# Trends in private and bikeshare riding in downtown Brisbane, Australia

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## 1 INTRODUCTION

Reliable information on trends in bicycle use are important to measure the effectiveness of government initiatives to increase cycling participation and also to provide a context to assess changes in numbers of injured cyclists. There have been relatively few regular and systematic observational data collections in relation to cycling [1]. Observational studies are critically important in terms of understanding trends, and can also provide baseline data of behavior to enable evaluation of legislative, and other, changes. Observational data is stronger than survey in terms of reliability, as it allows you to observe actual behavior and does not rely on self-reported behavior [2].

Bikeshare schemes have been proliferating around the world and there is strong interest in the extent to which they are contributing to increases in bicycle use. Many of the studies of bikeshare use have utilized membership data or data derived from origins and destinations of trips. Yet little research has tracked trends in private and bikeshare use within the same city to assess how much bikeshare contributes to total riding or whether the trends in bikeshare are similar to those of private bike use. This paper seeks to do this within the context of Brisbane, Australia.

The Brisbane bikeshare scheme, CityCycle, commenced in October 2010 with a small number of docking stations and by 2012 had about 1800 bicycles and 150 docking stations. Riders are required to wear a helmet (provided with many bikes) and must be over 17 years of age (http://www.citycycle.com.au/).

## 2 METHODOLOGY

Brisbane had a population of 2.3 million in 2014 and has a subtropical climate, with the average maximum daytime temperature in October being 26°C (72°F). Observations were conducted on Monday to Thursday in early October in 2010, 2012 and 2015 during the hours of 7-9am, 9-11am, 2-4pm, and 4-6pm. The observation period occurred during school term and did not include public holidays. Data collected during 2010 occurred during the first week CityCycle bicycles were available for hire.

Six downtown mid-block observation sites were chosen. All sites were near CityCycle stations and considered to be located on routes to key destinations. The sites had varying geometric features: different footpath widths, presence or absence of on-road bicycle facilities, one-way and two-way traffic, and a range of pedestrian volumes.

Traffic conflicts data have traditionally been collected by human observers who identify and rate conflicts by observing road users' movements and range of evasive actions taken, until the recent developments in automated video analysis techniques (e.g. [3]). Automated traffic conflict analysis is most frequently used, and looks at vehicle-vehicle, vehicle-bicycle, and vehicle-pedestrian conflicts. However, automated systems are less likely to distinguish pedestrians and cyclists in high-volume traffic areas and the field-observer method of conflict data collection was adopted in the current study. A simple form was developed for recording observations, and the variables collected for each observed cyclist included: CityCycle or private bicycle apparent gender, apparent age (child, adolescent, adult), helmet use, and location of cyclist (road or footpath). Any conflict between cyclists and motor vehicles or pedestrians was noted.

Observers received training prior to data collection to maximize consistency between observers. Given that cyclists can easily move between the road and footpath, and the presence of pedestrians could change, observers were instructed to record all bicycles at the moment the rider passed in front of them. Conflict was defined as: “where a collision would be imminent unless one or more road users did not undertake an evasive maneuver”. An evasive maneuver, such as hard braking or swerving (as an isolated action, or accompanied by shouting, bell ringing or horn honking), may have been taken by the rider or by another road user. However, only evasive maneuvers by the cyclist were recorded. The definition of a conflict was deliberately simplified, given the potential for high bicycle traffic in some locations and the potential for large groups of cyclists to pass the observation point together, and observers were not asked to describe the conflict. Observers recorded only those cyclists who were riding at the time, with no records made of people walking bicycles.

## 3 RESULTS AND DISCUSSION

The results of the observational study are summarized in Table 1.

*Table 1: Comparison of private and public bicycle hire bicycle*

| **Characteristic** | | **Year of observation** | | | | | |
|---|---|---|---|---|---|---|---|
| | | ***2010*** | | ***2012*** | | ***2015*** | |
| | | Citycycle | Private | Citycycle | Private | Citycycle | Private |
| Site | Ann St | 2 (0.7%) | 285 (99.3%) | 26 (9.8%) | 239 (90.2%) | 30 (12.3%) | 213 (87.7%) |
| | Adelaide St | 1 (0.2%) | 406 (99.8%) | 29 (3.9%) | 713 (96.1%) | 31 (4.5%) | 657 (95.5%) |
| | Eagle St | 4 (1.5%) | 328 (98.5%) | 21 (4.6%) | 432 (95.4%) | 28 (6.4%) | 412 (93.6%) |
| | William St | 1 (0.3%) | 317 (99.7%) | 24 (6.0%) | 375 (94.0%) | 23 (5.4%) | 512 (96.0%) |
| | George St | 12 (4.5%) | 253 (99.5%) | 9 (3.6%) | 244 (96.4%) | 17 (4.0%) | 401 (94.6%) |
| | Albert St | 3 (0.8%) | 379 (99.2%) | 5 (1.1%) | 435 (98.9%) | 16 (2.1%) | 757 (97.9%) |
| Time of day | 7-9am | 5 (0.7%) | 662 (99.3%) | 35 (3.7%) | 923 (96.3%) | 39 (3.4%) | 1117 (96.6%) |
| | 9-11am | 8 (3.7%) | 209 (96.3%) | 21 (8.6%) | 224 (91.4%) | 31 (9.1%) | 311 (90.9%) |
| | 2-4pm | 2 (0.6%) | 311 (99.4%) | 18 (5.1%) | 332 (94.9%) | 27 (7.4%) | 339 (92.6%) |
| | 4-6pm | 9 (1.1%) | 786 (98.9%) | 40 (4.0%) | 959 (96.0%) | 48 (4.2%) | 1085 (95.8%) |
| Riding location | Footpath | 9 (2.1%) | 426 (97.9%) | 46 (7.6%) | 556 (92.4%) | 62 (7.8%) | 736 (92.2%) |
| | Road | 15 (0.1%) | 1532 (99.0%) | 68 (3.5%) | 1882 (96.5%) | 83 (3.8%) | 2013 (96.2%) |
| Helmet use | Worn | 24 (1.2%) | 1911 (98.8%) | 109 (4.4%) | 2388 (97.9%) | 123 (4.7%) | 2786 (95.3%) |
| | Not worn | 0 (0.0%) | 57 (100.0%) | 5 (9.1%) | 50 (90.9%) | 6 (9.5%) | 57 (90.5%) |
| Rider gender | Male | 17 (1.0%) | 1686 (99.0%) | 90 (4.2%) | 2055 (95.8%) | 115 (4.6%) | 2373 (95.4%) |
| | Female | 7 (2.4%) | 281 (97.6%) | 24 (5.6%) | 383 (94.1%) | 30 (5.9%) | 479 (94.1%) |
| Conflict | No conflict | 24 (1.2%) | 1934 (98.8%) | 111 (4.4%) | 2399 (95.6%) | 134 (4.6%) | 2780 (95.4%) |
| | Pedestrian | 0 (0.0%) | 21 (100.0%) | 3 (11.1%) | 24 (88.9%) | 4 (18.2%) | 18 (81.8%) |
| | Vehicle | 0 (0.0%) | 12 (100.0%) | 0 (0.0%) | 15 (100.0%) | 7 (11.5%) | 54 (88.5%) |

The total number of riders observed increased from 1992 in 2010 to 2552 riders in 2012 (a 28% increase) to 2997 in 2015 (a further 17% increase). In 2010, there were 24 public bikes observed, increasing to 114 in 2012 (a 375% increase), and to 129 in 2015 (a further 13% increase). The percentage of riders who were on public bikes increased from 1.2% in 2010 to 4.5% in 2012 and 4.3% in 2015.

Overall, the percentage of female riders increased slightly from 14.5% in 2010 to 15.9% in 2012 to 17.0% in 2015 but the increase was not statistically significant ($\chi$=5.856, p=.053). Helmet wearing rates did not change over the observation period ($\chi$=2.732, p=.255). There was a steady increase in the proportion of riders cycling on the footpath, which is legal in Queensland, from approximately one fifth in 2010 to more than one quarter in 2015 ($\chi$=164.440, p=.000). The number of conflicts observed increased between 2010 and 2015, from 33 in 2010 to 83 in 2015 ($\chi$=14.308, p=.001). Where there was an observed conflict, with either a pedestrian or a vehicle, a greater proportion of conflicts involved vehicles in 2015 (75%) compared with 2010 (36.6%) and 2012 (35.7%) ($\chi$=39.900, p=.000).

A logistic regression using the data for 2012 and 2015 showed that public bikes were more likely to be ridden on the footpath and were more likely to be involved in conflicts with pedestrians and motor vehicles (even after adjusting for extra footpath riding). The proportion of riders who were on public bikes differed significantly across the observation sites, from 1.8% to 12.4%. While the univariate analyses showed significantly lower helmet wearing rates for public bikes than private bikes (95.7% versus 98.0%) and relatively more use of public bikes during off-peak periods, these variables were not significant in the logistic regression. The univariate analyses suggested that a higher percentage of public bike riders were female (20.8% versus 16.3%), but this was not found to be significant in the logistic regression.

## 4 CONCLUSIONS

The observations show that the number of people riding in downtown Brisbane has increased dramatically from 2010 to 2015. Bikeshare now contributes about just under 5% of riding in this area. The data from 2012 and 2015 suggests that private and bikeshare riding are growing at about the same rate. The higher amount of footpath riding by bikeshare users suggests that the high density of traffic and relatively poor bicycle infrastructure in the downtown area is seen as a safety concern by these riders (as well as by a quarter of the private bicycle riders). Thus steps to improve the safety of the infrastructure may be needed to further increase riding, including by women.

## REFERENCES

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