seconds). The drivers of free speed vehicles presumably all make a choice of what speed to travel at unlike the drivers of vehicles in a platoon that are limited to the speed of the front vehicle. By examining just free speed vehicles, freely chosen speeds can be analysed.

Table 3.2 shows the percentage of vehicles on each road type that were travelling at a free speed as defined above. Not surprisingly the road types with greater traffic flows tended to have a lower proportion of free speed vehicles travelling on them (due to greater traffic congestion).

**Table 3.2**  
Percentage of vehicles travelling at a free speed for each road type in 2007

Road type (speed limit)	Total vehicles	Free speed vehicles	% free speed
Adelaide local (50)	118909	110237	92.7
Adelaide collector (50)	249345	204835	82.1
Adelaide arterial two way no median (60)	707978	319188	45.1
Adelaide arterial two way with median (60)	713186	339469	47.6
Adelaide arterial multi-lane no median (60)	523467	286482	54.7
Adelaide arterial multi-lane with median (60)	822287	397969	48.4
Adelaide arterial (80)	657753	263535	40.1
Rural local (50)	110898	97027	87.5
Rural arterial (60)	72254	62352	86.3
Rural hills arterial (80)	92616	69095	74.6
Rural arterial (100)	119126	95500	80.2
Rural arterial (110)	390931	317903	81.3
Outback arterial (110)	7174	6645	92.6

The traffic volume and summary speed statistics for free speed vehicles passing the measured sites over a one week period are presented in Table 3.3 grouped by road type.

**Table 3.3**  
Free speed traffic volumes and speed statistics for each road type in 2007

Road type (speed limit)	Number of sites	Vehicle count	Mean speed	Median speed	85th percentile speed	%exceeding speed limit	%exceeding speed limit by more than 10 km/h
Adelaide local (50)	18	110237	45.19	46.4	55.8	34.90	6.83
Adelaide collector (50)	11	204835	50.04	50.4	58.0	52.13	10.06
Adelaide arterial two way no median (60)	6	319188	57.12	58.0	63.5	35.04	2.52
Adelaide arterial two way with median (60)	6	339469	56.16	57.0	62.1	26.29	1.47
Adelaide arterial multi-lane no median (60)	6	286482	55.92	57.1	62.5	28.78	1.80
Adelaide arterial multi-lane with median (60)	9	397969	60.24	60.6	65.7	54.75	4.67
Adelaide arterial (80)	6	263535	76.58	77.2	83.9	33.31	3.42
Rural local (50)	14	97027	51.70	53.4	61.7	64.16	20.72
Rural arterial (60)	4	62352	57.74	58.4	64.9	38.80	5.23
Rural hills arterial (80)	4	69095	77.65	77.1	86.6	36.31	9.18
Rural arterial (100)	10	95500	93.05	93.8	104.6	28.66	6.59
Rural arterial (110)	35	317903	102.76	103.9	113.9	27.48	4.23
Outback arterial (110)	3	6645	106.11	107.5	120.6	43.34	15.83

Figures 3.9 - 3.16 present the free speed distributions of the various road types.

**Figure 3.9**  
Free speed distributions for 50 km/h Adelaide local roads and Adelaide collector roads in 2007

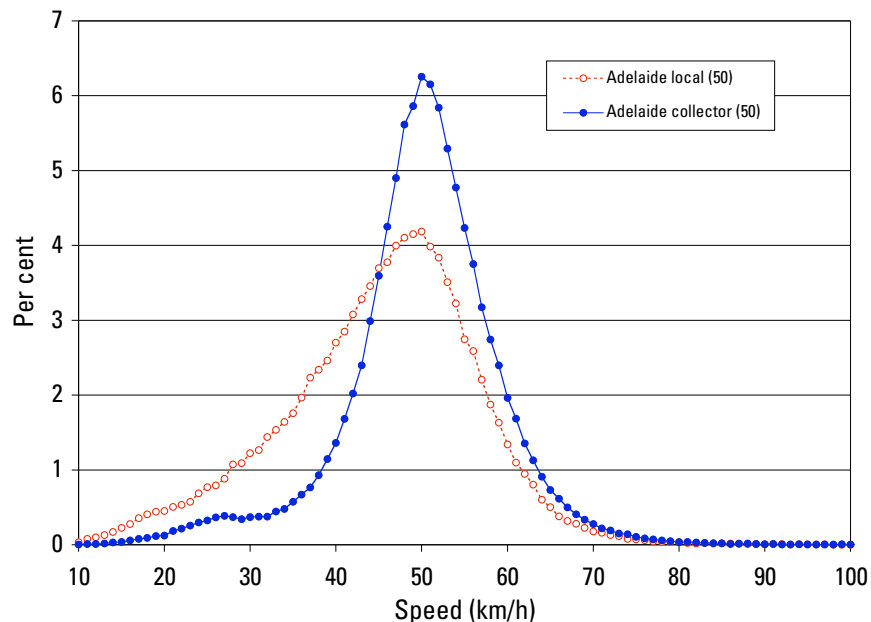


Figure 3.10  
Free speed distributions for 50 km/h Adelaide local roads and rural local roads in 2007

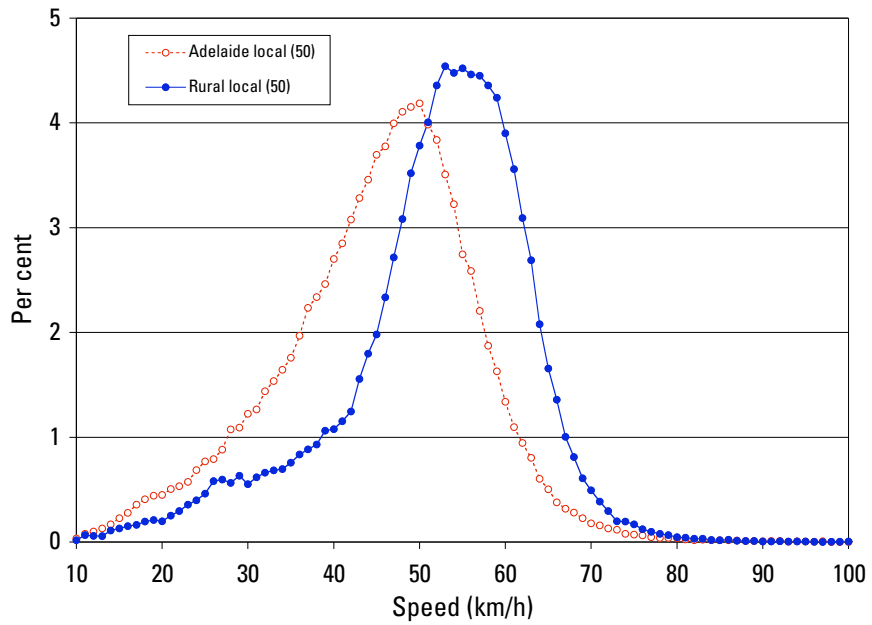


Figure 3.11  
Free speed distributions for 60 km/h Adelaide arterial two way roads by presence of a median in 2007

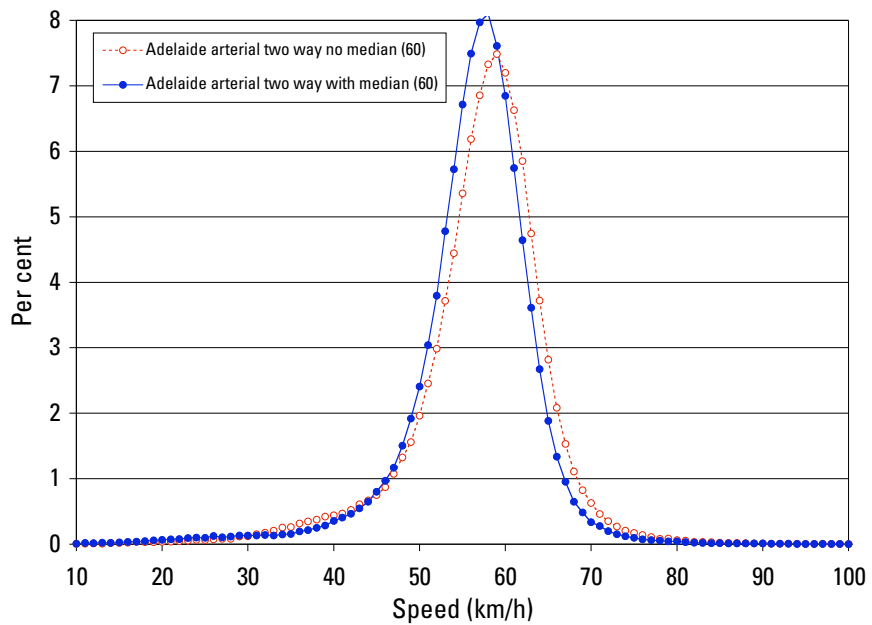


Figure 3.12  
Free speed distributions for 60 km/h Adelaide arterial two way roads by presence of a median in 2007

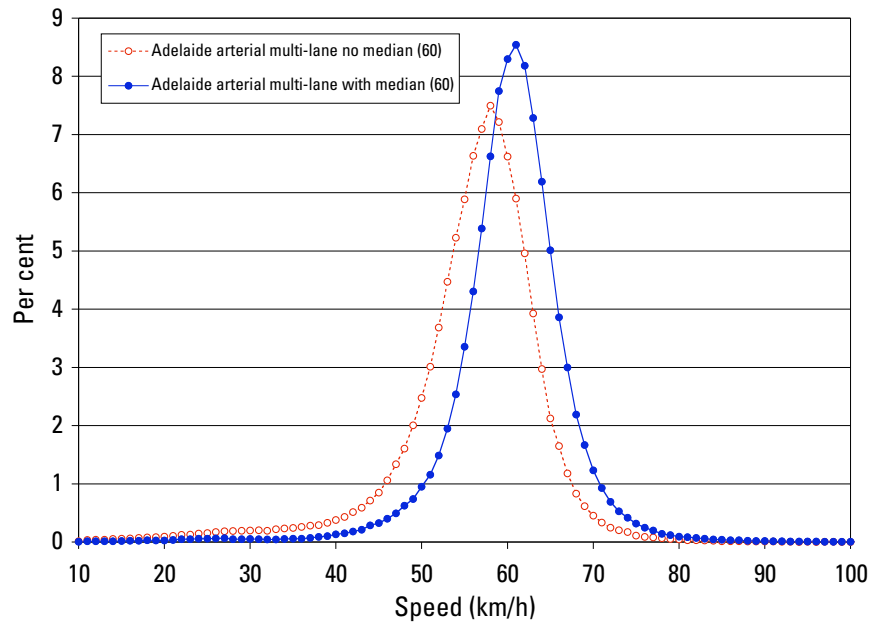


Figure 3.13  
Free speed distributions for 80 km/h Adelaide arterial roads and rural hills arterial roads in 2007

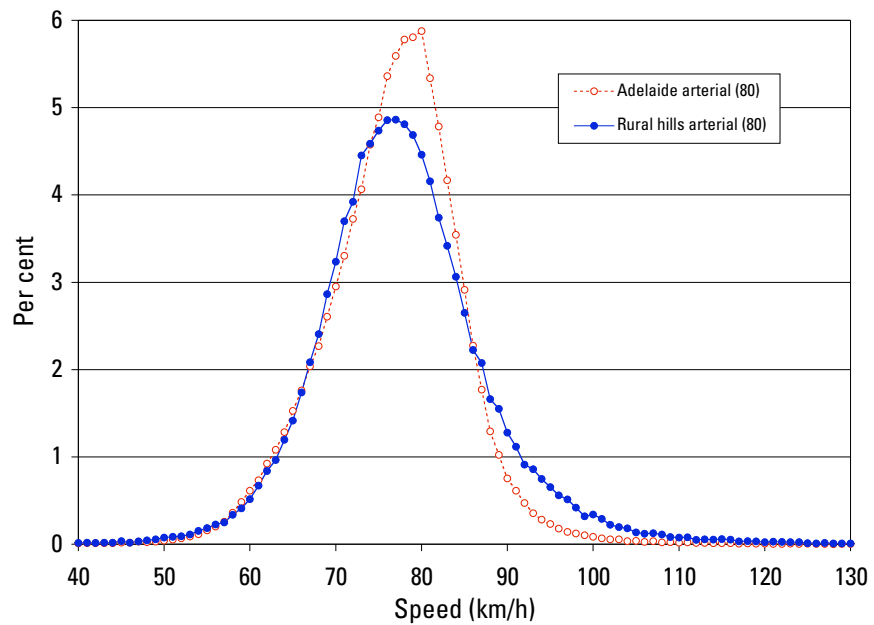




Figure 3.14  
Free speed distributions for 50 km/h rural local roads and 60 km/h rural arterial roads in 2007

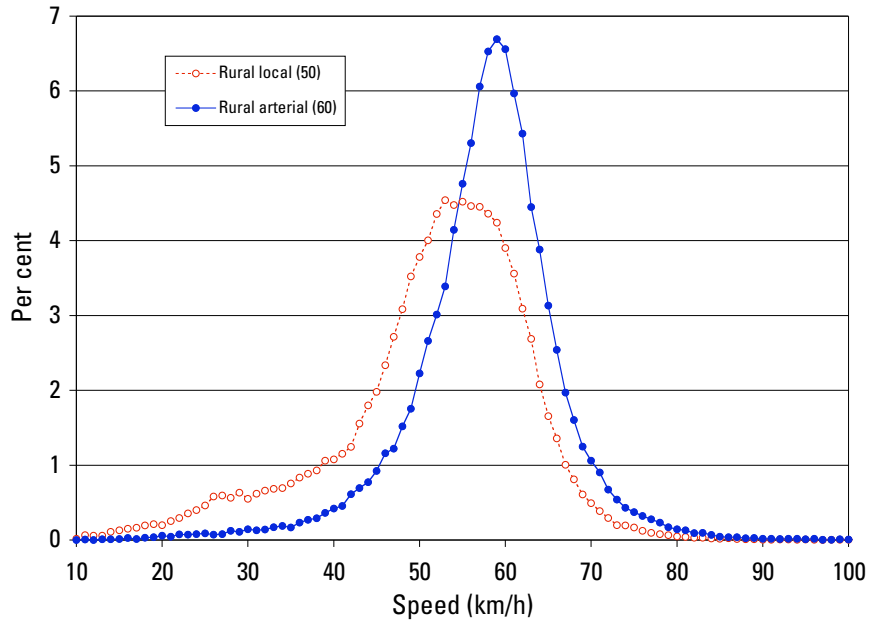


Figure 3.15  
Free speed distributions for 100 km/h rural arterial roads and 110 km/h rural arterial roads in 2007

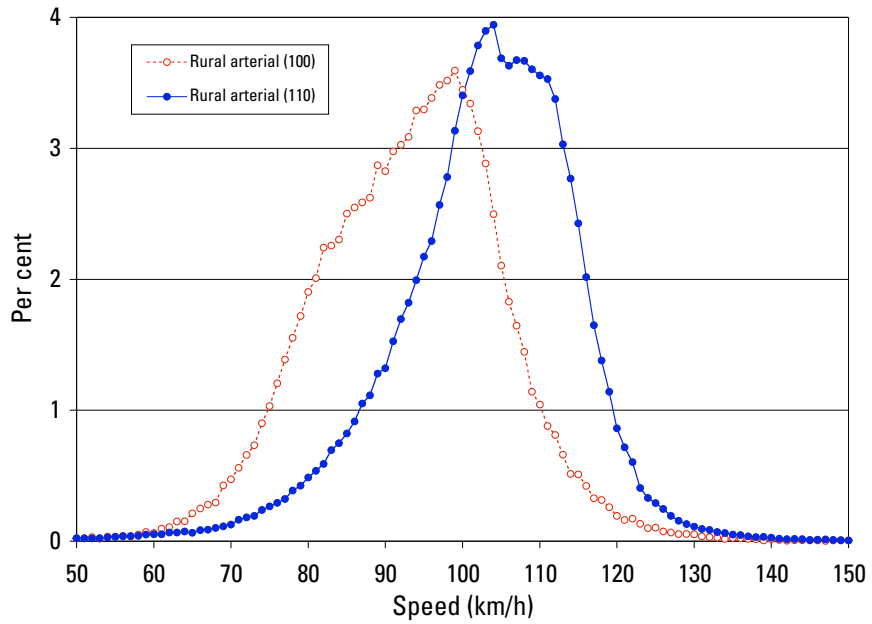
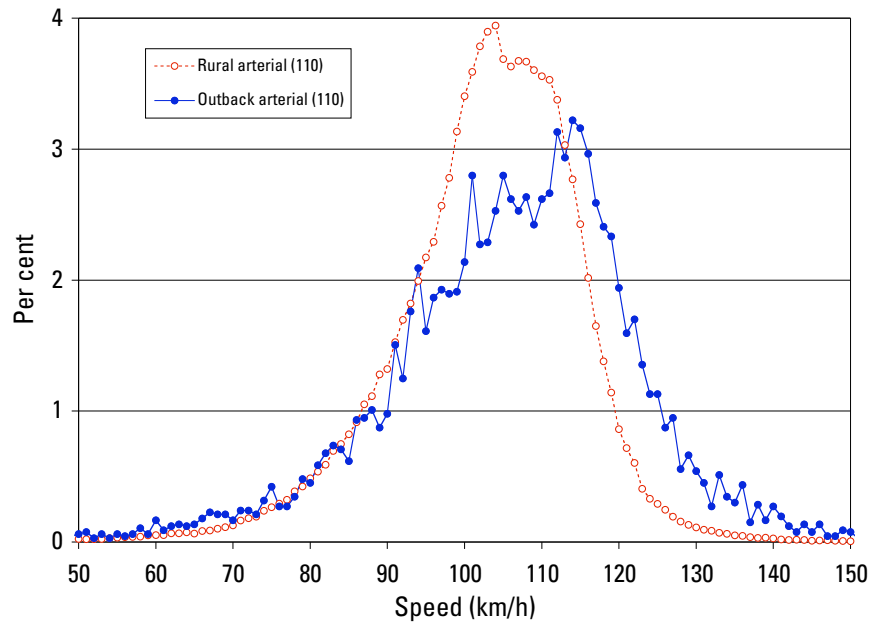


Figure 3.16  
Free speed distributions for 110 km/h rural arterial roads and outback arterial roads in 2007



## 4 Changes in speeds from 2002 to 2007 on roads in built up areas

In 2002, just before the introduction of the default 50 km/h speed limit in built up areas of South Australia, the speeds of vehicles were measured for one day at 52 sites (a week day with a preference for Wednesdays where possible). These measurements were repeated approximately one year later in 2003 and again in 2005 in order to assess the effect of the introduction of the default 50 km/h speed limit on vehicle speeds (Kloeden, Woolley, McLean; 2004, 2006).

Since the current set of 132 surveyed sites includes 51 of these sites it is possible to compare speeds in 2007 with those measured in 2002, 2003 and 2005. The individual sites are identified in Appendix A.

Since the sites in earlier years were only surveyed for one day of the week, data for that day was taken from each of the 51 relevant sites in 2007.

### 4.1 All vehicles

The combined traffic volume and speed statistics by year of survey for each type of road are presented in Tables 4.1 - 4.4. Note that all the 50 km/h roads were zoned at 60 km/h during the 2002 survey. Green numbers indicate a decrease in a speed measurement from the previous survey and red numbers indicate an increase in a speed measurement from the previous survey.

**Table 4.1**  
Traffic volumes and speed statistics for 50 km/h rural local roads by year of survey (12 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	8685	9592	9730	9764
Mean speed	49.93	48.53	46.85	47.79
Median speed	52.76	50.56	49.10	49.90
85th percentile speed	63.71	59.62	57.76	58.10
% exceeding 50 km/h	57.04	52.40	45.87	49.46
% exceeding 60 km/h	25.85	14.12	9.93	10.51

**Table 4.2**  
Traffic volumes and speed statistics for 50 km/h Adelaide local roads by year of survey (18 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	17663	19207	18513	17667
Mean speed	47.91	44.78	43.65	45.07
Median speed	48.97	46.13	45.14	46.50
85th percentile speed	60.00	55.38	55.02	55.70
% exceeding 50 km/h	46.22	33.57	31.87	35.01
% exceeding 60 km/h	14.94	6.52	5.92	6.48

**Table 4.3**  
Traffic volumes and speed statistics for 50 km/h Adelaide collector roads by year of survey (11 sites)

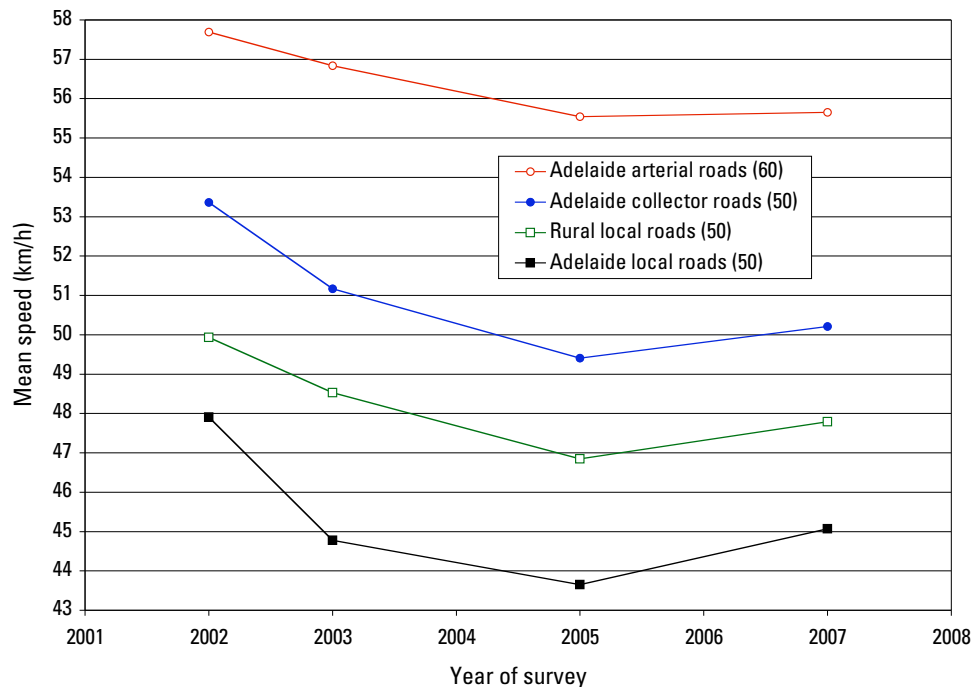
Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	33005	33462	34154	36081
Mean speed	53.36	51.17	49.41	50.21
Median speed	54.52	51.17	49.70	50.40
85th percentile speed	62.35	59.25	57.00	57.50
% exceeding 50 km/h	69.51	57.14	47.96	52.27
% exceeding 60 km/h	23.24	13.07	8.32	9.23

**Table 4.4**  
Traffic volumes and speed statistics for 60 km/h Adelaide arterial roads by year of survey (10 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	149135	153317	153668	159821
Mean speed	57.69	56.84	55.54	55.65
Median speed	58.86	57.90	56.82	57.20
85th percentile speed	64.73	63.92	62.46	62.60
% exceeding 60 km/h	42.34	36.25	28.93	30.16
% exceeding 70 km/h	4.35	3.45	1.43	1.34

The change in mean speed over the surveys for each road type is shown graphically in Figure 4.1. Note that all the 50 km/h roads were zoned at 60 km/h during the 2002 survey.

**Figure 4.1**  
Change in mean speeds over time by road type



The speed distributions in the 2007 survey are compared with the speed distributions in the 2005 survey for each road type in Figures 4.2 - 4.5.

Figure 4.2  
Speed distributions for 50 km/h rural local roads by year of survey (12 sites)

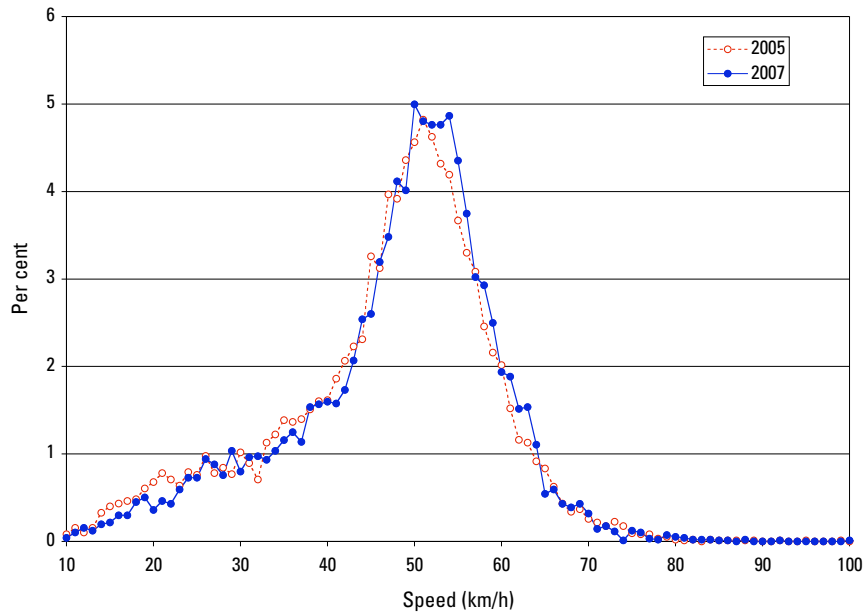


Figure 4.3  
Speed distributions for 50 km/h Adelaide local roads by year of survey (18 sites)

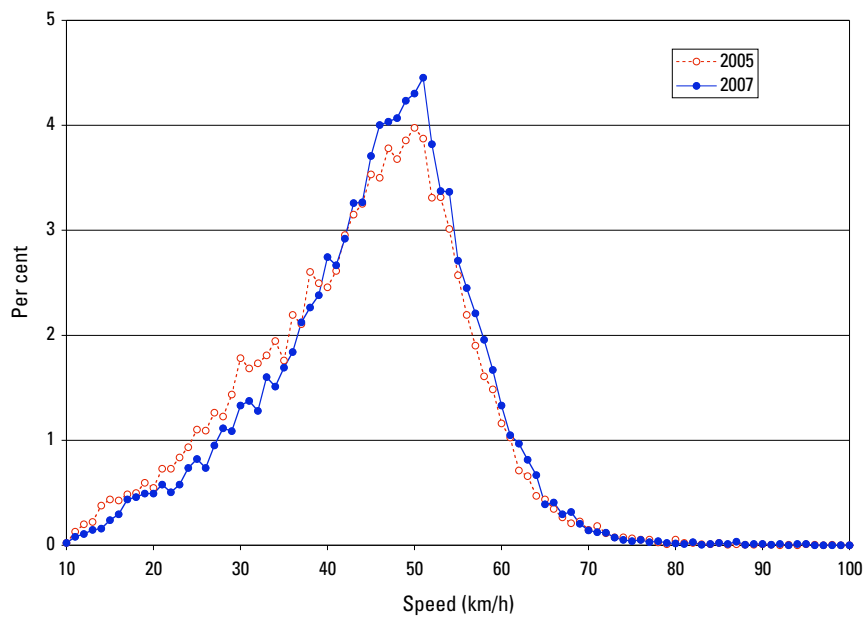


Figure 4.4  
Speed distributions for 50 km/h Adelaide collector roads by year of survey (11 sites)

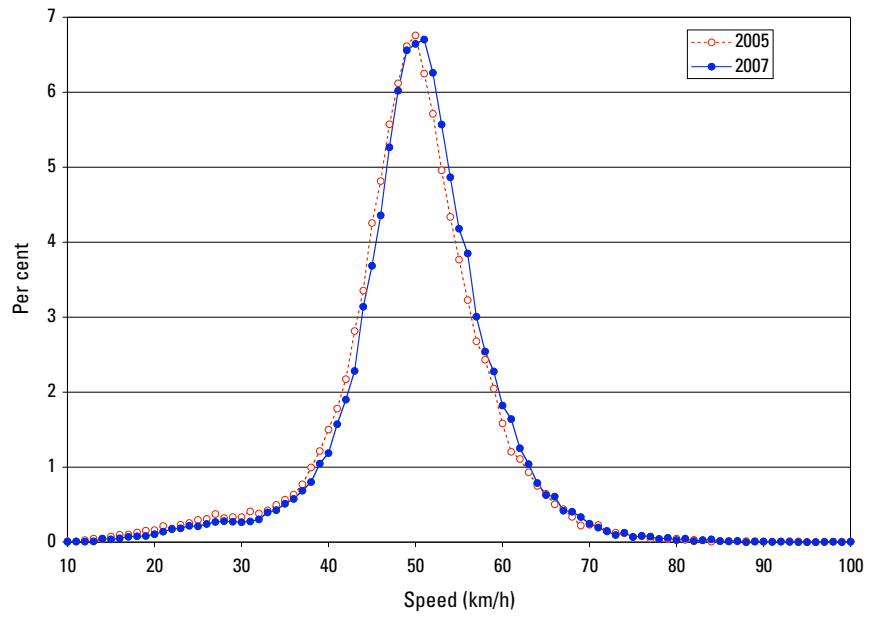
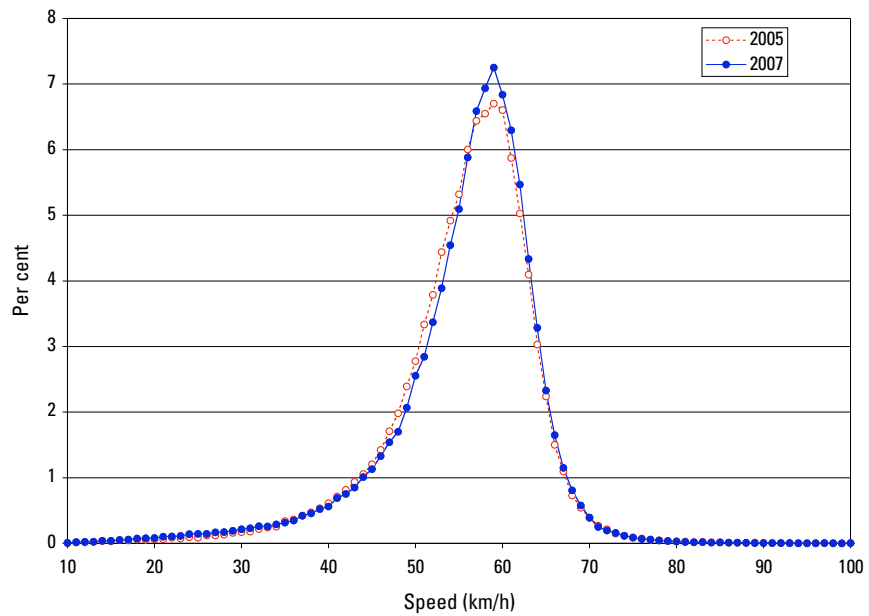


Figure 4.5  
Speed distributions for 60 km/h Adelaide arterial roads by year of survey (10 sites)



It is clear that the measured speeds increased from 2005 to 2007 on all of these four road types. However, a certain variation in daily speed measurements is to be expected so it is not clear if the change in speeds can be attributed to an underlying effect or to chance variation in the measurements. In order to test the statistical significance of the change in speed, each site/direction combination was treated as a single measurement with a before and after speed value and the changes in these values over the relevant sites were analysed.

As an example, consider the mean speed on Adelaide local roads in 2007 compared to 2005. There were 18 such sites (one of which was a one way street) giving 35 independent collections of speed measurements in each year. Taking the mean speed of each collection in 2005 and 2007 gives 35 pairs of mean speeds and 35 changes in mean speed. If all of the changes were in the same direction, then it would be likely that any overall difference was not the result of chance. If, however, close to half were in one direction and half were in the other direction (by about the same amounts), then the individual changes would likely have been due to chance.

In the particular case under examination, 27 changes showed an increase in mean speed and 8 showed a decrease in mean speed and the average change over all 35 pairs was an increase of 1.04 km/h. The probability of achieving such a result if there were no underlying effect is calculated using a matched pair t-test as 0.003 (ie only one time in 330). We can therefore conclude that it is highly likely that mean speeds on Adelaide local roads went up because of an underlying effect rather than through chance variation and that the average increase per site was 1.04 km/h.

This method was extended to all road types and traffic volume and speed measures and the average changes are presented in Table 4.5 with the statistically significant results marked.

**Table 4.5**  
**Average changes at sites in 2007 compared to 2005 by road type**

Road type (speed limit)	Number of speed collections	Vehicle count	Mean speed	Median speed	85th percentile speed	%exceeding speed limit	%exceeding speed limit by more than 10 km/h
Rural local (50)	23	1.48	0.46	0.34	0.44	1.56	-0.01
Adelaide local (50)	35	-24.17	1.04*	1.12*	0.46	1.40	0.16
Adelaide collector (50)	22	87.59	0.50	0.41	0.32	2.91	0.46
Adelaide arterial (60)	20	307.65*	0.38	0.50	0.43	2.18	-0.04
All 50 roads	80	13.94	0.72*	0.70*	0.42	1.86*	0.19
All of the above roads	100	72.68*	0.66*	0.66*	0.42*	1.93*	0.15

\* statistically significant (p < 0.05)

## 4.2 Free speed vehicles

The combined traffic volume and speed statistics by year of survey for each type of road are presented for free speed vehicles in Tables 4.6 - 4.9. Free speed vehicles were defined as those that had at least a four second headway gap to the vehicle in front of them (ie the time between the front wheels of the two vehicles passing the measurement site was at least four seconds). Note that all the 50 km/h roads were zoned at 60 km/h during the 2002 survey. Green numbers indicate a decrease in a speed measurement from the previous survey and red numbers indicate an increase in a speed measurement from the previous survey.

**Table 4.6**  
Free speed traffic volumes and speed statistics for 50 km/h rural local roads by year of survey (12 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	8073	8533	9136	8983
Mean speed	49.68	48.51	47.00	47.87
Median speed	52.72	50.47	49.19	49.90
85th percentile speed	63.73	59.85	57.94	58.30
% exceeding 50 km/h	56.78	52.02	46.29	49.39
% exceeding 60 km/h	25.98	14.67	10.27	10.95

**Table 4.7**  
Free speed traffic volumes and speed statistics for 50 km/h Adelaide local roads by year of survey (18 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	16512	17530	17440	16411
Mean speed	47.91	44.84	43.82	45.22
Median speed	48.97	46.15	45.21	46.60
85th percentile speed	60.50	55.54	55.16	55.90
% exceeding 50 km/h	46.33	33.98	32.20	35.39
% exceeding 60 km/h	15.06	6.71	6.18	6.74

**Table 4.8**  
Free speed traffic volumes and speed statistics for 50 km/h Adelaide collector roads by year of survey (11 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	28054	27389	29214	29638
Mean speed	53.46	51.42	49.69	50.42
Median speed	54.65	51.42	49.97	50.70
85th percentile speed	62.73	59.74	57.52	58.00
% exceeding 50 km/h	69.51	58.35	49.78	53.83
% exceeding 60 km/h	24.54	14.30	9.25	10.30

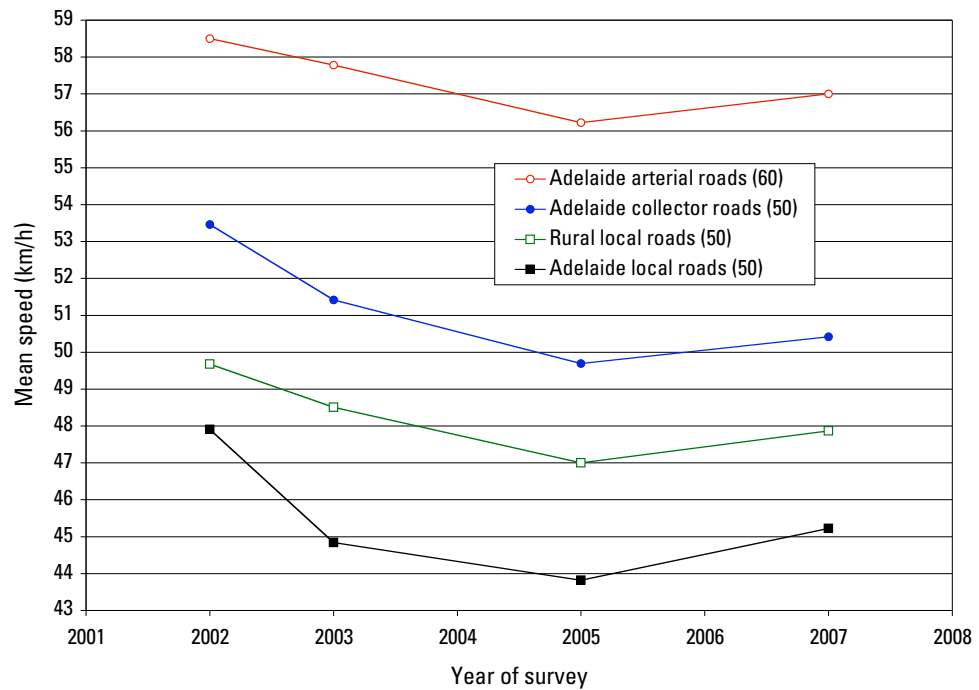


**Table 4.9**  
Free speed traffic volumes and speed statistics for 60 km/h Adelaide arterial roads by year of survey (10 sites)

Measurement	Year of survey			
	2002	2003	2005	2007
Traffic count	73830	73684	74077	68848
Mean speed	58.50	57.78	56.22	57.00
Median speed	59.46	58.60	57.45	58.20
85th percentile speed	65.61	64.83	63.27	63.60
% exceeding 60 km/h	46.34	40.81	33.09	36.24
% exceeding 70 km/h	6.11	4.91	2.39	2.40

The change in mean free speed over the surveys for each road type is shown graphically in Figure 4.6. Note that all the 50 km/h roads were zoned at 60 km/h during the 2002 survey.

**Figure 4.6**  
Change in mean free speeds over time by road type



The free speed distributions in the 2007 survey are compared with the free speed distributions in the 2005 survey for each road type in Figures 4.7 - 4.10.

Figure 4.7  
Free speed distributions for 50 km/h rural local roads by year of survey (12 sites)

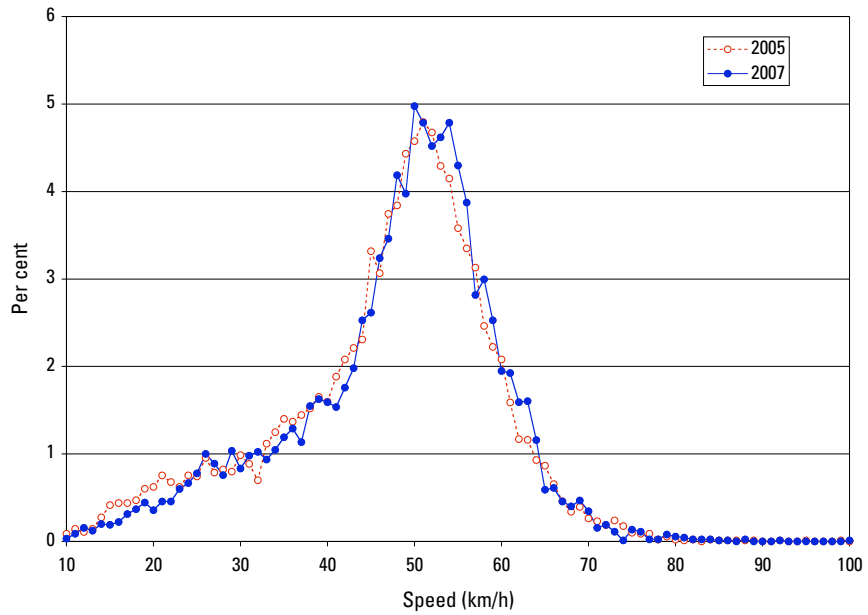


Figure 4.8  
Free speed distributions for 50 km/h Adelaide local roads by year of survey (18 sites)

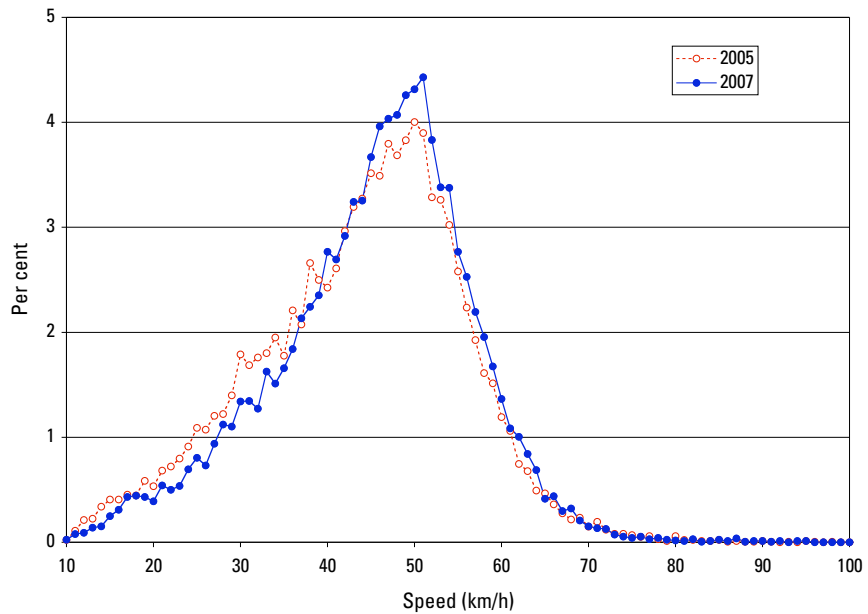


Figure 4.9  
Free speed distributions for 50 km/h Adelaide collector roads by year of survey (11 sites)

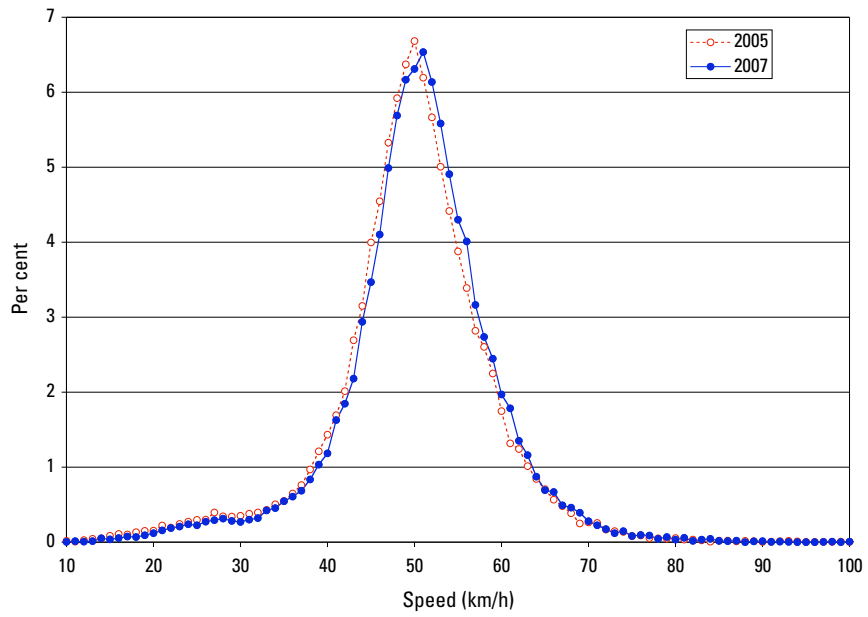
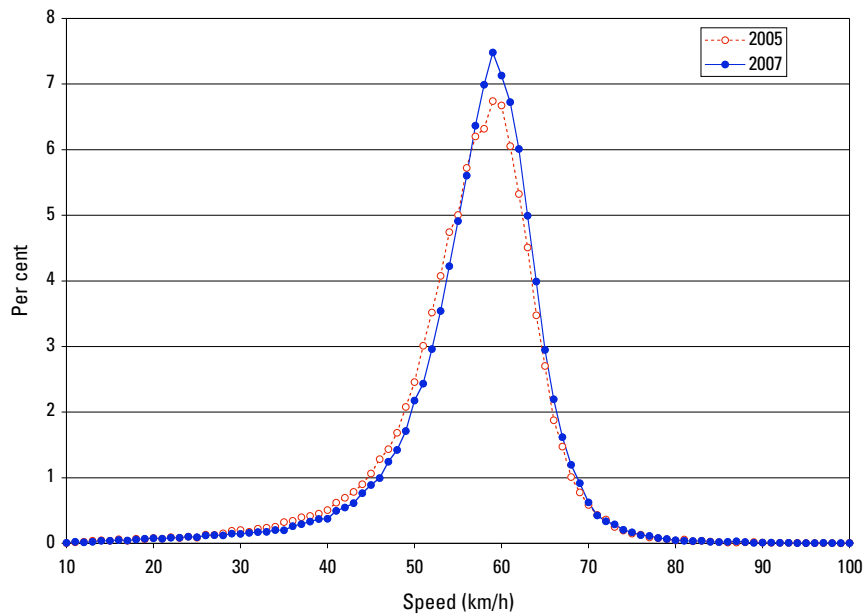


Figure 4.10  
Free speed distributions for 60 km/h Adelaide arterial roads by year of survey (10 sites)



The method explained at the end of Section 4.1 was applied to all road types to determine the average changes in traffic volume and speed measures along with the statistical significance of those results for free speed vehicles (see Table 4.10).

**Table 4.10**  
Average changes at sites in 2007 compared to 2005 by road type for free speed vehicles

Road type (speed limit)	Number of speed collections	Vehicle count	Mean speed	Median speed	85th percentile speed	%exceeding speed limit	%exceeding speed limit by more than 10 km/h
Rural local (50)	23	-6.65	0.46	0.32	0.43	1.46	0.03
Adelaide local (50)	35	-29.40*	1.00*	1.17*	0.43	1.30	0.13
Adelaide collector (50)	22	19.27	0.44	0.40	0.37	2.74	0.52
Adelaide arterial (60)	20	-261.45*	0.73	0.64	0.54	3.16	0.01
All 50 roads	80	-9.48	0.69*	0.71*	0.41	1.74*	0.21
All of the above roads	100	-59.87*	0.70*	0.70*	0.44*	2.02*	0.17

\* statistically significant (p < 0.05)

## 5 Changes in speeds from 2006 to 2007 on rural roads

The Harwood sites represent a selection of rural sites that DTEI has for some years been conducting speed measurements at for a one week period in August (named after the initiator of the surveys, Colin Harwood). The 2006 speed data for all 21 Harwood sites was obtained for comparison with the 2007 speed data. The individual sites are identified in Appendix A.

### 5.1 All vehicles

The combined traffic volume and speed statistics by year of survey for each type of road are presented in Tables 5.1 - 5.5. Green numbers indicate a decrease in a speed measurement from the previous survey and red numbers indicate an increase in a speed measurement from the previous survey.

**Table 5.1**  
Traffic volumes and speed statistics for rural local roads by year of survey  
(50 km/h speed limit - 2 sites)

Measurement	Year of survey	
	2006	2007
Traffic count	45636	46187
Mean speed	57.27	57.52
Median speed	59.00	58.00
85th percentile speed	65.00	63.70
% exceeding 50 km/h	83.28	87.48
% exceeding 60 km/h	43.08	35.17

**Table 5.2**  
Traffic volumes and speed statistics for rural arterial roads by year of survey  
(60 km/h speed limit - 4 sites)

Measurement	Year of survey	
	2006	2007
Traffic count	69852	72254
Mean speed	57.14	57.60
Median speed	57.80	58.20
85th percentile speed	64.60	64.60
% exceeding 60 km/h	36.72	37.79
% exceeding 70 km/h	4.45	4.77

**Table 5.3**  
Traffic volumes and speed statistics for rural arterial roads by year of survey  
(100 km/h speed limit - 6 sites)

Measurement	Year of survey	
	2006	2007
Traffic count	49922	52594
Mean speed	91.66	91.60
Median speed	91.90	92.00
85th percentile speed	104.70	104.80
% exceeding 100 km/h	26.01	26.47
% exceeding 110 km/h	7.53	7.50

**Table 5.4**  
**Traffic volumes and speed statistics for rural arterial roads by year of survey**  
**(110 km/h speed limit - 6 sites)**

Measurement	Year of survey	
	2006	2007
Traffic count	50571	50402
Mean speed	102.01	102.13
Median speed	102.90	103.00
85th percentile speed	112.40	112.00
% exceeding 110 km/h	22.53	21.27
% exceeding 120 km/h	3.20	2.86

**Table 5.5**  
**Traffic volumes and speed statistics for outback arterial roads by year of survey**  
**(110 km/h speed limit - 3 sites)**

Measurement	Year of survey	
	2006	2007
Traffic count	6280	7174
Mean speed	105.24	105.97
Median speed	106.70	107.20
85th percentile speed	119.50	120.30
% exceeding 110 km/h	40.86	42.50
% exceeding 120 km/h	14.25	15.49

The changes in mean speeds between 2006 and 2007 for each road type are shown graphically in Figures 5.1 and 5.2.

**Figure 5.1**  
**Change in mean speeds over time by rural road type (low speed limit roads)**

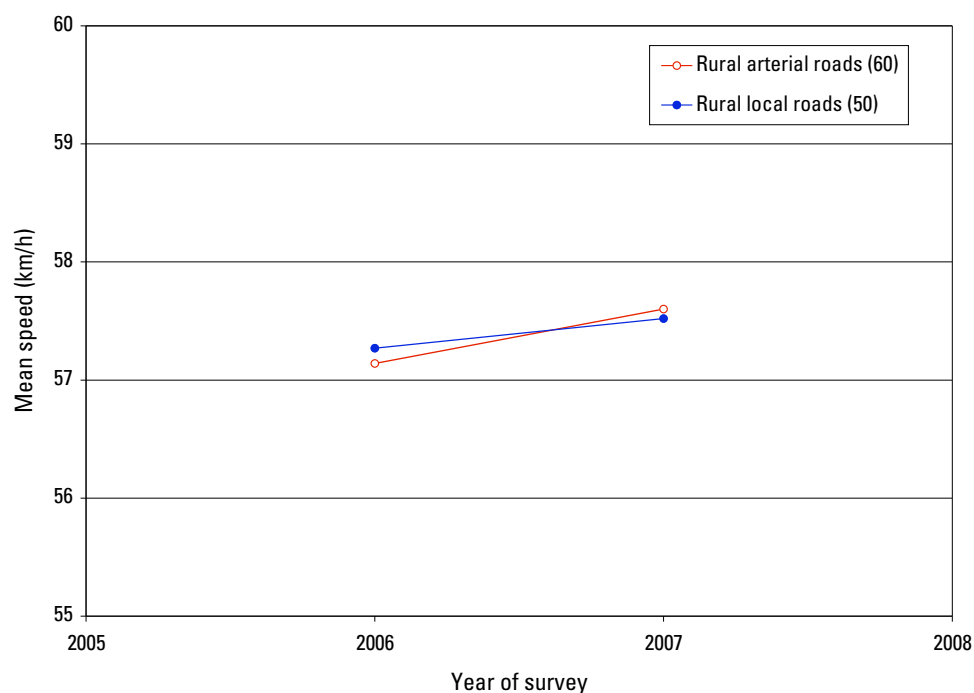
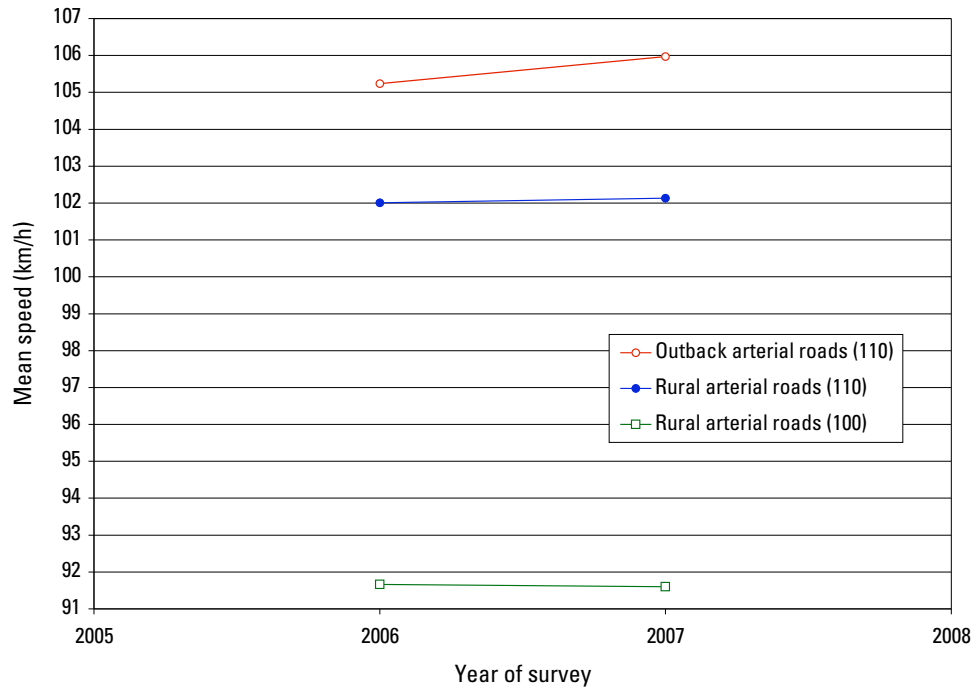


Figure 5.2  
Change in mean speeds over time by rural road type (high speed limit roads)



The speed distributions in the 2007 survey are compared with the speed distributions in the 2006 survey for each road type in Figures 5.3 - 5.7.

Figure 5.3  
Speed distributions for rural local roads by year of survey  
(50 km/h speed limit - 2 sites)

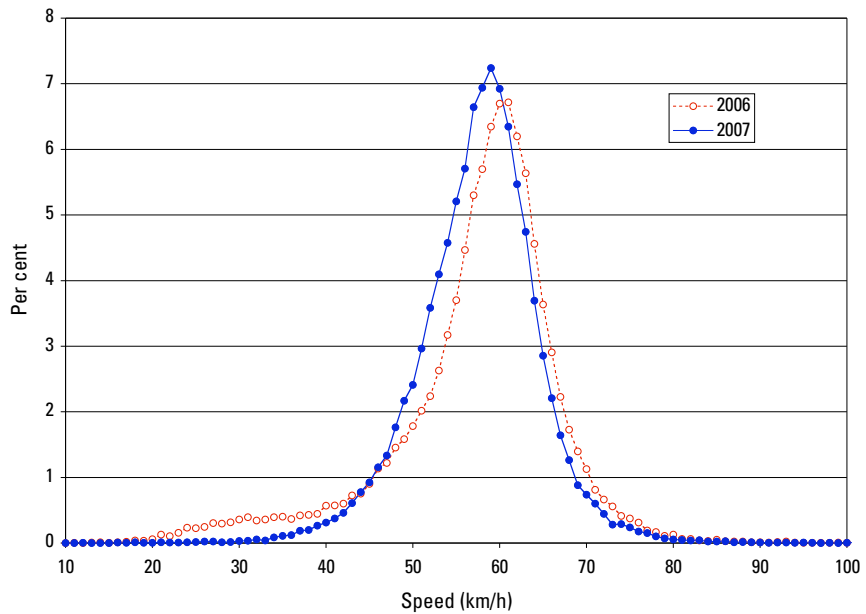


Figure 5.4  
 Speed distributions for rural arterial roads by year of survey  
 (60 km/h speed limit - 4 sites)

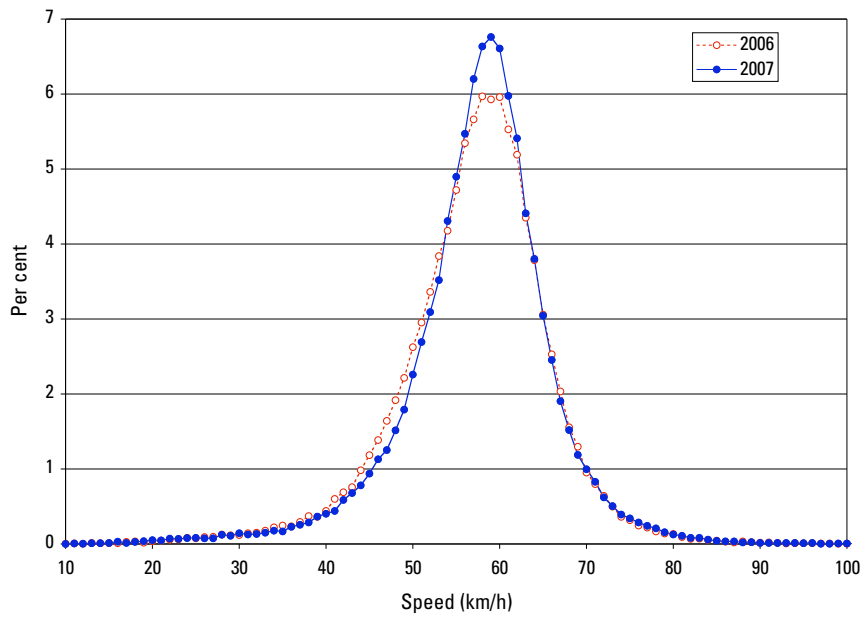


Figure 5.5  
 Speed distributions for rural arterial roads by year of survey  
 (100 km/h speed limit - 6 sites)

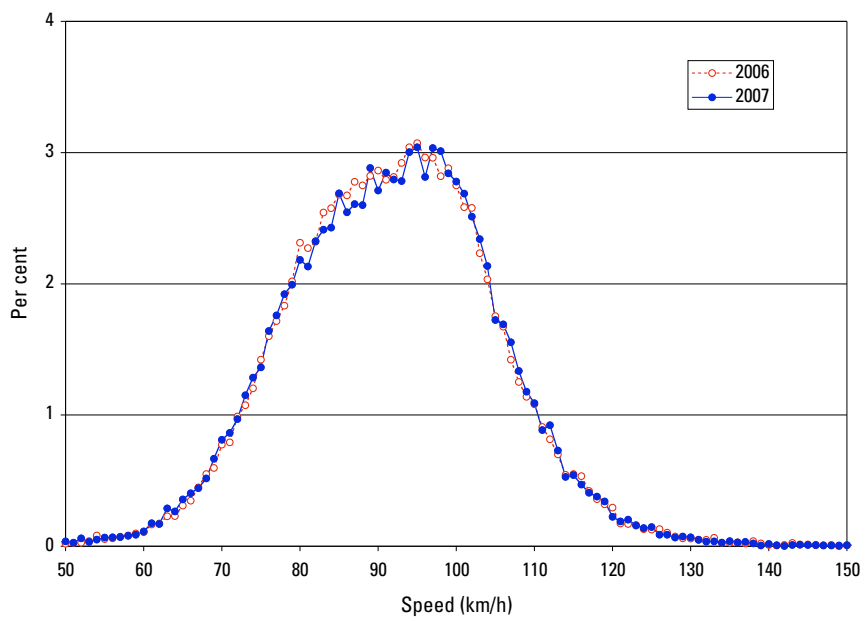




Figure 5.6  
Speed distributions for rural arterial roads by year of survey  
(110 km/h speed limit - 6 sites)

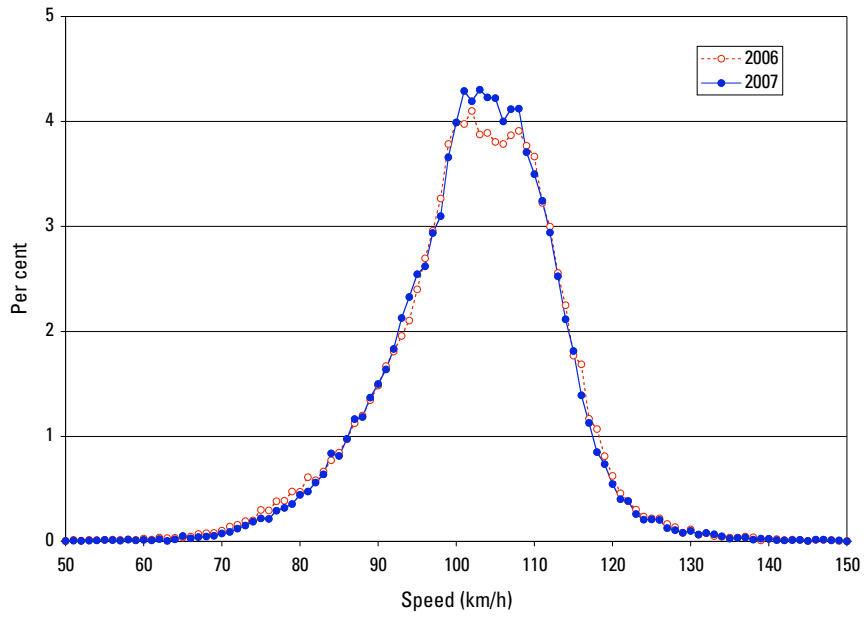
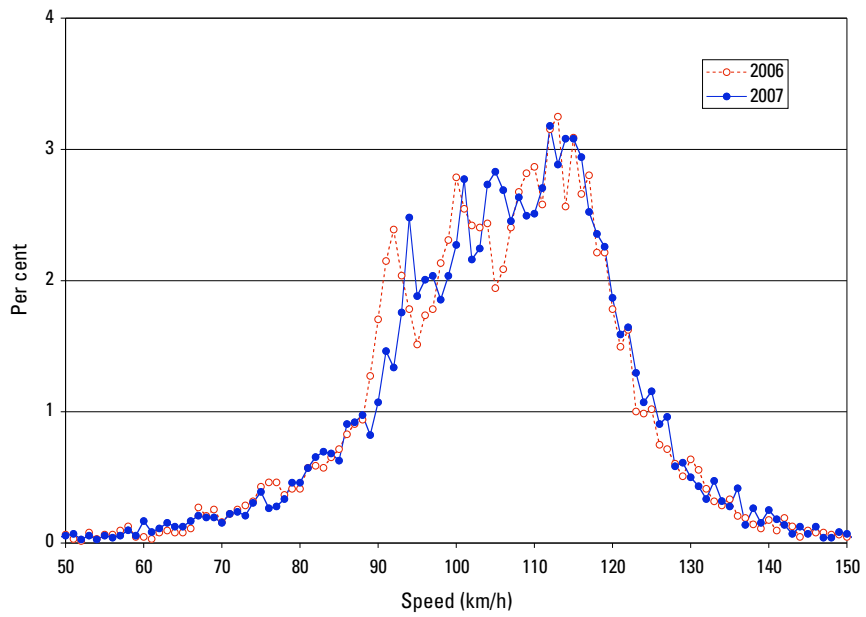


Figure 5.7  
Speed distributions for outback arterial roads by year of survey  
(110 km/h speed limit - 3 sites)



The method explained at the end of Section 4.1 was applied to all road types to determine the average changes in traffic volume and speed measures along with the statistical significance of those results (see Table 5.6).

**Table 5.6**  
Average changes at sites in 2007 compared to 2006 by rural road type

Road type (speed limit)	Number of speed collections	Vehicle count	Mean speed	Median speed	85th percentile speed	%exceeding speed limit	%exceeding speed limit by more than 10 km/h
Rural local (50)	4	137.75	0.29	-0.43	-0.70	4.14	-4.94
Rural arterial (60)	8	300.25	0.72	0.74	0.85	3.23	0.86
Rural arterial (100)	12	222.67*	-0.03	0.02	-0.38	0.31	-0.81
Rural arterial (110)	12	-14.08	0.62	0.36	0.43	0.57	0.26
Outback arterial (110)	6	149.00*	0.83	0.65	-0.22	1.11	0.85
All roads <= 60 km/h	12	246.08*	0.58	0.35	0.33	3.54	-1.07
All roads > 60 km/h	30	113.23*	0.40	0.28	-0.03	0.58	-0.05
All of the above roads	42	151.19*	0.45	0.30	0.08	1.42	-0.34

\* statistically significant (p < 0.05)

## 5.2 Free speed vehicles

The combined traffic volume and speed statistics by year of survey for each type of road are presented for free speed vehicles in Tables 5.7 - 5.11. As previously free speed vehicles were defined as those that had at least a four second headway gap to the vehicle in front of them (ie the time between the front wheels of the two vehicles passing the measurement site was at least four seconds).

**Table 5.7**  
Traffic volumes and speed statistics for rural local roads by year of survey  
(50 km/h speed limit - 2 sites)

Measurement	Year of survey	
	2006	2007
Traffic count	37558	37961
Mean speed	57.33	57.55
Median speed	59.00	58.00
85th percentile speed	65.20	63.90
% exceeding 50 km/h	82.73	86.78
% exceeding 60 km/h	43.18	35.92

**Table 5.8**  
Traffic volumes and speed statistics for rural arterial roads by year of survey  
(60 km/h speed limit - 4 sites)

Measurement	Year of survey	
	2006	2007
Traffic count	60600	62352
Mean speed	57.18	57.74
Median speed	57.80	58.40
85th percentile speed	64.80	64.90
% exceeding 60 km/h	36.95	38.80
% exceeding 70 km/h	4.80	5.23

**Table 5.9**  
Traffic volumes and speed statistics for rural arterial roads by year of survey  
(100 km/h speed limit - 6 sites)

Measurement	Year of survey	
	2006	2007
Traffic count	41978	43595
Mean speed	92.66	92.70
Median speed	93.00	93.20
85th percentile speed	105.60	105.80
% exceeding 100 km/h	28.63	29.20
% exceeding 110 km/h	8.50	8.60

**Table 5.10**  
**Traffic volumes and speed statistics for rural arterial roads by year of survey**  
**(110 km/h speed limit - 6 sites)**

Measurement	Year of survey	
	2006	2007
Traffic count	42289	42276
Mean speed	102.64	102.80
Median speed	103.60	103.60
85th percentile speed	112.90	112.60
% exceeding 110 km/h	24.62	23.34
% exceeding 120 km/h	3.53	3.24

**Table 5.11**  
**Traffic volumes and speed statistics for outback arterial roads by year of survey**  
**(110 km/h speed limit - 3 sites)**

Measurement	Year of survey	
	2006	2007
Traffic count	6037	6645
Mean speed	105.26	106.11
Median speed	106.90	107.50
85th percentile speed	119.60	120.60
% exceeding 110 km/h	41.11	43.34
% exceeding 120 km/h	14.44	15.83

The changes in mean free speeds between 2006 and 2007 for each road type are shown graphically in Figures 5.1 and 5.2.

**Figure 5.8**  
**Change in mean free speeds over time by rural road type (low speed limit roads)**

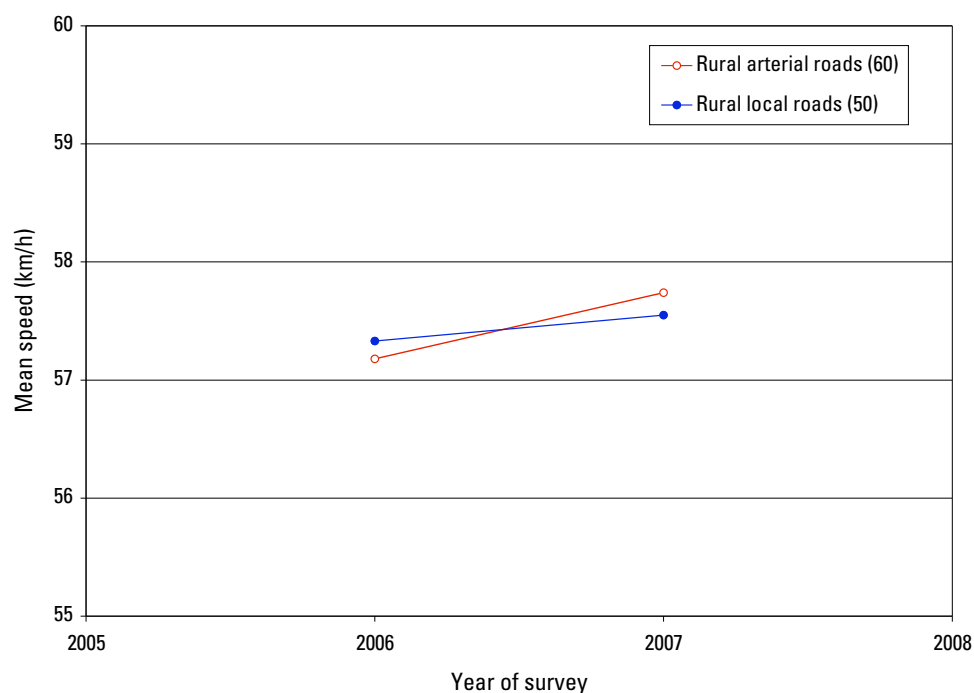
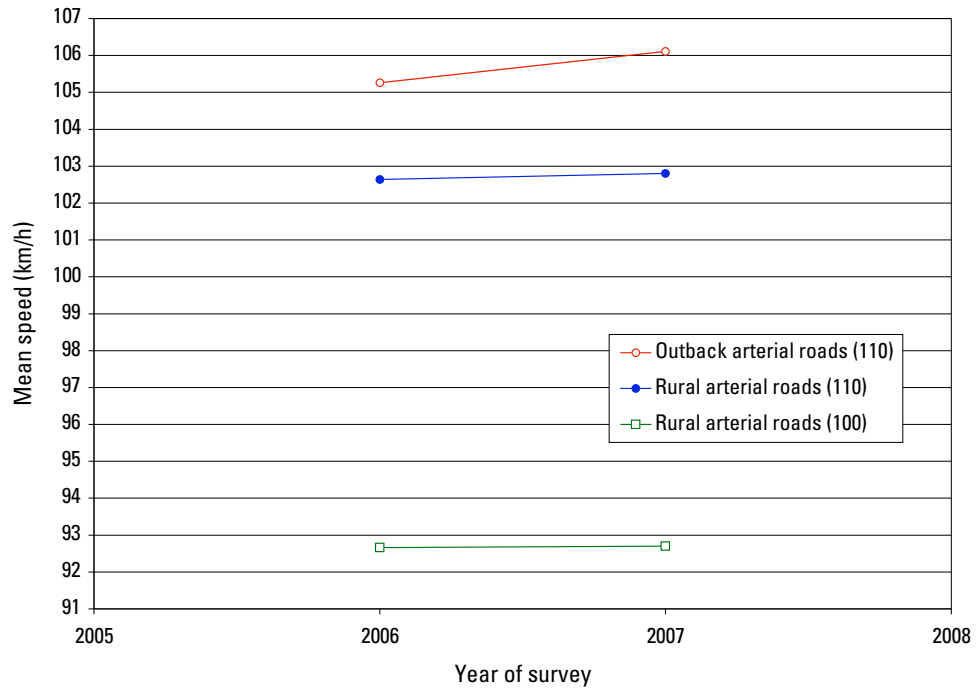


Figure 5.9  
Change in mean free speeds over time by rural road type (high speed limit roads)



The free speed distributions in the 2007 survey are compared with the free speed distributions in the 2006 survey for each road type in Figures 5.10 - 5.14.

Figure 5.10  
Free speed distributions for rural local roads by year of survey  
(50 km/h speed limit - 2 sites)

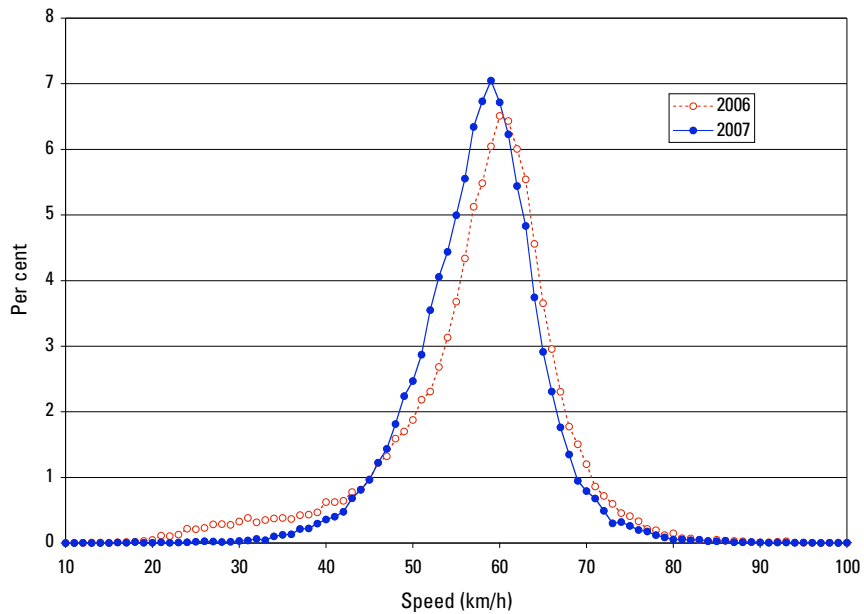


Figure 5.11  
Free speed distributions for rural arterial roads by year of survey  
(60 km/h speed limit - 4 sites)

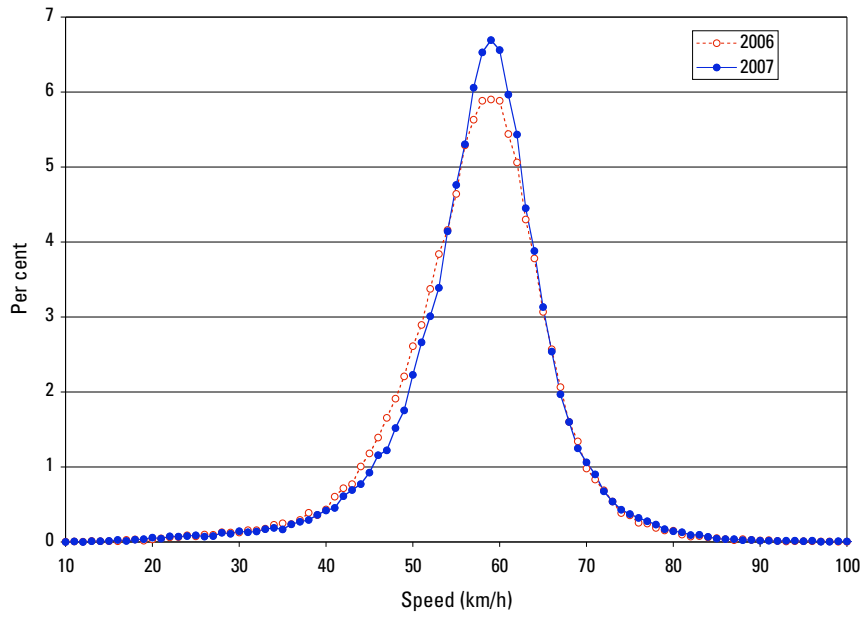


Figure 5.12  
Free speed distributions for rural arterial roads by year of survey  
(100 km/h speed limit - 6 sites)

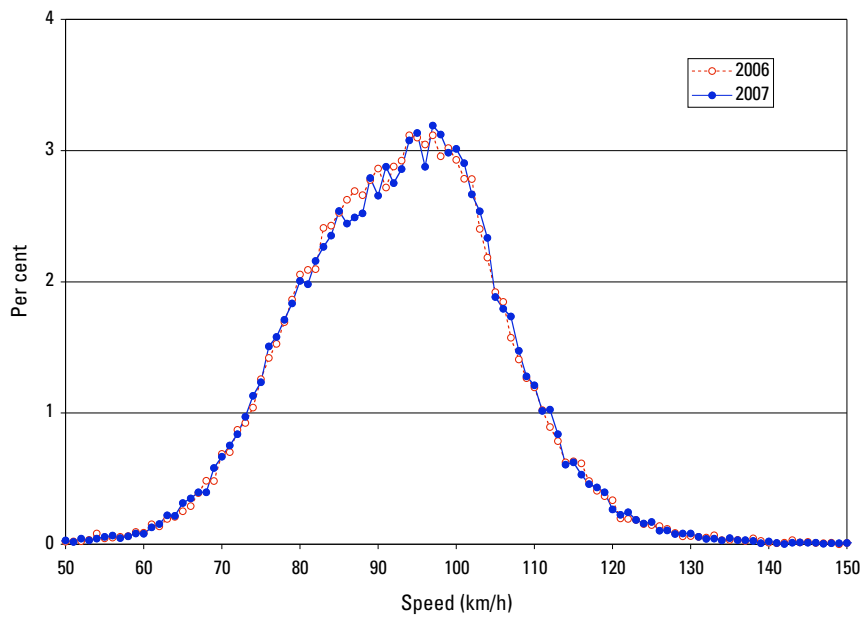


Figure 5.13  
Free speed distributions for rural arterial roads by year of survey  
(110 km/h speed limit - 6 sites)

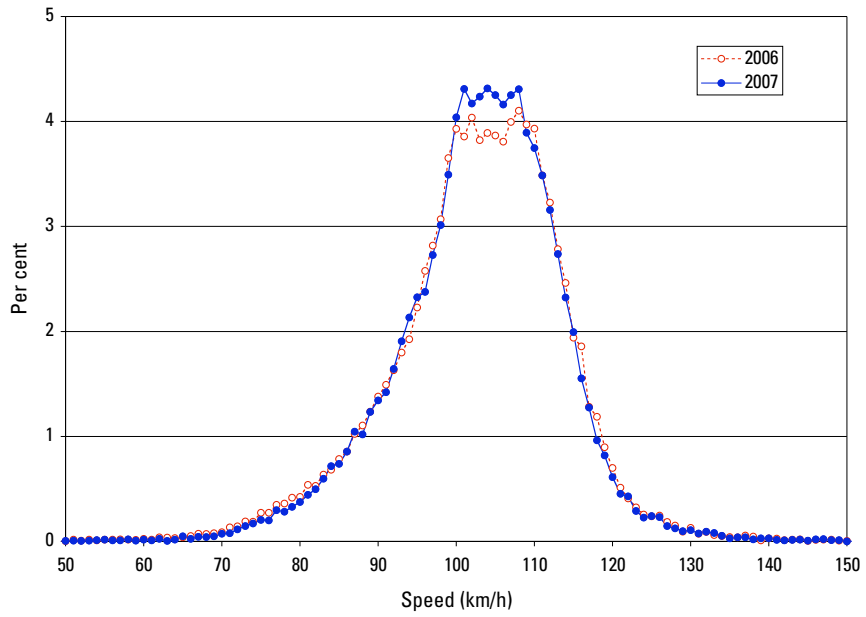
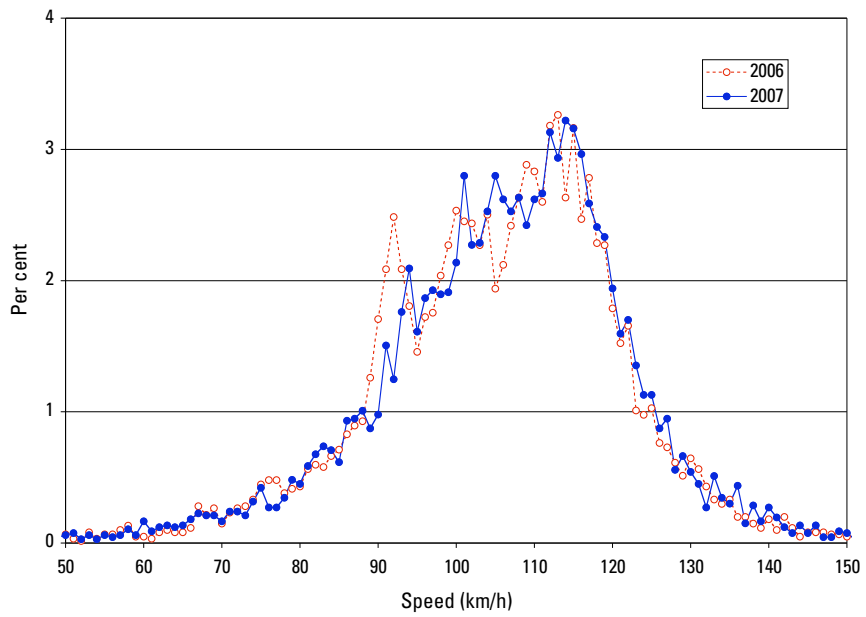


Figure 5.14  
Free speed distributions for outback arterial roads by year of survey  
(110 km/h speed limit - 3 sites)



The method explained at the end of Section 4.1 was applied to all road types to determine the average changes in traffic volume and speed measures along with the statistical significance of those results for free speed vehicles (see Table 5.12).

**Table 5.12**  
Average changes at sites in 2007 compared to 2006 by rural road type

Road type (speed limit)	Number of speed collections	Vehicle count	Mean speed	Median speed	85th percentile speed	%exceeding speed limit	%exceeding speed limit by more than 10 km/h
Rural local (50)	4	100.75	0.26	-0.40	-0.75	3.99	-4.67
Rural arterial (60)	8	219.00	0.76	0.74	0.86	3.53	0.90
Rural arterial (100)	12	134.75*	0.02	0.02	-0.33	0.39	-0.74
Rural arterial (110)	12	-1.08	0.64	0.38	0.41	0.41	0.30
Outback arterial (110)	6	101.33*	1.05	0.75	-0.12	1.75	1.07
All roads <= 60 km/h	12	179.58*	0.59	0.36	0.32	3.68	-0.96
All roads > 60 km/h	30	73.73*	0.48	0.31	0.01	0.67	0.04
All of the above roads	42	103.98*	0.51	0.32	0.10	1.53	-0.24

\* statistically significant (p < 0.05)



## 6 Discussion

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### 6.1 Baseline speed measurements

Speed measurements at 132 sites around South Australia have been collected and will form the baseline against which future surveys at the same set of sites will be compared. There were equipment malfunctions at some sites, necessitating the recollection of data at those sites early in 2008. For future surveys, the speed collection contractor should forward collected data as soon as possible for verification so that problem sites can be resampled closer to the target time period.

Rural local roads and outback arterial roads had the greatest proportion of vehicles exceeding the posted speed limit by more than 10 km/h (more than 15% of vehicles in each case).

### 6.2 Changes in speeds from 2002 to 2007 on roads in built up areas

A subset of the 2007 survey sites on Adelaide roads had single day speed surveys conducted in 2002, 2003 and 2005 as part of the evaluation of the introduction of the default 50 km/h urban speed limit. This allowed changes in speeds from 2002 to 2007 to be examined. Previous reports on this data found reductions in speeds on all the road types examined from 2002 to 2003 and further reductions from 2003 to 2005 (Kloeden, Woolley and McLean; 2004, 2006).

When examining a comparable subset of the 2007 speed data, speeds on all the examined road types increased from 2005 to 2007. Further analysis found that the increase was only statistically significant for Adelaide local roads. However, the relative consistency of the increase on different road types and the fact that the increase achieves statistical significance when all road types were combined suggest that the increase in travelling speeds observed is unlikely to be due to chance. The best estimate of the size of the change for all the examined roads is a 0.66 km/h increase in mean vehicle speeds and 0.70 km/h for mean free vehicle speeds from 2005 to 2007.

### 6.3 Changes in speeds from 2006 to 2007 on rural roads

A subset of the 2007 survey sites on rural roads had comparable speed surveys conducted in 2006 (as part of the Harwood series of surveys). This allowed changes in speeds from 2006 to 2007 to be examined on those roads.

Although there were indications of a slight increase in speeds on these roads from 2006 to 2007, further analysis found no statistically significant difference in any of the speed measures between the two years.

### 6.4 Sampling issues

There are a number of sampling issues that need to be taken into consideration when carrying these speed surveys forward.

#### Random variation

When taking repeated samples of traffic flows at a specific location, a certain variation in mean speed is to be expected even if driver speeding behaviour remains unchanged due simply to the random nature of traffic. This means that a change in mean speed at a given site from one year to the next cannot be considered as meaningful in a general context.

The solution to this problem is to sample multiple sites and conduct statistical tests on the consistency of any changes across the sites. The more sites used, the smaller the overall

change can be and still be considered as being unlikely to be due to chance alone. This is the reason for the large number of sites in the survey. It also has implications for looking at subsets of the surveyed sites: when small subsets are examined, only very large changes can be considered to be unlikely to be due to chance.

### Time of year

It is reasonable to assume that the speed distribution of vehicles changes throughout the year. Given that data is being collected for one week at each site, it is important to avoid school holidays, public holidays and other special events that could conceivably affect traffic speeds. Both August and November (the target survey months) contain no school or public holidays.

Ideally, surveys should be conducted at a specific site during the same week every year and it is important to make every effort to achieve this goal.

A detailed discussion of the advantages of permanent monitoring sites was made in Woolley (2008) and Woolley and Kloeden (2008). At the time of these surveys there were no permanent monitoring sites in the metropolitan area compared to approximately 40 in rural areas.

### Weather conditions

Large fluctuations in rainfall and temperature from one year to the next could be expected to affect vehicle volumes and speeds. It may be worth monitoring rainfall and temperature during the survey periods with a view to changing the sampling window when large year to year variations are observed although this would mean collecting additional data at sites without continuous monitoring. This may also introduce additional time of year differences so it is not an ideal solution.

### Road works

Road works can have a large affect on vehicle speeds. For this reason site measurements are delayed if road works are in progress at a given site. An attempt should be made to avoid scheduling road works at the survey sites during the survey times.

### Traffic incidents

Short term disruptions to traffic (ie road crashes, short term road work, broken down vehicles, nearby events with large crowds) can affect the resultant speed distributions. The collection of data for a full week will minimise the effect of these disruptions on the overall speed distribution but the effect could still be a significant one. It may be worthwhile comparing vehicle counts and speeds during the week for each site between surveys and eliminating or controlling for obvious large changes in traffic patterns or speeds.

### Changes to roads

It is possible that the physical layout of a survey site may change or that surrounding changes to roads and lighting sequences may affect the traffic patterns at the survey site. This needs to be monitored both by physically checking the sites each year and examining the traffic flow and speed distributions for unexpected changes.

### Enforcement practices

Enforcement practices can affect the speeds of vehicles on a given section of road. If sites identified as having a high proportion of speeding vehicles in this study are targeted by police because of this, then the sites in this study will no longer be representative of roads in general. It is for this reason that details of the actual location of sites is not presented in

this report. An alternate approach would be to obtain the cooperation of the police in avoiding enforcement at or near the survey locations during the survey periods.

### Calibration of equipment

The anemometer tubes used to collect data should be placed one metre apart. If this distance is out by one centimetre the error in speed at 60 km/h will be 0.6 km/h which is around the size of the effects that are to be expected. It is therefore important that the equipment is checked and calibrated after it is installed.

## 6.5 Further analysis

This report examines the overall speed and free speed distributions of traffic at the surveyed locations. However, the datasets collected contain much more data than this. Examination of the hour of day and day of week traffic volume and speed data would be valuable. Vehicles are also identified in the data by class and so travelling speeds by vehicle type could be explored along with a more detailed analysis of vehicle gaps. The effects of seasonal variation can also be explored at sites where continuous speed data has been collected.

## Acknowledgements

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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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## Appendix A - Site locations

Tables A.1 - A.13 give the locations of the sites measured in the 2007 survey grouped by the road type. The locations with survey years 2002, 2003 and 2005 were also surveyed for a one day period in those years as part of the evaluation of the introduction of the default 50 km/h urban speed limit. The locations with a survey year of 2006 had a one week period surveyed in that year as part of the Harwood series of survey (note that annual surveys were conducted at the Hardwood sites back to 2000 but that data is not analysed here).

**Table A.1**  
**Adelaide local roads (50 km/h speed limit)**

Road ID	Suburb	Survey years
LM01	Rosewater	2002, 2003, 2005, 2007
LM02	Beverley	2002, 2003, 2005, 2007
LM03	Maylands	2002, 2003, 2005, 2007
LM04	Campbelltown	2002, 2003, 2005, 2007
LM05	Seacliff Park	2002, 2003, 2005, 2007
LM06	Kilburn	2002, 2003, 2005, 2007
LM07	Smithfield Plains	2002, 2003, 2005, 2007
LM08	Salisbury East	2002, 2003, 2005, 2007
LM09	Glenelg North	2002, 2003, 2005, 2007
LM10	Broadview	2002, 2003, 2005, 2007
LM11	Marleston	2002, 2003, 2005, 2007
LM12	Paralowie	2002, 2003, 2005, 2007
LM13	Salisbury East	2002, 2003, 2005, 2007
LM14	Glenelg South	2002, 2003, 2005, 2007
LM15	Beverley	2002, 2003, 2005, 2007
LM16	Adelaide	2002, 2003, 2005, 2007
LM17	North Adelaide	2002, 2003, 2005, 2007
LM18	Payneham South	2002, 2003, 2005, 2007

**Table A.2**  
**Adelaide collector roads (50 km/h speed limit)**

Road ID	Suburb	Survey years
CM01	Netherby	2002, 2003, 2005, 2007
CM02	West Beach	2002, 2003, 2005, 2007
CM03	Noarlunga Downs	2002, 2003, 2005, 2007
CM04	Stirling	2002, 2003, 2005, 2007
CM05	Largs Bay	2002, 2003, 2005, 2007
CM06	Hallett Cove	2002, 2003, 2005, 2007
CM07	Hackham	2002, 2003, 2005, 2007
CM08	Kidman Park	2002, 2003, 2005, 2007
CM09	Norwood	2002, 2003, 2005, 2007
CM10	St Peters	2002, 2003, 2005, 2007
CM11	Novar Gardens	2002, 2003, 2005, 2007

**Table A.3**  
Adelaide arterial two way roads with no median (60 km/h speed limit)

Road ID	Suburb	Survey years
AA01	Happy Valley	2002, 2003, 2005, 2007
AA02	Clapham	2002, 2003, 2005, 2007
AA03	Kent Town	2002, 2003, 2005, 2007
AA04	Findon	2007
AA05	Pennington	2007
AA06	Flinders Park	2007

**Table A.4**  
Adelaide arterial two way roads with a median (60 km/h speed limit)

Road ID	Suburb	Survey years
AB01	Blair Athol	2002, 2003, 2005, 2007
AB02	Newton	2007
AB03	St Peters	2007
AB04	Tranmere	2007
AB05	Keswick	2007
AB06	Ethelton	2007

**Table A.5**  
Adelaide arterial multi-lane roads with no median (60 km/h speed limit)

Road ID	Suburb	Survey years
AC01	Cumberland Park	2002, 2003, 2005, 2007
AC02	Burnside	2002, 2003, 2005, 2007
AC03	Warradale	2007
AC04	Fullarton	2007
AC05	Evandale	2007
AC06	Ridleyton	2007

**Table A.6**  
Adelaide arterial multi-lane roads with a median (60 km/h speed limit)

Road ID	Suburb	Survey years
AD01	Fullham Gardens	2002, 2003, 2005, 2007
AD02	Newton	2002, 2003, 2005, 2007
AD03	Manningham	2002, 2003, 2005, 2007
AD04	Brooklyn Park	2002, 2003, 2005, 2007
AD05	Salisbury Downs	2007
AD06	Hectorville	2007
AD07	Clarence Gardens	2007
AD08	Warradale	2007
AD09	Para Hills	2007

**Table A.7**  
Adelaide arterial roads (80 km/h speed limit)

Road ID	Suburb	Survey years
AM01	Salisbury Park	2007
AM02	West Beach	2007
AM03	Morphett Vale	2007
AM04	Gilles Plains	2007
AM05	Modbury North	2007
AM06	O'Halloran Hill	2007

**Table A.8**  
**Rural local roads (50 km/h speed limit)**

Road ID	Suburb	Survey years
LR01	Mount Gambier	2002, 2003, 2005, 2007
LR02	Mount Gambier	2002, 2003, 2005, 2007
LR03	Millicent	2002, 2003, 2005, 2007
LR04	Naracoorte	2002, 2003, 2005, 2007
LR05	Berri	2002, 2003, 2005, 2007
LR06	Berri	2002, 2003, 2005, 2007
LR07	Renmark	2002, 2003, 2005, 2007
LR08	Barmera	2002, 2003, 2005, 2007
LR09	Port Augusta	2002, 2003, 2005, 2007
LR10	Port Augusta	2002, 2003, 2005, 2007
LR11	Crystal Brook	2002, 2003, 2005, 2007
LR12	Walleroo	2002, 2003, 2005, 2007
LR13	Freeling	2006, 2007
LR14	Nuriootpa	2006, 2007

**Table A.9**  
**Rural arterial roads (60 km/h speed limit)**

Road ID	Suburb	Survey years
CR01	Clare	2006, 2007
CR02	Port Lincoln	2006, 2007
CR03	Naracoorte	2006, 2007
CR04	Waikerie	2006, 2007

**Table A.10**  
**Rural hills arterial roads (80 km/h speed limit)**

Road ID	Survey years
AH01	2007
AH02	2007
AH03	2007
AH04	2007

**Table A.11**  
**Rural arterial roads (100 km/h speed limit)**

Road ID	Survey years
AR01	2006, 2007
AR02	2006, 2007
AR03	2006, 2007
AR04	2006, 2007
AR05	2006, 2007
AR06	2006, 2007
AR07	2007
AR08	2007
AR09	2007
AR10	2007



Table A.12  
Rural arterial roads (110 km/h speed limit)

Road ID	Survey years
HR01	2006, 2007
HR02	2006, 2007
HR03	2006, 2007
HR04	2006, 2007
HR05	2006, 2007
HR06	2006, 2007
HR07	2007
HR08	2007
HR09	2007
HR10	2007
HR11	2007
HR12	2007
HR13	2007
HR14	2007
HR15	2007
HR16	2007
HR17	2007
HR18	2007
HR19	2007
HR20	2007
HR21	2007
HR22	2007
HR23	2007
HR24	2007
HR25	2007
HR26	2007
HR27	2007
HR28	2007
HR29	2007
HR30	2007
HR31	2007
HR32	2007
HR33	2007
HR34	2007
HR35	2007

Table A.13  
Outback arterial roads (110 km/h speed limit)

Road ID	Survey years
BR01	2006, 2007
BR02	2006, 2007
BR03	2006, 2007