



STREET LEVEL CYCLES

CITY OF BERKELEY

**ELECTRIC BIKE
EQUITY PROJECT**

February 2025

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Summary

In late spring of 2023, the City of Berkeley, along with Waterside Workshops and GRID Alternatives, launched the Berkeley Electric Bike Equity Project (BEEP) to provide e-bikes and ridership support to eligible households for, initially, a one year pilot to increase mobility access with a clean transportation option. During this year, 56 Berkeley low- to moderate-income households were able to have an e-bike while providing program administrators feedback and data to study impacts. As cities continue to consider programs of their own, and look to model successful programs similar to Berkeley, we offer context on the program, how Berkeley funded and implemented the program, results, and recommendations.



We started an e-bike club in our building and the manager built us another bike rack in the garage - Stephanie

At a Glance

Stats

- **56 e-bikes were distributed** during this program
- **134 Berkeley residents benefited** from this program including 114 residents using the e-bikes in the 56 BEEP households and 20 Waterside Workshops interns who assembled and maintained the e-bikes
- **Participants rode 13 miles on average each week with their e-bike** - Active participants logged a total of 27,169 miles on their e-bikes during the one year pilot. Participants rode an average of 697 miles, around 13 miles per week. There were 39 active participants who provided complete, consistent data reporting and e-bike riding over the course of the pilot.
- **11.6 tons of CO₂ emissions reduced** - Assuming these miles replaced miles driven by an average vehicle, these participants avoided 11.6 tons of CO₂ emissions
- **Participants save an average of \$150 per year** on fuel alone when replacing car miles with e-bike miles, and avoided nearly \$900 in total car ownership costs on average.

Key Takeaways

- **Access to e-bikes is life changing for many participants.** E-bike riders expressed high overall satisfaction with their e-bike and program experience.
- **E-bike access leads to transportation mode shifts for the vast majority of active participants:**
 - 77% reported a decrease in use of a car or motor vehicle
 - 69% reported spending less on transportation
 - 46% reported a decrease in use of ride hailing (e.g., Lyft, Uber, etc)
- **E-bikes and city riding pose challenges for many new riders.** A proactively supportive program can help most riders overcome challenges through careful bike fitting, training & offering equipment to make bikes more safe and functional. Other challenges require city engagement and investment to make safer infrastructure. Participants reported a wide range of impediments to biking more frequently.
 - Participant concerns included weather, theft, e-bike weight, infrastructure, and stress on the body.
 - E-bike ridership is unlikely to be high for individuals who lack existing comfort in bicycle riding at large. Some individuals will need coaching to gain skills and confidence in starting, maneuvering and stopping the higher weight of an e-bike.
 - At the beginning of the program, only 23% of participants were already experienced and comfortable riding an e-bike. At the end of the program, 85% of participants rated their comfort level at 4 or 5 out of 5.
- **E-bike theft and accidents were rare for BEEP participants.** One participant 'totaled' their e-bike and four were stolen.

Recommendations based on BEEP implementation

- Engage participants, early and often. Prioritizing frequent participant engagement leads to an increase in e-bike adoption for some bike riders.
- Integrate free or low cost e-bike maintenance into program design. It increases participant ridership and equipment longevity.
- Provide multiple safety trainings (both on and off the bike) for participants to increase capacity for e-bike adoption for new riders. These trainings build confidence for riding and navigating in traffic safely and integrating e-bikes into their transportation practices.
- Provide safety and storage equipment, such as locks, lights, saddlebags, and apparel, to lower barriers to riding. At home, secure overnight storage was a barrier for participation and e-bike adoption.

About the [Berkeley Electric Bike Equity Project \(BEEP\)](#)

The City of Berkeley established a Climate Equity Fund (CEF) Pilot in 2020 to provide climate and resilience benefits to low- to moderate-income residents in Berkeley through programs that support building and transportation electrification. While low-income households typically have low greenhouse gas (GHG) emissions, they often bear the greatest burdens of a changing climate. The purpose of this funding is to maximize equitable GHG emissions reductions, climate adaptation, and resilience benefits for income qualified households. CEF Pilots are consistent with the goals of the Equity Guardrails developed as part of Berkeley's Existing Buildings Electrification Strategy (BEBE Strategy):

- **Maximize Access to Health, Safety & Mobility Benefits:** Prioritize the benefits of building and transportation electrification including health, safety, and comfort to those most impacted by climate change.
- **Maximize Access to Economic Benefits:** Leverage incentives and financing, reduce costs when possible, and support high-road job opportunities.
- **Maximize Ease of Participation:** Be easy for all community members to access, and integrate with other programs and services when possible.
- **Promote Housing Affordability & Anti-Displacement:** Support housing preservation and renter protections, and not displace renters or homeowners.

Program Area #2 of the CEF sought an Electric Mobility Access Pilot to enhance mobility for income qualified community members in ways that reflect community priorities and support sustainable modal shifts. Waterside Workshops, in partnership with GRID Alternatives Bay Area, created this electric bike (e-bike) access program, Berkeley E-bike Equity Project (BEEP). Goals for this program area are consistent with the [Berkeley Electric Mobility Roadmap](#):

- Ensure equity in access to electric mobility
- Improve alternatives to driving
- Achieve zero carbon emissions

Comparison to other e-bike incentive programs

This program was substantively different in the level of support given to participants, making it unique from other e-bike incentive programs. Recipients of the e-bikes in this pilot received multiple points of contact to program managers including personalized equipment packages based on indicated needs, test rides before commitment to the program, and regular individual check-ins.

Unlike other incentive programs, BEEP provided e-bike safety training and a full year of maintenance support. The program was also locally funded to support a year long study resulting in this report which can help inform future program designs encouraging transportation mode shift to an e-bike. Participants were asked to provide a deposit to participate and provided ongoing data for the year, after which they received their deposit back and retained ownership of the e-bike. To our knowledge, few e-bike incentive programs offer participant training, e-bike maintenance, rider support, and do not require participants to provide a financial commitment.

Another unique aspect of this program is the inclusion of sustainable vocational youth education by Waterside Workshops. Incorporating e-bike maintenance internships, this program developed one of the first known e-bike maintenance curriculum catered towards youth. Supporting the advancement of youth vocational training and specifically access to sustainable employment increased the community's capacity for climate resilience.

My electric bike makes it easy for me to get out more without having to rely on rides from others. - Iris

Contributors



Waterside Workshops engages youth and the community through hands-on learning in bicycle mechanics, wooden boatbuilding, and outdoor education. Waterside is a safe place for youth to feel heard, gain confidence, develop work skills, and access the tools and resources needed to lead healthy, sustainable lives. Waterside Workshops managed the acquisition and assembly of the e-bikes, recruitment and engagement of participants, training of mechanics, and ongoing monitoring and maintenance of the e-bikes and participants.



GRID Alternatives' mission is to build community-powered solutions to advance economic and environmental justice through renewable energy. We envision a rapid, equitable transition to a world powered by renewable energy that benefits everyone. GRID provided expertise in community engagement, program design, and program reporting throughout this project.



The City of Berkeley's Office of Energy & Sustainable Development Division (OESD) develops policies and implements programs to promote resilience and sustainable practices, and to reduce energy and water use and the associated greenhouse gas emissions in both City operations and the Berkeley community.



The Climate Equity Collaborative, a project of the non profit Ecology Center to amplify Black, Indigenous, People of Color (BIPOC) voices, elevate their experiences, and build their capacity to collaborate as partners in developing and implementing climate change and resilience solutions, supported the community engagement effort to inform the program design.



Walk Bike Berkeley, a non profit organization that promotes safe pedestrian and bicycle infrastructure and e-bike education, provided a volunteer (Tom Lent) who assisted the Project with survey design and data analysis.

Acknowledgements

Major thanks to all the Berkeley residents who participated in the program and gave valuable insights about e-bikes and their benefits. This project was made possible with funding from Berkeley City Council for the City of Berkeley Climate Equity Fund Pilot to reduce greenhouse gas emissions and the impact of climate change on low-income residents. Additional support was provided through the University of California Berkeley Chancellor's Grant, which expanded the participation for the project, as well as the Transportation Sustainability Research Center which advised on data collection and reporting. Thank you Kala Art Institute, Bike East Bay, Terry Taplin and Tom Lent for your championing support for this project, e-bikes and bicycling. This project was carried out through the collaboration between Waterside Workshops and GRID Alternatives to connect community members with these emerging transportation technologies.



Thank you to the program, thank you to Hannah, thank you all the team in the shop. - Zenia

Many of my coworkers have been inspired to go out and purchase an e-bike. - Participant

I am feeling more connected to the people and the land in the East Bay than I have in 7 years of living here. Thanks to the way Waterside Workshops/BEEP is managed, I've also met other lovely new friends through this program and feel a sense of growing/deepened community because of that. - LeeAnn

Scope

I. Purpose and Goal(s)

This program was set up following Climate Equity Fund (CEF) goals. The program team followed guidelines from the Electric Mobility Access Pilot (Program Area #2), which was designed to enhance mobility for low-income community members in ways that reflected community priorities and support modal shifts. This program area had a maximum of \$250,000 in CEF Pilot funds from the City of Berkeley.

Goals for this program area are consistent with those of the Berkeley Electric Mobility Roadmap:

- A. **Ensure equity in access to electric mobility by prioritizing the participation of income qualified Berkeley residents**, specifically those living at or below 80% area median income. To achieve this, the program team focused on engaging community based organizations and Berkeley residents already participating in income qualified programs. 98% of BEEP participants were income qualified with 3 participants residing in an SB 585 designated Disadvantaged Community (DAC).
- B. **Improve alternatives to driving by supporting mode shift to e-bikes in Berkeley** through engagement, education, and decreasing barriers. The program team shared product knowledge, coordinated four safety trainings, and provided quarterly maintenance services to maintain safety and operability of the e-bikes. This was effective as participants provided insights to improve e-bike adoption strategies for future programs.
- C. **Achieve zero carbon emissions by encouraging participants to use their e-bikes** in place of their cars. The program team provided ongoing support throughout the program which included providing support services and access to educational resources. This was considered success because all of the final participants opted to keep their e-bikes and 73% (n= 39) of active participants shared that their driving has decreased since participating in the program (See the “Results and Analysis” section below for definition of “Active Participation.”)

II. Methods and Approach

In 2022, this program was awarded the maximum amount from the CEF Electric Mobility Access Pilot (Program Area #2). In 2023, an additional \$20,000 was secured through the University of California's Chancellor's Community Partnership Fund allowing additional participants and partnership with the University of California's Transportation Sustainability Research Center (TSRC). The total budget for this program was \$270,000 which is detailed below in table 1:

Table 1.

Category	Details	Amount	Percent of Budget
Supplies and Materials		\$ 99,000	37%
	E-bikes (56 count)	\$ 68,600	
	Parts, Accessories, and Equipment	\$ 30,400	
Program Staff		\$ 171,000	63%
	Program Management	\$56,000	
	Program Implementation	\$115,000	
Total		\$ 270,000	100%

Program design was informed by an in depth community engagement process. Recipients of the e-bikes provided insights in response to a monthly survey and were able to keep the e-bike upon completing these program requirements. This project provided safe UL certified e-bikes, safety gear, training, and ongoing support to 56 Berkeley households for an initial pilot term of 12 months. Due to the variable start times for participants, this pilot ultimately provided a total of 15 months of programming. This pilot also trained low-income, diverse youth, ages 14-24, from Berkeley and the greater East Bay, to assemble, inspect, and service the e-bikes throughout this project. The pilot prioritized low- to moderate-income Berkeley residents both to receive e-bikes and to participate in the youth bicycle mechanics internship program, with a preference for those at or below 80% area median income (AMI). Alameda County's AMI for 2022 is \$142,800 (based on a household with 4 persons).

Waterside Workshops used the following methodology to reach and ensure resources went to income qualified residents/households:

- A. If income information was not collected directly, residents had to show proof of participation in income qualified federal, California State, or regional programs such as the PG&E CARE program, CalFresh Supplemental Nutrition Assistance Program (SNAP), MediCal, Section 8 Housing, etc. Half of BEEP participants submitted proof of participation in an income qualified program.
- B. The City approved the distribution of resources to ensure they would go to low- to moderate-income residents. Waterside Workshops maintained records of the income qualifications, and other demographic data, of the e-bike recipients and bicycle internship youth participants.
- C. Collaborative outreach efforts were carried out with local community based organizations who serve income qualified Berkeley residents.

Operations

I. Design and Outreach

September 2022 - February 2023

To inform program design, GRID Alternatives connected with 39 partners through the Climate Equity Collaborative and other established organizations who provide income qualified programming to Berkeley residents. We shared digital fliers widely, conducted pop-up surveying at local public events, and hosted three focus groups with organizational partners. The three main questions were:

1. What are some of your transportation needs?
2. Can an e-bike fill those needs?
3. What are some deposit considerations?

Leveraging our Climate Equity Collaborative connection, GRID Alternatives' Micromobility team hosted eleven pop-up surveying events at farmers markets, schools, and food distribution events. GRID Alternatives also hosted focus groups including 19 respondents to supplement and inform our digital survey with more personal insights. Across all engagement activities, GRID Alternatives collected emails in order to provide future updates to potential participants serving as our initial and expansive outreach efforts. GRID Alternatives' Micromobility team received a total of 251 total responses via digital and in person surveys for this community engagement period. Of these responses, 218 (86%) were from community members who reside in Berkeley.



I am smiling and engaging with my community when I ride. I am able to stop and talk. I am able to share this wonderful program as an equity participant in climate change and community health and safety improvement by providing economically accessible ways to get around. I am able to strengthen my legs, seek beauty with my eyes, and renew my spirit with breath and song.

- Marilyn

It would promote people to get out and see things you can't see in a car I.e small shops and parks you would normally drive past

- Devonte

Application and Lottery

As directed by the CEF, to qualify for this project, an e-bike recipient was required to be (1) a City of Berkeley resident, and (2) have a household income at or below 80% of Alameda County's AMI. Participants were also required to (3) be over 18 years old, and (4) provide proof of secure overnight bicycle storage.

Information about the program and the application was shared publicly through Waterside Workshops and City of Berkeley press releases and was distributed through local news outlets and community organizations. The lottery application was open for three weeks during which we received just over 600 applications. More information about this process is detailed in the Program Participants section. See table 2 “Total Applicants...” and other related tables below.

Table 2.

Total Applicants 613	Total Applicants entered in the lottery 598
Total Applicants chosen in the lottery 80	Number of Berkeley residents who benefitted from this program 124
Total Participating households 56	Active data participants These participants were categorized as active and used for data analysis. 39

II. Procurement and Youth Education

March 2023 - June 2023

After researching industry standards, staff selected Aventon and RadPower as the best fit for the program based on availability, the price point of their products, and safety certifications. All models were tested and comply with UL 2849.



Program managers ensured that all e-bikes were equipped with front and rear lights as well as wheel reflectors. If e-bike models did not include integrated lights and reflectors, these were installed during assembly. Additionally, program staff installed a rear cargo rack, kickstand, and anti-theft seat leash. All participants received a new helmet, equipped with a rear light, and a large chain lock for the e-bike. All participants received at least the following equipment in table 3.:

Table 3.

Item	Retail Price
Aventon Pace 350	\$1,200.00
Kali Central Helmet	\$80.00
Aventon Rear Cargo Rack	\$40.00
Kryptonite Evolution Series 4 Chain Lock	\$110.00
Kryptonite KryptoFlex 525 Loop Cable	\$10.00
Subtotal before tax:	\$1,440.00

Beyond these items, participants were surveyed to determine their specific needs before purchasing specific e-bikes and additional accessories. Many participants requested the ability to transport passengers, primarily children. Others mentioned balance issues or the need to carry cargo such as groceries and personal items. E-trikes, panniers, cargo baskets, and child seats were made to accommodate all reasonable requests.

RadPower models did not include odometers and adding an odometer aftermarket brought challenges: (1) wireless computers had weak signals which did not reach the sensors due to the height and design of the models and (2) GPS bike computers were not factored into this program’s budget. The participants affected by this problem submitted “best guess” estimates of their riding mileage. Since this only involved two of the 39 active participants, and their estimates were not out of line with other participants (they were both slightly below average) these estimates should not substantially affect the overall accuracy of the project mileage analysis. The following table outlines the models purchased for the program:

Table 4.

Model Type	Brand	Count
Traditional hybrid e-bike	Aventon	45
E-cargo bike (two passengers)	Aventon	8
Half e-cargo bike (one passenger)	RadPower	1
e-Trike	RadPower	2

Waterside Workshops provides vocational training for underserved transitional age youth in the Bay Area. Utilizing the retail bike shop, Street Level Cycles, youth learn repair techniques, customer service, and ubiquitous job skills. Until this project, the Street Level Cycles internship did not provide training in e-bike repair, diagnostics, or safety. Ignoring this rapidly growing sector of the bicycle industry did not provide youth with an appropriate breadth of knowledge for future employment in the bicycle industry. This project allowed for the modernization of the Street Level Cycles curriculum and workshop capacity to meet this need. This entailed:

- **E-bike certifications for educators** to ensure safe maintenance operations with electrical components during assembly and repair
- **Curriculum development to build community capacity** for maintenance and vocational training
- **Equipment purchases** to safely work on e-bikes such as electric power lift repair stands and diagnostic tools



Youth interns were fully integrated into the assembly and maintenance of the BEEP fleet of e-bikes, with staff providing hands-on lessons and quality control. The two e-bike specific powerlifting repair stands allowed interns and staff to work on heavy e-bikes safely. Additionally, two senior staff members attended a two-day, 16 hour E-bike Fundamentals certification course in Bloomfield, CO offered by QBP (Quality Bicycle Parts) Training Institute. This course covered basics-to-advanced general e-bike technical information, as well as training and certification for major e-bike systems.

Lastly, program managers developed and deployed our first ever e-bike maintenance curriculum. This has powerfully modernized our bike shop capabilities allowing the program to serve more of the public and future-proof the skills and knowledge interns gain from participation. Program staff mechanics and youth interns assembled the fleet of e-bikes once they arrived. During this assembly, staff and interns took preventative maintenance measures to ensure reliable operation by installing additional flat tire and theft prevention materials onto the e-bikes such as tube sealant and seat leashes.

III. Onboarding and Delivery

April 2023 - June 2023

Before receiving the e-bike, participants were required to:

1. Test ride an e-bike for proper size
2. Attend an e-bike safety training webinar
3. Complete participation agreement form in person
4. Provide a \$100 refundable deposit

Program staff minimized any potential barriers by offering appointments outside of typical operation hours (in the evenings, on weekends and weekdays), providing in person training in our office, and allowing participants to volunteer at Waterside for four hours in lieu of leaving a monetary deposit. Ten participants opted to volunteer because the deposit was a financial barrier to their participation. The majority of participants picked up their e-bikes between April 28, 2023 and July 5, 2023. An approved participant requested an e-trike but decided to drop out of the pilot before picking up the e-trike, which led to difficulty finding a final participant for that e-trike model. Since this model has a very large footprint it was difficult finding a participant with secure overnight storage space. This final participant, identified through a local community based organization, Bay Area Outreach and Recreation Program (BORG), was able to pick up on September 3, 2023.



IV. Survey, Training, Engagement, and Maintenance

June 2023 - July 2024

Monthly odometer readings and quarterly surveys were required for participation. Participants submitted monthly odometer readings using a Customer Relationship Management (CRM) equivalent set of tools built on Airtable by the GRID Alternatives' Micromobility team. To gather more data from participants, quarterly surveys were implemented using the same procedure. The survey operations were a great opportunity to build research capacity by implementing CRM tools on this ongoing study. Due to the substantial amount of data being collected, automations were used by the program team. Participants were reminded to complete the survey via automated email and when no response was received, program managers manually sent text messages. This gave participants ample time to complete the survey, on average 3 weeks, and opportunities to communicate any challenges they were experiencing with the program at large. Program managers were pleased with the response rates for each quarter which ranged between 86 and 61%, see Table "Participant engagement rate."

The goal of the survey was to gather both qualitative and quantitative data on participants' riding habits and any relevant lifestyle changes. Participants were asked to report the frequency of e-bike use, lifetime mileage, common destinations, changes in household vehicle use, transportation expenses, community impacts, and their overall experience. There was a reorientation of data gathered about six months into the study to better understand the insights being gathered. Issues such as equipment functionalities, unreliable timestamps, email automations, and difficulties consolidating responses led to some manual data correction and analysis in Google Sheets. Program managers addressed these challenges by adjusting automations and refining the survey questions after reviewing the second-quarter results.

Every quarter, the survey data was reviewed by program managers. If participants mentioned barriers to riding or expressed concerns, attempts were made to provide additional training via email or in person during the mechanical check-in. The mechanical check-ins were incredibly valuable for maintaining communication, providing services, and increasing engagement. Integrating mechanical check-ins with survey activities were shown to be practical methods to infuse equity into the program. Through the check-ins, we were able to meet participants at their level by providing ample opportunities for them to request support. For example, at least two participants requested fenders as they found they wanted to ride in wetter conditions. For others, they requested product



education, at least five participants had questions about e-bike operation and another three asked specific bicycle riding tips. Participants who often sought support were elder community members, who may not have had other opportunities to gain this type of e-bike adoption support if it were not for the equity focused program design and services provided. Program managers noted that this regular engagement increased capacity for e-bike adoption for at least one third of participants.



Community engagement activities were also integrated into program design as a method to support e-bike adoption through socialization, knowledge sharing, and support networks for participants. All BEEP participants were encouraged to participate in the following activities through the program:

- August 2023 - Social Picnic at Shorebird Park
- October 2023 - Group Bookmaking Art with Cheryl Deloitte, [Print Public Municipal Artist-in-Residence](#), at Kala Art Institute
- May 2024 - E-bike Fix-a Flat Clinic with Bike East Bay Instructors
- June 2024 - E-bike Portraiture with Cheryl Deloitte
- July 2024 - Program Celebration BBQ at Waterside Workshops

Partnering with Cheryl Deloitte added an artistic and community building element to the perks of this program. A small group of participants participated in these activities and expressed their excitement about them.

"It was great to work with BEEP participants through the Kala Art Institute-City of Berkeley Partnership. I am so happy that 55 residents were able to receive e-bikes from the City's Climate Equity Pilot Projects. I'm glad that some of the recipients could take in art shows at Kala, and attend an introductory bookmaking workshop as part of the program."

--Cheryl Derricotte, Municipal Artist-in-Residence 2023/2024



Interacting socially and allowing space for participants to share their experiences gave another opportunity to strengthen the bicycling community and gain feedback directly from participants. We also got to hear from their family or friends who attended the BBQ who shared ways in which the e-bike improved their life. It was encouraging to hear that participants were very pleased with the e-bike and opted to keep it. There was mention of figuring out a method to have participants swap e-bikes with each other to meet sizing, cargo, or ergonomic needs. Others were curious of future programs, whether it was another incentive or educational program to support their adoption of e-bikes in their daily lives.

V. Ownership Transfer and Closing

August 2024 - September 2024

The final survey included participant acknowledgement of the program close, a method to return deposits, and resources for future support. The program-end coincided with the final survey and maintenance check so participants were invited to complete the end of program paperwork and receive their deposit in person when their e-bike was checked over. Upon completion of these steps, participants were able to take permanent ownership of their e-bikes. Program staff reminded participants that while BEEP had come to a close and services were no longer offered for free, Street Level Cycles remains available for hire for future repairs. Street Level Cycles also operates a free bicycle repair Open Shop allowing anyone in the community to work on their bicycle with knowledgeable mechanics.

I am just happy and grateful for having been part of the program. I wish more people in need would benefit from a program like this. In my opinion it was extremely helpful. - Julio

This is absolutely an amazing project. I would not have otherwise had the opportunity to experience riding an e-bike if it wasn't for this project. Thank you. - Hattie

Loved the program.. please make this available for our high school students trying to get to school - Jessica

I began to drive a car less than before. - Participant

I hope this pilot continues- to say it has been life-changing to receive access to something I would not have been otherwise able to afford and that has been so transformative is an understatement. Thank you to Hannah and everyone involved in making this program possible! - LeeAnn

I hope that you're able to continue this program and help more folks get around town! - John



Results and Analysis

I. Program Participants

City of Berkeley

The City of Berkeley is a 17.7-square-mile (46 km²) area that includes 10.5 square miles (27 km²) of land and 7.2 square miles (19 km²) (40.83%) water, most of it part of San Francisco Bay. Berkeley borders the cities of Albany, Oakland, and Emeryville and Contra Costa County, including unincorporated Kensington, as well as San Francisco Bay. Berkeley is home to the University of California, Berkeley, the Lawrence Berkeley National Laboratory, and the Graduate Theological Union, one of the largest religious studies institutions in the world. Berkeley is considered one of the most socially progressive cities in the United States. In 2023, the City of Berkeley's population was 118,962.

Berkeley is situated along the foothills of the Pacific Coast Mountain range. The city limits contain two large natural reserves: Tilden Regional Park and Claremont Canyon Regional Preserve. The city comprises 8 main zip codes. West and South Berkeley (Zip codes: 94710, 94703, and 94702) are relatively flat, easy bike riding along and near the Pacific Ocean. Central and North Berkeley (Zip Codes: 94704 and 94709) contain the University buildings and the downtown district which has a mixture of flat roads and steeper hills. The Berkeley Hills (Zip codes: 94705, 94707, and 94708) are further east, very hilly, and challenging for bike riders.

For nearly five decades, Berkeley has been a leader in the effort to promote the use of the bicycle for transportation and recreation. The first Berkeley Bicycle Plan—created in 1971—laid out a citywide network of bikeways which are still in use today. There are bike paths and [a map for cyclists to find bike routes](#). There are many active cycling and bike advocacy groups in and around Berkeley including Bike East Bay, Kidical Mass, Walk Bike Berkeley and Grizzly Peak Cyclists. StopWaste and the Alameda County Transportation Commission support bicycle re-use in the community to divert used bicycles from the landfill. There is a leading and growing culture of e-bike riders in Berkeley committed to alternative, climate friendly transportation.

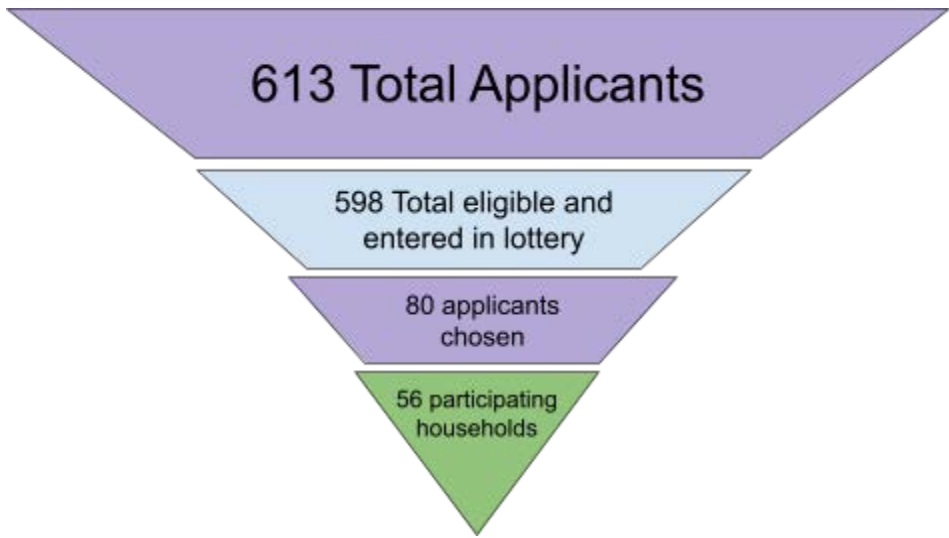
Program Enrollment

During the program application period, 613 people submitted applications, of which around 68% reported that they were enrolled in an income-qualified program. Applicants who self-reported high income for their household size, had no participation in an income qualifying program, or were less than 18 years old were removed from the applicant pool. A total of 596 applicants were input into the anonymous lottery and ranked. Program managers contacted winners numerically to complete verification. These winners were requested to submit proof of residency, income, and secure bicycle storage which staff reviewed before participants were invited to begin the onboarding process. Some lottery winners did not qualify and were ultimately declined from the program:

- 5 lottery winners did not live in the City of Berkeley
- 1 lottery winner self-reported that their income was too high to participate and removed themselves
- 3 lottery winners removed themselves from participation citing concerns around storage and theft
- 12 lottery winners failed to communicate with program staff and meet program deadlines
- 5 lottery winners removed themselves from participation citing lifestyle changes

Notably only 14% of the pre-qualified applicant list was depleted before the participant spaces were fulfilled. The remaining 86% are assumed to still be interested in e-bike incentive programs. The table below shows the process applicants moved through.

Table 5.



Based on programming funding, a total of 56 households were selected to participate and 55 were income verified to be at or below 80% AMI for Alameda County in 2023. Participants chose to provide proof of participation in an income qualified program (E.G. Medical, Medicaid, CalFresh, etc) or present program managers with their 2022 or 2023 tax returns with redacted personal information. Referenced above, an approved program participant who had requested an e-trike removed themselves from the program and it was difficult to find a recipient for the unique e-trike due to its large footprint delaying the enrollment for this final slot. Program managers therefore tapped their partnership with the BORP (Bay Area Outreach and Recreation) Adaptive Cycling program and were able to find a Berkeley resident who wanted to participate. This was the only participant who was not able to submit income qualifying documentation however they do encounter mobility and balance issues.

For the purposes of this program analysis, 39 participants were considered ‘active participants’ with complete, consistent data reporting and e-bike riding over the course of the pilot. This determination is based on the following: a total of 56 people received e-bikes, four were stolen while in the participants possession, one e-bike was crashed and determined inoperable, seven participants had major life events in the first 6 months that limited their ability to make use of the e-bike, and five other participants submitted insufficient odometer data to evaluate their activity. To note, on four occasions participants requested an additional adult be authorized to actively use and operate the e-bike. In most cases this was a spouse living in the same household where children needed to be transported regularly. We considered these adults to be “secondary participants” and they were not surveyed for their attitudes and experiences. The “secondary participants” were required to attend the same e-bike safety webinar as the “primary participant.”

E-Bike Participant Demographics

A majority of active participants reported income levels between \$0 and \$80,000. 19 active participants reported having no income or having income of less than \$40,000. (See tables “Reported income levels of participants”, “Age range of participants”, “Racial identity of participants” and “Participant approximate location map” and “Zip code of participants”)

Table 6.

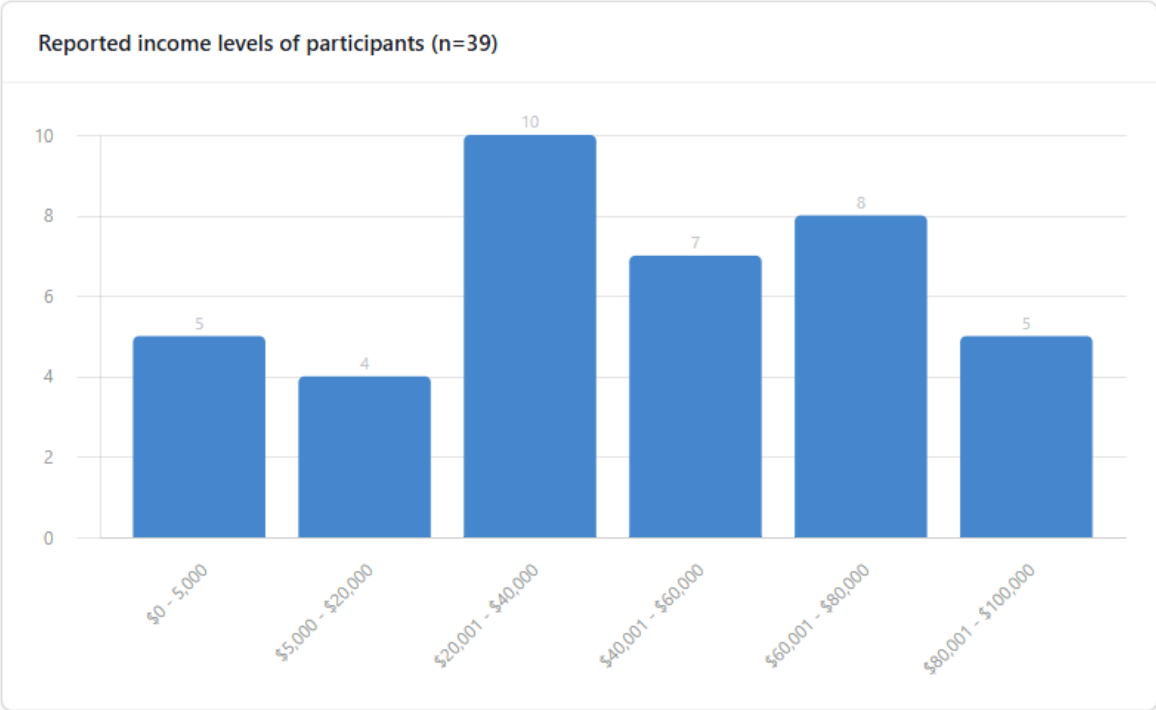


Table 7.

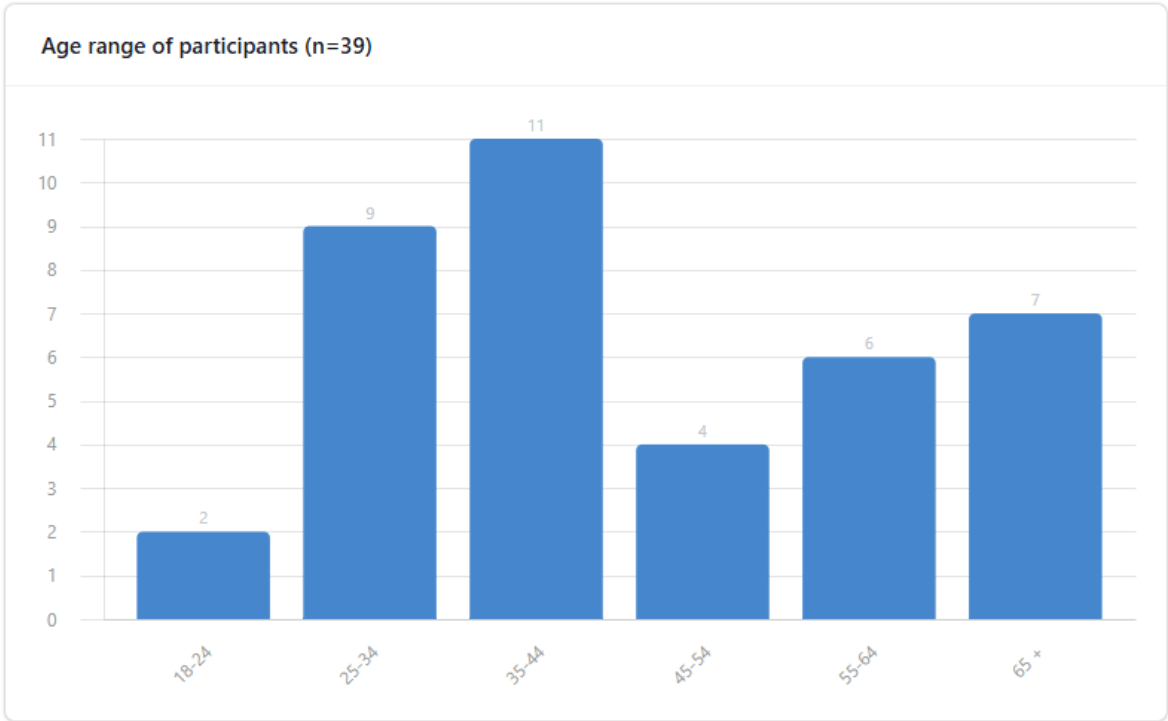


Table 8.

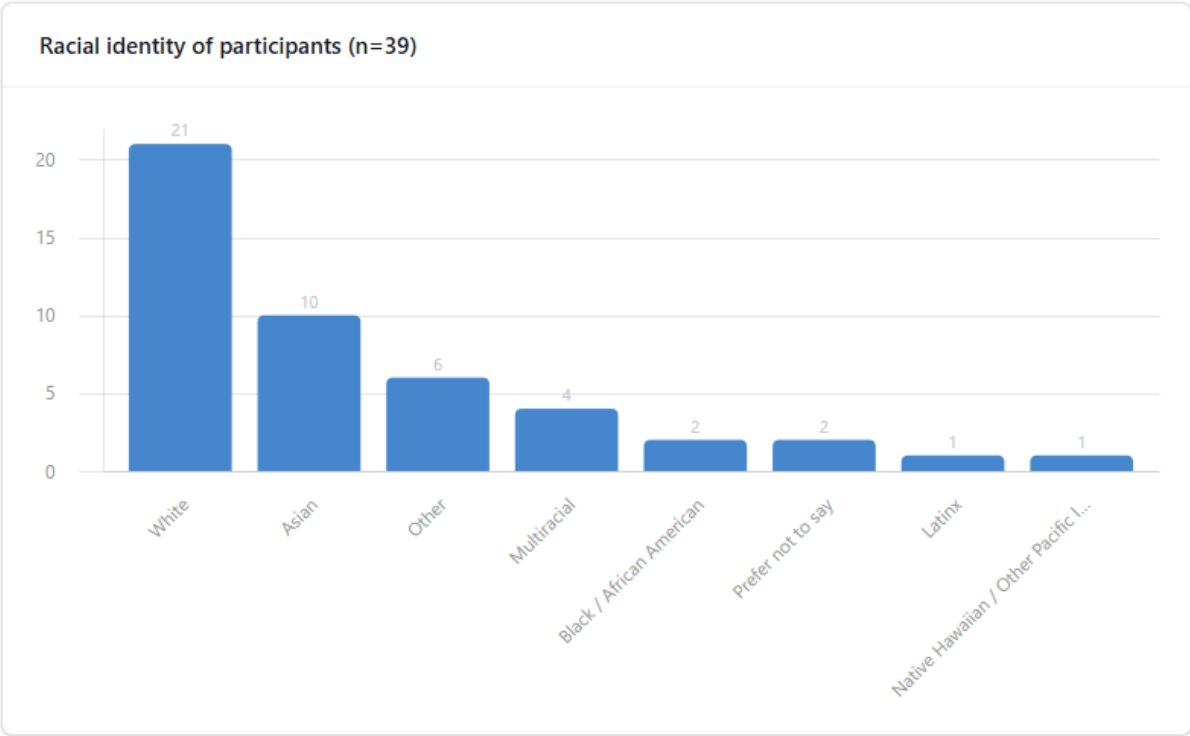
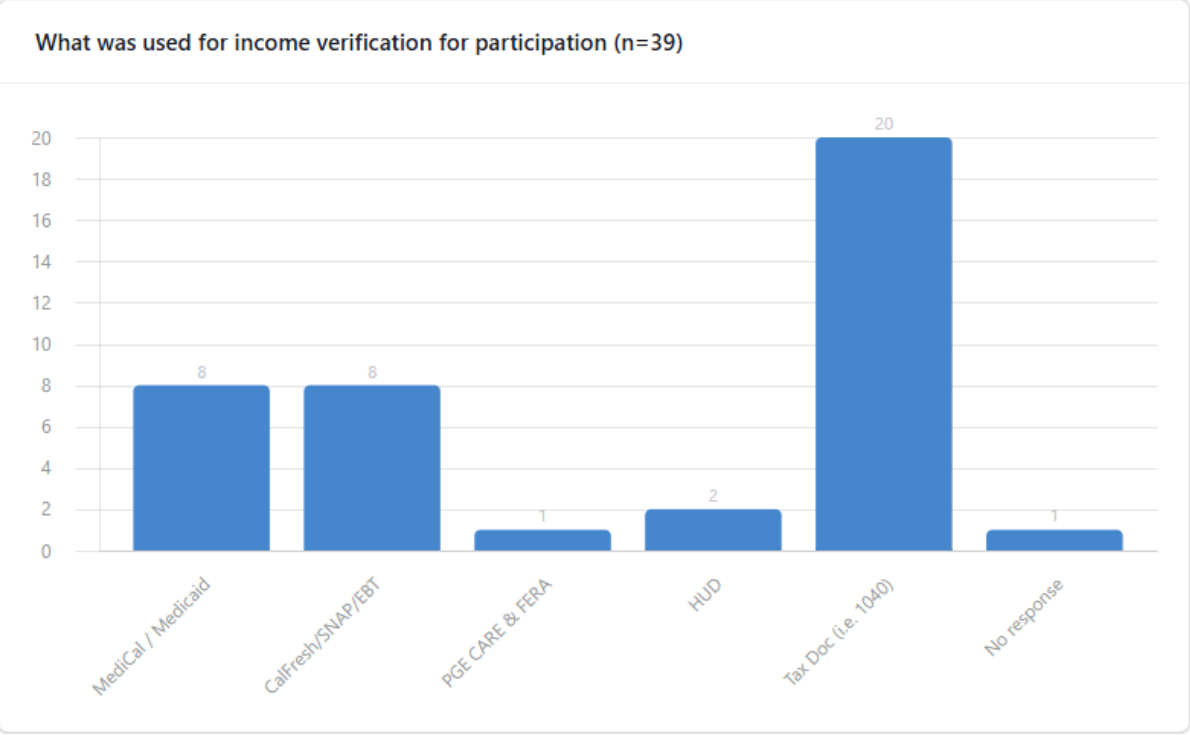


Table 9.



I've noticed more people with e-bikes in my neighborhood and grew closer my immediate neighbor across the street, asking her son for tips, since he loves his e-bike. A lot of people have commented on my riding, and I'll take this as a positive, since they haven't said anything negative and seem amused. At least they are more aware of this alternative.

- Sarah

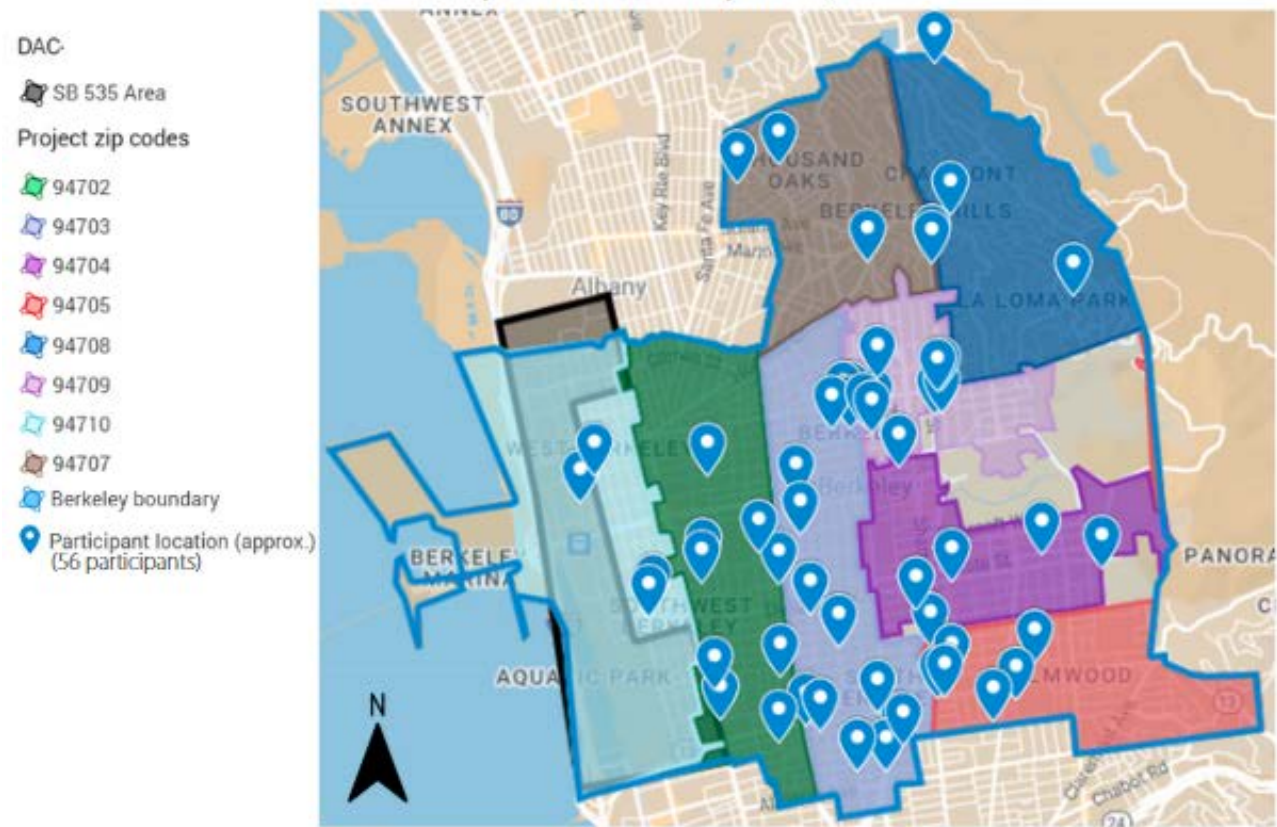


Using income pre-qualification methods, such as referencing an applicant's enrollment in an income-qualified program, is an effective administrative and outreach tool that enhances equitable community engagement. Data extraction and fatigue, as well as the risk of divulging personally identifiable information, can be minimized by using pre-qualification tools during screening. Supporting community-based organizations with additional funding to facilitate meetings and cross-program promotion may further advance these equity goals.

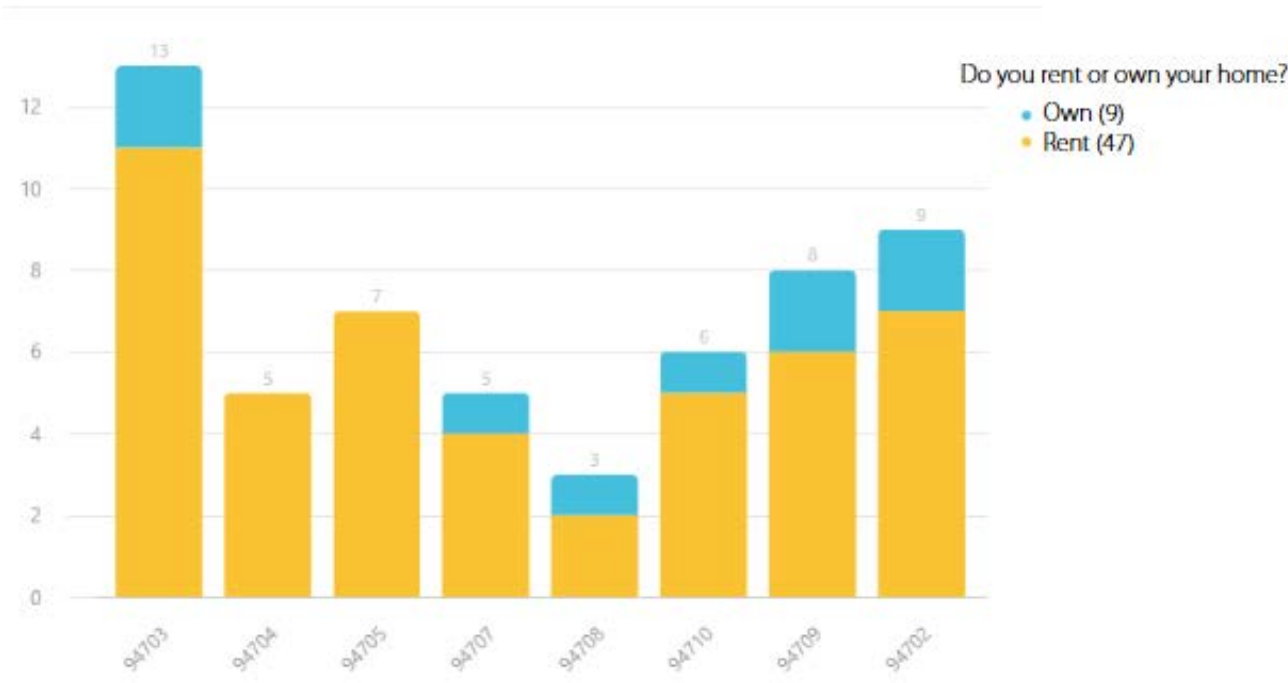


Table 10.

City of Berkeley Map



Zip code of participants (n=56)

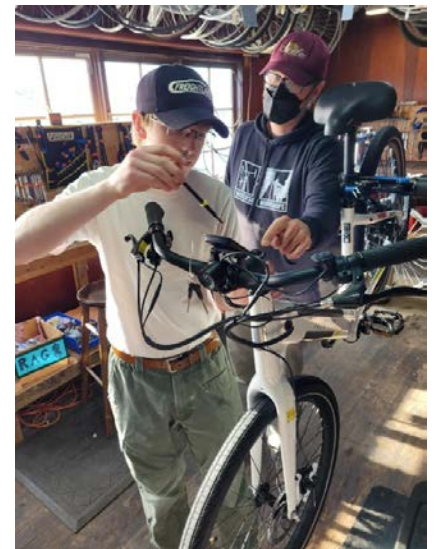


Internship Program Participants

Street Level Cycles, a program of Waterside Workshops, operates a full service bike shop that also serves as our bicycle education, repair, and reuse program. Working alongside skilled instructors, our youth interns learn professional bike repair by refurbishing used bicycles, which are distributed back to the community as affordable, sustainable transportation. Youth also help community members fix their own bicycles in our do-it-yourself Open Shop workspace. Each year, with the support of our interns, we refurbish, reuse, or recycle over 1,000 unwanted bicycles and serve around 1,300 community members in Open Shop.

BEEP enabled interns to get their first e-bike mechanics experience. Street Level Cycles and staff engaged youth in Berkeley in e-bike mechanics, specifically assembly, diagnostics, and maintenance. BEEP provided necessary equipment and staff certifications to uplift and modernize the Street Level Cycles bicycle internship program. This powerfully modernized our bike shop capabilities allowing the program to serve more of the public and future-proof the skills and knowledge interns gain from participation.

Waterside internship programs serve youth who face barriers to employment, including foster youth, homeless youth, youth with learning differences, and youth who are at risk of dropping out of high school. Twenty youth participants, aged 16-24, participated in 4 initial workshops at the launch of this curriculum module. Once completing the first two units, interns were integrated into the assembly of the e-bikes with senior mechanic supervision. Based on self-reported household data, 80% of Waterside interns are low-income (qualify for free or reduced price lunch), 40% live below the poverty line (less than 50% of the Area Median Income for Alameda County), and 80% self-identify as youth of color. Many of our participants receive special education services in school, or they are identified by their counselors and case managers as requiring intervention to support their academic growth and social-emotional wellbeing. This e-bike module has now been integrated into all future programming since internships are typically asynchronous. Four advanced interns completed all units and they participated in quarterly repairs and safety checks throughout the program.



For these advanced and interested interns, Waterside continues to provide access to e-bike maintenance training and is exploring Light Electric Vehicle Association (LEVA) certifications for interns in 2025. Annually, 75 interns will benefit from this modernized program. All interns enrolled in Waterside's Street Level Cycles bicycle program will learn about e-bike maintenance as part of their regular internship. See appendix 3: E-Bike Internship curriculum. Some youth participants commented on how different e-bike assembly is from non-electric bikes; specifically the investigative nature of troubleshooting issues requires more attention to detail, product knowledge, and access to diagnostic tools.



Under the guidance and supervision of our staff, a youth intern, Micah, featured here, refurbished a donated e-bike for transportation in and around Berkeley.

Additional capacity-building strategies and funding for e-bike maintenance within incentive and education programs provide communities with the tools needed to build climate resilience. E-bikes, along with programs that encourage their adoption, create opportunities for workforce development and support the shift from cars to e-bikes. Offering residents ongoing access to maintenance services further encourages the adoption of e-bikes and supports the shift to more sustainable transportation options.

II. Response Rates and Mechanical Services

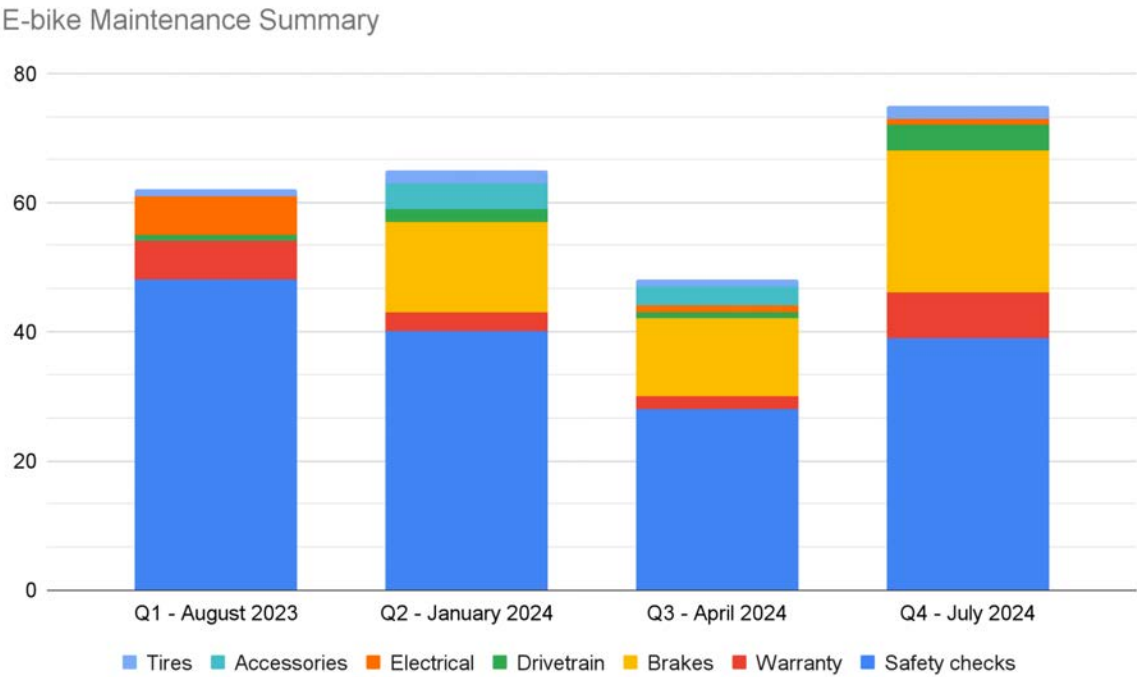
Each quarter, participants were allowed ample time to respond with no penalty. Response rates for monthly odometer checks and quarterly surveys ranged from 61% to 94% per month, excluding participants whose bicycle was stolen or crashed. Each survey also incentivized participation and infused equity by offering free in-person service appointments with bike program mechanics.

Leveraging community engagement opportunities like quarterly check-ins, surveys, and mechanical service supported participants in optimizing their adoption of the e-bike. Additionally, these moments allowed for participants to share more insights with the program team. This feedback loop gave opportunities to better support mode shift adoption. Including these timed support and engagement points was a major benefit to guide participants to successfully complete the program and be better equipped to adopt an e-bike.

Table 11.

Participant engagement rate				
Project Quarter	Q1	Q2	Q3	Q4
Survey Responses Captured	48	45	34	40
Survey Response Rate	86%	80%	61%	71%
Mechanical Safety Checks	48	40	28	39
Total Mechanical Services Provided	62	65	48	75

Table 12.

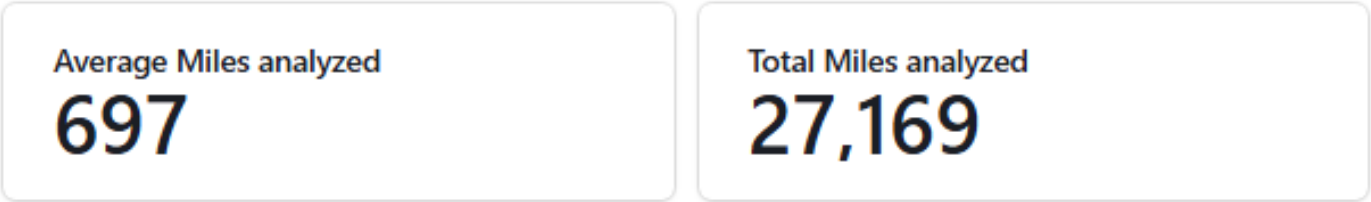


The quarterly maintenance checks were great. I felt like my ebike was always in perfect riding form. - Julio

III. Ridership Impacts

Vehicle Miles Traveled

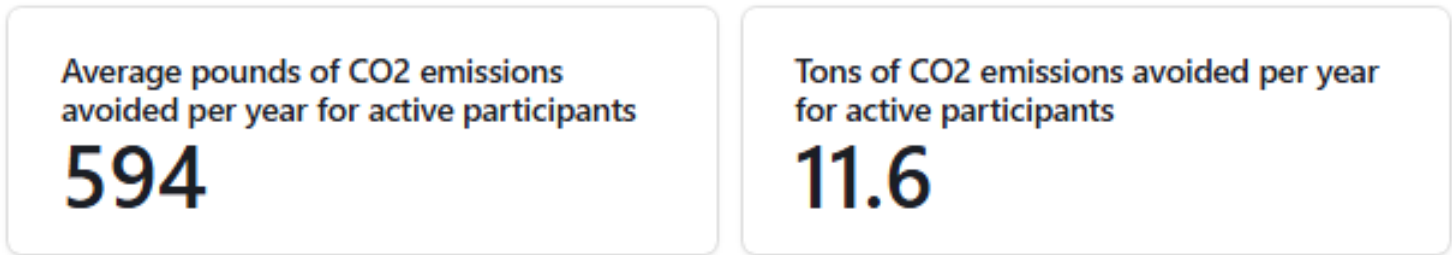
Active participants rode their e-bikes a total of 27,169 miles during the program period. This averages 697 miles per participant. The participant with lowest miles rode 46 miles, and the participant with the highest mileage was able to ride 2,315 miles around the Berkeley area. E-bikes continue to show their great benefit in increasing the mobility access of participants. (See table “Average Miles analyzed” and “Total miles logged”)
Table 13.



Programs that provide access to e-bikes or other active transportation options can result in varied use rates. E-bikes and other active transportation options meet a variety of use cases.

Volume of vehicle use - GHG metrics

Through the use of their e-bikes for the year, active participants avoided 11.6 tons of CO₂ emissions. This averages 594 pounds of CO₂ per year per participant if all those miles were driven in a fleet average vehicle. The participant who rode their bike the least (86 miles/year), only avoided 73 pounds of CO₂ emissions per year, and the participant with the highest annualized mileage (2,941 miles/year) was able to avoid 2,510 pounds of CO₂ emissions per year just riding around the Berkeley area. (See appendix 5 “Calculation of avoided carbon emissions & fuel costs”)
Table 14.



E-bikes complement other active transportation solutions to decrease Greenhouse Gas emissions while providing more mobility access to communities. Access to an e-bike resulted in major emission reductions by participants. We expect emission reductions to increase over time as many participants continue to gain confidence, identify more trips they can take with an e-bike, and adapt their e-bikes to better support more uses.

The highlight has just been expanding where I go on the bike. Since I have the bike, then I look for opportunities to go places on it. I have really enjoyed biking along Wildcat Canyon Rd where the road is closed to cars. - Christy

I have made several new friends because of being able to bike with them, and have also connected with other bikers who are using an e-bike for mobility access and climate goals! Also learning a lot more about transit issues in the East Bay and feel more empowered to speak up on behalf of cyclists everywhere! I am also more able to get around town and connect with my community now that I have transportation independence!! - Hanne

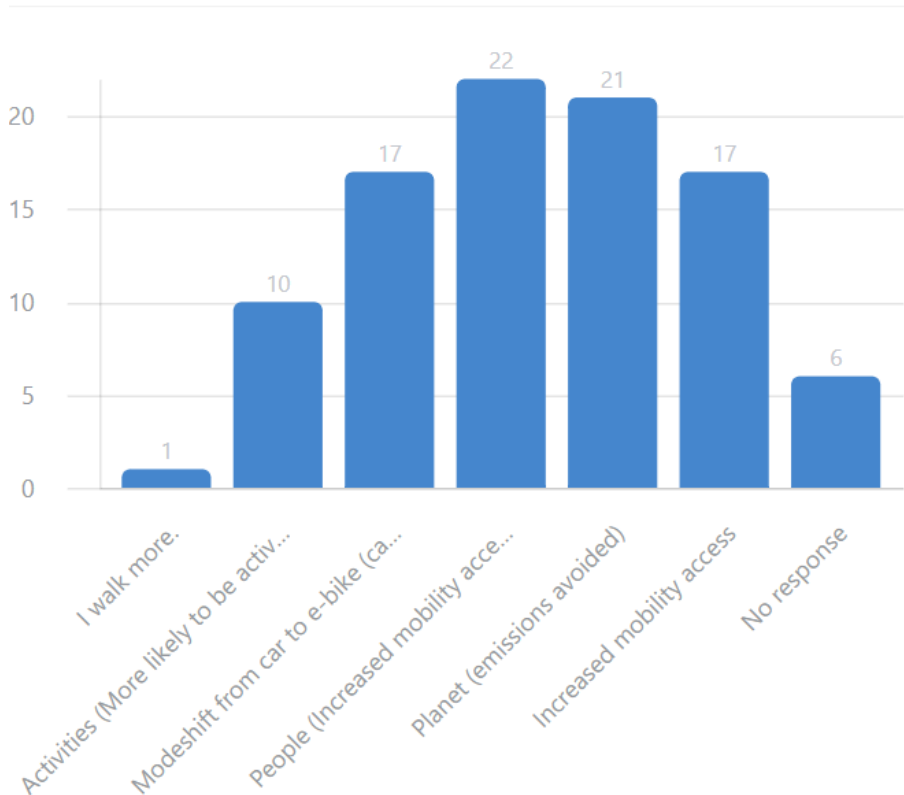
Climate Mitigation

Participant responses show high prevalence of mode shift through using an e-bike and having access to e-bike relevant support programs. At the end of the program, all participants chose to keep their e-bikes, most reported that they used the car less, and were able to get more exercise in as well as having more fun getting around. In survey responses, participants suggested that mode shift to e-bikes could be increased with support from additional chargers or battery capacity, to address range anxiety. They also indicated that additional education on traffic safety skills or other rebate programs for protective equipment can increase mode shift. See tables “How has having an e-bike changed how you get around town?” and “What are things you wish this pilot had provided?”

I'm riding the bike instead of driving. I even will take longer routes just to get more riding in and enjoy the outdoors.
- Sherry

I can take my bike if I don't have my 3 teen dependents going with me.. if the program is offered again I think it should include teens 15 and up with a parent that is also participating - Jessica

Table 15. Quarter 4: How has having an e-bike changed how you get around town? (Active participants; n=39)



The bike has helped me be more active on a regular basis, and being outdoors improved my mental health significantly. - LeeAnn

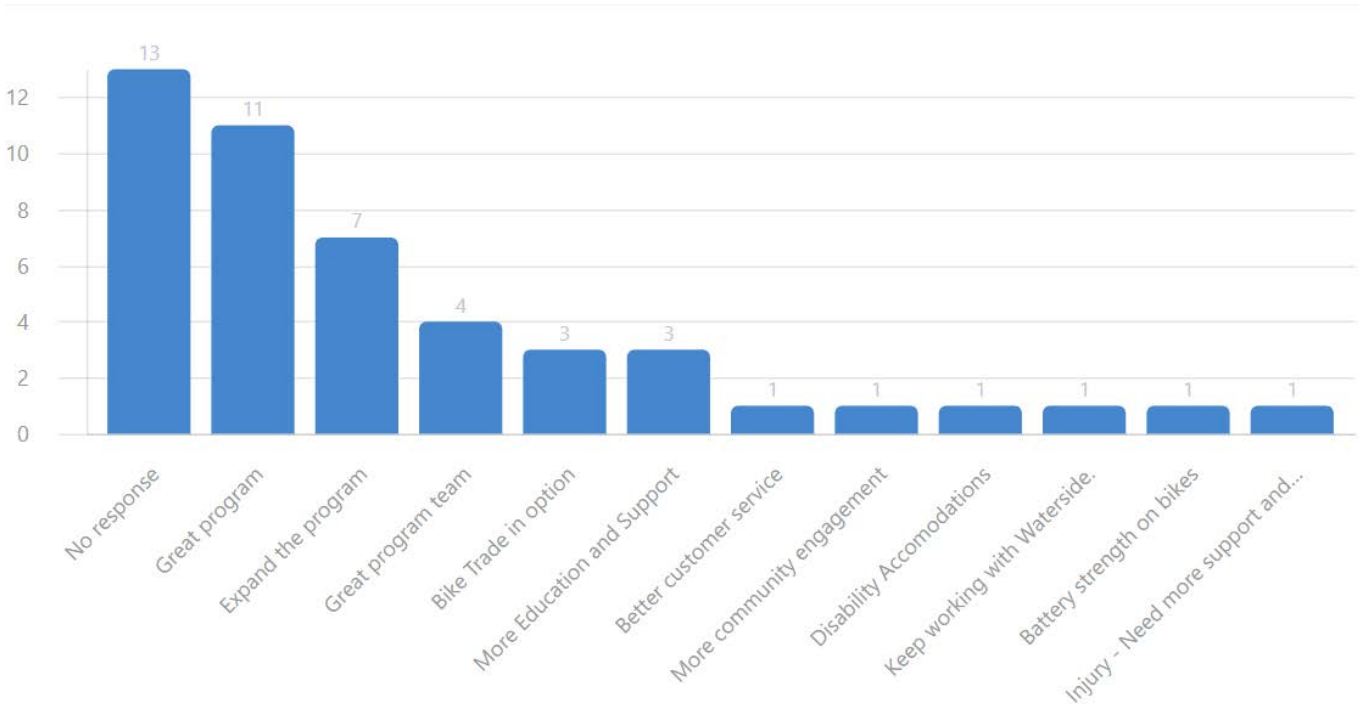
Shorter trips to my local shops and grocery store don't require me to use my car as often. - Jonathan

I no longer use the car for short trips - Devonte

It helps me discover things in my community. Like classes at the Berkeley wellness center. - Cam

Table 16.

What are things you wish this pilot had provided? Ex. additional or different education workshops, accessories, safety equipment, etc (Active participants; n=39)



more education workshops: maneuvering skills practice courses' riding public transportation to EBRPD rides, maintenance understanding. - Marilyn

A nice biking windbreaker :-)- Max

Maybe workshops teaching basics of caring for the ebike - Kaisha



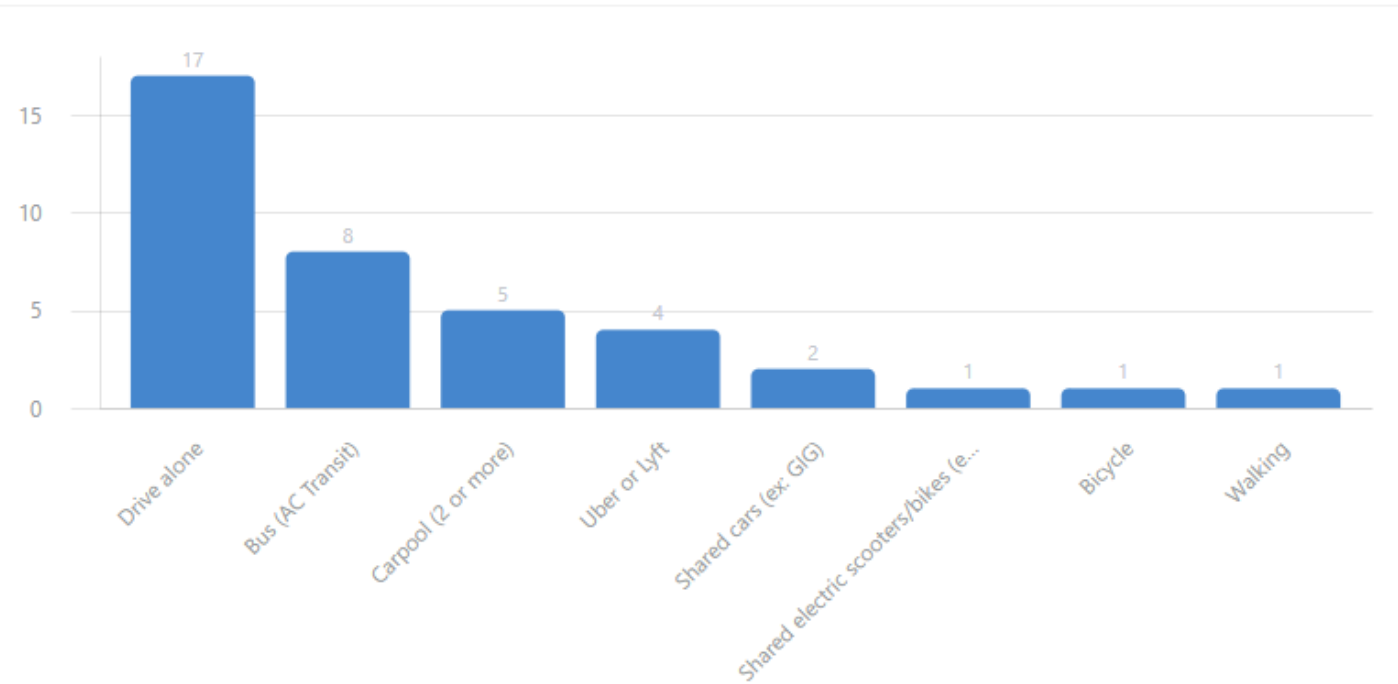
Potential Mode Shift

At the start of the program, participants were asked for their current method of travel. Participants in Berkeley were very multimodal in general. There were 17 participants that stated they drive alone, followed by 9 who carpooled, used shared cars, Uber or Lyft, see table “How do you currently travel for daily trips?” While Berkeley has had major success in diversifying the transportation options available to residents, there is still a strong trend for car-based travel along with other travel methods.

Table 17.

How do you currently travel for daily trips? Study Start (n=39)

Filtered for most impact on modeshift * *participant responses were filtered to a single selection that would have most impact from modeshift to e-bike. (eg. if a participant selected walking, bicycle, and drive alone, then drive alone would be the selection represented in this chart



To understand these initial trends, we looked at participant sentiment regarding bicycle safety infrastructure obstacles during the program. It was observed that there is a strong correlation to the trend of car-based travel if there are obstacles to bicycle use. There is room to improve bicycle safety infrastructure to encourage further adoption of e-bikes and other active transportation for local trips.

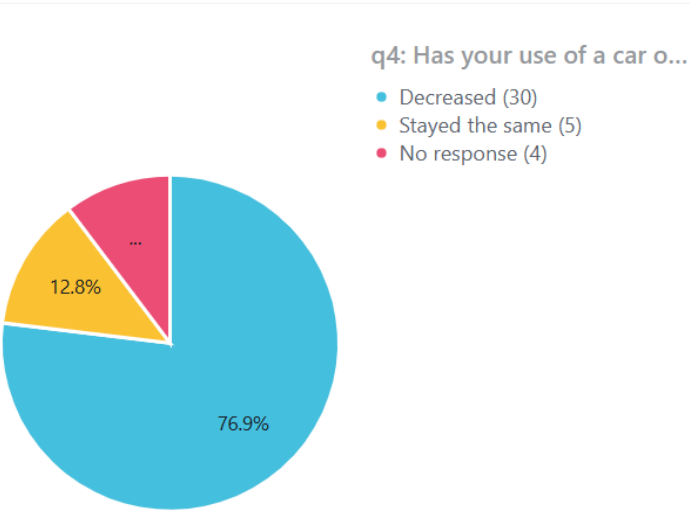
No traffic enforcement. Cars running stop signs and red lights...
- Participant

Fear of cars. - Cody

Just a lot of fear of car accidents and bad infrastructure that doesn't prioritize paved roads or bike lanes. - Hanne

During the final survey, participants were asked if their use of different vehicles has changed since they participated in the program. There was a strong trend that showed that participants used less cars or motor vehicles, as well as less rideshare, while the use of pedal bikes and public transportation roughly stayed the same. This indicates that program participants were primarily using their ebikes to replace car usage, not pedal bike and transit usage. See table “Has your use of a car or motor vehicle gone up or down since the beginning of the program?” and “Has your use of pedal-only bicycles gone up or down since the beginning of the program?” Table 18.

Has your use of a car or motor vehicle gone up or down since the beginning of the program? (Active participants; n=39)



There have been great efforts to incentivize the adoption of electric and hybrid cars, including rebates, credits, and discounts, which give adopters anywhere from 25% - 40% in savings. These incentives increase the success of mode shift from internal combustion engines (ICE) to electric and hybrid cars. Additionally, the support for these adopters of electric and hybrid cars continues to grow and the available amenities continue to increase user comfort and adoption. Similar incentives and discounts would increase e-bike and active transportation adoption, as well as begin to balance impacts to user experience. Along with infrastructure investment and equipment improvements, further education and incentives programs will continue to increase user experience and comfort, and climate resilience.

Table 19.

Has your use of public transportation gone up or down since the beginning of the program? (Active participants; n=39)

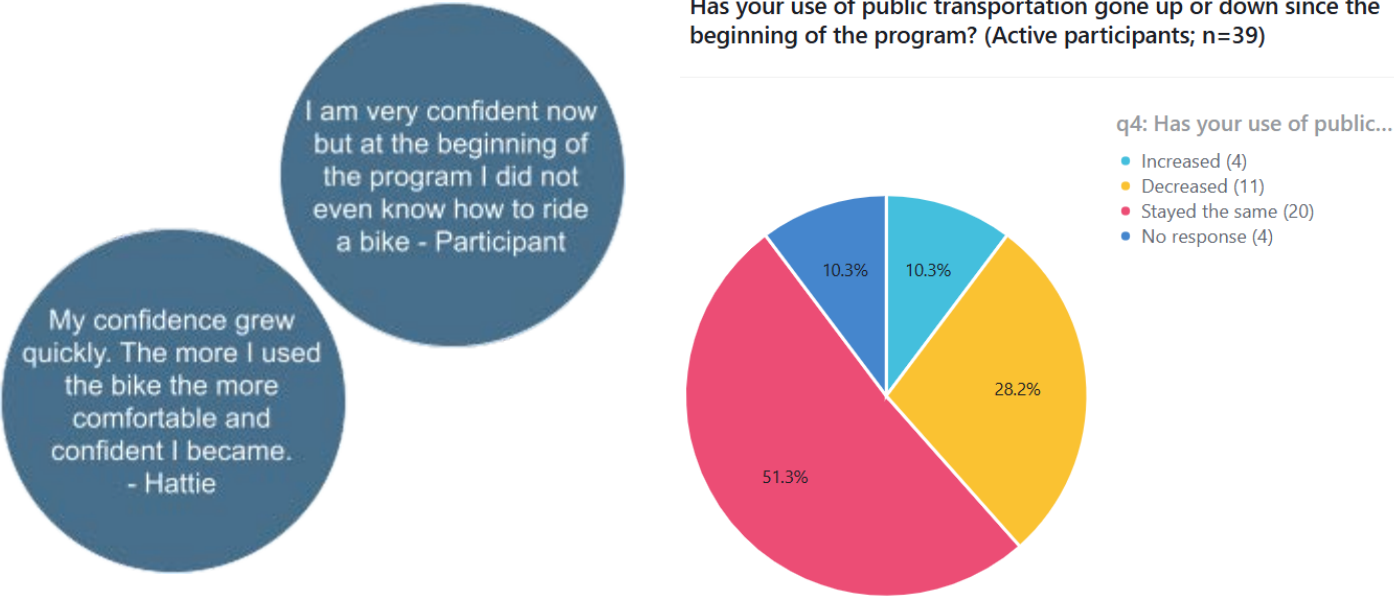
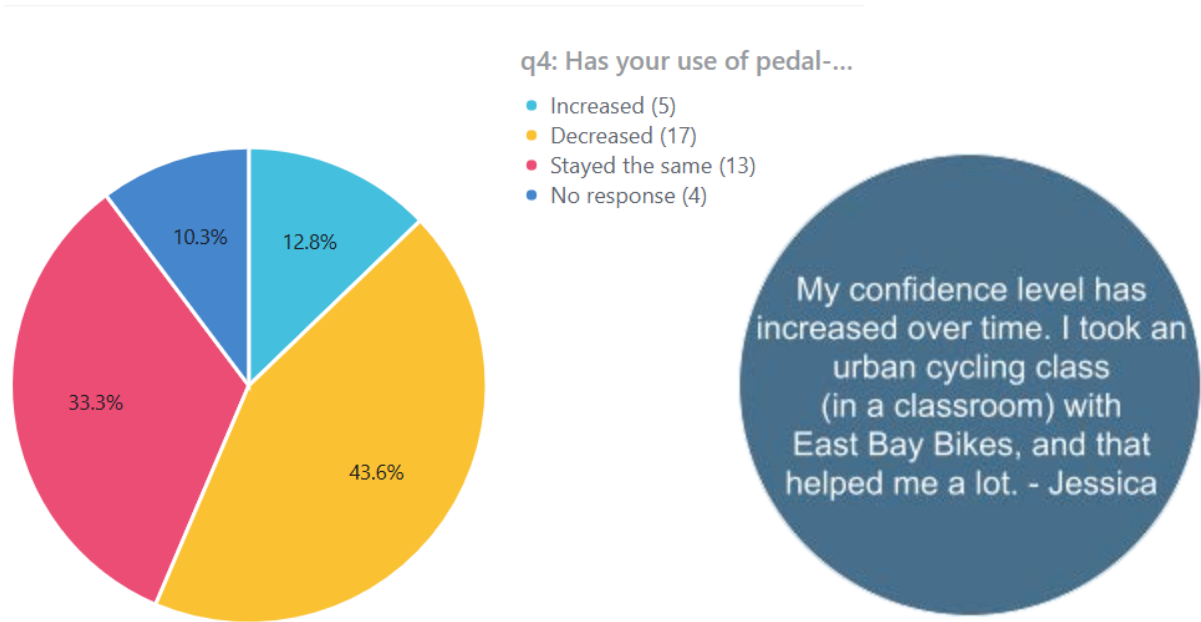


Table 20. Has your use of pedal-only bicycles gone up or down since the beginning of the program? (Active participants; n=39)



Converted E-bike Commuter Narrative

In at least one case, a participant, Abigail, was not a self defined “bike rider”, didn’t own a regular bicycle, and hadn’t ridden in years. But since winning the BEEP lottery and receiving the e-bike they ride multiple times a week. At the first quarter survey, they were still getting used to their new e-bike and found it a difficult to commute to Richmond for work but would use the e-bike for errands and getting around Berkeley specifically taking advantage of the Ohlone Greenway. “I like being on my bike because I get a little exercise (but it’s not too hard), and I feel connected to the other bicyclists and pedestrians I see on the street.” By the second quarterly survey this participant had ridden nearly 900 miles in 6 months, around 35 miles per week. Abigail also went above and beyond the program requirements for bike education by attending Urban Cycling 101 hosted by Bike East Bay at the Berkeley Public Library.

When winter arrived they adjusted their habits and equipment for the colder weather. “I’m always looking for opportunities to ride my bike, so now I find that I’m interested in buying things from local shops rather than ordering them online” By the end of the pilot, Abigail was riding one day a week to work in Richmond which takes nearly an hour from their house. This participant logged around 1600 miles of riding throughout the pilot. At the final survey, Abigail indicated that their use of motor vehicles went down. They were also riding their bike most frequently for work and second most frequently for grocery shopping. “I don’t know what the one highlight was, because I have loved having my e-bike so much. I can’t emphasize this enough--I love riding my bike, and I really do try to ride it as much as I can for trips around town. I’ve held steady with my goal of riding to work one day a week (it’s a long commute to Richmond, so I had that modest goal of one day a week on my bike--and I’ve stuck with it). I didn’t have a bike of any kind before getting this e-bike, and I’m so happy to have it.”

IV. Participant Financial Impact

Survey responses show that a majority of participants, 62% spending less and 8% spending much less (n=39), experienced a change in their transportation budget and spent less on transportation at the end of the study period. There were some that did not report a change, and nobody reported spending more on transportation. E-bikes have a strong correlation to spending less on transportation. Looking at the cost savings by comparing miles traveled by the e-bike to travel by car referencing a \$0.215 per mile fuel savings for traveling by e-bike over a car shows \$150 average annualized savings. If referencing a \$0.70 ownership costs which covers other car ownership costs besides fuel, then there is an \$890 average annualized savings in car ownership costs. See Appendix 5 “Calculation of avoided carbon emissions & fuel costs”

Table 21.

Change in participant budget using the e-bike during the study period (Active participants; n=39)

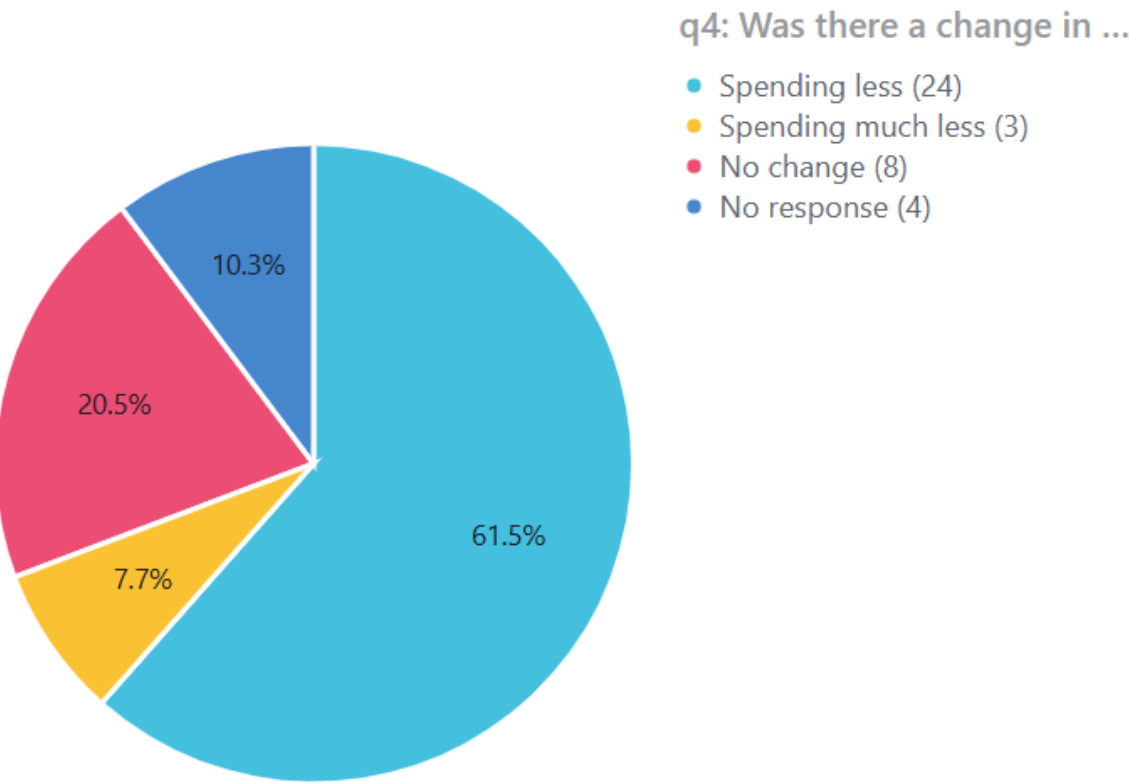


Table 22.

Average annualized fuel savings
\$150
Average annualized savings versus car ownership
\$890

E-bike adoption resulted in transportation savings and more potential for local spending or economic upward mobility. Further funding and programs to support mode shift adoption has major potential economic benefits and returns on investment to the community and community members. E-bikes and community programs supporting mode shift adoption show strong trends for continued local reinvestment and growth.



V. Participant Knowledge and Comfort Level

When starting the program only 23% of participants shared they were very experienced using e-bikes, another 31% had little experience, and about 41% of participants reported that they had no experience. By the end of the program 56% of participants reported feeling most confident, 5 out of 5, on e-bikes and an additional 28% of participants reporting that they felt confident, 4 out of 5. See tables “Beginning: What is your comfort level with riding e-bikes?” and “Did your confidence level with the e-bike change?”

Table 23.

Beginning: What is your comfort level with riding e-bikes? (Active participants; n=39)

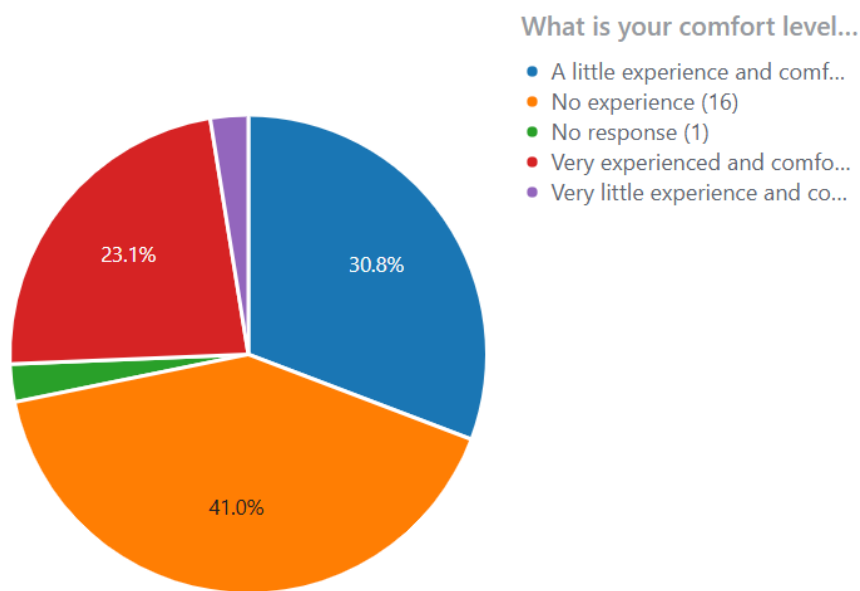
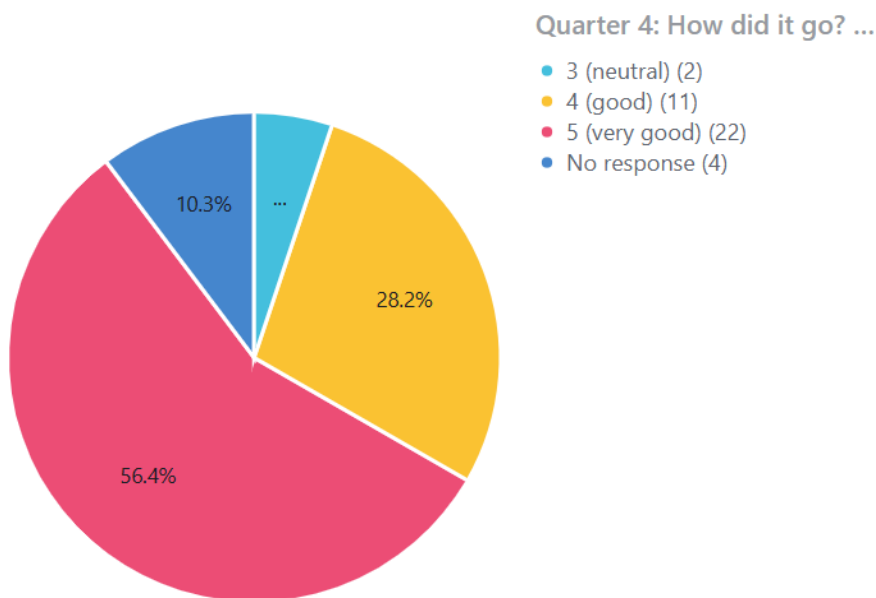


Table 24.

Quarter 4: How did your e-bike rides go? What is your confidence level with the e-bike? (Active participants; n=39)



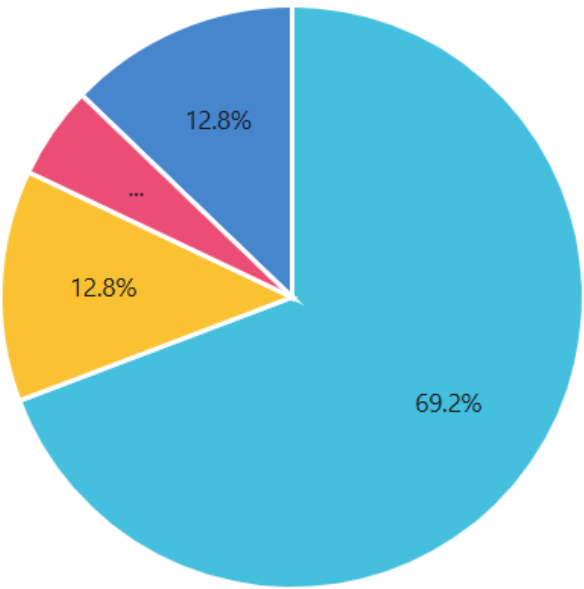
Including safety training and education, the program increased participant confidence and transportation mode shift potential. Making sure that programs have funding for education or capacity building for education will ensure that adoption of e-bikes is a safe transition and focuses on improving user experience. We saw participants' confidence grow and we heard that they have started conversations with friends, family and neighbors about e-bikes. The appetite for e-bikes is growing. Serving our community with supplemental education and incentives for improving user experience beyond the purchase of the e-bike will continue to grow the share of road users choosing e-bikes and bicycles.

Table 25.

Quarter 4: Did your confidence level with the e-bike change?
(Active participants; n=39)

DATA Quarter 4: Please tel...

- Increased (27)
- No reported change (5)
- Decreased (2)
- No response (5)



New Rider Narrative

This pilot was intentionally designed with little to no barriers for participation. Therefore, the lottery resulted in a participant pool with a wide variety of knowledge of, exposure to, and comfort with bicycles at large. This became evident prior to e-bike distribution and program managers identified three types of participants prior to e-bike distribution: frequent riders, middle of the road, and new riders. These groups were anecdotally identified based on participants' requests for education around equipment, route planning, or riding tips. Program managers state that the cohort was evenly distributed between the three groups, one third of participants were new riders, one third were middle of the road, and one third were frequent riders. The participant care and services provided during this program equitably allowed new riders to also become e-bike adopters.

During quarterly surveys, all participants were asked to describe their confidence level with riding the e-bike giving us insights into potential adjustments that could encourage ridership. In many cases, program managers were able to take the time to educate participants or provide resources so that they were riding confidently. However, there were some new riders who indicated needing even more education beyond the program's staffing ability. In the survey results, several participants cited concerns around balance and bicycle control. They specifically highlight concerns around feeling comfortable gaining balance rapidly from a stop, maneuvering in traffic, and stopping in a controlled manner. Even for those frequent riders, the heavier weight of the e-bike requires some practice to execute smooth controlled starts and stops. New riders would have experienced this on a greater degree from frequent riders based solely on their muscle memory and familiarity with riding a bicycle. E-bikes can be game changing mobility devices for people with a variety of handicaps, but handling these weight issues at start and stop can be an impediment to their use. A small amount of training can go a long way to helping new riders overcome this challenge. There are a variety of approaches that can help, which the program team implemented:

- Sizing the bike frame to body size
- Considering a step thru frame design
- On-bike training in how to gain momentum from a stop including practice with using the throttle (class 2 e-bike) or a higher level of support (class 1 or 3 e-bike)
- Starting and stopping with the foot resting on a raised curb rather than the ground
- Additional practice with an instructor in a controlled environment, such as a quiet street or an empty parking lot, to practice transition maneuvers for a confident start and stop

There was no requirement for how much to ride the e-bike during the pilot. But participation did have a physical requirement of being able to ride the e-bike by oneself. This was confirmed by participants meeting with program managers in person and test riding an e-bike prior to receiving theirs. Only once during onboarding did a participant refuse to test ride an e-bike and was asked not to participate in the program due to this limitation.

Screening participants for experience with e-bikes and bicycles can help increase the success rate of adoption. Alternatively, providing support, education, adjustments and/or additional accessories may increase the adoption of e-bikes by new riders, especially for those who have no experience. Community members are willing to try out e-bikes and can be better prepared for ownership with the correct e-bike fit and equipment. Prioritizing outreach to new riders through educational programming like "Learn to Ride" or "Urban Cycling 101" by Bike East Bay and other local bike safety programs would increase success in mode shift adoption and improve user experience and satisfaction.

VI. Community Impacts

Participant responses show strong support for mode shift using an e-bike and having access to e-bike relevant support programs. When asked what their travel options were at the beginning of the program, a majority of the 39 active BEEP participants reported that they drive alone, closely followed by people that use the bus, or carpool and use shared mobility. At the end of the program all participants chose to keep their e-bikes and they reported that they used the car less, were able to get more exercise in as well as having more fun while getting around. Additional things that participants shared to support mode shift to e-bikes included support for additional charging options or battery capacity, to address range anxiety, as well as support for education and rebate programs to prepare residents with protective equipment and traffic safety skills.

Household trips per week by e-bikes

Participants from the West and South Berkeley neighborhoods consistently made more frequent round trips per week. Participants from the Berkeley Hills neighborhoods made less trips per week. See table “Count of riders by reported trips per week.”

As supported by participant quotes, the infrastructure in the West and South Berkeley neighborhoods needs further improvements, as shared by participants and by the Berkeley community in general. Despite the infrastructure obstacles, riders in these neighborhoods were able to consistently use their e-bikes for a variety of trips. Improvements to infrastructure would support adoption of e-bikes and active transportation.

Table 26.

Count of riders by reported trips per week (Active participants; n=39)

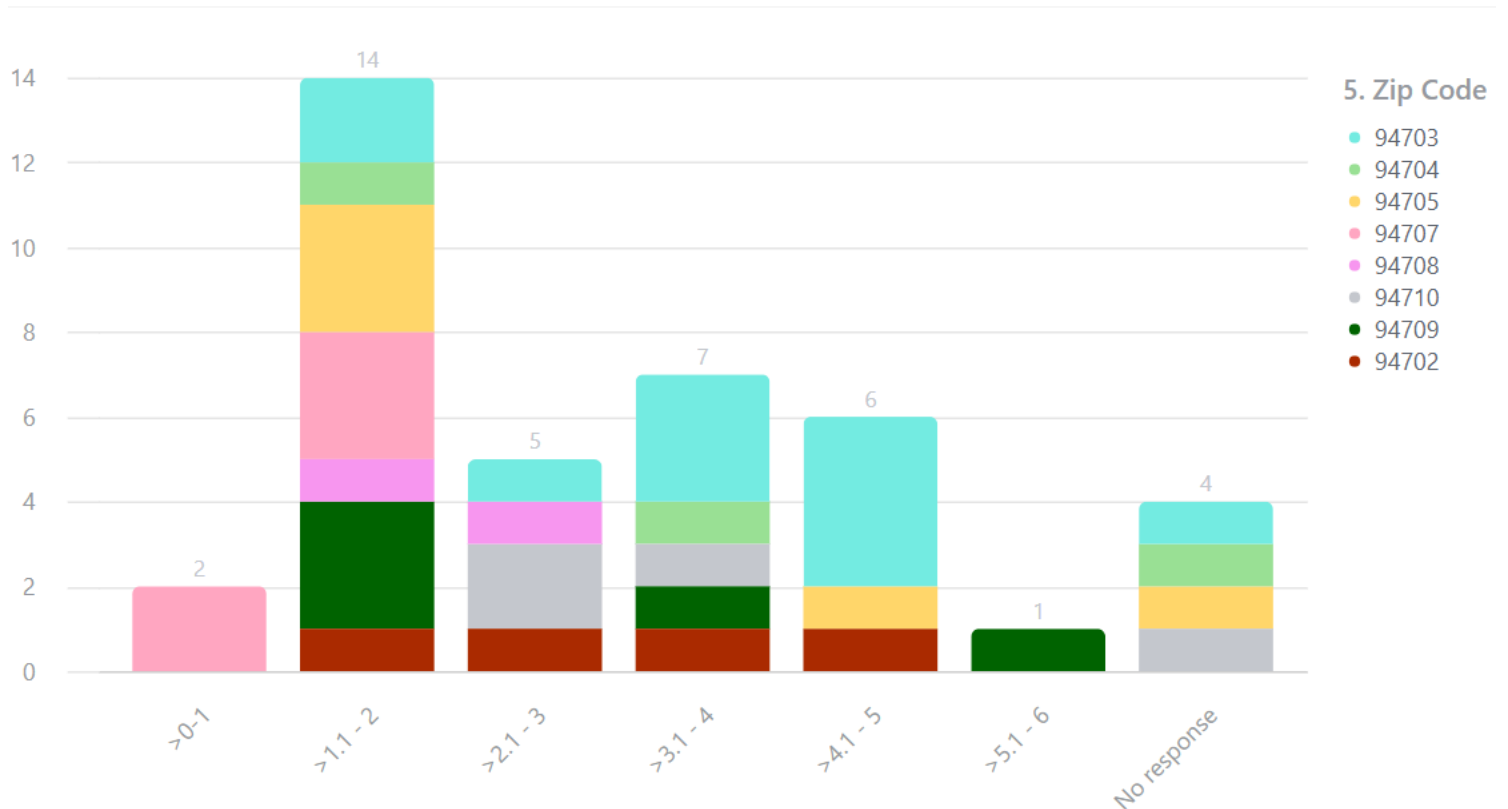
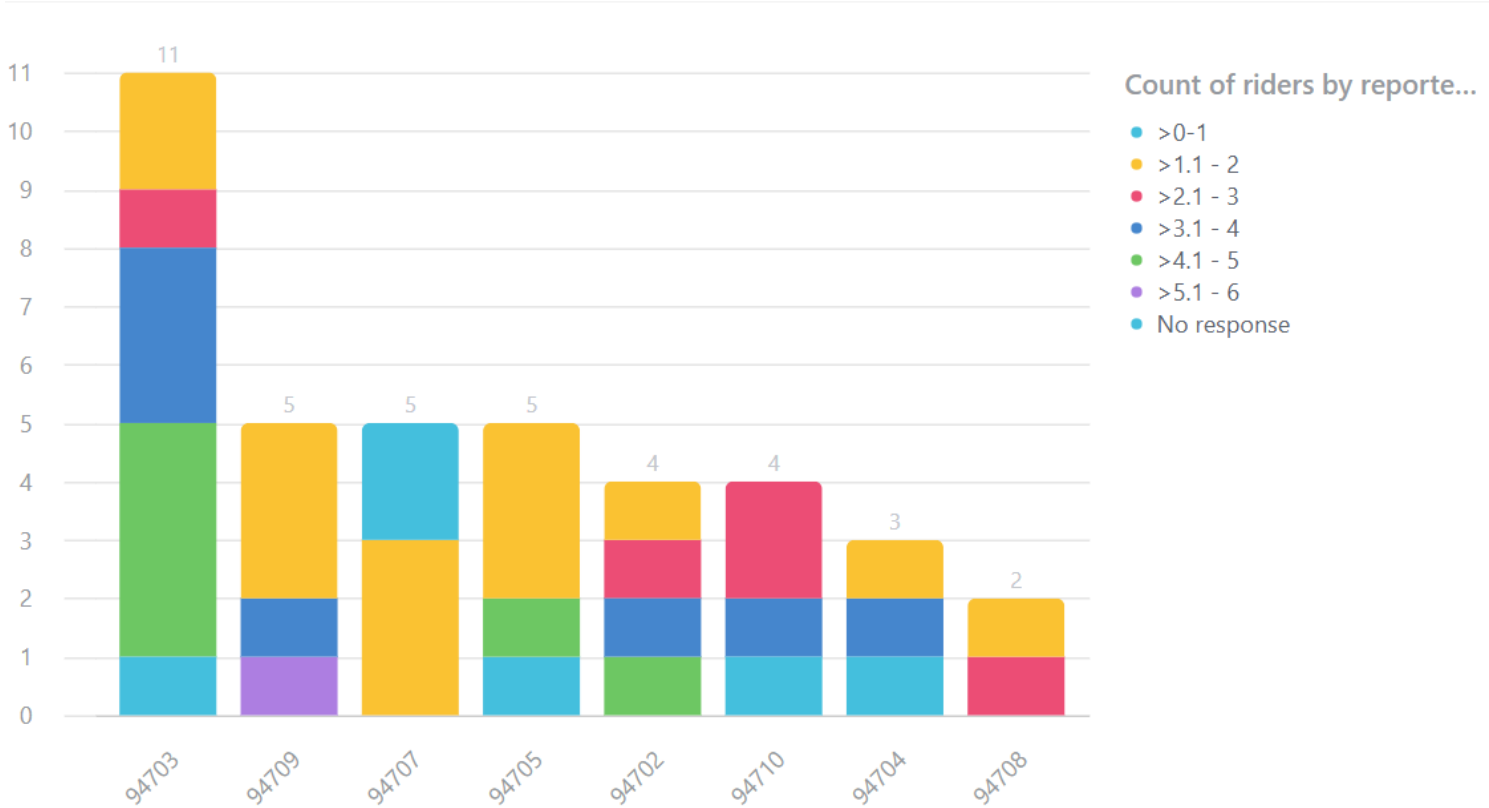


Table 27.
 Count of riders by reported trips per week (Active participants; n=39)



Surprisingly difficult to get through South Berkeley/Emeryville east of San Pablo.
 - Michael

Most important is knowing a safe route to take that avoids sketchy sections of road. For example,google maps will sometimes direct me down telegraph ave because it is a bike route, but much of telegraph in Berkeley feels sketchy for bikes.
 - Evan

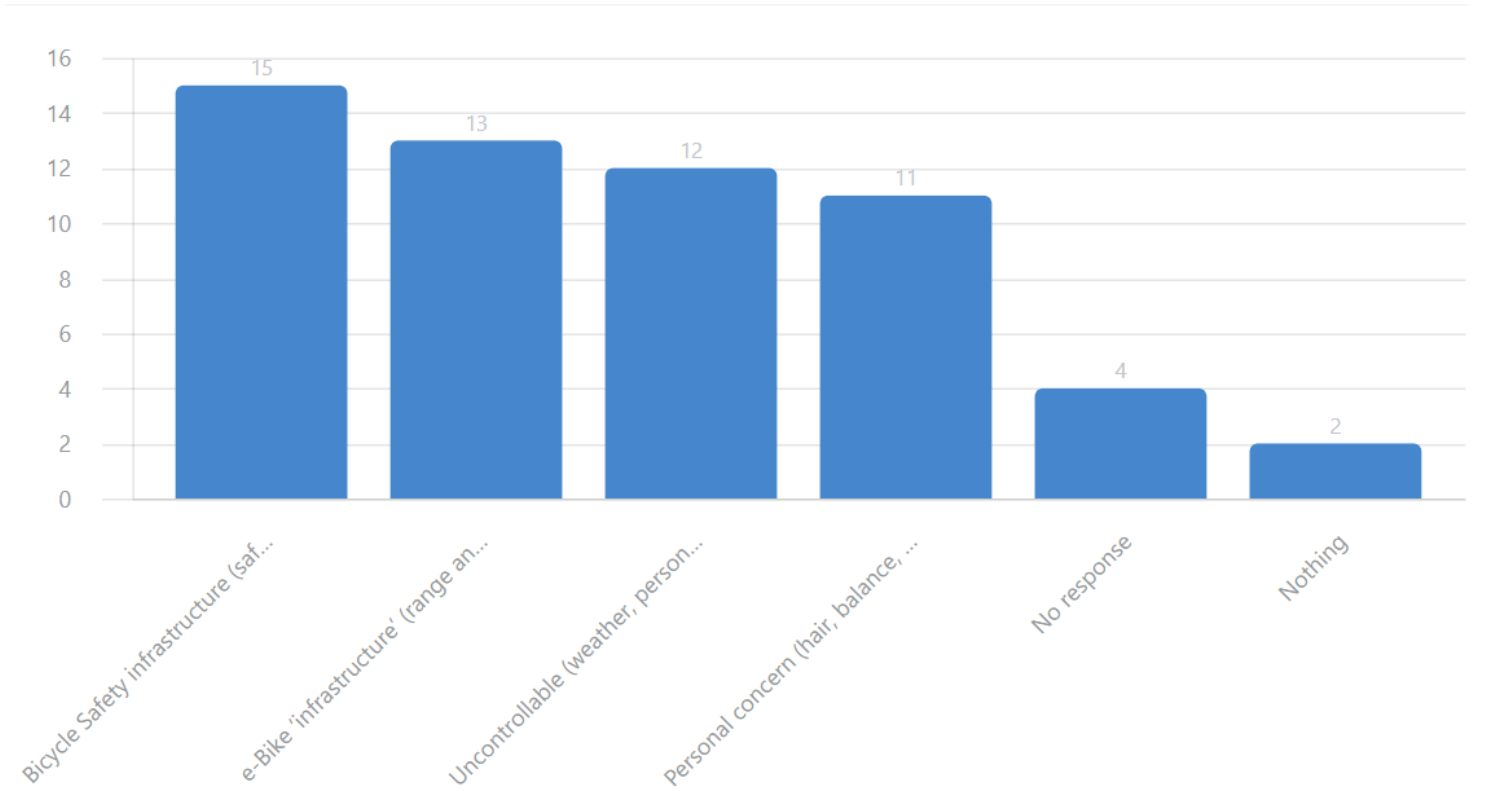
Safe streets! Bike lanes, and low traffic streets with traffic lights at arterial streets.
 - Ian

You are still riding in traffic, with cars. Bike lane improvements downtown are excellent. We need more.
 - Emerald

To understand any gaps in usage, we asked participants what obstacles they experienced when using an e-bike. The most frequent concern shared by participants was bicycle safety infrastructure (safe streets, fear of theft, storage, fast cars, too much traffic, knowing a safe route, road conditions etc). After that concern, the nature of the e-bike ‘infrastructure’ (range anxiety, mechanical issues, weight of bicycle etc) was the second most frequent concern shared. The third most frequent obstacle shared by participants was Uncontrollable (weather, personal injury, health, darkness/nighttime etc). See table “What are the biggest obstacles to riding your e-bike for more trips?”

Table 28.

What are the biggest obstacles to riding your e-bike for more trips? (Active participants; n=39)



I'm pretty confident as long as I stay off busy streets. - Sherry

Just a lot of fear of car accidents and bad infrastructure that doesn't prioritize paved roads or bike lanes. - Hanne

Participants were able to overcome obstacles and increase their confidence, showing that just having an opportunity to try an e-bike can provide major mode shift adoption benefits even when there are limitations in infrastructure improvement funds. This also shows that e-bike ‘infrastructure’ is not automatically a deterrent once the rider becomes familiar with the equipment. The prevalence with which participants cited safety, indicates that

improvements to infrastructure could greatly support mode shift adoption to e-bike and active transportation. Supplementing infrastructure improvements with education and incentive programs would increase mode shift adoption to a larger audience.

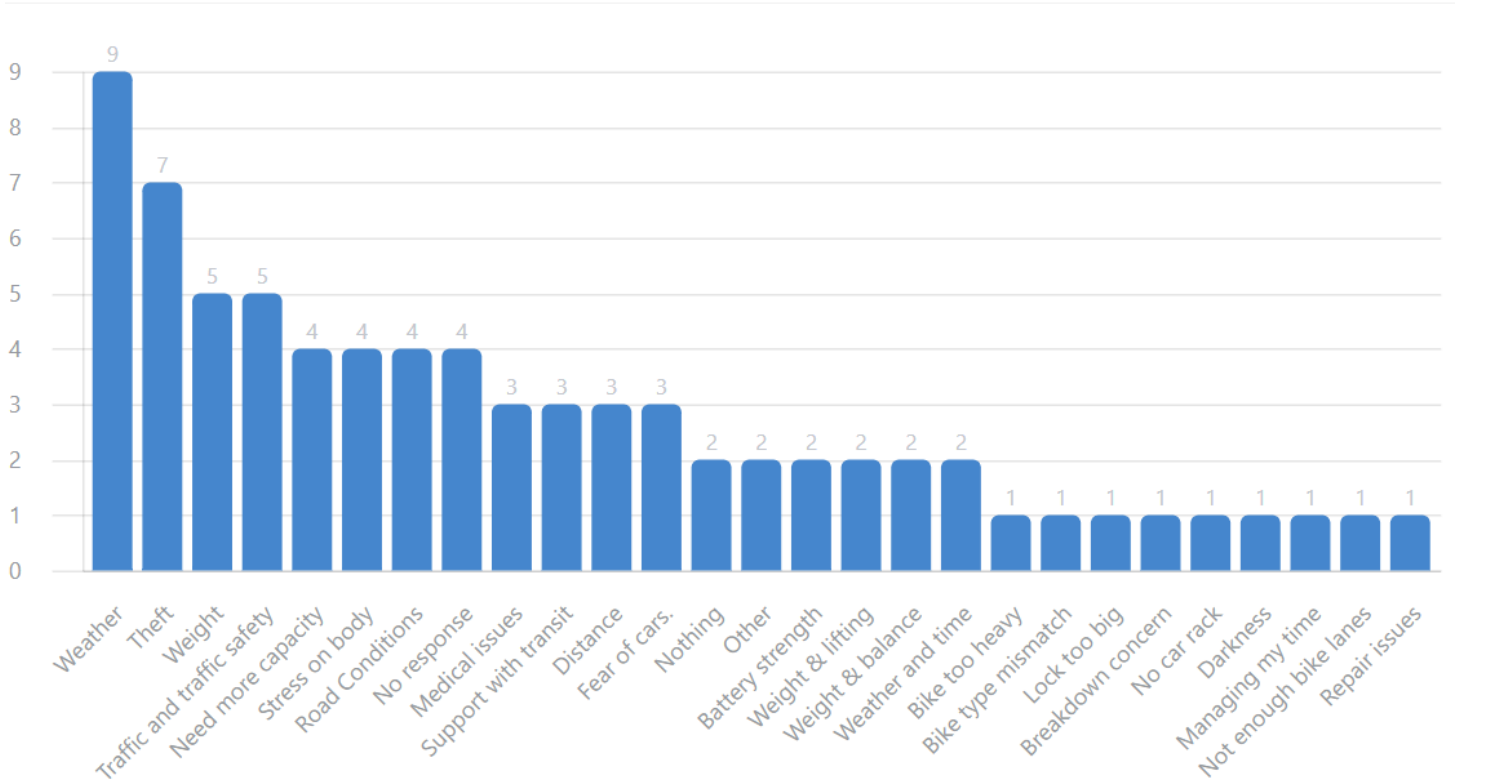
When looking further into these obstacle responses, participants shared that weather was one of the biggest obstacles to their use of an e-bike, followed by concerns of theft. Additionally, participants shared that they dealt with an injury, illness or other sort of medical issue as the obstacle that prevented them from using an e-bike. The next biggest obstacle that was shared was related to the weight of the e-bike. See table “What are the biggest obstacles to riding your e-bike for more trips?”

Participants were able to learn and share about the limitations and obstacles that traveling by e-bike presents, such as impacts from weather, and infrastructure concerns. The program was able to provide further cargo accessories and fenders, but there was less ability to provide weather preparedness in the form of rider apparel. Supplementing programming with incentives for accessories, along with education on how to safely travel in suboptimal weather would further increase mode shift adoption and improve user experience.

Participant responses further show that a number of participants also reported stress on the body, whether it was wrist pain, eyes reaction to faster speed, or difficulty to maneuver the e-bike into storage when fatigued from a ride. Additional insights include a shared concern for traffic and traffic safety. See table “What are the biggest obstacles to riding your e-bike for more trips?”

Table 29.

What are the biggest obstacles to riding your e-bike for more trips? (Active participants; n=39)

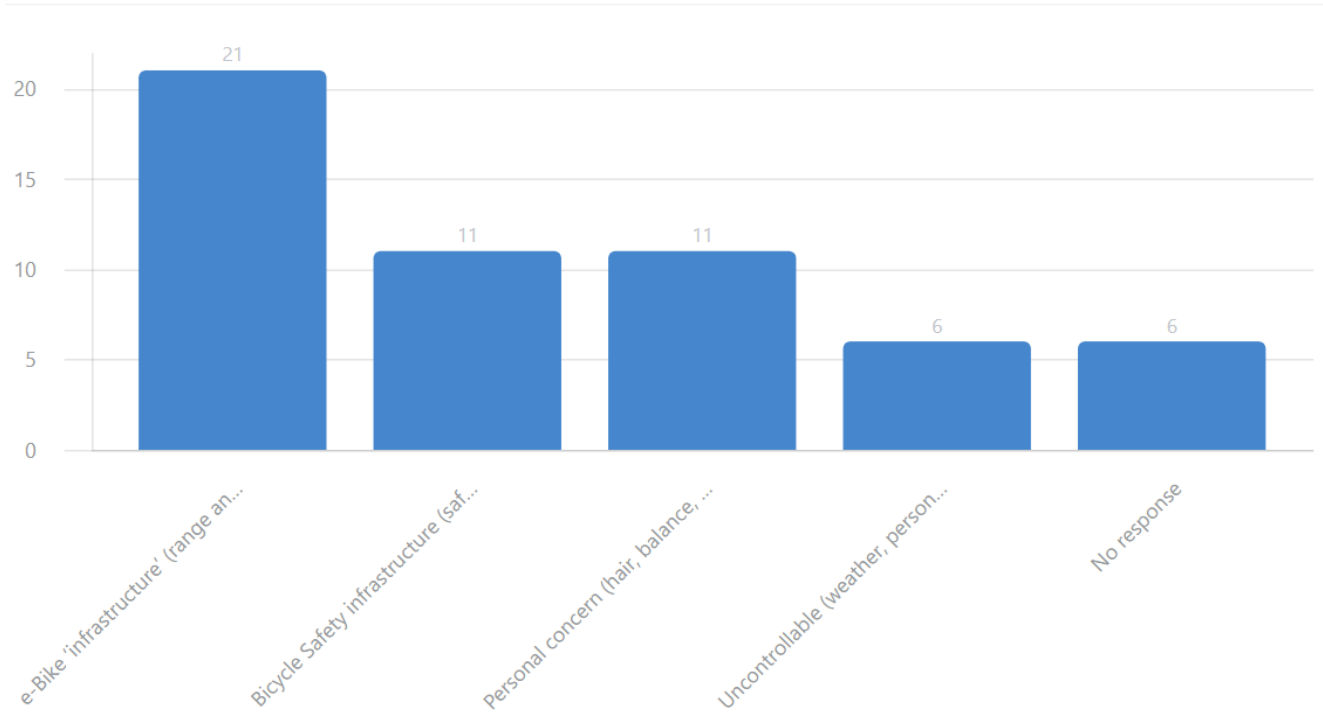


Participants benefited from education for both safety, but also for fitting the e-bike. Having the education training available for participants further supported the program goals for mode shift adoption. The concern for traffic and traffic safety also improves with education training. Programs with this education training provide participants with any experience level an opportunity to better utilize and adopt the e-bike for extended use.

Additionally, we asked participants what things they might need to make a trip by e-bike successful. Participant responses most commonly shared that they felt having enough or more battery power available, having protective equipment, and having self-confident positive mental attitudes were the things that were most needed to successfully use their e-bike. These responses were pretty well distributed among census tracts. These findings show that e-bike battery charging solutions and a little bit of encouragement can go a long way to inspire transportation mode switch. Bike safety infrastructure on the streets still shows up as a major concern for a significant group of participants. See table “In your experience, what do you need for an e-bike trip to be successful?”

Table 30.

In your experience, what do you need for an e-bike trip to be successful? (Active participants; n=39)



Participants learned how to better prepare for trips by e-bike over the course of the program. Battery range anxiety and the need for protective equipment can be supported with incentives to improve adoption. Additionally, education and training to better utilize the e-bikes and equipment further support positive experiences with the e-bike adoption.

The most frequent destinations for people were for work, leisure, and school activities. The second most visited destinations were grocery stores, followed by work and then the gym. Under one third of the active participants (12) indicated that their trips were 2 miles or under. More than half (17) reported their normal trips to be between 2.1 - 6 miles using the e-bike. See table “What is the most frequent trip you take with your e-bike?” and “What has been your average miles per round trip?”

Participants benefited from having an e-bike available to meet last mile applications. Providing opportunities for the use of an e-bike showed to greatly replace the amount of car trips with e-bike trips. Incentivizing workplaces to provide amenities to bicyclists would greatly benefit adoption. Amenities or infrastructure to mitigate theft risk would benefit from being focused and included in work, gyms, and school areas. E-bikes were able to fill last mile needs along with extending the range of what is considered accessible. E-bikes are great for replacing local trips made by car.

Table 31.

What is the most frequent trip you take with your e-bike? (Active participants; n=39)

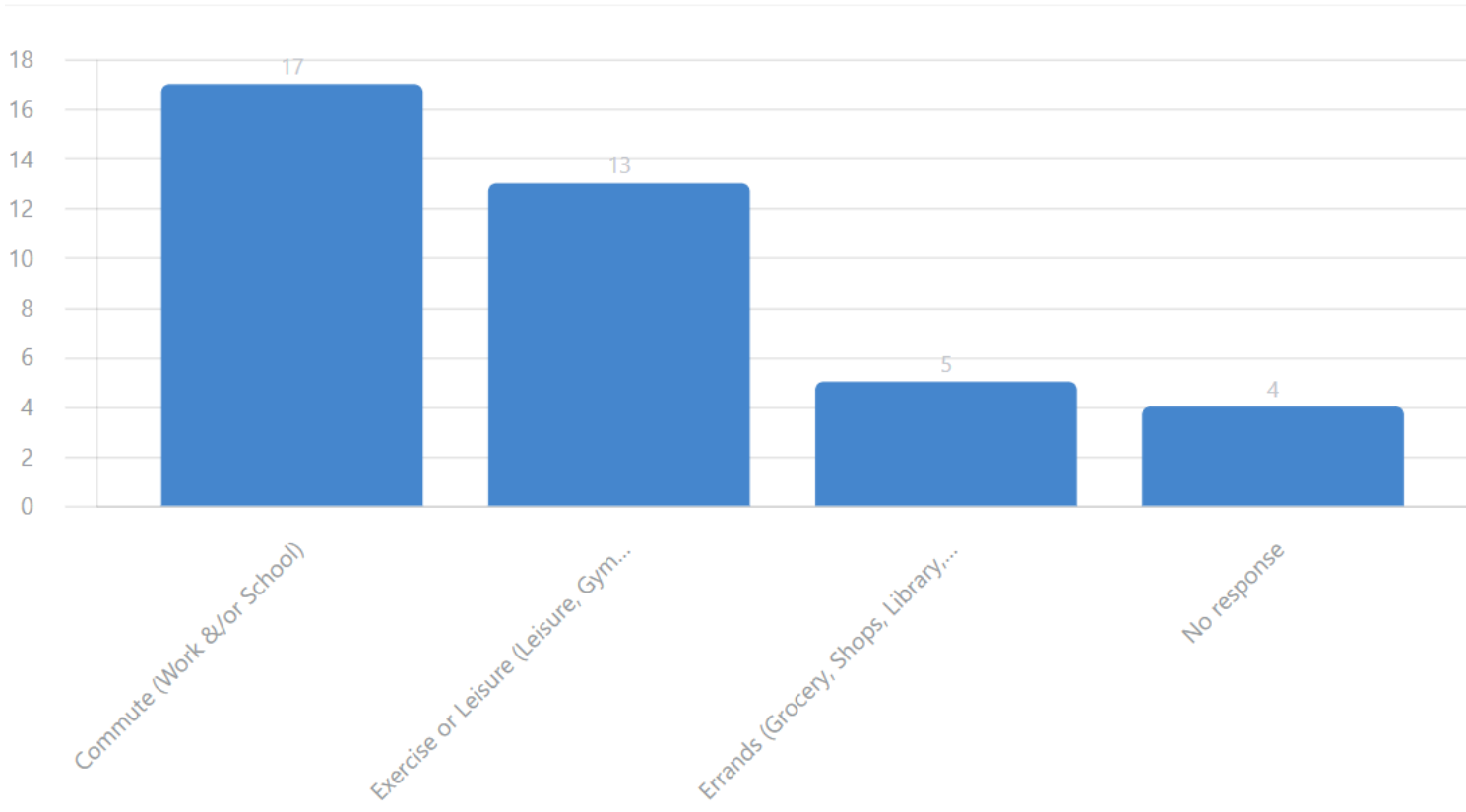
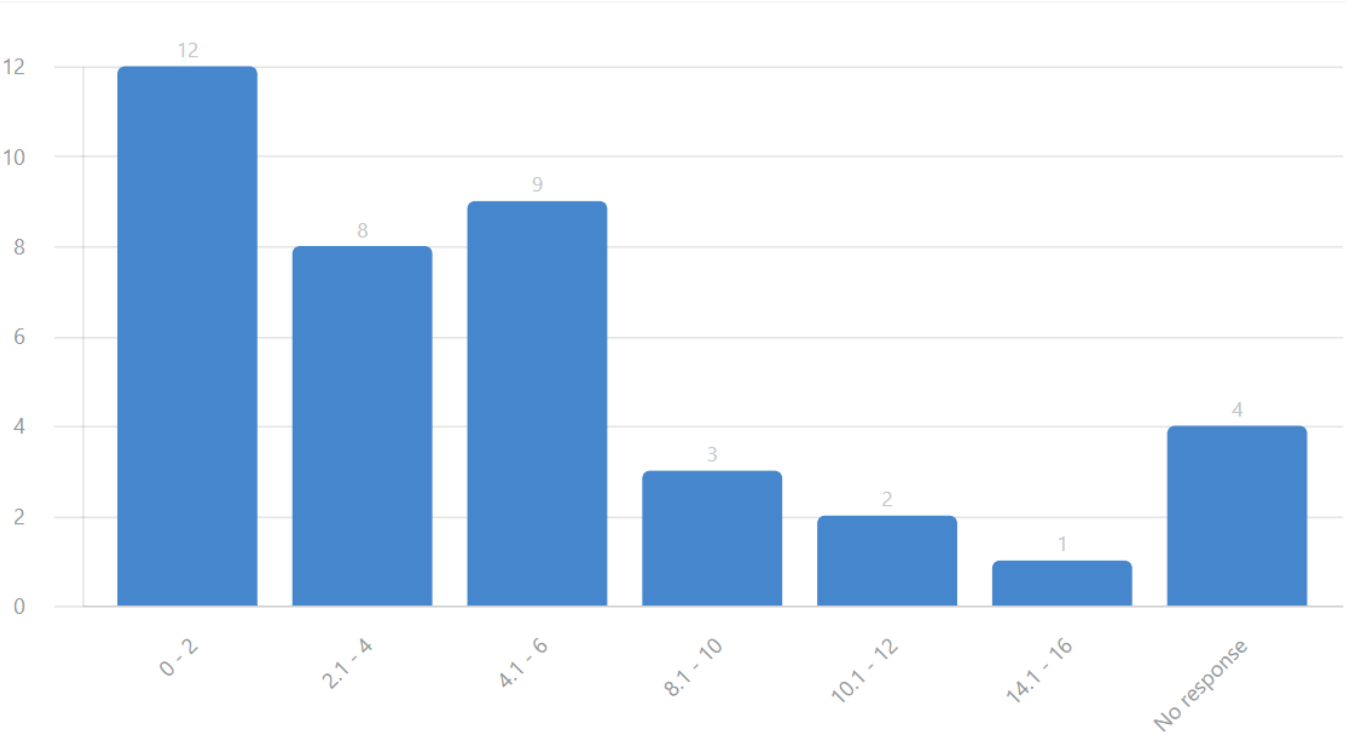


Table 32.

What has been your average miles per round trip? (Active participants; n=39)

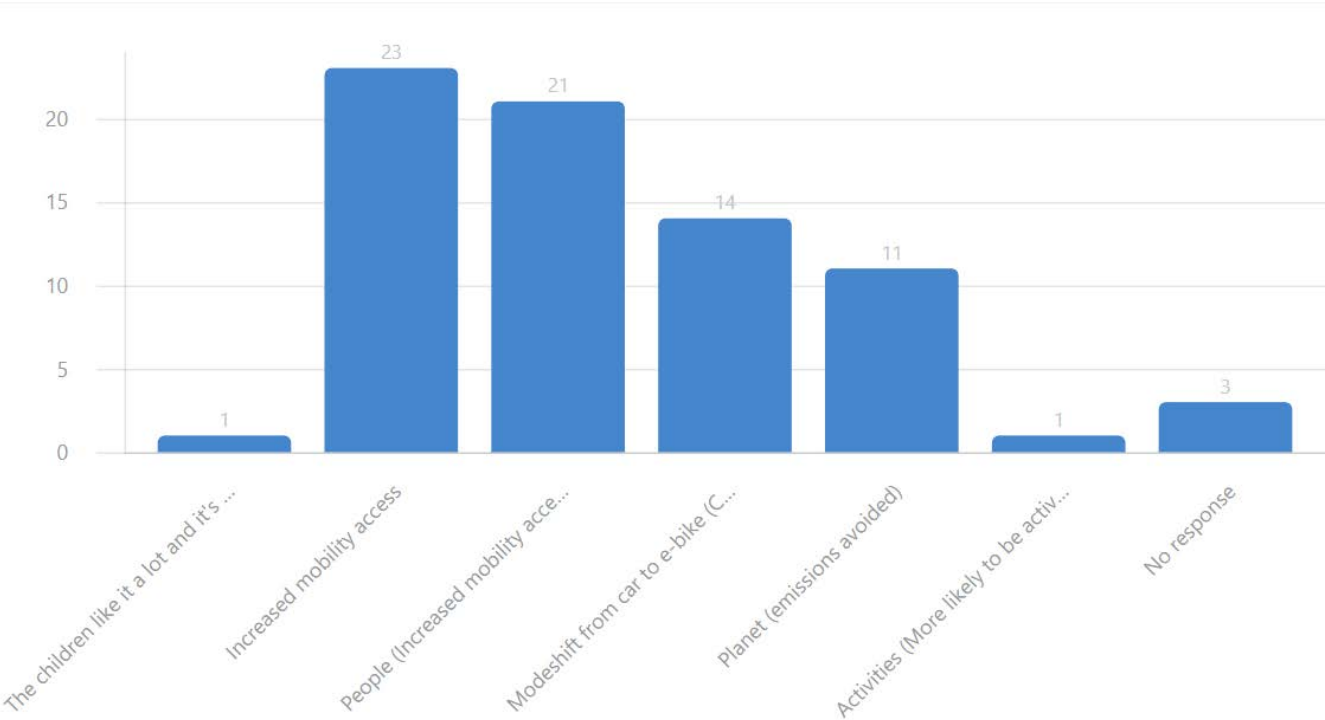


Health and Lifestyle Impacts

Participants were asked qualitative questions in the quarterly survey to understand additional benefits they experienced during the study period. When asked questions related to health and mobility access, 30% of responses showed that having an e-bike vastly increased their mobility access. Many participants also shared that they used their car less and were less dependent on public transportation and rideshare. See table“Quarter 1: How has having an e-bike changed how you get around town?”

Table 33.

Quarter 1: How has having an e-bike changed how you get around town? (Active participants; n=39)



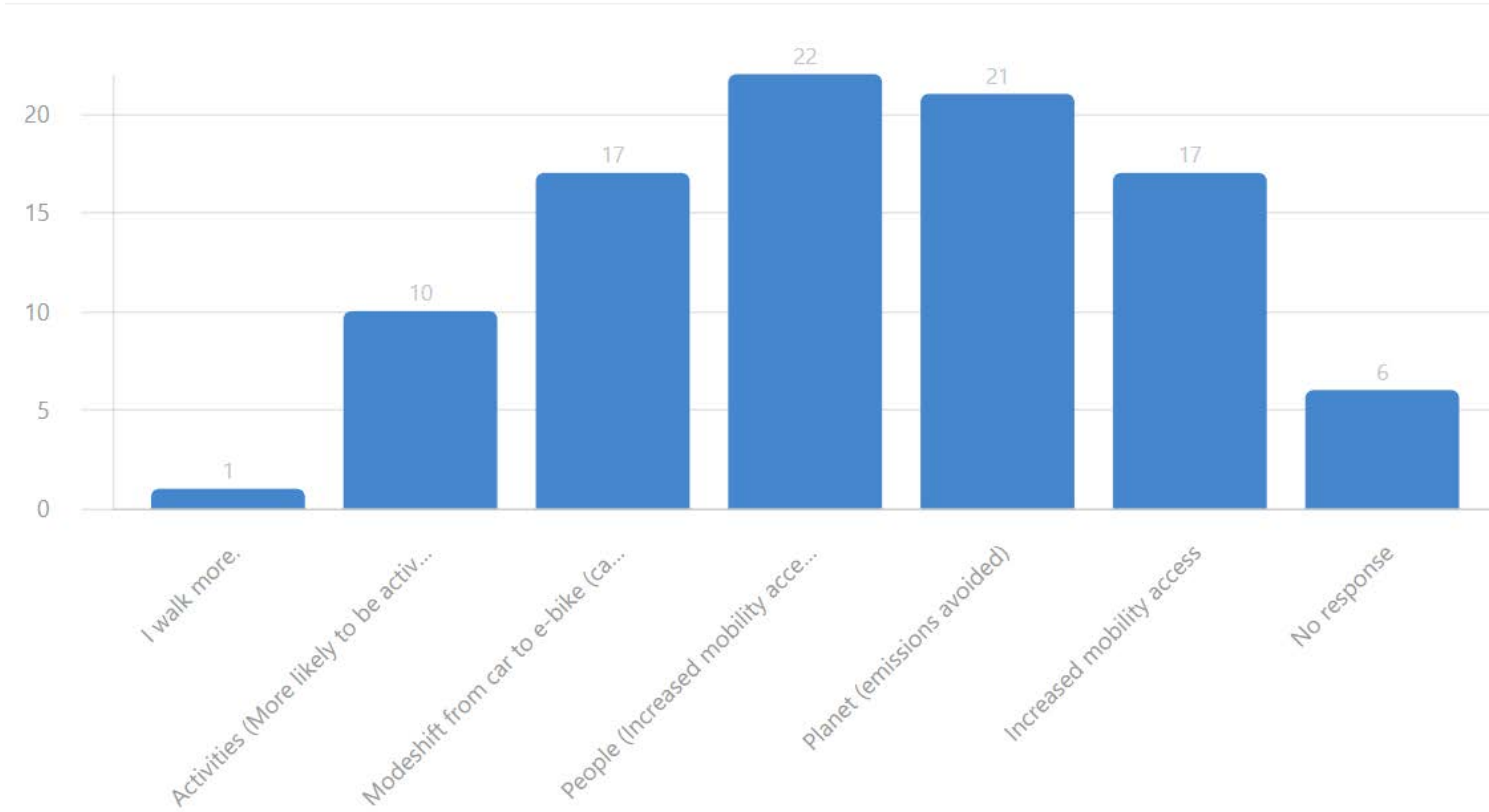
Participants increased their mobility access and are likely to continue enjoying the benefits from using an e-bike as they continue optimizing their user experience. Providing access to an e-bike gives communities pathways to increase connectivity and mode shift from cars to e-bikes.



During the final survey participants were asked the same question and similar response trends appeared. A strong trend for mode shift appeared with participants sharing that they used a car less, and many others also shared that they had increased mobility access. See table “Quarter 4: How has having an e-bike changed how you get around town?”

Table 34.

Quarter 4: How has having an e-bike changed how you get around town? (Active participants; n=39)



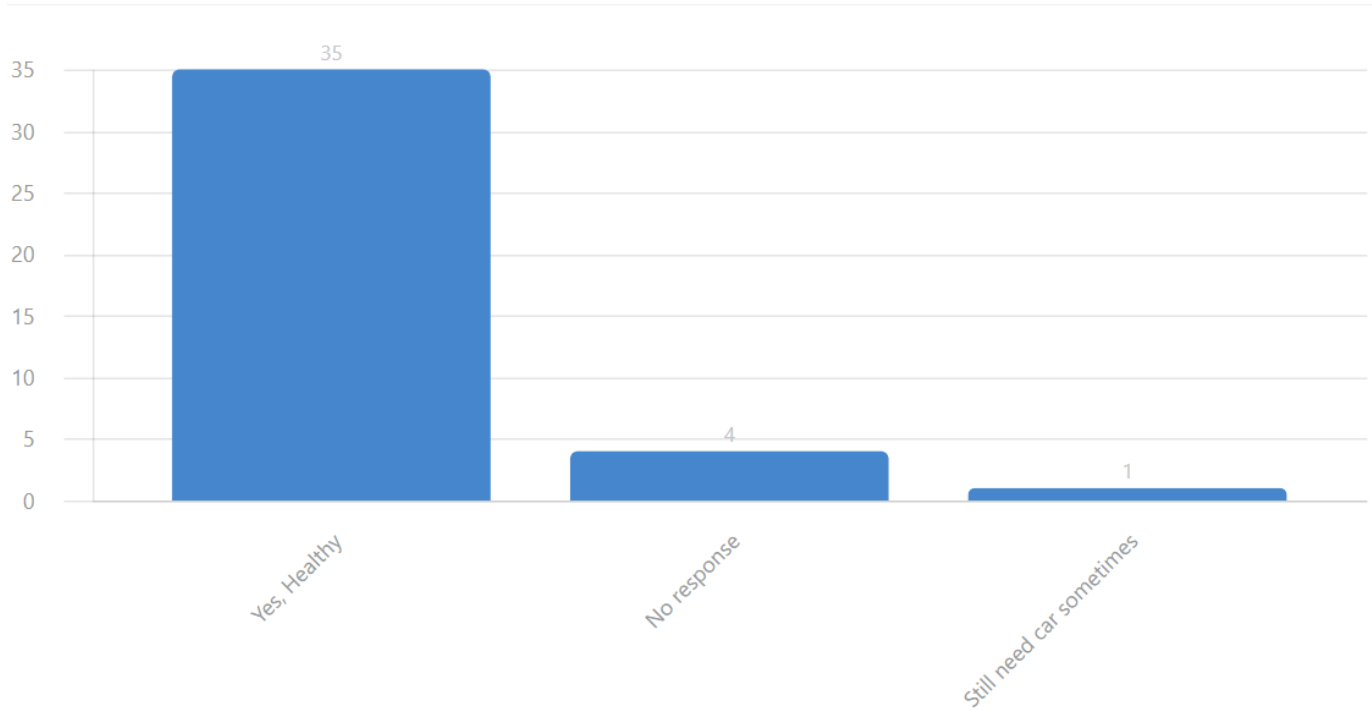
As participants optimized their use of the e-bike, there were consistent trends that show potential for increasing mobility access, as well as mode shift from a car to e-bike. Programs that provide the use of an e-bike can supplement other mode shift efforts and can maximize returns from improvements to infrastructure as users increase their access to the community by using the e-bike

Community and Individual Health

Participants were also asked in the final survey whether they believed their transportation options healthy for them or their community: 83% (n=39) of active participants shared 'yes'. There were a few participants who shared their experience with their e-bike to improve personal health through exercise and community health through emissions reduction. One participant shared that they lost 95 pounds by using the e-bike. See table "Quarter 4: Do you consider your current travel options as healthy for you? Healthy for your community?"

Table 35.

Quarter 4: Do you consider your current travel options as healthy for you? Healthy for your community?
(Active participants; n=39)



E-bikes were used by participants and showed their potential to avoid emissions and improve community health. Sentiments from participants support that view and give opportunities to grow the community of e-bike users through word of mouth information sharing. Providing further incentives, education, and infrastructure support would support new users to improve their experience and have mode shift adoption to an e-bike or other active transportation more successful and enjoyable.

Definitely! i use my car as little as possible and usually bike! - Rosemary

It's healthier for me to bike than drive places for sure and it reduces emissions, benefiting the community. - Christy

Family Rides Narrative

During community surveys, parents indicated a need for reliable transportation options for them and their children. In response, the program included the purchase of eight e-cargo bikes provided to lottery winners who expressed the need for transporting passengers. One such family, the Marshall family, has two children under five years old. Their e-cargo bike was outfitted with a front rack, passenger rails, footrests, seat pad and child seat. This configuration allows one adult to carry two children and their backpacks to and from school, for example. Families in the pilot indicated the most common e-bike destinations were school, grocery store, park, and library. The Marshall family reported to program staff that their morning commutes to school have been dramatically changed and became “smooth”. They explained in surveys that riding the e-bike is simply part of the family routine since participating in the program.

They reported that their children are spending more time outside, being active, and entertained by the bike ride. “I’m able to reach more places to do errands, and it is a game-changer as far as taking care of and entertaining the children.” This family also reported barriers to using their e-cargo bike. Families in the project noted a lack of safe streets and bike infrastructure that prevents them from riding their bike more frequently or farther. The Marshall family cited a specific area that creates barriers for their commute: “surprisingly difficult to get through South Berkeley/Emeryville east of San Pablo.” Families responding to the surveys, including the Marshall family, indicated the use of public transportation, ride shares, and their personal vehicles had gone down since receiving the e-bike.



Conclusions

Climate mitigation: travel type prior to program, during and potentially after program

Participant feedback shows the support for programs like this one, providing opportunities for residents to try an e-bike, which can be a major factor to increase mode shift from car based to e-bike travel. In one year, participants collectively accumulated more than 27,000 miles on an e-bike and avoided 11.6 tons of CO₂ emissions while saving more than \$5,000, all while still learning how to adopt an e-bike into their lifestyle. Participants faced some obstacles to riding more, like infrastructure and education gaps. Improvements to infrastructure and further programs to incentivize e-bike education and active transportation adoption can greatly improve experience and satisfaction with mode shift adoption.

Lasting positive impacts for low- to moderate-income communities

All participants opted to keep their e-bikes. Many shared transportation budget benefits, health benefits, climate resiliency benefits just within their first year of e-bike adoption. Participants experienced transportation savings and that ability to save or reinvest into the community through a stronger purchasing power particularly benefits low income community members, which this program focused on. Incentives, discounts and programs like this one would increase e-bike and active mode shift adoption as an entry point. Along with infrastructure investment and equipment improvements, further education and incentives programs will continue to increase user experience and comfort, and build long lasting climate resilience. More support to engage and support access to e-bikes and e-bike programming in these communities will be pivotal in increasing climate resilience in low income communities. Education programs coupled with incentives for equipment and apparel to increase e-bike and bike adoption should be funded and focused on collaboration with CBO's that serve these communities.

Program design

Program managers designed this pilot with decades of experience working in the bike and non-profit industries with various areas of expertise including maintenance, purchasing and sales, youth education, and income qualified program operations. Combining all of these areas into a single pilot presented challenges to balance goals and optimizations. Here are a few considerations for future programs:

- Bike procurement: (1) Consider making purchases at the end of the summer or fall, avoiding competition with other industry bike shops. (2) Choose electric models that already include an odometer if the program is interested in tracking participant mileage.
- Warranty: Plan for 5-10% of mechanical troubleshooting and warranty repairs during assembly
- Size and Weight of e-bikes: Future iterations could include more hands-on education to help participants confidently manage the weight of e-bikes. Onboarding paperwork could ask about a participant's physical capabilities to lift 50 lbs increasing the safe maneuverability for participants and ability to bring bikes into indoor overnight storage.
- Additional education: (1) Provide or require opportunities for additional on-bike training and education. (2) Provide a recording (and online assessment) as an alternative to the online class to alleviate scheduling issues.
- Cohort model: Future iterations of the program could have a narrower target audience or grouped cohorts based on needs. Cohorts could be grouped in the following: families with young children, seniors, working professionals with new commutes, or those interested in e-bikes for their physical health and wellbeing.

The hands-on approach for this program is unique compared to other e-bike incentive programs. With experienced bicycle industry staff, participants had an experience similar to purchasing their own e-bike. They were given the opportunity to try out the e-bike in person before fully committing to the program. They also actively participated in creating their own accessory package, within program budget constraints. The opportunities to provide more knowledge and participant care, continued throughout the program duration.

Capacity building achievements

The potential of e-bikes goes beyond climate impact mitigation and the increase of healthy communities. New connections were formed to distribute this program and the ability to participate in a community strengthening space. For instance, the Climate Equity Collaborative provided an opportunity to share resources more equitably in Berkeley. In addition to the bonds our project team made, our participants frequently reported that they were able to create bonds in their communities with neighbors about their e-bike and the program. The ability for an e-bike to spark a conversation is unmatched. More programming such as this project is sure to get people energized to participate in living more sustainably.

Appendices

Appendix 1 - User agreement

Appendix 2 - Survey Tool

Appendix 3 - E-bike Internship curriculum

Appendix 4 - Participant facing materials

Appendix 5 - Calculation of avoided carbon emissions & fuel costs

Appendix 1 - User agreement

Berkeley E-Bike Equity Project (BEEP) User Agreement

Name: _____ Age: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Primary Phone: _____ E-mail: _____

We sometimes take photographs of the participants in our programs to use for brochures, publicity, website content, social media, grant presentations, and other lawful purposes.

☐ Please check here if you do **NOT** grant us permission to take photos of and use them in the ways described above.

The goal of the Berkeley E-Bike Equity Project (BEEP) is to pilot a program that will expand access to electric mobility for Berkeley residents. Through this project, we hope to gather data on how participants are using the bicycles and the impact the bicycles have on their lives. In order to participate, you must be willing to participate in ongoing data collection, periodic surveys, and periodic community events over a one-year period between March 2023 – August 2024.

Terms for participation in the Berkeley E-Bike Equity Project (BEEP). Your initials are required on each item:

- _____ 1. I certify that I am a resident of Berkeley, CA.
- _____ 2. I agree to provide proof of income qualification, such as CalFresh, PG&E CARE, Medi-Cal, etc., to Waterside Workshops.
- _____ 3. I agree to participate in a one-hour e-bike safety class held online and hosted by Bike East Bay. If I am unable to participate online, I will attend this class in-person at Waterside Workshops.
- _____ 4. I agree to provide Waterside Workshops with a \$100.00 deposit prior to receiving an e-bike. This deposit will be returned to me at the conclusion of the program, provided I have completed all monthly, quarterly, and final surveys, and quarterly maintenance check-ins.
 - ☐ In lieu of providing a \$100.00 deposit, I would prefer to provide four (4) hours of volunteer work in support of BEEP and/or Waterside Workshops’ other community programs. This option will only be available to a limited number of participants.
- _____ 6. I attest that I have the ability to securely store the e-bike (inside my home, inside a garage, or behind a locked gate) at my place of residence.
- _____ 7. I agree to use the provided lock to secure the bicycle whenever it is not in use, even while stored at my place of residence.

- _____ 8. I agree to not lend the bike to anyone and that this bicycle is for my personal use only.
- _____ 9. I agree to wear a helmet at all times while riding the bicycle. Should I carry any additional passengers, they will also wear a helmet at all times while riding the bicycle.
- _____ 10. If I use this bicycle to transport children, I agree to only transport children of whom I am the parent or legal guardian.
- _____ 11. In the unfortunate instance of the bicycle being stolen or damaged beyond repair, I understand that I will not be given another bicycle.
- _____ 12. I will submit a police report if the bicycle is stolen, or if it is damaged by another person. I understand that without a police report, my deposit will not be returned.
- _____ 13. I agree to not alter, modify, paint, or deface the bicycle in any way, including modifying the electrical or mechanical systems.
- _____ 14. I agree to submit monthly odometer readings to Waterside Workshops via text, email, phone, or in person.
- _____ 15. I agree to participate in quarterly (once every three months) bike maintenance checks at Waterside Workshops. During these maintenance check-ins, I also agree to participate in a short user survey.
- _____ 16. I agree to participate in an intake survey prior to receiving the bicycle, and a final survey at the end of the project.
- _____ 17. At the conclusion of BEEP in 2024, I will either take full ownership of the bicycle or return it to Waterside Workshops.
- _____ 18. I understand that there is a limited selection of available bike styles, sizes, colors, and accessories, and that not all requests can be accommodated.

I have read and understand the conditions for participation in the Berkeley E-Bike Equity Project above.

Participant Printed Name

Today's Date

Participant Signature

Berkeley E-Bike Equity Project (BEEP) Liability Waiver

Assumption of Risk:

I understand and accept that participating in biking, including electrified bikes with throttles and pedal assist, exposes me to many hazards and entails unavoidable risk of death, personal injury (including but not limited to severe spinal or head injury) and loss of or damage to property. I also understand I should be in good physical health to participate in bicycling. I choose to participate in bicycling in spite of these risks and hereby assume all risk of injury or loss of life to myself and loss of or damage to property arising out of using this bicycle and participating in bicycling. I understand the inherent risk involved in using this equipment and I accept full responsibility for any and all such damage or injury which may result. I understand that this activity may result in hazards posed by other bicycles and traffic or road conditions. I understand how to operate the bicycle and brakes. I also understand that I must abide by all local and state traffic rules and regulations and I should not participate in this activity while under the influence. Injury and death are increased if the bicycle is operated while under the influence and/or disregard to traffic safety law.

Waiver & Release:

In consideration of Waterside Workshops providing me this bicycle, I specifically release and forever discharge Waterside Workshops and its officers, agents, employees, partners, and funders from any and all liability or claims for injury, illness, death or loss of or damage to property which I may suffer while using this bicycle and participating in bicycling. This discharge specifically includes, but is not limited to, liability or claims for injury, illness, death or damage caused by the negligence of Waterside Workshops or its officers, agents, employees, partners, and funders. It is my intent by signing the Waiver and Release Agreement to fully release Waterside Workshops and hold harmless from all liability for any such property loss or damage, personal injury or loss of life, whether caused by negligence of Waterside Workshops or whether based upon breach of contract, breach of warranty, or any other legal theory. In signing this document, I fully recognize that if injury, illness, death or damage occurs to me while I am engaged in having this bicycle or participating in bicycling, I will have no right to make a claim or file a lawsuit against Waterside Workshops, its officers, agents, employees, or funders, even if they or any of them negligently cause my injury, illness, death or damage. If transporting children on this bicycle, I affirm that I am the parent or legal guardian of those children, and I assume all risk and responsibility for any injury, illness, death or loss of or damage to property as a result of my children being transported on the bicycle.

I REALIZE THE IMPORTANCE OF WEARING A HELMET AND I HEREBY COMMIT TO WEARING A HELMET AT ALL TIMES WHILE RIDING A BICYCLE PROVIDED BY WATERSIDE WORKSHOPS.

Waterside Workshops staff have answered any questions that I have.

By signing, I have inspected the equipment and I deem it to be in good condition and I accept full responsibility for care of the equipment while under my possession. Damaged parts or components will be repaired/replaced at the discretion of Waterside Workshops staff and employees and I agree to pay regular shop rates and retail prices for components needing replaced outside the scope of normal wear and tear but does not include damaged battery, damaged motor, broken spokes, rims, bent rims, damaged frames, handlebars, seats or other parts from misuse and/or crashes.

I HAVE CAREFULLY READ THIS AGREEMENT AND UNDERSTAND ITS CONTENT. I AM AWARE THIS IS AN ASSUMPTION OF RISK, WAIVER AND RELEASE OF LIABILITY AND I SIGN IT VOLUNTARILY.

Participant Printed Name

Today's Date

Participant Signature

Appendix 2 - Survey Tool

Monthly Odometer <https://airtable.com/appn5pioRwEQqe8Oa/shrzOJLxvVCfn3nbl>



Month 14 Odometer Check (JUNE)

Please answer the following questions to the best of your ability. You can either upload a picture of your odometer screen or you can write in the numbers. Please email beep@watersideworkshops.org if you need any help at all.

Odometer14 submitted?

Application ID

Full Name *

Email Address *

Month 14 (June): Picture of the e-bike odometer

Attach file

Drop files here

Month 14 (June): type in your odometer
You do not have to submit both a picture and a number

Month 14 (June): On average, how many days per week do you use the e-bike? *

Month 14 (June): On average, how many e-bike round trips are you taking per week? *

Month 14 (June): On average, how many miles do you ride on a round trip? *

Submit



Q3 Quarterly (April 2024) participant survey

Thank you for participating in the Berkeley E-bike Equity Project (BEEP). We hope your e-bike has been serving you well for the past few months. Please answer all the questions below from your own experience before the end of April 2024. We have changed the language slightly so please read carefully.

Once you have completed this form, please click continue to be redirected to schedule your in-person service appointment at Street Level Cycles. We anticipate this appointment taking just an hour of your time. Our mechanics will check over your e-bike for any potential issues. We expect to return the bicycle back to you at the end of the appointment unless a larger issue comes up. More details can be found after you complete the survey and click "Submit" below.

Application ID

Quarterly3 submitted?

Name *

Email Address *

Write in odometer reading *

Picture of the e-bike odometer

You can also type in the number below

Attach file

Drop files here

What has been your average miles per round trip? *

On average, how many e-bike round trips are you taking per week? *

On average, how many days per week are you riding the e-bike? *

What kind of trips are you taking with your e-bike? *

Choose all that apply

Select an option

What is the most frequent trip you take with your e-bike? *

Please select your top two most frequent destinations

How many times per week did you take this trip?

How did it go? What is your confidence level with the e-bike? *

Choose one star for the least confidence level and five stars for the highest confidence level.

Please tell us a little bit more about your confidence level with the e-bike.

What are the biggest obstacles to riding your e-bike for more trips? *

In your experience, what do you need for an e-bike trip to be successful? *

How has having an e-bike changed how you get around town? *

Was there an increase in the time you spent outdoors or exercising? *

Was there a change in your transportation budget? Did you spend more or less on transportation? *

How did this program positively impact your community? *

Did something change in your income or your home location? *

Do you participate in other community groups? Please share them below

Include groups that you are involved in, such as the PTA, local garden, Biketopia, Berkeley Youth Alternatives, Healthy Black Families, and neighborhood council etc.

Submit

Do not submit passwords through this form. Report malicious form



BEEP Q4 - July 2024 - FINAL Participant Survey

Thank you for participating in the Berkeley E-bike Equity Project (BEEP). We hope your e-bike has been serving you well for the past few months. This is the final survey for our pilot program. Please answer all the questions below from your own experience before the end of July 2024.

Once you have completed this form, you will be automatically redirected to schedule your in-person service appointment at Street Level Cycles. We anticipate this appointment taking just an hour of your time. Our mechanics will check over your e-bike for any potential issues. We expect to return the bicycle back to you at the end of the appointment unless a larger issue comes up.

At the end of your appointment you will be able to receive your deposit back, if you left one, and, if you are keeping your e-bike, receive any remaining keys for your e-bike. More details can be found after you complete the survey and click "Submit" below.

Quarterly4 submitted?

Application ID

Name *

Email Address *

Has your income changed? *

Has your location changed? *

Has the number of Individuals in your household changed? *

How many e-bike trips are you taking per day?

Picture of the e-bike odometer

You can also type in the number below

Attach file

Drop files here

Write in odometer reading

If you have provided an image of your odometer you do not need to write the number here

What has been your average miles per round trip? *

On average, how many e-bike round trips are you taking per week? *

On average, how many days per week are you riding the e-bike? *

What kind of trips are you taking with your e-bike? *

Choose all that apply

- ☐ Bank
- ☐ Coffee Shop
- ☐ Grocery Store
- ☐ Gym
- ☐ Leisure
- ☐ Library
- ☐ Park
- ☐ Pharmacy
- ☐ School
- ☐ Shops
- ☐ Work
- ☐ Other
- ☐ UPDATE TO CATEGORIES BELOW
- ☐ Errands (Grocery, Shops, Library, Pharmacy, Bank)
- ☐ Commute (Work &/or School)
- ☐ Exercise or Leisure (Leisure, Gym, Park, Coffee Shop)

What is the most frequent trip you take with your e-bike? *

- ☐ Bank
- ☐ Coffee Shop
- ☐ Grocery Store
- ☐ Gym
- ☐ Leisure
- ☐ Library
- ☐ Other
- ☐ Park
- ☐ Pharmacy
- ☐ School
- ☐ Shops
- ☐ Work
- ☐ UPDATE TO CATEGORIES BELOW
- ☐ Errands
- ☐ Exercise
- ☐ Commuting
- ☐ Errands (Grocery, Shops, Library, Pharmacy, Bank)
- ☐ Commute (Work &/or School)
- ☐ Exercise or Leisure (Leisure, Gym, Park, Coffee Shop)

How many times per week did you take this trip? 1st frequent *

What is the second most frequent trip you take with your e-bike? *

- ☐ Bank
- ☐ Coffee Shop
- ☐ Grocery Store
- ☐ Gym
- ☐ Leisure
- ☐ Library
- ☐ Other
- ☐ Park
- ☐ Pharmacy
- ☐ School
- ☐ Shops
- ☐ Work
- ☐ UPDATE TO CATEGORIES BELOW
- ☐ Errands (Grocery, Shops, Library, Pharmacy, Bank)
- ☐ Commute (Work &/or School)
- ☐ Exercise or Leisure (Leisure, Gym, Park, Coffee Shop)

How many times per week did you take this trip? 2nd frequent *

How many motor vehicles do you own? *

How many bicycles or e-bikes do you own? *

How many scooters or e-scooters do you own? *

Has your use of public transportation (BART, Bus, etc) gone up or down since the beginning of the program? *

Has your use of rideshares (Lyft, Uber, etc) gone up or down since the beginning of the program? *

Has your use of a car or motor vehicle gone up or down since the beginning of the program? *

Has your use of pedal-only bicycles gone up or down since the beginning of the program? *

How did your e-bike rides go? What is your confidence level with the e-bike? *

Choose one star for the least confidence level and five stars for the highest confidence level.

Please tell us a little bit more about your confidence level with the e-bike. *

What are the biggest obstacles to riding your e-bike for more trips? *

How has having an e-bike changed how you get around town? *

Select an option

Was there an increase in the time you spent outdoors or exercising? *

Was there a change in your transportation budget as a result of having an e-bike? Did you spend more or less on transportation? *

Do you consider your current travel options as healthy for you? Healthy for your community? *

Q4: How might an e-bike help you improve your health? The health of your community? *

How did this program positively impact your community? *

What was the highlight of this BEEP pilot and having use of an e-bike for you? *

On a scale of 1-10, how satisfied were you with the level of customer service you received during this pilot? *

1 would be least satisfied and 10 would be most satisfied

On a scale of 1-10, how satisfied were you with the level of mechanical service provided on the e-bike during this pilot? *

What are things you wish this pilot had provided? Ex. additional or different education workshops, accessories, safety equipment, etc *

Select an option

Is there any other feedback you would like to share with us to improve this pilot in the future? *

Select an option

Do you want to keep the bike? *

Submit

Do not submit passwords through this form. Report malicious form



City of Berkeley Pilot Climate Equity Fund

Waterside Workshops

E-Bike Internship Curriculum

Rationale

E-bikes are becoming increasingly popular as a form of transportation and recreation. In addition to Waterside Workshops' collaboration with the City of Berkeley and GRID Alternatives, the California Air Resources Board is launching an e-bike incentives program in 2023, with an estimated \$10 million dollars funding around 7,000 e-bike incentives across the state ([CalBike.org](https://calbike.org)). In order to provide relevant workforce development opportunities in this growing field, Waterside Workshops will incorporate e-bike specific training and education within our existing youth internship programs. Interns will receive training around e-bike technology, including assembly, operations, repair, and maintenance. By offering specialized e-bike training and job experience to participants in our job training programs, we will support high-road job opportunities for our interns to progress in this rapidly expanding segment of the bicycle industry.

Goals & Objectives

By the end of the e-bike internship program, youth participants will gain the following skills and competencies in e-bike assembly, maintenance, and repair:

- Interns will understand and follow essential safety protocols while working with e-bikes.
- Interns will be able to identify e-bike tools, equipment, and components.
- Interns will be able to install or remove mechanical components, including wheels, drivetrain, and brakes, by following standard procedures.
- Interns will be able to connect electronic components, including wires, sensors, drive unit, and batteries, by following standard procedures.
- Interns will be able to diagnose and fix defects or problems in e-bike performance.
- Interns will be able to troubleshoot errors in e-bike software systems.

Scope and Sequence

Unit	Skills & Competencies
<u>Unit 1</u> Understanding of E-Bike Safety	● Understanding of: ○ Different classes of e-bikes: I, II, and III ○ STEPS and Bosch system compatibility ○ Amps and wattage charger compatibility ○ Labeling and classification requirements ○ Speed tuning ○ Motor disengagement (motor should stop when braking or when pedaling stops) ○ Battery safety protocols (never alter or open a battery case. Always remove battery when working on drivetrain) ○ Best battery charging practices (specific/proprietary chargers only-don't mix and match chargers, no direct sunlight, room temperature, not overnight, and charging location with timer) ○ How to recognize a defective or damaged battery (deformities, excessive heat, smoke, or melting plastic) ○ Repair stand protocol
<u>Unit 2</u> Identification of E-Bike Tools, Equipment, and Components	● Identification of: ○ Different drive systems: mid-drive, hub-drive ○ Industry standard e-bike drive systems (Bosch, Steps, Bafang, and Fazua) ○ Display units ○ Sensor types: cadence, brake, and speed ○ Battery mounts and batteries ○ Switch and controller types ○ Wire types

	○ Manufacturer systems: wiring diagrams, service manual, software program, and other proprietary tools
<u>Unit 3</u> Installation and Removal of E-Bike Components	● Installation and removal of: ○ Bicycle computers or displays ○ Switches or controllers ○ Sensors ○ Wheels with hub motors ○ Mid-drive units ○ E-bike crank arms and chain rings ○ Electronic shifting components ○ Battery mounts
<u>Unit 4</u> Connecting Electronic Components	● Connection of: ○ Drive unit wires ○ Display unit wires ○ Sensor wires and positioning ○ Battery mount wires ○ Controller wires ○ Common e-bike wiring charts
<u>Unit 5:</u> Diagnosing and Fixing Mechanical Problems	● Diagnosing and fixing: ○ Drive unit engagement and disengagement ○ Defective or unresponsive drive unit ○ Drive unit mounting hardware ○ Display defects: compatibility, damage, mounting, clean interface, distortion ○ Improper battery mount positions ○ Firmware updates for controller and drive unit ○ Firmware error codes and generating service reports

<u>Unit 6:</u> Advanced Skills and E-Bike Certification	● Certification using available online and dealer training: ○ Shimano STEPS E-Bike Systems ○ Bosch E-Bike Systems ○ Other available e-bike certification programs
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Instructional Methods

Waterside’s e-bike internship program will prioritize hands-on, project-based learning strategies in order to foster an engaging learning environment for youth participants. Interns will almost always be involved in activities that require them to problem solve, think critically, and “learn by doing.” Some lessons may require direct explanation from adults, especially for topics related to safety, but the vast majority of the internship will be structured around active intern engagement with e-bikes tools and components.

Instructional methods will include 1) modeling, 2) cooperative learning, 3) small group discussion, and 4) reciprocal teaching.

Modeling

When modeling, a skilled instructor will demonstrate the method to accomplish a task while interns observe. Interns will then attempt to replicate (or “model”) the same task. This method will be used more frequently for lessons in which safety is a concern, such as the handling of batteries or operating repair stands.

Cooperative Learning

In cooperative learning, two interns of similar skill levels will work together at the same repair stand, attempting to solve a new problem or complete a new task together. For instance, an adult staff member may ask them to fix an unresponsive drive unit, letting the interns collaborate and share ideas about how to do so successfully. This method helps to “draw out” interns’ abilities by asking them to work through a problem together.

Small Group Discussions

When introducing a new concept or skill to interns, a staff member may facilitate a discussion among interns in which they share ideas with one another. Through questioning, staff can prompt interns to think critically about a topic before they begin working on it. For example, in a lesson about battery safety, a staff instructor might ask interns, “Why might it be important to always remove the battery before working on the drivetrain of an e-bike?” While interns share ideas, the staff instructor would record notes on a whiteboard, using those notes to highlight important lessons around battery safety.

Reciprocal Teaching

In reciprocal teaching activities, interns become the teachers themselves. In order to reinforce their own learning about a previous concept, interns will frequently be asked to teach a staff member, another intern, or Open Shop patron how to complete a task. For instance, interns might be asked to show and explain how to install mid-drive units; how to install sensor wires; or how to diagnose software error codes. The act of teaching others through demonstration and explanation will help interns strengthen their own understanding of complex topics.

Intern Evaluations

Evaluations will occur on an ongoing basis. An initial evaluation will take place two weeks into the internship, allowing staff to differentiate instruction based on each intern’s initial abilities and skill levels. For example, if an intern demonstrates advanced proficiency after just two weeks, they may be introduced to more complex tasks earlier in the internship. On the other hand, interns who are not yet demonstrating proficiency in basic skills will receive additional support, including reviewing fundamental concepts alongside a staff member and having larger tasks broken down into smaller steps.

Although we have separated skills and competencies into units, there will be no fixed timeframes or deadlines for interns to complete the program. As interns improve their abilities, they will be introduced to new

concepts that are appropriately matched to their current skill level. In this way, interns will progress through the program at their own pace, allowing staff to support each participant's individual needs.

Intern evaluations will be used to inform staff instruction. By regularly assessing intern abilities, staff will be able to determine the point at which an intern is ready to begin learning a new set of skills. Evaluation data will be collected using 1) staff observations, 2) performance tasks, and 3) intern self-evaluations.

Staff Observations

Interns' work on e-bikes will always happen under staff supervision. Staff will hold regular check-ins with interns in order to share general observations and provide constructive feedback on their progress, including strengths and areas of growth. Interns will also have the opportunity to share feedback with their supervisors, including whether they may require additional support in particular areas. Check-ins will be an opportunity for staff and interns to collaborate, work through challenges, and discuss next steps regarding the intern's progression.

Performance Tasks

At the end of each unit of instruction, interns will be asked to complete a specific task, explaining their reasoning and rationale, as a staff member monitors and records notes. These performance tasks will be used to check intern understanding of specific skills. For instance, an intern may be asked to install electronic shifting components on an e-bike, or to safely dispose of a defective battery. After the completion of a performance task, interns will debrief with a staff member to determine whether or not they demonstrated proficiency of the targeted skill. Interns who do not demonstrate proficiency will receive specific feedback and training before attempting to complete the same task during their next instructional session.

Intern Self-Evaluations

At least once per month, interns will be asked to complete a self-evaluation in which they assess their own performance and set goals. They will be asked to write brief responses to prompts on a self-evaluation form (Appendix A). One goal of the self-evaluation form will be to provide interns a chance to reflect on their progress, celebrate their successes, and identify areas in which they can still improve. Additionally, staff will collect intern self-evaluations, using them to better understand each intern's perspective and to help them achieve their goals.

Intern Job-Readiness

A key component of Waterside's existing internship program is to provide youth with job readiness training. Even though interns are trained in bicycle assembly and repair, we know that not every youth at Waterside will aspire to become a bike mechanic. So, we aim to prepare youth for success in any field or career through the development of essential soft skills, including timeliness, communication, cooperation, and problem solving. To assess these skills, Waterside will conduct a job readiness evaluation at the beginning, midpoint, and end of each internship, using an internal rubric (Appendix B). The rubric will be a tool used to assess interns' needs, provide feedback, and track growth.

Conclusion

For many of our participants, an internship at Waterside Workshops will be their first job experience. We will foster a supportive and inclusive learning community that is responsive to our interns' needs. Waterside's e-bike internship program will emphasize hands-on youth engagement, flexible pacing, and a collaborative evaluation process. Interns will graduate from the program with skills and competencies in e-bike mechanics, as well as an ability to succeed in a variety of career pathways.

Appendix 4 - Participant facing materials



*Thank you for participating in the first ever
e-bike pilot program funded by the Climate Equity Fund
through the City of Berkeley!*

Helmet Tips

E-Bikes go fast ~ Wear your helmet when you ride!

Before you ride ask yourself:

1. Is it sitting straight on my head and not falling backwards or forwards?
2. Is the helmet snug around my head?
3. Is the chin strap snug but not too tight?

**All passengers must wear a helmet*

Locking Tips

- The chain lock must go through the bicycle frame, not just the wheel!
- Prevent your battery from being stolen, don't leave your battery key on the e-bike when you leave it
- Take all accessories that are easily removed off of the bike
- If you can, take it inside with you or park it in a place where you can keep an eye on it

Maintenance Tips

- Lube your chain every month or so. If it squeaks, it needs some!
- Prevent flats: check your tire pressure every 10 days or so.
- Check your e-bike for anything abnormal before you ride
- Don't charge a broken or damaged battery, don't leave it unattended



Aventon Resources

<https://rideaventon.zendesk.com/hc/en-us>

- The link above is where you will find everything an owner's manual would have. This includes How To's and other helpful instructions
- Type the above URL into your web browser
- Scroll down a little bit until you find "Owner's Resources"
- Click the name of the e-bike model you have (This model name is printed on the bicycle and your receipt from Street Level Cycles)
 - Pace 350.2, Pace 350.3 Pace 500, Soltera, Abound, etc
- You will find many links here that will help you ride, operate the e-bike, report your odometer readings, and make the most of your experience

Program Support & Contacts

Your full service bike shop for the
next year and beyond!



Street Level Cycles
84 Bolivar Dr Berkeley, CA 94710
510-644-2577

Other issues?
Call or email



beep@watersideworkshops.org
510-473-2617

Other Resources

Bike East Bay
Workshops & Classes
<https://bikeeastbay.org/education>

Walk Bike Berkeley
Group Rides & Advocacy
<https://www.walkbikeberkeley.org/>

BART
<https://www.bart.gov/guide/bikes>

BikeLink - Secure Bike Parking
<https://www.bikelink.org>

1 of 2

2 of 2

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Other Resources

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Group Rides & Advocacy
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BART
<https://www.bart.gov/guide/bikes>

BikeLink - Secure Bike Parking
<https://www.bikelink.org>

Appendix 5 - Calculation of avoided carbon emissions & fuel costs

Avoided carbon emissions and fuel costs were estimated under the assumption that each mile ridden by a BEEP participant on their e-bike was replacing a mile that would have been driven in a car of average fuel efficiency.

Fuel efficiency of the average car was based on the most recent US BTS estimate of the fuel efficiency of the US fleet on the road in miles per gallon.

Fuel efficiency of the e-bikes was based upon the average electricity required per mile to charge the e-bikes in the Walk Bike Berkeley E-bike Monitoring Project. The Project monitored 30 bikes, for 3,457 miles of riding over 123 charging cycles.

Carbon emissions per mile for driving a car was calculated based upon the average US EIA car fuel efficiency divided by the US EPA's emissions coefficient for gasoline in pounds of CO₂ per gallon.

Carbon emissions per mile from riding an e-bike were based on that charging efficiency multiplied by the carbon emitted by CA utilities per kwh generated as of November 2024.

The estimated avoided emissions are the difference between these emissions factors multiplied by the total miles ridden by all participants.

Fuel cost per mile for the average car was calculated based upon the average California retail gas price from June 2023 to May 2024 divided by the US EIA average car fuel efficiency.

Fuel cost per mile for an ebike was calculated based upon the average cost per kwh for electricity from CA electric utilities in November 2023 times the average electricity required per mile to charge the e-bikes.

The estimated annual savings are the difference between these cost factors multiplied by the average annualized miles ridden per participant.

Calculations:

Car carbon emissions

19.6 pounds CO₂ per gallon gasoline (U.S. Energy Information Administration (EIA) Carbon Dioxide Emissions Coefficients https://www.eia.gov/environment/emissions/co2_vol_mass.php accessed 2/23/2021)

22.8 miles per gallon (MPG) all car & light truck 2022 fleet average (Average U.S. light duty vehicle fuel efficiency, Bureau of Transportation Statistics (BTS) <https://www.bts.gov/content/average-fuel-efficiency-us-light-duty-vehicles> accessed 11/27/2024)

$19.6 / 22.8 \times 100 = 85.965$ pounds CO₂ per 100 car miles driven in an average car in the 2022 fleet

e-bike carbon emissions

216,628,794 mWh Total electric power industry annual generation - CA (U.S. Energy Information Administration (EIA) State Electricity Profiles California State Profile - 2023 Net generation (MWh) <https://www.eia.gov/electricity/state/california> accessed 11/27/2024)

43,360 thousand metric tons Total electric power industry CO₂ emissions -CA (same as above)

2204.623 pounds per metric ton

$43,360 \times 1000 \times 2204.623, \times 216,628,794 = \mathbf{0.441 \text{ pounds CO}_2 \text{ per kwh}}$ from the CA grid

1.36 kWh per 100 miles Average e-bike electric efficiency (e-bike Monitoring Project
<https://sites.google.com/view/e-bikestudy/results> accessed 11/27/24)

$0.44 \times 1.36 = \mathbf{0.600 \text{ pounds carbon dioxide per 100 e-bike miles}}$

Net carbon car minus e-bike

$85.96 - 0.60 = \mathbf{85.365 \text{ pounds carbon dioxide avoided per 100 e-bike miles}}$

Total carbon emissions avoided by active BEEP participants

27,169 ebike miles logged

$27,169/100 \times 85.365 = \mathbf{23,193 \text{ pounds off CO}_2 \text{ emissions avoided (11.6 tons)}}$

Car fuel costs

\$4.96/gallon - California average retail gas cost per gallon - (US EIA CA Weekly Retail Gasoline and On-Highway Diesel Prices average of the monthly costs from June 2023 to May 2024
https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_m.htm accessed 11/27/24)

$\$4.96/22.8 = \mathbf{\$0.2175 \text{ fuel cost per mile of car driving}}$

Ebike fuel costs

\$0.2984/kwh - California average residential retail utility rate November 2023 ("U.S. Energy Information Administration (EIA), Electric Power Monthly Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector, by State, November 2023 (Cents per Kilowatthour)"
https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a accessed 11/27/24)

$\$0.2984 \times 1.36 \text{ kWh per 100 miles}/100 = \mathbf{\$0.0022 \text{ fuel cost per mile of ebike riding}}$

Net car fuel costs minus ebike fuel costs

$\$0.2175 - \$0.0022 = \mathbf{\$0.2153 \text{ fuel cost savings per ebike mile}}$

Fuel cost savings for average program participant

$\$0.2153 \times 697 \text{ miles (annualized average for all active BEEP participants)} = \mathbf{\$150.06 \text{ average annual fuel cost savings}}$

Discussion

Do e-bike miles directly replace car miles? That will vary widely by individual and trip. On the whole, however, it is likely to be a reasonable assumption for this calculation. While there may have been some use of e-bikes to replace walking and transit, the project survey shows that the use of public transportation

roughly stayed the same, while participants reduced use of cars and rideshare. Some other studies of e-bike riders have indicated that as they shift to bike based errands and recreation, they tend to learn about and focus on more local options within their range. This may indicate that the miles accrued on the bicycle odometer may *underestimate* the actual car miles avoided. Studying the change in car miles driven was beyond the scope of this project analysis.

Car fleet average efficiency: The most recent car fleet average efficiency available from the EPA is for the 2022 fleet. Despite rising CAFE standards, the average efficiency of the fleet has actually changed remarkably little over the last two decades, even beginning to decline in the last two years due to increased numbers of trucks and SUVs. EVs should be starting to increase the fleet efficiency but few low income people own them so it will be some time before EV adoption begins to reduce average low income carbon emissions.

Electric grid emissions: e-bikes carbon emissions are based upon the average emissions from the California electric grid. Many Berkeley residents are in Ava Energy's Renewable 100 plan which is completely carbon free so their carbon dioxide emissions from e-bike miles would be zero. Even Ava's basic Bright Choice plan has a higher renewable content than the PG&E offering, so is likely lower carbon content than the California grid average used in this calculation. Given that the level of carbon emissions from e-bikes charged with standard California grid electricity is already less than 1% of the carbon emissions from an average car per mile, the emissions by electricity source will have little impact on the outcome.

Life cycle analysis: This analysis only addresses immediate emissions from the consumption of the fuel used to power the cars and e-bikes. Life cycle analyses of e-bikes have consistently shown that bikes have a far lower life cycle impact per mile than cars, generally by an order of magnitude or more. Including life cycle emissions from cars and e-bike in this analysis would only further amplify the climate advantages of e-bikes. <https://climateaction.center/e-bike-studies#lca>