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Cyclists, left turning drivers and the impact of road infrastructure

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Abstract

Intuitive infrastructure is key to providing a safe road environment, particularly to intersections where drivers and cyclists need to share the space. This interaction can become confusing when the cyclist is continuing to travel straight and the driver is turning left. This study is a naturalistic observational study of four signalised intersections in Melbourne, Victoria. The study extends previous research and is the first to explore behaviour at complex intersections with multiple dedicated left turn lanes and the role of an advanced signal phase for cyclists. In total, 48 hours of footage were recorded. In this paper, a subset (12 hours, n=230 interactions) were analysed in detail. Interactions were consistent with highly predictable cyclist behaviour at the sites with a bike lane compared to high variation at the site with no cycling infrastructure. A further 98 interactions were avoided at those sites with an advanced green signal phase for cyclists. Benefits from providing separation between cyclists and drivers may be achievable through infrastructure, including both dedicated bicycle lanes and advanced signal phasing for cyclists.

1 Introduction

Infrastructure is highly influential on road safety as intuitive and consistent road design helps to create a predictable environment. Previous studies have found that crashes involving left turning motor vehicles and cyclists continuing straight are common in crashes resulting in cyclist deaths (McCarthy and Gilbert, 1995), injuries (Cumming, 2012) and near-collision events (Johnson et al, 2010).

Confusion for both cyclists and drivers may be attributed to road designs being ineffective in guiding behaviour, inconsistency in the cycling infrastructure at intersections across the state and the complete lack of cycling infrastructure in many instances. Further to this, at times the behaviour suggested by the infrastructure is in conflict with the law and is likely to contribute to left turn interactions being one of the least understood areas of cycling related road rules (Tierney, 2015).

The aim of this study was to investigate how cyclists (continuing straight) and drivers (turning left) interact at intersections including sites with dedicated left turn lanes and advanced signal phasing for cyclists.

2 Method

The observational study was conducted at four sites in Melbourne, Victoria. Each observation was conducted for two hours during peak commute times in the morning (7-9am) or afternoon (5-7pm). In total, 48 hours of observations were recorded. A subset of these recordings (12 hours, 230 interactions) were then analysed to examine the interactions between cyclists and left turning motor vehicles.

2.1 Observation sites

All observed sites were signalised intersections.

Site 1 (AM): green bike lane that stopped on approach to the intersection and advanced stop box (bike storage box) at intersection. The site had one left turning lane and did not have dedicated cyclist signals
Site 2 (PM): no dedicated cycling infrastructure. It had two left turning lanes, including one dedicated left turn lane. It did not have dedicated cyclist signals.
Site 3 (AM): green bike lane, stopped on approach to intersection and advanced stop box (bike storage box) at intersection. The site had one left turn lane. It had dedicated cyclist signals that allowed cyclists to travel through the intersection first.
Site 4 (PM): green bike lane that stopped on approach to the intersection and advanced stop box (bike storage box) at intersection. It had one left turn lane. It had dedicated cyclist signals that allowed cyclists to travel through the intersection first.

2.2 Data analysis

All video footage was manually screened (SC). The data reduction process included a count of all motor vehicles, cyclists and identification of all left turn interactions. Interactions were coded as a one-to-many relationship by cyclist, that is, one motor vehicle may have been involved with multiple cyclists. For example, if there were three cyclists interacting with one car that would be considered three interactions. Factors that were coded included the party giving way, cyclist and driver travel paths and the presence of pedestrians.

3 Results

Of the 12 hours of observations, 230 left turn interactions were observed. The majority of cyclists involved in the interactions were male (66.3%) which is comparable to the reported proportion of male cyclists in Australia (Austroads, 2017).

In most interactions, the driver gave way to the cyclist (68-88%). The majority of interactions where the cyclist gave way occurred during the green signal phase, compared to drivers who were more likely to give way when they and/or the cyclist had arrived during the red signal phase. Note that all cyclists and drivers obeyed the red signal, this refers to the signal phase at the time the cyclist and driver arrived at the intersection.

On approach to the intersection, the majority of cyclists (96.9-98.4%) used the bike lane when available (not present at Site 2). Of 230 interactions, 17 involved a variation in path by the cyclist or the driver including two near-collisions. In comparison, Site 2 (no cycling infrastructure), had most variation in the positioning of cyclists in relation to drivers with cyclists more likely to pass on the right compared to the other sites.

While pedestrians were often observed to be crossing the street the drivers were turning into, their presence did not seem to influence the behaviour of the cyclist or driver involved in the left turn interaction. However, this is known to contribute to the behaviour of cyclists who are more likely to pass the turning motor vehicle on the right (Johnson et al, under review).

An additional 98 potential interactions were avoided at Site 3 (n=42) and Site 4 (n=56) as a result of the cyclist green signal. As a result of cyclists travelling through the intersection prior to the motor vehicles any potential conflict was avoided.

4 Discussion

Given the high proportion of cyclists who followed the bike lane, we propose that this infrastructure provides an intuitive path for cyclists to follow that requires minimal thought. When followed, this increases the level of predictability for drivers and could potentially minimise the risk of collision.

Comparatively, at the site that did not have cycling infrastructure, variation in the path taken by cyclists was high. The double left turning lanes is potentially confusing and we anticipate that this variation had an impact on drivers who may have considered cyclists less predictable and potentially contributed to increased feelings of discomfort for both drivers and cyclists. It may also be the motivation for some cyclists who chose to approach this intersection by riding on the footpath (illegal for people aged 12 years and older in Victoria).

The inclusion of the dedicated cyclist green signal phase provided clear benefits by separating cyclists from left turning motor vehicles. While this may initially seem to reduce the efficiency of a driver’s trip while they wait for the combined green phase, this is offset by not having to wait for cyclists as the signal changes from red to green. However, there may be some limitations related to activation. Further research is needed to identify the best way to maximise travel time efficiencies for all modes.

5 Conclusion

This study identified key considerations in the left turn interaction between cyclists (continuing straight) and drivers (turning left). Cyclists were highly likely to follow the cycling infrastructure when present. Left turn lanes, particularly dedicated left turn lanes are complex to negotiate and this complexity is increased at sites that do not have cycling infrastructure. Behaviours at these sites are likely to be less predictable and negatively impact feelings of comfort for both cyclists and drivers. There was a noted benefit in the advanced cyclist signal phase that allowed cyclists travelling straight to clear the intersection ahead of turning motor vehicles. Further research is needed to maximise the benefits of signals while maintaining efficiencies for all modes.

6 References

Austroads. 2017. Australian Cycling Participation.

Cumming, B. 2012. Conflict path analysis: Analysing and managing the cyclist-driver interface. AITPM 2012 National Conference.

Johnson, M., Charlton, J., Oxley, J., & Newstead, S. 2010. Naturalistic cycling study: identifying risk factors for on-road commuter cyclists. Association for the Advancement of Automotive Medicine 54: 275-283.

Johnson M., Johnston V., Nicholls H., Stephan K., Napper R., Taylor W. (under review). 8th International Cycling Safety Conference, ICSC 2019, Brisbane 18-20 November 2019

McCarthy, M., & Gilbert, K. 1995. Cyclist road deaths in Lon- don 1985-1992: Drivers, vehicles, manoeuvres and injuries. Accident Analysis & Prevention 28(2): 275-279.

Tierney, P. 2015. Review of Victorian cycling related road rules & legislation. VicRoads.