

# **Further insights into an urban area with lower speed limits: the Unley Case Study**

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**Biography:** Jeremy Woolley has been working in the field of road safety since 1997. He has spent most of this time as Research Fellow with the Transport Systems Centre at the University of South Australia and more recently as a Senior Research Fellow at the former Road Accident Research Unit at the University of Adelaide. Jeremy's interests include, red light running, younger and older drivers and campaign evaluations. In particular, Jeremy has focussed on issues surrounding speeding and lower speed limits.

## **ABSTRACT**

Previous papers by the authors have documented experiences in the City of Unley in relation to a citywide 40 km/h speed limit. The ongoing research, now in its 12th year, has done much to reveal how residents and motorists respond to a low urban speed limit. This paper documents further findings in relation to enforcement and crash outcomes as separate issues and some discussion is made on the possible impacts of the new 50 km/h General Urban Speed Limit (GUSL). A trial with enforcement on 40 km/h local roads was conducted to determine halo effects in combination with traffic monitoring equipment. Laser gun enforcement was shown to be most effective with an effect lasting up to 10 days from the time of deployment. Speed feedback signs (at enforcement sites) were shown to have no halo effect and lost effectiveness with continued deployment at the same site. In reviewing crash data from before and after the implementation of the 40 km/h scheme, it is concluded that the 40 km/h speed limit has been responsible for a reduction in crashes on local roads given the 60 km/h GUSL operating elsewhere (now 50 km/h).

## **1 INTRODUCTION**

The City of Unley, in inner metropolitan Adelaide, has had a long relationship with Local Area Traffic Management (LATM) dating back to the early seventies. During this time many flavours of traffic calming have been implemented including the commonly adopted mix of road closures, roundabouts, threshold treatments and speed humps. In 1991, a 40 km/h speed limit trial in a small area of the jurisdiction proved that the concept was feasible (LASL 1993). In 1999 the Council committed to a citywide 40 km/h speed limit on all local roads (ie not collector roads) in an attempt to improve the amenity and safety of their local roads. At that time, the general urban speed limit was 60 km/h throughout South Australia. Figure 1 shows a map of the roads in the Unley jurisdiction covering an approximate area of 15km<sup>2</sup>.

The authors have previously reported the benefits of this 40 km/h scheme in terms of speeds, volumes, community support, travel times and environmental impact in significant detail (for example see Woolley et al 2000 and 2002). The scheme was shown to be successful in terms of:

- reducing speeds of vehicles and reducing the variation in speeds of vehicles
- reducing volumes on local roads
- improving amenity on local roads
- maintaining community support

In addition, these previous studies revealed that there were no detrimental effects on collector roads in terms of volumes or speeds as a result of local roads having a 40 km/h speed limit. Computer traffic modelling of the road network demonstrated that the extra travel time and delays imposed by the lower speed limit were small.

However, the earlier studies were unable to draw firm conclusions on enforcement or net road safety outcomes in terms of crashes. This paper describes two separate projects (Dyson and Woolley 2003a and 2003b) which attempted to quantify benefits that can be received from regular enforcement on local roads and overall crash outcomes as a result of the adoption of the citywide 40 km/h speed limit.

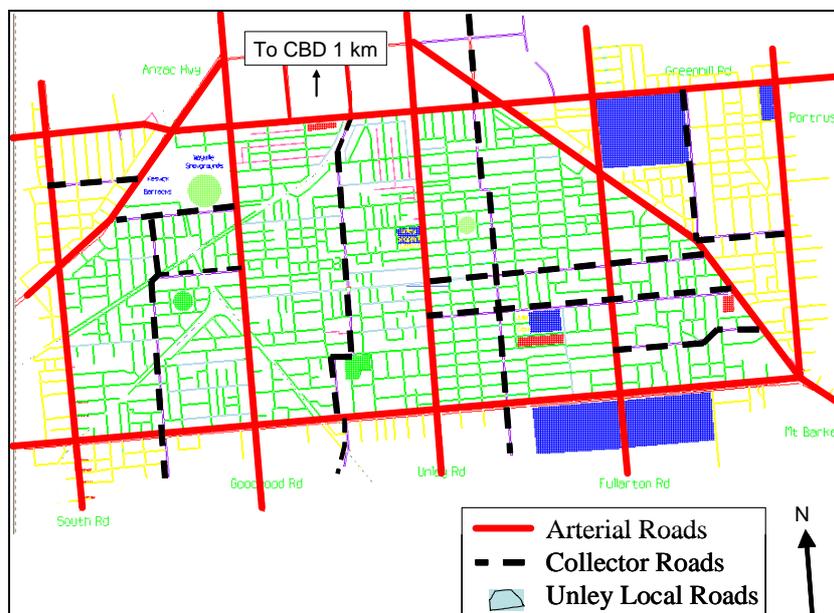


Figure 1 - The City of Unley road Hierarchy

## 2 ENFORCEMENT STUDY

### 2.1 Introduction

The enforcement study over April to June 2002 aimed to evaluate the effectiveness of enforcement on 40 km/h local streets conducted by the SA Police and to take advantage of feedback from a voluntary mailback questionnaire on enforcement that the Council was conducting in March 2002.

The potential that enforcement had for lowering speeds on lower volume 40 km/h streets and the duration of any halo effects were largely unknown. It was envisaged that the outcomes of the study would assist the Unley Road Safety Committee (URSC) and the SA Police derive an efficient strategy for enforcement on residential streets in the City of Unley.

### 2.2 Study Design

#### 2.2.1 Enforcement

The enforcement program was conducted by SA Police based on a flexible schedule negotiated between the Police and the researchers. Enforcement, although meant to encapsulate both speed camera and laser gun operation, was limited almost solely to laser gun operation by motorcycle police. Infringement notices and cautions given to motorists, who were pulled over, were studied. Enforcement was conducted at nine different sites within the City of Unley and traffic data for the enforced street were collected continuously during the study using traffic counter/classifiers. The sites were selected on the basis that they could be safely enforced and traffic volume was high enough to ensure some enforcement activity. Due to limited police resources, a priority system was developed and morning enforcement (8 am to 9 am) and evening enforcement (9 pm to 6 pm) were given highest priority. These times corresponded to known problems on problematic streets with high vehicle speeds in Unley.

Two phases of enforcement were employed: the first consisted of intense enforcement (as intense as SA Police resources would allow) that was regular and designed to have maximum impact. The second consisted of random enforcement and deployment of the Council's Speed Observation Sign (SOS) which provided feedback to motorists of their travelling speed via an electronic sign. Figures 2 and 3 show the designed and actual enforcement schedules for the study.

Street	Week beginning 08 April					Week beginning 15 April					Week beginning 22 April					Week beginning 29 April					Week beginning 06 May					Week beginning 13 May					Week beginning 20 May														
	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F										
Wood Grove	a	a	a	0	a	am	0	0	0	0																a	a	a	0	0	0	a	0	0	p										
Frederick Edmund	a	0	0	0	0																0	a	0	0	0	ap	a	0	0	0															
Northgate Aroha	a	am	0	0	0	0	0	p	p	0	a	0	0	0	0	0	0	p	0	0	a	0	a	0	0																				
Urrbrae Joslin	0	p	0	a	a	am	0	p	0	0																																			
Arthur	0	0	am	n	am																																								

0 = laser gun enforcement could have been deployed, but was not  
 a = morning enforcement (8-9am)  
 p = evening enforcement (4-6pm)  
 m = middle of the day enforcement (10am-3pm)  
 = public holiday

**Figure 2 - Laser Gun deployment (to achieve maximum intensity)**

Street	Week beginning 03 June					Week beginning 10 June					Week beginning 17 June					Week beginning 24 June				
	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F	M	Tu	W	Th	F
Wood Grove	pla*	a	la*	a																
Frederick Edmund												d					p	a		
Campbell Florence												p						a		
Northgate Aroha									la*										a	
Urrbrae Joslin												p	a	a						
Arthur						m	m		m		m	m								m

la\* = laser gun used in morning rush hour  
 d = all day (08:00 to 18:00)  
 a = morning enforcement (8-9am)  
 p = evening enforcement (4-6pm)  
 m = middle of the day enforcement (10am-3pm)  
 Study ended on 12 July (no laser/SOS between 26 June and 15 July).  
 Routine enforcement resumed on 15 July.  
 = public holiday

**Figure 3 - Speed Observation Sign in combination with random laser gun enforcement**

### 2.2.2 Mailback Survey

A voluntary mailback survey consisting of 13 questions was conducted to gauge community opinion and attitudes towards enforcement. The questionnaire was distributed in the form of an information brochure to all mail boxes in the Unley area. Useful insights were obtained on general attitudes towards traffic enforcement in Unley despite an element of bias in the responses due to the voluntary nature of the survey design.

## 2.3 Outcomes of the Study

### 2.3.1 Mailback Survey

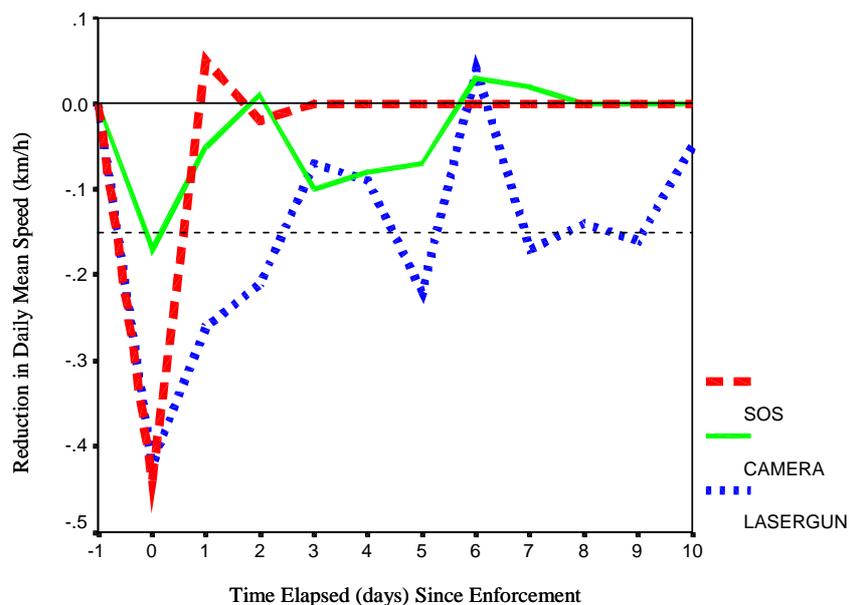
The outcomes of the survey matched previous patterns of responses obtained from telephone surveys of random samples of Unley residents: support for the City-wide 40 km/h scheme is between 60 per cent and 70 per cent. As choosing to respond in this survey was voluntary, it might be expected that a greater proportion of those with more firmly held views would participate. By combining degrees of agreement/disagreement, such influences were minimised.

Limitations of the scheme were assessed via an open ended question regarding trouble spots which all residents were invited to answer in relation to excessive and unsafe speeds. It is thought that many residents mentioned their own street, however, many respondents also listed streets that were spatially well separated from their own streets.

### 2.3.2 Enforcement Study

Data files of continuous traffic monitoring per direction per site were formed. Aggregated data from these files were collated in a summary file that consisted of the daily mean speed and whether a device was operated that day at that site. The file was reduced to working days as driver and traffic characteristics were thought to be quite different on weekend. In order to determine time halo effects, the relationship between enforcement and daily speed data was compared for each site until the effect disappeared (up to two weeks following the enforcement activity). Coefficients were generated in a multiple regression of daily per site mean speed on linear time and device use, direct and lagged, removing site effects and weighted according to vehicles per site per day.

These coefficients were then divided by the overall average length of a session (hours) for that type of equipment, to standardise, very crudely, the effect on daily mean speed of a one hour enforcement (laser, camera) or display (SOS) session. The result is shown in Figure 4. The horizontal axis shows the number of days following the event occurring on day zero (time elapsed= 0 days). The dashed line at -0.15 km/h indicates approximately the 95 per cent significance threshold, that is, values below the line are significantly different from zero.



**Figure 4 - Estimated reduction in daily mean speed (km/h) for one hour of enforcement**

Speed enforcement on streets with a 40 km/h limit had an immediate impact on speeds, though the effect was not very large. This effect was more notable with laser than with camera enforcement, though there is presumed to be an additional delayed effect from camera enforcement on the drivers receiving a General Expiation Notice (GEN). There was a significant halo effect from laser gun enforcement, up to 10 days after

the event. It appears that laser enforcement is more efficient than camera enforcement by a factor of four if the overall deferred effect of GENs is disregarded. It is likely that the results for camera enforcement in Figure 4 represent the effect on motorists who notice that enforcement is taking place. However, the limited amount of camera enforcement and data associated with that enforcement did not allow further effects to be explored in more detail.

The study suggests that efficient enforcement on busier 40 km/h streets would consist of at least one hour of laser gun operation at the same site every two weeks, preferably on different days and during peak periods. A single hour of laser gun enforcement can have lasting effects of at least ten days.

It is estimated that the deployment of the SOS device is of comparable efficiency, in terms of personnel inputs, with laser gun enforcement and there is presumed to be much less resulting antagonism than with enforcement. Another advantage of SOS deployment over laser gun enforcement is that the Council manages the sign, and can therefore respond to perceived need without having to defer to another authority.

Repeated exposure of the SOS sign did not result in a halo effect. It was deployed more than once in six streets, at intervals of only a couple of days. In one case the sign was deployed on six occasions on the same street. A rather insecure estimate is that the impact of the SOS (reduction in mean speed) reduces by about 15 per cent with each use at the same site if only short time intervals between successive deployments are used. Therefore the SOS should be used sparingly at particular sites. If the site presents a chronic problem, it is suggested that a different (physical) remedy be employed. A comparison of the enforcement techniques is shown in the table below.

**Table 1 - Comparison of enforcement techniques**

<b>Approach</b>	<b>Cumulative reduction in daily mean speed for 1 hour of activity</b>	<b>Halo Effect</b>	<b>Comments</b>
Speed Camera	<b>0.41 km/h</b>	Unable to quantify – possibly 2 days from those seeing the activity	Motorist receives fine in the mail – consequent effect on speed unknown
Laser Gun	<b>1.75 km/h</b>	Evidence of effect up to 9 days after the activity	Motorist pulled over
Speed Observation Sign	<b>0.41 km/h</b>	Loses 15% effectiveness with each use – Limited halo effect	Obvious to all motorists in a given direction

### **3 CRASH STUDY**

#### **3.1 Introduction**

Amongst the many benefits that a lower speed limit could offer, a reduction in numbers and severity of crashes involving vehicles was frequently used as the most important justification for the introduction of the 40 km/h scheme. This paper estimates the reduction in numbers of crashes of varying degrees of severity in the Unley area since the introduction of the 40 km/h scheme.

#### **3.2 Study Design**

Crash data from the South Australian Traffic Accident Reporting System (TARS) for the period 1990 to 2001, and provisionally for serious injury crashes from 1990 to 2002, were collated for the whole Adelaide metropolitan area and specifically within the Unley Local Government Area. Crashes were categorised by the type of road on which they occurred, as defined by function and speed limit, and the maximum severity of injury sustained. Annual numbers of categorised crashes in Unley, both absolute and relative to the whole Adelaide metropolitan area, were analysed to test whether, and to what extent, the 40 km/h scheme had reduced road trauma.

#### **3.3 Outcomes of the Study**

The 40 km/h scheme has resulted in markedly reduced *total* crash numbers, by around 17%, *in absolute terms* on roads with a reduced limit. A small part of this reduction may be attributed to a small decline in traffic volumes. Since 1998, traffic volumes have, by and large, increased overall in metropolitan Adelaide, but they have declined by around 5 per cent on 40 km/h roads in Unley.

However, when all roads within the Unley boundaries are taken into account, total crash numbers, dominated by numbers on non-council arterial roads, are relatively static. In contrast, corresponding crashes for the Adelaide metropolitan area have risen by over 5 per cent, coincident with increases in overall traffic volumes. It is possible that other factors have contributed to this outcome but there is no clear indication what they might be.

The 40 km/h scheme is associated with a reduction in crashes leading to *injury*, overall, on all the Unley-administered roads (local and collector roads) by approximately 20 per cent *when compared with numbers of injury crashes numbers on non-council arterial roads in the area*. However, minor injury crash numbers have risen considerably in the period 1999-2001. It is thought that this apparent increase can be attributed to drivers increasingly choosing to take pre-emptive action against possible litigation. The tendency to do this appears to vary with location, even within Unley.

Whilst numbers of *serious injury* crashes across the Adelaide metropolitan area are relatively static, those occurring within the Unley boundary (including arterial roads) have fallen since 1999, by approximately 15 per cent.

Each of these measures tells a similar story. They are certainly not independent but they do explore different facets of the road trauma scenario. Across all severity levels, road trauma in Unley from 1999 into 2002 was between 15 and 20 per cent lower than it is projected to have been in the absence of the 40 km/h scheme.

Given the recent change (March 2003) to a 50 km/h General Urban Speed Limit in Adelaide (GUSL), it is appropriate to discuss likely outcomes should Unley have initially adopted a 50 km/h limit instead of a 40 km/h limit. If this were the case, it seems very doubtful that a matching outcome would have been found. It is theorised that there would have been more crashes if a 50 km/h limit had been applied in the place of the 40 km/h limit, in 1999. This claim is based on the assertion that vehicle speeds would have been higher in many situations and the traffic calming effect of the 40 km/h limit less effective. This is thought to be particularly so on the longer, wider streets commonly used for "rat running" in peak hour. It should be noted that the earlier studies also showed that the 40 km/h limit was effective in reducing traffic volumes on local roads slightly (in the context of a 60 km/h GUSL) and provided Unley with a strong identity as a special traffic area distinct from other areas. It is likely that all these benefits will be lost if Unley reverted to the 50 km/h GUSL

## 4 CONCLUSIONS

This paper outlines the findings from two separate studies conducted on the City of Unley 40 km/h scheme in Adelaide. An enforcement study has shown that enforcement on local roads can deliver benefits in terms of speed reductions and time halo effects. Overt laser speed gun enforcement was found to be the most effective method and achieved a peak reduction of 1.75 km/h in mean speeds with a corresponding halo effect up to ten days after the enforcement. Speed camera operations were shown to have some effect but experimental limitations ruled out any firm findings in relation to this method. A council Speed Observation Sign which provided speed feedback to motorists was found to be effective whilst deployed but had diminishing effect with each exposure at the same site and had no halo effect. The study suggests that efficient enforcement of 40 km/h streets should consist of an hour of laser gun activity every two weeks.

An analysis of crash data has revealed that the 40 km/h scheme in Unley has been responsible for a reduction in total crash numbers of 17% in absolute terms on roads whose speed limit had been reduced to 40 km/h. Serious injury crashes on Unley roads have decreased, coincident with the 40 km/h scheme. Across all severity levels, road trauma in Unley from 1999 into 2002 was between 15 and 20 per cent lower than it is projected to have been in the absence of the 40 km/h scheme. It is concluded on the basis of reductions in traffic speeds that the reduction in crashes in Unley are far greater than they would have been if a 50 km/h limit was adopted instead of the 40km/h limit in 1999. It is also likely that further amenity from traffic claming would also deteriorate.

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## **KEYWORDS**

speed limit, evaluation, enforcement, Local Area Traffic Management, crash reductions, General Urban Speed Limit