Transportation Research Part F 55 (2018) 403–414

Contents lists available at ScienceDirect

Transportation Research Part F

journal homepage: www.elsevier.com/locate/trf

Factors associated with cyclists' self-reported choice of lane position

Julie Hatfield [a,*], Roslyn G. Poulos [b], Chris Rissel [c], Lloyd K. Flack [b], Raphael Grzebieta [a], Andrew S. McIntosh [d,e], Susanne Murphy [b]

[a] Transport and Road Safety Research, The University of New South Wales, Australia
[b] School of Public Health and Community Medicine, The University of New South Wales, Australia
[c] Sydney School of Public Health, The University of Sydney, Australia
[d] ACRISP, Federation University, Australia
[e] MUARC, Monash University, Australia

ARTICLE INFO

Article history:
Received 31 January 2017
Received in revised form 21 February 2018
Accepted 24 March 2018

Keywords:
Bicycle rider
Lane position
Safety

ABSTRACT

Riders cycling on roads without bicycle lanes are generally advised to ride in the centre of their lane (primary position), and to move toward the left of the lane (in left-hand traffic; secondary position) only to let faster traffic pass and when it is safe. The present research investigated which situational and personal characteristics were associated with choice of lane position, and whether choice of lane position is associated with on-road crash involvement. A large cohort of bicycle riders from New South Wales Australia reported on their cycling patterns and crashes in 6 reporting weeks over a 1-year period using on-line surveys. During one reporting week 1525 participants identified their preferred choice of lane position in each of 6 visually-depicted scenarios that were designed to investigate the influence of number of lanes (in the cyclists' direction of travel), parked cars, and bus lanes. A majority of respondents preferred the secondary position in scenarios with a clear kerbside lane. Respondents were significantly more likely to choose the primary position in multiple-lane situations compared to single-lane situations, if there were parked cars in the kerbside lane, and if they were female, younger, experienced riders, transport riders, or high intensity riders. Controlling for personal characteristics, choosing the primary position in a single clear traffic lane scenario was associated with a higher on-road crash rate, while choosing the primary position in a traffic lane with parked cars scenario was associated with a lower on-road crash rate. Results suggested that when riding on-road the bicycle riders in this Australian cohort prefer to keep their distance from motorised traffic, allowing traffic to pass safely when space allows. Nonetheless, results suggested that choice of lane position is highly dependent on the local road and traffic environment. Further research is needed to support advice to cyclists.

1. Introduction

Evidence suggests that cycling-specific infrastructure (including on-road bicycle lanes) is safer for bicycle riders than sharing roads with cars (Reynolds, Harris, Teschke, Cripton, & Winters, 2009). Nonetheless, riders often cycle on roads

* Corresponding author.
E-mail address: j.hatfield@unsw.edu.au (J. Hatfield).

https://doi.org/10.1016/j.trf.2018.03.016
1369-8478/

without bicycle lanes – for example, because cycling-specific infrastructure is unavailable, or because it does not offer the most direct or convenient route. Bicycle riders around the world and in Australia are explicitly encouraged to ride on roads without bicycle lanes. Roads in Sydney, for example, are marked with bicycle symbols to indicate a bicycle route. Thus strategies for minimising the risks of cycling on roads are important.

Bicycle riders seeking advice on the safest way to ride on roads without bicycle lanes may find relevant literature in books and online. Much of this literature is aligned with the co-operative cycling approach (also known as vehicular cycling), which essentially advises riders to ride their bicycle like any other vehicle in traffic.[1] A key element of this approach is that the rider takes a central lane position, except in specific circumstances. For example, in his grey-literature book, *Cyclecraft* (4th Edition published 2007), John Franklin advises that riders adopt the "central riding position" as the normal (or "primary") position, and to adopt the "secondary position" (about 1 m to the kerb-side of moving traffic, but not closer than .5 m from the kerb) only when it is safe, reasonable, and necessary to allow faster traffic to pass. *Cyclecraft* underpins the UK's national standard for cycle training, which has, in turn, informed bicycle safety education in Australia. Recommendations akin to the co-operative cycling approach can be found at a variety of websites.

Thus bicycle riders who have sought advice are likely to identify that it is safer for them to "take the lane" by riding in a central position, and could elaborate on the circumstances which influence their lane position. However, it is likely that many cyclists do not seek advice, and ride where they feel most comfortable. To the authors' knowledge there has been no research directly examining the prevalence of riding in the primary position, or the factors which influence it. Limited research has investigated influences on the distance that cyclists ride from the road-edge. Harkey and Stewart (1997) recorded photographs and videos of trailed motor vehicles passing bicycles in Florida, and found that the lateral position of a bicyclist (when being passed) was influenced by facility type (wide kerb lane, bicycle lane, shoulder), total width of the paved roadway, number of lanes, speed limit, presence of vehicles (in the adjacent lane that may have limited lateral movement of the passing vehicle), and area type (urban/rural). They found that bicycles travelled closest to the road edge in a wide kerb lane, with an adjusted mean of 0.43 m (s.d. = .013). Across facility types, the distance between the bicyclist and the roadway edge increased with total paved width of the roadway (Harkey & Stewart, 1997). The nature of other effects was not reported, and findings observed across the three types of facility, may not hold for the wide kerb lane situation (considered alone).

As a risk-relevant behaviour, choice of lane position is likely to be influenced by personal characteristics such as sex and age (Rhodes & Pivik, 2011), (cycling) experience and self-efficacy (Lajunen & Summala, 1995). To the authors' knowledge no research has considered the effects of personal factors on lane position.

With available advice suggesting that bicycle riders adopt a central lane position when riding on a road (without a bicycle lane) it is critical to consider whether this position is, in fact, the safest. Riders cycling in a central lane position have the advantage of being more visible to following drivers and those who might cross their path (Harkey & Stewart, 1997; Walker, 2007), and of having the best two-way visibility of side roads and other features along the road (Harkey & Stewart, 1997). Moreover, they have a greater margin from shoulder/gutter debris and opening doors of parked vehicles (Walker, 2007) and from vehicles (or pedestrians) moving out from the kerb (Harkey & Stewart, 1997), as well as a greater margin for manoeuvring away from vehicles that encroach on them from the roadway (Harkey & Stewart, 1997; Walker, 2007). However, drivers may be aggressive toward riders cycling in a central lane position if they are seen to "get in the way" (Basford, Reid, Lester, Thomson, & Tolmie, 2002, p14).

Bicycle riders' choice of lane position may also influence the leeway provided by passing traffic. The co-operative cycling approach appears to assume that cycling in a central lane position will discourage vehicles from passing in the same lane; so that vehicles will not pass unless they can move fully into an adjacent lane – safely (e.g. because traffic conditions allow) and legally (e.g. because line-markings allow). However, this assumption may not be valid. Depending on lane width, vehicles may attempt to "squeeze past" or deviate only slightly into an adjacent lane. In this case, maximising the space available to traffic (e.g. by riding in the secondary position) may be safest.

Three studies have considered the effect of bicycle lane position on passing leeway. Kroll and Ramey (1977) recorded interactions of motorised traffic with a confederate cyclist riding on roads with and without a bicycle lanes in California, and concluded that the mean passing leeway was strongly influenced by "the motorist's available travel space" (the distance between the bicyclist and the centerline), regardless of the presence of a bicycle lane.

Walker (2007) reported that in two UK towns (Salisbury and Bristol) cycling further from the edge of the road was associated with reduced passing leeways and predicted "near passing" (bottom quartile leeway, as compared to top quartile leeway). Walker (2007) concluded that drivers follow the same overtaking path regardless of rider position (although not strictly consistent with the data), and suggested that findings were inconsistent with the co-operative cycling approach; in particular dismissing the "idea that riding close to the road edge might encourage drivers to 'take a chance' and squeeze through narrow gaps" (p.422). However, Walker (2007) rode at fixed distances (.25 m, .50 m, .75 m, 1 m, and 1.25 m) from "edge of the useable road (i.e. the physical edge, or the outermost edge of parked cars)" (p.419) on a wide variety of roads (including some with a shoulder, a parking lane, or a bicycle lane). Thus, *position in the lane* cannot be known, and a central position would seldom have been obtained because lanes in the UK are typically wider than 2.5 m.

[1] Some have argued that the co-operative cycling approach has been used to undermine calls for cycling-specific infrastructure, and to perpetuate motorised-vehicle-centric transport planning. The present paper focusses only on the soundness of recommendations regarding lane position when cyclists *are* cycling on roads with traffic.