Transportation Research Part A 91 (2016) 120–133

Contents lists available at ScienceDirect

Transportation Research Part A

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

We can all get along: The alignment of driver and bicyclist roadway design preferences in the San Francisco Bay Area

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ARTICLE INFO

Article history:
Received 9 March 2014
Received in revised form 4 March 2016
Accepted 10 June 2016

Keywords:
Bicycle facilities
Roadway design
Bicyclist design preferences
Driver design preferences
Bicycle lanes

ABSTRACT

Two trends in the United States—growth in bicycling and enthusiasm for complete streets—suggest a need to understand how various roadway users view roadway designs meant to accommodate multiple modes. While many studies have examined bicyclists' roadway design preferences, there has been little investigation into the opinions of non-bicyclists who might bicycle in the future. Additionally, little research has explored the preferences of the motorists who share roads with cyclists—despite the fact that motorists compose the vast majority of roadway users in the United States and similarly developed countries.

This paper presents results from an internet survey examining perceived comfort while driving and bicycling on various roadways among 265 non-bicycling drivers, bicycling drivers, and non-driving bicyclists in the San Francisco Bay Area. Analysis of variance tests revealed that both drivers and bicyclists are more comfortable on roadways with separated bicycling facilities than those with shared space. In particular, roadways with barrier-separated bicycle lanes were the most popular among all groups, regardless of bicycling frequency. Striped bicycle lanes, a common treatment in the United States, received mixed reviews: a majority of the sample believed that they benefit cyclists and drivers through predictability and legitimacy on the roadway, but the lanes were rated significantly less comfortable than barrier-separated treatments—particularly among potential bicyclists.

These findings corroborate research on bicyclists' preferences for roadway design and contribute a new understanding of motorists' preferences. They also support the U.S. Federal Highway Administration's efforts to encourage greater accommodation of bicyclists on urban streets.

1. Introduction

Increasing bicycling trips has been national policy in the United States since the U.S. Department of Transportation set its 1994 goal to double the U.S. cycling rate (FHWA, 2004). Twenty years later, data from national transportation surveys show that bike commuting has increased an average of 47% in major U.S. cities over the last decade (Flusche, 2012). In some cities, such as Lexington, Kentucky, and Portland, Oregon, the percentage of bike commuters has grown over 300% since 2000, and many other U.S. cities have seen growth in excess of 100–200% (Flusche, 2010; Pucher et al., 2011). Given this trend toward increased cycling and potentially commensurate increased conflict over limited roadway space, efforts to design and build roadways that accommodate multiple types of roadway users—also known as "complete streets"—have intensified. In fact,

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http://dx.doi.org/10.1016/j.tra.2016.06.002
0965-8564/

over 665 regional and local jurisdictions, including 60% of U.S. states, have already adopted complete streets policies or made a written commitment to do so (National Complete Streets Coalition, 2014).

To complement the movement toward complete streets, practitioners need an understanding of roadway designs that maximize comfort and safety for all roadway users. This paper presents findings from research exploring perceptions of adult bicycling risk, experiences bicycling, and roadway design preferences among bicycling drivers, non-bicycling drivers, and non-driving bicyclists in the San Francisco Bay Area (Author, 2013). The results corroborate research showing that bicyclists of all types—and particularly potential cyclists—prefer greater separation from motorists. Additionally, the results provide new information about motorists' preferences for sharing the road with bicyclists, indicating that motorists also prefer greater separation. These findings suggest an alignment between roadway user groups' design preferences for multi-lane, commercial streets, and provide additional evidence of the benefits of complete streets for all roadway users. Methodologically, these findings also suggest advantages from studying the preferences of multiple user groups regarding shared facilities.

2. Literature review

2.1. Bicyclists' roadway design preferences

Internationally, studies examining current—and sometimes potential—bicyclists' roadway design preferences are diverse and plentiful, though they have not directly considered motorists' design preferences for sharing the roadway with bicyclists. Many of those studies have found that bicyclists generally prefer a separate space from motorists. For example, in their online survey of 1605 Texas cyclists, Sener et al. (2009) found that nearly 80% of respondents characterized the overall quality of bicycle facilities in their communities as "inadequate" or "very inadequate". Similarly, in their telephone survey of 566 Portland, Oregon, residents, Dill and Voros (2007) found that 37% of those who wanted to bicycle more reported that there were not enough bike lanes or trails near where they wanted to go. Haworth and Schramm (2011) surveyed 2523 adult cyclists in Queensland, Australia, and found that utilitarian bicyclists were hesitant to ride on the roadway and often rode on the sidewalk—particularly if they were new to bicycling.

Winters and Teschke (2010) used a combination phone and internet survey to evaluate the roadway design preferences of approximately 1400 cyclists of all experience levels (including potential cyclists, defined as those who owned a bike and would consider bicycling in the future). As one of the first studies to ask about separated, on-street bicycle facilities in North America, they found that a concrete-barrier-separated cycle path on a major street was the fourth-ranked (out of sixteen) option for potential and occasional cyclists (after off-street paths and traffic-calmed neighborhood streets with and without bicycle markings), and ranked second and third, respectively, for regular and frequent cyclists. In contrast, major city streets without bicycle facilities were the least preferred by all respondents. Studies conducted since have found similarly strong preferences—particularly among potential cyclists and women—for separated bicycle facilities (Dill and McNeil, 2013, N = 908; McNeil et al., 2015, N = 2283).

Recognizing that people do not make travel choices in a vacuum, some studies have sought to define the "value" of a certain bicycle facility in terms of travel time. In their adaptive stated preference survey of a convenience sample from the University of Minnesota, Minneapolis, Tilahun et al. (2007) presented 167 participants with ten-second videos featuring two routes with different bicycle facilities and associated travel times. A computer-adapted choice sets in response to participants' selections until a final facility value was reached. A utility model of the data revealed that the average respondent was willing to travel the farthest to avoid a street with on-street parking but no bike lane. In general, the presence of a bicycle lane had a much greater impact on the odds of choosing the higher quality facility than did the elimination of on-street parking or the presence of an off-road facility. This tendency was magnified among women, and not significantly influenced by cycling experience.

Similarly, Parkin et al. (2007) used video to present their 144 survey participants with various route options for bicycling in Bolton, United Kingdom. Models created from user ratings of the facilities, although resulting in a relatively low R^2 (maximum of 0.275), suggested that the presence of a striped bicycle lane on any road type decreased perceived risk, while the presence of on-street parking increased perceived risk along residential roads. It should be noted that neither of these studies offered route options with green or separated bicycle lanes.

More recently, in their stated preference survey of 1941 people working in Dublin, Ireland, Caulfield et al. (2012) found that an "off-road cycle lane" (essentially a curb-separated bicycle lane) was the most preferred bicycle facility, even compared to a greenway/bicycle trail. This preference held regardless of respondents' self-reported confidence levels, although the effect was stronger for less confident cyclists, as would be expected.

Other bicycling research has monitored route choice in an effort to understand the attractiveness of certain roadway designs when built. While this data is limited to built bicycle treatments, it can provide important information to compare with stated preference findings. Winters et al. (2010) used reported routes from 74 participants in their Vancouver bicycling study to examine the distance people detour from the shortest path to use a bicycle facility. They found that bike trips were significantly more likely to occur along routes with enhanced bicycle facilities including traffic calming, stencils, and signage; while only 21% of trips would be along designated bike routes in a shortest path scenario, on average, 49% of actual trip distance took place along a bike route. They also found that participants who reported being discouraged from cycling