Cyclists and red lights – a study of behaviour of commuter cyclists in Melbourne

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Abstract

The primary aim of this research was to investigate the behaviours of cyclists and their interactions with vehicles at signalised intersections. The findings presented are from a three week observational study of Melbourne commuter traffic. An unobtrusive video camera was used at two intersections to observe all road users during morning in-bound and afternoon out-bound peak hour traffic, 5,420 cyclists were observed.

A minority of cyclists who faced a red light rode through the intersection, including 3% of morning cyclists and 11% of afternoon cyclists. An in-depth analysis of the afternoon cyclists identified three distinct types of behaviours: (i) the 'racers' who approached an amber light, accelerated but entered the intersection on the red signal; (ii) the 'impatients' who stopped and waited, then rode through the still red-signalised intersection; and (iii) the 'runners' who rode through the red-signalised intersection without stopping. The results focus on the three types of behaviour at red lights. Males were more likely to continue through the red light than females and the majority of males who rode through red lights were 'runners'. The findings are important as they differentiate between the types of red light running behaviour and highlight factors influencing cyclists' risk exposure. The study is part of a larger research project investigating cyclist-driver interactions. Outcomes will contribute to the development of targeted countermeasure strategies for cycle safety.

Keywords

Cyclist, red light running, bicycle safety, signalised intersections

Introduction

In Australia, the number of people riding for active transport, sport and recreation is increasing and cycling is the fourth most popular form of physical activity of people aged over 15 years (Department of Communications Information Technology and the Arts, 2006). However, as the popularity of cycling increases, cycling safety concerns are also likely to grow.

Cyclists are not a homogenous group and this research focuses on commuter cyclists riding during peak morning and evening traffic. On-road commuter cyclists are a sub-group of riders who interact frequently with drivers and there is some evidence that the behaviours of commuter cyclists and the attitudes of other road users towards them contribute substantially to on-road cyclist safety (Basford et al., 2002; Davies et al., 1997). Of particular concern are cyclists who ride on the road, as cyclists involved in collisions with vehicles have the poorest survival rate (Bostrom and Nilsson, 2001) Moreover, commuter cyclists shift the focus of riding a bicycle away from a leisure or play activity to a form of transport (Cox, 2005).

Crash statistics

National data

The road toll for all road users in Australia is decreasing (Australian Transport Safety Bureau, 2006; Australian Transport Safety Bureau, 2004). From 1982 to 2006, cycling fatalities represented 2-4% of the total road toll, the number of cyclist fatalities for this period is displayed in Figure 1 below. While this represents a small percentage of all road deaths, it is expected that with the increase in cycling popularity, there is potential for an increase in the number of collisions resulting in fatalities and serious injuries unless appropriate countermeasures are implemented.

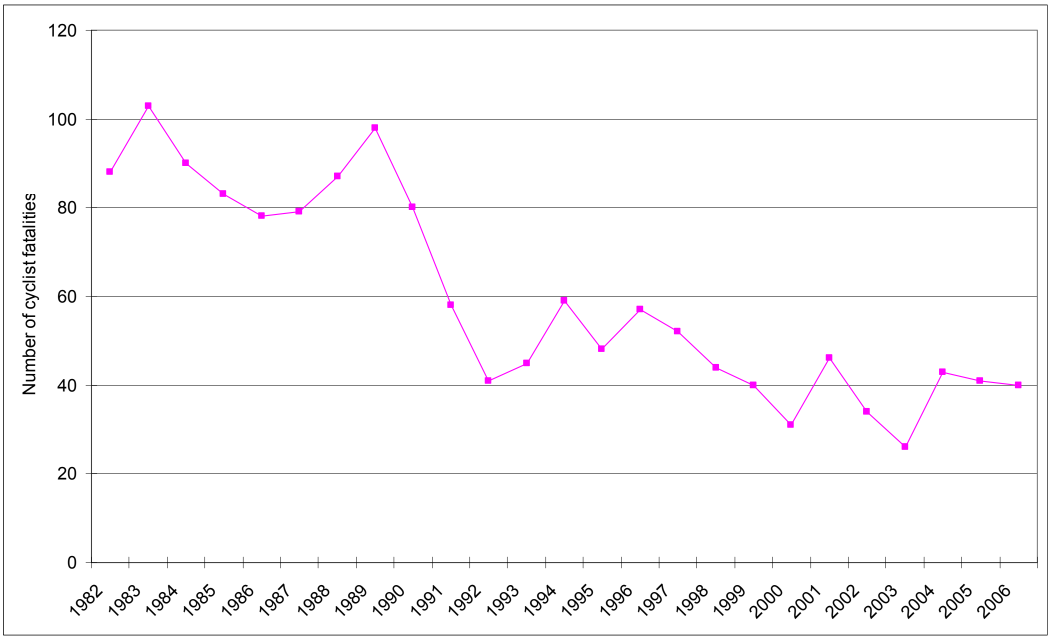


Figure 1 Australian cyclist fatalities 1982-2006

Source: Australian Transport Safety Bureau, Road deaths Australia 2006 Statistical Summary

In the period from 1982 to 1990 there was on average 90 cyclist deaths per year. There was a marked decrease in the number of fatalities from 1990 to 1992 and this period coincided with the introduction of bicycle helmet legislation in Australia (Cameron et al, 1994).

From 1992 to 2000 there were approximately 45 cyclist fatalities per year and this has decreased slightly from 2000 to 2006 with an annual average of 38 deaths per year. According to the national cyclist fatality statistics, males are over-represented (86%), the majority of cyclist fatalities are aged 18 years and over (60%) (Australian Transport Safety Bureau, 2007) and the majority of fatal collisions (86%) involved a vehicle (86%) in a speed zone of 60km/h or less (Australian Transport Safety Bureau, 2006).

Cyclists are a small proportion of the total road toll however the proportion of cyclists who are seriously injured is considerably higher. In the three years from July 1999 to June 2002, 11 per cent of the total number of people seriously injured on the roads were cyclists (Australian Transport Safety Bureau, 2004). A recent report from Victoria Police report stated that *nonfatal* cycling collisions are grossly under reported and conservatively estimate that only 1 in 30 collisions is reported (Harman, 2007). Serious injury data for Australia shows similar patterns of involvement as fatality data described above. That is, more males than female cyclists and more adults than children sustain serious injuries in a cyclist crash. (Australian Transport Safety Bureau, 2004).

Victorian data

An analysis of the VicRoads CrashStats database for crashes involving cyclists in Victoria between 1 January 1990 and 31 December 2006 (VicRoads, 2000) found that there were 196 fatalities, 6,293 serious injuries and 14,783 other injuries in this period. The Victorian data show a similar pattern to the national data for both fatalities and serious injuries, the majority of collisions involved male cyclists (79%), adults aged over 18 years (63%) and a vehicle was involved in the majority of all collisions (fatalities: 91%, serious injuries: 85%, other injuries: 89%). Consistent with national figures, the majority (89%) of all collisions occurred in speed zones of 70km/h or less. More collisions occurred at an intersection (58%) and in metropolitan Melbourne (73%).

It is important to note that the crash data reported here are not adjusted for exposure. There is a paucity of information on the volume of cyclists and when, where and how frequently they ride. This data is critical for a more complete interpretation of the crash statistics. For example, the high proportion of males involved in collisions *may* reflect the greater numbers of males (64%) cycling than females (36%) (Department of Communications Information Technology and the Arts, 2006). The figures may also reflect different propensity for risk taking behaviour of males and females (Garrard et al., 2006). Accurate exposure data is essential to advance our understanding of the relative risk status of different groups of cyclists (e.g., age group and gender) and different road and traffic situations.

Notwithstanding the limitations of the current crash data, it is clear that the greatest number of cyclist collisions resulting in serious injury or death involve adult males, on urban roads in low speed zones and at intersections. Several studies have highlighted high-risk behaviours of cyclists at intersections (O'Connor & Brown, 2007; Daff & Barton, 2005). 'Red light running' rates for Melbourne cyclists have been reported at around 9%. However, little is known about the types of cyclist (and driver) behaviours that predispose them to risk of crashes and the characteristics of cyclists (e.g., age and gender) who engage in high risk behaviours such as red light running. The focus of the current study was to better understand the behaviour of adult cyclists at urban intersections using covert video observation techniques.

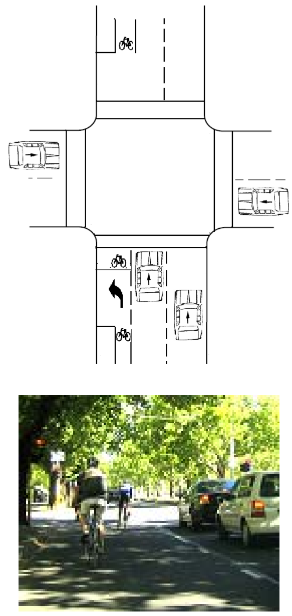
Methods

A pilot study was conducted at several sites along Melbourne's most used cycling commuter route. The objective of the pilot study was to identify observation sites with a high volume and number of interactions between cyclists and drivers. Two intersections were selected for the first of a series of observational studies which was conducted over three weeks in March 2008.[1] The observations were conducted during peak hour commuter traffic periods, from 7am to 10am and from 4pm to 7pm.

The study intersections, one in-bound and one out-bound had the same road geometry with two lanes of vehicular traffic travelling in the same direction, a carside bike lane (to the right of parked vehicles) that discontinued on approach to the intersection, a bike storage box in front of a left turning lane and a through cross road (see Figure 2).

Figure 2 Cross intersections

Road geometry of observational sites.



A video camera was used to observe the behaviour of road users. The camera was positioned using a technique developed by Archer (Archer, 2008), the camera was placed inside a box which was attached to a sign pole on the side of the road. In this position the camera was not visible to participants and as far as could be ascertained, participants were unaware they were being observed.

The study was approved by the Monash University Standing Committee on Ethics in Research involving Humans (SCERH).

Results

A total of 36 hours of video recordings, 18 hours per site, were conducted and 5,420 cyclists were observed, the majority of whom were male (79%). In total, 7 per cent of all cyclists who faced a red light phase, rode through the red light. Red light infringements were more common in the afternoon (11%) compared to the morning (3%). These figures include those cyclists who approached the intersection on amber and entered the intersection against a red light. The focus of the analyses presented here is on the afternoon cyclists who rode through a red light (see Table 1).

The majority of afternoon cyclists who faced a red light stopped (89%). In total, 93 cyclists rode through the intersection against a red signal. Eighty (86%) of these red light runners were males. Results of a two-sample t-test revealed significant differences between the proportions of male and female red light 'runners', $t(874)= 2.504$, $p=.0125$.

Further analysis of the intersection observations revealed three distinct categories of cyclists who rode through the red light in different ways. The first group are referred to here as 'racers'. These cyclists approached the intersection when the signal was amber, accelerated towards the intersection and entered the intersection just after the light changed to red. The second type, referred to as 'impatients', stopped at a red signal, waited for a period of time, and then rode through the intersection while the signal was still red. The third type, referred to as

[1] Note that it is intended that other sites will be selected for two further observation periods scheduled for the summer months of 2008-09 and 2009-2010.

'runners', approached a red signal, however they did not stop and continued through the intersection while the signal was still red. The majority of the cyclists who rode through the red light were 'runners' (42%), one-third were 'impatients' and one quarter were 'racers'.

Table 1 Cyclists who rode through a red signalised intersection (afternoon)

		Males	Female	Total
Total cyclists		658 (75%)	218 (25%)	876
Faced red light	Stopped	578 (88%)	205 (94%)	783 (89%)
	Rode through	80 (12%)	13 (6%)	93 (11%)
Type of red light behaviour	Racer	20 (25%)	3 (24%)	23 (25%)
	Impatient	26 (32%)	5 (38%)	31 (33%)
	Runner	34 (43%)	5 (38%)	39 (42%)

The majority of the 'runners' continued straight through the intersection (n=29; 74%), arguably exposing themselves to a high level of risk, as their course intersected with the cross vehicle traffic. Intersection ride-through times for these cyclists ranged from 7 to 24 seconds (Mean: 14.6 s, SD: 3.9 s). The amount of time taken to cross the intersection was related to the presence of cross vehicles; the more cross traffic, the longer the 'runner's' ride-through time. For some 'runners' (38%), there were no cross vehicles present in the intersection on the cyclist's approach or crossing of the intersection. Of the 'runners' who did cross the intersection when cross-traffic was present, all but one waited until the vehicle(s) had crossed the intersection before entering. In the case of the one (male) cyclist who failed to wait for the cross-traffic to clear, a gap of just 3 seconds was observed between cyclist and the vehicle.

The observed waiting time at the intersection for 'impatients' ranged from 2 to 60 seconds (Mean: 25 s, SD: 16 s). The duration of the red light phase ranged from 34 to 77 seconds (Mean: 61 s, SD 10 s). The wait times for the 'impatient' cyclists are shown in Figure 3.

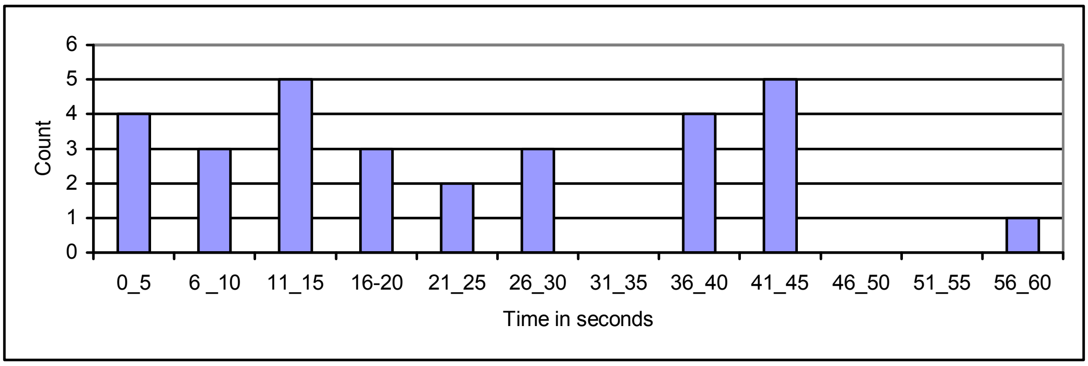


Figure 3 Wait time, all 'impatient' cyclists (afternoon)

Further analysis of the waiting time for 'impatients' revealed that in 23% of cases, there was no vehicular cross-traffic. These cyclists waited from 4 to 27 seconds before crossing through the intersection against the red light. For the remaining 'impatient' cyclists (n=24; 77%), cross-traffic passed through the intersection. Waiting times for these cyclists ranged from 3 to 60 seconds (Mean: 25 s, SD: 16.5 s). Around half of these 'impatients' appeared to be waiting for the intersection to be clear of cross-traffic before proceeding (< 5 s after the cross vehicle) while the majority of others proceeded well after the last vehicle cleared the intersection (8 s or longer).

Discussion

The aim of this study was to examine the behaviours of cyclists and their interactions with vehicles at selected signalised intersections. A total of 5,420 cyclists were observed across two observation periods (am/pm peak traffic) at two signalised intersections. The majority of cyclists (89%) observed the traffic signals by stopping at red lights. This finding may have important implications for interactions with other road users since previous research suggests that drivers perceive cyclists as a homogenous group whose behaviour is discourteous regardless of the specific manoeuvre undertaken (Basford et al., 2002).

Whilst most cyclists complied with the traffic signals, of concern were the 11 percent of cyclists who rode through a red light, placing themselves at considerable risk of a crash with vehicular cross-traffic. Daff and Barton (2005) reported similar figures (9% red-light running rates) for Melbourne cyclists on the same road, although no details were provided of the precise study location, the observation times or the number of cyclists observed. Interestingly, in the current study, higher rates of red light infringements by cyclists were observed amongst afternoon cyclists (11%) compared with morning cyclists (3%) and males (12%) were more likely to run red lights than females (6%). However, given the relatively small number of observation sites analysed to date, these findings should be interpreted with caution and will be explored further in ongoing research at other locations.

Three distinct types of behaviours were observed by cyclists facing red lights: those who race through the amber light and continue through the red light phase ('racers'), those who first stop and then continue through the red phase ('impatients') and those who face red and fail to stop ('runners'). Arguably, the three classes of behaviours may be exposed to different levels of risk of a crash with cross-traffic. The 'racers' cross through the intersection before the signal facing the cross-traffic has changed to green. Thus, with no cross-traffic the 'racers' have the lowest exposure to risk. Potentially, the 'impatients' are exposed to a higher level of risk than the 'racers' as the light phase permits cross-traffic to flow through the intersection at the same time as they cross. However, in the observations analysed to date, no 'impatient' cyclist entered the intersection in front of a cross vehicle. That is, all 'impatients' stopped and proceeded only after cross-traffic had cleared the intersection. Thus, while 'impatients' clearly place themselves at risk, their decision to first stop and wait for cross-traffic before riding through the red light suggests a more *considered* judgement of the cross-flow traffic conditions and associated risk than the 'runners.' The 'runners' do not stop and while some slowed down on their approach, it is argued that as a group, 'runners' have the highest exposure to risk. Like the 'impatients,' 'runners' pass through the intersection whilst cross-flow traffic faces a green signal, but unlike 'impatients' they do not stop. Hence, 'runners' are likely to have less time to observe the traffic and less time to brake to avoid a collision. 'Several runners' were observed crossing the intersection in front of cross vehicles and one male 'runner' put himself in a position of high risk by riding in front of a cross vehicle with only three seconds clearance. The remaining 92 cyclists who rode through the red intersection did so when the intersection was clear of all cross vehicles and this reduced the level of risk in their red light running behaviour. The cyclists who ran the red light, appear to have treated the traffic signal as a yield. Some researchers have suggested that this kind of behaviour by cyclists may evoke a negative reaction from drivers, who perceive the cyclists to be flouting the law (Davies et al., 1997).

This study confirmed that the majority of cyclists ride through intersections in a law-abiding manner. Amongst the minority of cyclists who ran red lights, three distinct types of behaviours were seen. The findings underscore important points of difference amongst cyclists who are riding illegally and suggest the need for targeted countermeasures to address high-risk cycling behaviour. The next stage of this research will also investigate driver and cyclist attitudes towards cyclists who ride through red lights.

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