

Do e-bikes matter for bikeshare safety? Early evidence from Baltimore Bikeshare system

Mojdeh Azad[#], Christopher R. Cherry^{*}

[#]Department of Civil and Environmental
Engineering
University of Tennessee
311 John D. Tickle Building, Knoxville, TN
37995-2313, USA
email: mazaddis@vols.utk.edu

^{*}Department of Civil and Environmental
Engineering
University of Tennessee
321 John D. Tickle Building, Knoxville, TN
37995-2313, USA
email: cherry@utk.edu
(corresponding author)

Keywords: Bikeshare Safety, Big Data, E-bike, Route Choice

1 INTRODUCTION

City developments have created new economic, social, and environmental goals and at the same time important concerns all over the world in the current century. One of the goals is to create more multimodal transportation systems to provide better mobility and accessibility to the residents as well as better serving the public health (1). Bike share systems have exploded in popularity just over a decade ago in Europe and exists in 712 cities on five continents with approximately 806,200 shared bicycles as of June 2014 (2; 3). During the recent years, electric assist bikes (e-bikes) have been integrated to the system as an alternative to reduce some of existing barriers in traditional bikesharing system by providing higher levels of service to the commuters (4).

Compared to the traditional bikes, e-bikes could provide more benefits to commuters by increasing travel range and reducing travel time as well as removing the terrain, physical limitation, or age barriers (5). However, in a survey of 685 e-bike users in Denmark, Haustein and Moller (6) found that 29% of e-bike riders experienced a safety-critical condition which would probably not have happened on a traditional bike mainly because of their speed being underestimated by other road users. They also found that the excitement about speed and different riding styles were positively associated with being involved in dangerous situations. This was somewhat inconsistent with the study conducted by Langford, Chen, and Cherry (7) indicating the bicycle type (e-bike vs conventional bike) has a small influence on safety behaviors, controlling for other factors.

To better understand the riding behaviors of cyclist, researchers have started using low-cost GPS technology to collect real-time data which would reduce the biases associated with using stated preference data or surveys (8). Bikesharing systems are valuable resource for generating bike trip data, specifically because of on-board telematics. Some, like Baltimore Bike Share, offer both bike and e-bikes in their sharing system, allowing users to choose bicycle type based on their needs and also offering researchers an important dataset to draw from for safety or other studies.

2 DATA DESCRIPTION

Baltimore Bike Share launched in 2016, is the largest electric-assist bicycle fleet in North America with 22 stations and more than 250 bikes currently. The program aims to include 50 stations and 500 bikes with approximately

200-250 e-bikes by the end of phase 1 in 2017. The current stations cover an area approximately 3.5 miles east to west and 2.5 miles north to south with more than ten stations in downtown area. The data used for this study relied on Baltimore Bike Share system trips in November 2016, which included total 5222 number of trips (2020 trips with e-bikes) made by 1709 users before data cleaning. The frequency of the GPS data was one per second which helped to create a high resolution map of the trips. The data also includes age and gender information for most of the members except the single trip riders.

3 GOALS, OBJECTIVES, AND EXPECTED RESULTS

In this study, we first visualize (Figure 1) geographical distribution of total trip routes as well as for different types of bikes (conventional bikes and e-bikes), and identify the segments used by riders. We also study and compare trip characteristics and safety behaviors between those categories of bike types along with the membership types (registered and single trip users). The analysis includes comparing bicycle type by factors such as direction and classification of roadways, speed, grade, trip length, time of day, day of week, weather condition, behavior at intersections, route choice and number of right and left turns. When we visualize the bikesharing GPS data, we found out that it is rich in information and provides a better base to study the safety behaviors of bike and e-bike riders in a sharing system.



Figure 1. Visualization of bikeshare use data, including intersection detail

REFERENCES

- [1] Litman, T. *Understanding smart growth savings* Evaluating Economic Savings and Benefits of Compact Development, and How They Are Misrepresented By Critics. In, Victoria Transport Policy Institute 2017.
- [2] Shaheen, S., S. Guzman, and H. Zhang. Bikesharing in Europe, the Americas, and Asia: past, present, and future. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2143, 2010, pp. 159-167.
- [3] Shaheen, S. A., E. W. Martin, A. P. Cohen, N. D. Chan, and M. Pogodzinsk. Public Bikesharing in North America During a Period of Rapid Expansion: Understanding Business Models, Industry Trends & User Impacts, MTI Report 12-29. 2014.
- [4] Langford, B., C. Cherry, T. Yoon, S. Worley, and D. Smith. North America's First E-Bikeshare: A Year of Experience. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2387, 2013, pp. 120-128.
- [5] Dill, J., and G. Rose. Electric bikes and transportation policy: Insights from early adopters. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2314, 2012, pp. 1-6.
- [6] Hausteijn, S., and M. Møller. E-bike safety: Individual-level factors and incident characteristics. *Journal of Transport & Health*, Vol. 3, No. 3, 2016, pp. 386-394.
- [7] Langford, B. C., J. Chen, and C. Cherry. Comparing safety-related riding behaviors on bicycles and electric bicycles. In *Transportation Research Board 94th Annual Meeting*, 2015.
- [8] Khatri, R., C. R. Cherry, S. S. Nambisan, and L. D. Han. Modeling route choice of utilitarian bikeshare users with GPS data. *Transportation Research Record: Journal of the Transportation Research Board*, No. 2587, 2016, pp. 141-149.