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Bike-Share in the Sacramento Region Primarily Substitutes for Car and Walking Trips and Reduces Vehicle Miles Traveled

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Issue

Dock-less, electric bike-share services offer cities a new transportation option with the potential to improve environmental, social, and health outcomes by increasing physical activity and reducing vehicle miles traveled (VMT) and related greenhouse gas emissions. But these benefits accrue only if bike-share use replaces car travel. If bike-share pulls users from public transit, personal bikes, or walking, the benefits will be limited. Little is known about the factors influencing whether bike-share substitutes for driving. Understanding the degree to which and under what circumstances bike-share use reduces car travel can inform cities' efforts to meet VMT reduction goals set under California's Sustainable Communities and Climate Protection Act of 2008 (Senate Bill 375).

Researchers at the University of California, Davis collected user surveys and system-wide trip data from a Sacramento-area dockless e-bike-share program in 2018 and 2019 to examine factors influencing travel mode substitution and estimated system-wide VMT reductions caused by bike-share use. They developed a model to examine factors influencing bike-share demand and estimated potential VMT reductions for hypothetical expanded service scenarios.

Key Research Findings

Bike-share in the Sacramento region most commonly substitutes for car and walking trips. An average of nearly 40% of all weekday bike-share trips substituted for car travel via private vehicle, ride-hailing, or carpooling (Figure 1). Women in particular were likely to substitute bike-share travel for car travel.

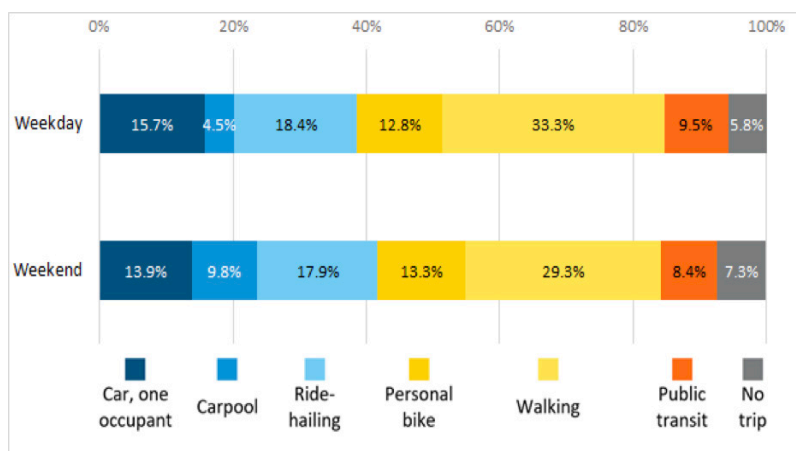


Figure 1. The reported travel modes that would have been used had bike-share not been available on a typical weekday and weekend

Each bike in the Sacramento region bike-share fleet reduces users' VMT by an average of 2.8 miles per day. The estimated VMT reduction per weekday, counting only travel that substitutes for personal vehicle travel and ride-hailing when a passenger is in the vehicle, was 1,795 miles across 650 active bikes before a service expansion in June 2019. After the expansion the estimated daily VMT reduction increased to 2,160 miles from 750 active bikes (Figure 2). The VMT reduction attributable to bike-share was even higher when accounting for ride-hailing VMT between passengers, or "deadheading."



Figure 2. Estimated daily reduction in vehicle miles traveled (VMT) attributed to the Sacramento region bike-share system, before and after the June 2019 service expansion. The VMT reduction was estimated in two ways: (blue) accounting for substitution of only ride-hailing miles with a passenger and (yellow) accounting for ride-hailing miles with a passenger plus “deadheading” miles without passengers.

Areas with a higher proportion of low-income households tend to use bike-share less. This outcome is despite equity requirements in Sacramento to rebalance a portion of the bike fleet in low-income “opportunity zones” during morning hours and to provide discounted rates for low-income groups. Additional policies to increase bike-share use in these opportunity zones, which are mostly in residential areas where bike-share trips are more likely to substitute for driving, could achieve even greater overall VMT reductions.

Bike-share availability appears to induce new trips to restaurants and for recreation. Bike-share users who took trips for these purposes often reported that they would not have taken those trips if bike-share were not available. This suggests that a bike-share system can promote physical activity and contribute to a community’s economic vitality.

Bike-share trips from commercial and office areas were more likely to replace walking or transit trips, while bike-share trips from non-commercial areas (and trips to home or restaurants) were more likely to replace car trips. This finding could suggest a potential trade-off in choosing where to locate the bikes: bikes in high-demand commercial and office areas could lead to more service efficiency in terms of trips taken on each bike per day, whereas bikes in lower-demand, non-commercial areas

could maximize VMT reduction. However, even bike-share trips from commercial or office areas that substitute for walking or transit may indirectly reduce VMT. For example, the availability of bike-share for errands from these areas could encourage commuters to forgo driving to work.

Expanding the bike-share service boundary at the same fleet density decreases system efficiency and VMT reductions per bike. Modeling shows that expanding the existing Sacramento region service boundary into largely residential areas and maintaining a fleet density of 12.5 bikes per square mile would result in more bike-share trips and greater VMT reductions. However, service efficiency would drop from 3.1 trips taken on each bike per day to 2.1. This highlights the potential trade-off between public policy objectives and operational concerns.

More Information

This policy brief is drawn from the report “How Dock-less Electric Bike Share Influences Travel Behavior, Attitudes, Health, and Equity: Phase II”, authored by Tatsuya Fukushima, Dillon Fitch, and Susan Handy of the University of California, Davis. The report can be found here: www.ucits.org/research-project/2020-05/.

For more information about findings presented in this brief, contact Tatsuya Fukushima at tfukushige@ucdavis.edu.

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