INTERACTIONS BETWEEN PEDESTRIANS AND CYCLISTS IN THE CITY CENTRE

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ABSTRACT

The city centre represents a complex environment for cycling with large volumes of pedestrians and motorised vehicles and frequent signalised intersections. Much of the previous literature has focused on cyclist-motor vehicle interactions because of the safety implications for cyclists, but there is increasing concern from pedestrians about the threats they perceive from cyclists. In the absence of objective data, this has the potential to lead to restrictions on cyclist access and behaviour. This presentation reports the development of a method to study the extent of cycling in the city centre and the frequency and nature of interactions between cyclists and pedestrians. Queensland is one of the few Australian jurisdictions that permits adults to cycle on the footpath and this was also of interest. 1992 cyclists were observed at six locations in the Brisbane city centre, during 7-9am, 9-11am, 2-4pm and 4-6pm on four weekdays in October 2010. The majority (85.5%) of cyclists were male, and 21.8% rode on the footpath. Females were more likely to travel on the footpath than males. One or more pedestrians were within 1m for 18.1% of observed cyclists, and one or more pedestrians were within 5m for 39.1% of observed cyclists. There were few conflicts, defined as an occasion where if no one took evasive action a collision would occur, between cyclists and pedestrians or vehicles (1.1% and 0.6% respectively) but they were more common for adolescents and riders not wearing (or not fastening) helmets.

INTRODUCTION

Many jurisdictions around the world are promoting walking and cycling for health and transport reasons. Both modes are especially suited to short distance trips which represent a high proportion of trips in the city centre. Brisbane City Council launched CityCycle, a major bicycle hire scheme in October 2010, with the aim of encouraging residents to use hired bicycles for short trips around central Brisbane instead of cars. The Scheme could potentially increase the number of cyclists (and particularly the number of inexperienced cyclists) within an area with large volumes of pedestrians and motorised vehicles and frequent signalised intersections. Much of the previous literature has focused on cyclist-motor vehicle interactions because of the safety implications for cyclists, but there is increasing concern from pedestrians about the threats they perceive from cyclists. In the absence of objective data, this has the potential to lead to restrictions on cyclist access and behaviour.

Cycling on the footpath is one way of separating cyclists from motor vehicle traffic but it is prohibited in most Australian jurisdictions for adults except when accompanying a child of 12 years of age or younger. In Queensland, Tasmania and the Australian Capital Territory it is legal for adults to ride a bicycle on the footpath. This arguably allows cyclists a safer option in locations where the rider considers the road and traffic conditions to be too dangerous. The prohibition against cycling on the footpath appears to be based on concerns about dangers to cyclists associated with motor vehicle crashes at driveways and intersections and cyclists posing a threat to pedestrians on footpaths.

Both research and media reports have demonstrated that cyclists riding on the footpath are considered a hazard by elderly pedestrians. In a Swedish survey of factors affecting the usability of walking by older adults in snow- and ice-free conditions (Wennberg *et al*, 2009), "no cyclists in pedestrian areas" received the highest rating (a mean of 4.6 on a five-point rating scale). "Clear separation of pedestrians and cyclists" also received one of the highest ratings (4.4). "No parked bicycles" was also mentioned but received a lower score (4.1). A Danish survey of preferences and behaviour of pedestrians and cyclists (Bernhoft & Carstensen, 2008) reported that a significantly higher proportion of older (70 years and above) than younger respondents (40-49 years) consider it dangerous to walk when there are cyclists or roller skaters on the footpath. This was also true for those respondents who cycled regularly (40% of the older and 85% of the younger sample). In the younger group, more men than women were troubled by cyclists and roller skaters on the footpath. Cycling on the footpath is illegal in Denmark and older people are less likely to cycle on the footpath than younger people.

Despite reports of pedestrian concerns, there is little published data available regarding the effects of footpath cycling on pedestrian safety. An early observational study of cycling in Victoria (where footpath cycling by adults is illegal unless accompanying children) collected data on the number of pedestrians passed by cyclists on footpaths (Drummond & Gee, 1988). Most of the pedestrians passed were on footpaths beside arterial roads and in shopping centres and most of the cyclists passing pedestrians were adolescents. A related study (Drummond, 1989) examined hospital records for admitted patients and those treated in emergency departments at eight hospitals in Victoria. The study identified only two pedestrians who were injured as a result of a collision with a cyclist on a footpath (and two potential additional cases where actual location could not be determined) during the period 1 April to 20 December 1987. The study concluded that "pedestrian casualties resulting from collisions with cyclists on the footpath are a relatively very small problem" (p.5) but cautioned that it could not measure the number of pedestrians whose injury was too slight to require hospital treatment or the reduction in amenity to pedestrians caused by concerns about potential collisions with cyclists.

Australia-wide hospital separations data for land transport accidents (Henley & Harrison, 2009) provides limited but more recent information on pedestrians injured by cyclists. In the financial year 2006-07, 42 pedestrians were hospitalised for a total of 230 bed-days as a result of a traffic accident where the counterpart was a pedal cyclist (on the footpath or on the road). This corresponds to 2.8% of hospitalised pedestrians and 1.0% of pedestrian bed-days from traffic accidents. In the same year, 27 pedal cyclists were hospitalised for a total of 59 days as a result of a traffic accident where the counterpart in the collision was a pedestrian or animal (on the footpath or on the road). This corresponds to 0.5% of hospitalised cyclists and 0.4% of cyclist bed-days from traffic accidents. Data provided to the researchers by the Queensland Trauma Registry showed that only 2 pedestrians were hospitalised for more than 24 hours as a result of a collision with a bicycle on a footpath.

Riding on the footpath potentially contributes to the risk of cyclist-pedestrian crashes, particularly in Queensland where this practice is legal. A recent survey of more than 2,500 Queensland adult cyclists (Haworth & Schramm, 2011) reported that about 5% of distance ridden and a similar percentage of self-reported cyclist injury crashes occurred on footpaths. Almost 70% of footpath crashes were single-vehicle crashes (involving only the bicycle) and less than 10% involved pedestrians. Of all pedestrian-cyclist crashes, the largest number occurred on bike (including shared) paths (18% of bike path crashes and 68% of pedestrian-cyclist crashes). The number of pedestrian-cyclist crashes on footpaths was similar to the number on urban roads. In comparison with crashes in other locations, footpath crashes (like bike path and off-road crashes) resulted in less serious injuries to cyclists than crashes on urban roads.

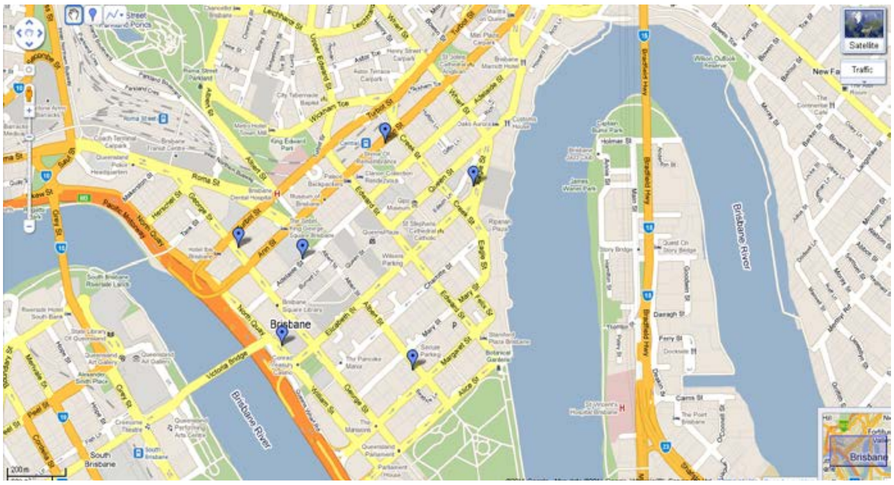
This paper reports the development of a method to study the extent of cycling in the Brisbane city centre and the frequency and nature of interactions between cyclists and pedestrians. This method was applied in Brisbane in 2010 to gather data on cycling at the time of the introduction of the CityCycle scheme.

METHOD

The observations were conducted on Monday 4 October to Thursday 7 October 2010 from 7-9am, 9-11am, 2-4pm, and 4-6pm to capture commuter cycling as well as the short trips that are the target of the CityCycle scheme. This period was during the school term and did not include any public holidays. It was the first week of the introduction of the CityCycle scheme but relatively few pods and bicycles were operational. The weather was fine on all days of the study. The project received approval from the Queensland University of Technology Human Research Ethics Committee (approval no. 1000000937).

Trained observers counted cyclists at six CBD locations selected in terms of width of footpath, presence or absence of on-road bicycle facilities, one-way or two-way traffic and pedestrian volumes. These locations were Ann St outside Central Railway Station, Eagle St opposite Riparian Plaza, Adelaide St outside City Hall, George St between Ann and Turbot Sts, William St outside the Old Treasury Building and Albert St between Margaret and Mary Sts (see Figure 1 and Table 1). All are near CityCycle stations, and considered to be routes to key points in the city.

Fig. 1: Locations of sites where observations were made



Tab. 1: Characteristics of sites were observations were made

	Traffic direction	Bicycle markings	Pedestrian volume	Location comment
Adelaide St	Two-way	Yellow awareness markings	High	Close to bus stops and King George Square Bus Station
Albert St	Two-way	No markings	Medium	Near Botanical Gardens, office workers
Ann St	One-way	No markings	Medium	Near secondary entrance to Central Railway Station
Eagle St	Two-way	No markings	Low	Office workers
George St	One-way	Yellow awareness markings	Low	Office workers
William St	Two-way	No markings	Low	Not near offices or public transport

A simple form was developed for recording observations (see Appendix). The variables collected for each cyclist included: apparent gender, apparent age (child, adolescent, adult), helmet use; and location of cyclist (road or footpath). The number of pedestrians within a 5 metre radius was estimated as a measure of pedestrian density and the number of pedestrians within 1 metre of the cyclist was counted as an indicator of potential for collision. The number of cyclist conflicts with motor vehicles and pedestrians (e.g. evasive manoeuvres such as swerving or hard braking) was noted.

Given that whether they were on the road or on the footpath and the presence of pedestrians could change as cyclists rode along, observers were instructed to draw an imaginary line across the footpath and street and only record data as cyclists passed that line. Observers recorded only those cyclists who were riding at the time, no records were made of people walking bicycles.

RESULTS

General characteristics of the sample

Table 2 summarises the characteristics of the 1,992 cyclists observed. The highest number was observed during the evening peak (4-6pm: 33.1 per hour) with the smallest number during 9-11am (10.9 per hour). The largest amount of bicycle traffic was on Adelaide St and Albert St, with the least bicycles observed on Ann St and George St. The overwhelming majority of cyclists were male (85.5%), adults (97.6%) and wearing helmets (97.1%). Just over a fifth (21.8%) rode on the footpath and only 1.2% were riding a CityCycle bicycle.

Tab. 2: General characteristics of cyclists observed

Characteristic	Number	Percentage
Male	1703	85.5
Female	288	14.5
Unknown	1	0.1
Adult	1945	97.6
Adolescent	45	2.3
Child	0	0.0
Unknown	2	0.1
Wearing helmet	1935	97.1
Helmet on, but not fastened	25	1.3
Not wearing helmet	21	1.1
Unknown	12	0.6
Riding on road	1557	78.2
Riding on footpath	435	21.8
CityCycle bicycle	24	1.2
Non-CityCycle bicycle	1968	98.8
Monday	381	19.1
Tuesday	595	29.9
Wednesday	512	25.7
Thursday	504	25.3
7-9 am	667	33.5
9-11 am	217	10.9
2-4 pm	313	15.7
4-6 pm	795	39.9
Adelaide St	407	20.4
Albert St	382	19.2
Ann St	287	14.4
Eagle St	333	16.7
George St	265	13.3
William St	318	16.0

Proximity to pedestrians

There were one or more pedestrians within 1m of 18.1% of observed cyclists, and there were one or more pedestrians within 5m of 39.1% of observed cyclists. Unsurprisingly, cyclists riding on the footpath were more likely to have one or more pedestrians with a 1m (46.5%) or a 5m radius (60.9%) than were cyclists riding on the road (10.4% within 1 m, 33.0% within 5m). The numbers of cyclists on footpaths and roads according to the number of pedestrians within 1m and 5m are summarised in Table 3.

Tab. 3: The numbers of cyclists on footpaths and roads according to the number of pedestrians within 1m and 5m.

Number of pedestrians	Footpath		Road	
	1m	5m	1m	5m
0	232 53.5%	170 39.1%	1394 89.6%	1042 67.0%
1	110 25.3%	83 19.1%	91 5.8%	194 12.5%
2	52 12.0%	49 11.3%	53 3.4%	139 8.9%
3	20 4.6%	45 10.3%	14 0.9%	73 4.7%
4	10 2.3%	23 5.3%	1 0.1%	43 2.8%
5	9 2.1%	21 4.8%	0 0.0%	30 1.9%
6-10	1 0.2%	42 9.7%	3 0.2%	33 2.0%
More than 10	0 0.0%	2 0.2%	0 0.0%	2 0.2%

Conflicts with pedestrians

Overall, 1.1% of cyclists were observed to have had a conflict with a pedestrian; defined as an occasion where if no one took evasive action a collision would occur. By comparison, 0.6% of cyclists were observed to have had a conflict with a vehicle. No collisions were observed.

Three-quarters of the conflicts with pedestrians occurred on the footpath (76.2%) and the remaining quarter occurred on the road (23.8%). Almost all (90.5%) of the pedestrian conflicts were avoided by the cyclist swerving, with only one on-road conflict being was avoided by hard braking, and one footpath conflict was resolved by an unspecified ‘Other’ response.

The characteristics of cyclists involved in conflicts with pedestrians are summarised in Table 4. While two-thirds of cyclists involved in pedestrian conflicts were helmeted adults, adolescents and riders not correctly wearing helmets (not wearing a helmet, or strap not fastened) were over-represented in conflicts with pedestrians. Adolescents were also more likely to be not correctly wearing helmets ($\chi(1)=27.1$, $p<.01$), making this relationship difficult to interpret.

Tab. 4: Characteristics of cyclists involved in conflicts with pedestrians

Characteristic	Pedestrian conflict	No pedestrian conflict	Statistical test*
Male	20	1683	
Female	1	287	$\chi(1)=1.62$, ns
Unknown	0	1	
Adult	17	1928	
Adolescent	4	41	$\chi(1)=27.1$, $p<.01$
Unknown	0	2	
Correctly wearing helmet	17	1918	$\chi(1)=26.2$, $p<.01$
Not correctly wearing helmet	4	42	
Unknown	0	11	

* unknowns excluded

Footpath conflicts with pedestrians were more likely to occur on Ann St and on Adelaide St which had the highest pedestrian densities. Eagle St had the highest number of pedestrian conflicts on the road but pedestrian lights have now been installed to improve pedestrian safety (and control pedestrian movements) near that location. Footpath conflicts were most likely to occur during morning peak, and early afternoons.

DISCUSSION

This paper reported the development of a method to study the extent of cycling in the Brisbane city centre and the frequency and nature of interactions between cyclists and pedestrians. The data collection method was quite successful, with large numbers of cyclists observed and few missing values for the data items collected. Each of the sites generated a sufficiently large sample of cyclists and no problems were encountered during data collection. It appears to be a valid alternative to video data collection with less scoring issues.

The data confirms that cyclists and pedestrians are often in close proximity in the city centre, with one or more pedestrians within 1m for 18.1% of observed cyclists, and one or more pedestrians were within 5m for 39.1% of observed cyclists. Despite this proximity, there were few conflicts, defined as an occasion where if no one took evasive action a collision would occur, between cyclists and pedestrians or vehicles (1.1% and 0.6% respectively). No collisions were observed. Thus it appears that the current situation poses relatively few problems in pedestrian-cyclist interactions in the city centre.

Despite the general low rate of cyclist-pedestrian conflicts, adolescents and riders not correctly wearing helmets appeared to be a concern. Given the large overlap between these two groups, it is unclear from the data which variable is the underlying issue. However, from a practical standpoint, it may be useful for enforcement in the city centre to focus on riders not wearing helmets, given that these riders are more likely to be involved in conflicts with pedestrians.

This study had a number of limitations. Observations took place on a weekday during school term resulting in no children and few adolescent cyclists in the sample. The early observational study of cycling in Victoria (Drummond & Gee, 1988) found that most cyclists passing pedestrians were adolescents. It is possible that the some cyclists may have been counted more than once, either on different days or in different locations. Thus the sample relates to cyclist-observations, rather than strictly to individual cyclists. While the city centre was the area of interest for this study, it may be that cyclist and pedestrian behaviours may be different in other areas, such as suburban shopping precincts and off-road paths. The larger number of pedestrian-cyclist crashes on bicycle and shared paths compared to footpaths reported by Haworth and Schramm (2011) underlines the need to examine interactions in those environments.

The authors are planning to repeat the study in October 2011, 12 months after this study to examine the impact of the CityCycle scheme on rider numbers, behaviours and pedestrian-cyclist interactions.

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Appendix: Observation sheet

Recorder sheet

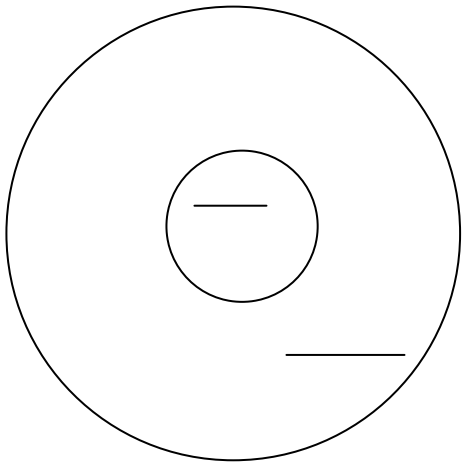
Date: Timeslot:

Location: Location details:

Apparent Gender	☐ Male	☐ Female		
Apparent Age	☐ Child (<13)	☐ Adolescent (13-17)	☐ Adult (>17)	
Helmet Use	☐ Yes	☐ No	☐ On but not fastened	
Location	☐ Footpath	☐ Marked Bicycle Lane	☐ Traffic Lane	
Bicycle Hire Scheme bicycle	☐ Yes			

within 1m

within 5m



Number of pedestrians

Number of pedestrians

Conflict	☐ None	☐ Pedestrian	☐ Vehicle	
Evasive manoeuvre by cyclist	☐ None	☐ Swerving	☐ Hard braking	☐ Other
Collision	☐ None	☐ Yes		