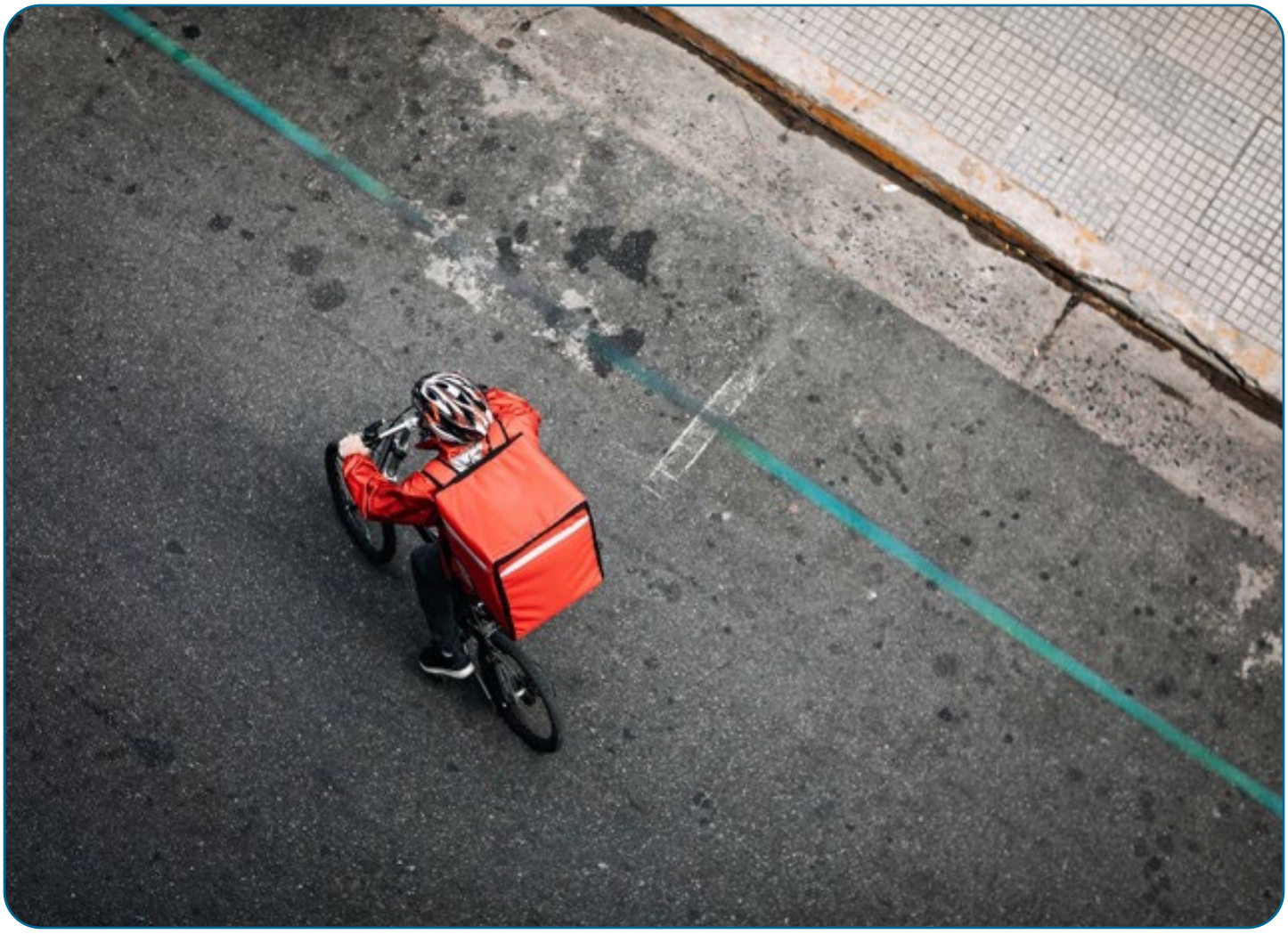

SAN FRANCISCO

Electric bike pilot for delivery workers

November 2024

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SAN FRANCISCO ENVIRONMENT DEPARTMENT

Background

The Clean Transportation Program at the San Francisco Environment Department (SF Environment) develops and implements strategies and actions to decarbonize the transportation sector by 2040. As outlined in the City's 2019 Electric Vehicle Ready Community Blueprint, achieving widespread electrification will require an increase in public awareness, incentives, and emerging mobility specifically as it relates to the environmental and economic benefits of electric bikes (e-bikes). As part of these efforts, understanding the needs and preferences of on-demand workers is crucial to identifying how e-bikes can play a role in the city's transition to a fully electric transportation system.

In 2020, the San Francisco Local Agency Formation Commission (LAFCo) enlisted researchers from the University of California Santa Cruz to survey on-demand workers such as ride-hailing drivers and app-based delivery workers to help the City better understand "gig" job models and opportunities for emerging mobility. Using survey results from 600 drivers and delivery workers, researchers found that several respondents were interested in using e-bikes to make deliveries if the e-bikes were free or low-cost and if they felt safer riding on the streets. According to the survey, 321 people working for Uber and/or Lyft said that they would switch to meal delivery (12%) with an e-bike incentive, and 13% said maybe. Of the 179 people that were already working for a meal delivery company, 39% said they'd switch to an e-bike, and 31% said maybe with an incentive. The LAFCo Emerging Mobility Labor Study encouraged the City to explore an e-bike rebate program specifically for on-demand delivery workers.

Using findings from the LAFCo study, SF Environment developed a proposal and secured funding from the California Energy Commission to pilot an e-bike program for app-based food delivery workers. The goal of the pilot was to study and quantify the benefits and barriers of e-bike deliveries compared to those made with cars. Throughout the year-long pilot, SF Environment provided no-cost e-bikes and supportive services to delivery workers and evaluated the impact mode shift had on working conditions, income, safety, and the efficiency of deliveries. At the same time, data was collected from car-based delivery workers to use as a comparison group. For the delivery workers, the findings help outline the financial and logistical benefits of using e-bikes for deliveries. For local governments, the findings help inform policies and incentives to decarbonize last-mile delivery services. For app-based delivery companies, the findings inform strategies to encourage the use of e-bikes for their couriers.

E-bikes' alignment with broader San Francisco Climate Action Plan goals

Transportation and land use policies are an essential part of San Francisco's Climate Action Plan (CAP), which outlines strategies and actions to achieving net-zero emissions by 2040. Getting the city on a path to a healthier, cleaner and more equitable future will require significant investments in reducing greenhouse gas emissions from the transportation sector.

San Francisco has a goal of achieving 80% of trips by low-carbon modes, including walking, biking, and transit, by 20230. E-bikes are a critical part of achieving this goal.

Program overview

The project team aimed to design and implement a pilot to get delivery workers out of cars and onto e-bikes and study the impacts that this mode shift had on several economic and environmental factors. A comprehensive one-year pilot was conducted to collect and analyze real-world delivery data to assess the feasibility and effectiveness of e-bikes for last-mile food deliveries in San Francisco. The data was then used to assess overall program benefits including greenhouse gas (GHG) emission reductions, improvements in mobility and congestion, and reduced demand on the curb, while evaluating and providing direct benefits to local delivery workers.

This project would not be feasible without the invaluable support of program partners, whose contributions provide critical resources, expertise, and logistical coordination. Their collaboration helped ensure the success of each phase, from participant recruitment and training to data collection and program evaluation.

Figure 1. **Pilot partners**

Organization	Role
GRID ALTERNATIVES	**Implementation partner:** Procure and manage equipment including e-bikes, e-bike accessories, and personal safety equipment; recruit program participants; implement day-to-day program; and provide case management/participant support.
SAN FRANCISCO BICYCLE COALITION	**Safety training partner:** Provide mandatory safety trainings, bike safety case management, and ongoing safety support for participants.
DRIVER'S SEAT	**Data collection partner:** Develop, distribute, and collect quantitative data through the Driver's Seat application including number of deliveries and earnings.
THE HUB BICYCLES	**Equipment vendor:** Assist with e-bike and related equipment selection, procurement, and set-up for participants.
	**Local bicycle shops:** Provide e-bike maintenance to participants. • Sports Basement • Third Rail E-bikes • Warm Planet Bikes
	**Advisors:** Several agencies helped support program design and implementation to ensure that the pilot aligned with broader City transportation goals. • San Francisco Local Agency Formation Commission (LAFco) • San Francisco Public Utilities Commission (SFPUC) • San Francisco Municipal Transportation Agency (SFMTA) • San Francisco County Transportation Authority (SFCTA)

Program activities

The Program was organized into four phases: pilot design, participant recruitment, cohort launch, and data collection and analysis.

PILOT DESIGN (DECEMBER 2022-MARCH 2023)

SF Environment developed an implementation plan with key partners including GRID Alternatives, SF Bike, and Driver's Seat. The implementation plan included details on equipment procurement, participant selection criteria, and pilot program requirements.

PARTICIPANT RECRUITMENT (MARCH-JUNE 2023)

GRID led participant recruitment and selection. Pilot participants fell into two categories based on the mode used for deliveries: e-bike riders and drivers. The pilot enrolled 30 e-bike participants across two cohorts. E-bike participants had the incentive to receive full ownership of their e-bike at the end of the four-month study period. The pilot also enrolled 30 drivers to serve as the control group. Driver participants were incentivized with a $100 stipend when they completed the two-week study period.

GRID worked through local networks of community organizations in San Francisco to solicit interest. Recruitment was also supported by networks of existing app-based delivery workers that currently service San Francisco. Priority was given to current users of the Driver's Seat platform, and contacts at Uber Eats, Door Dash, and Grubhub were given the opportunity to connect GRID to potential interested drivers.

The program received over 500 applicants. Because space in the pilot was limited, priority was given to applicants that demonstrated financial need, which was determined based on an applicant's enrollment in local or state benefit programs.

Cohort structure

The pilot launched two e-bike cohorts of 15-20 e-bike riders each (30 total) and one driver control group of 30 drivers.

Each e-bike cohort ran for a total of 6 months:

- One month of onboarding and safety trainings
- Four months of deliveries and data collection
- One month of offboarding

Given data collection limitations and the expected amount of car-based delivery data, the car control group study period was two weeks, though many participants offered access to more than 2-weeks' worth of data. The control group was launched on a rolling basis during the same time the e-bike cohorts were running to ensure parallel delivery data was collected.

COHORT LAUNCH (JUNE 2023-MARCH 2024)

The first cohort of e-bike riders (Cohort 1) launched in June 2023 and wrapped in December 2023 and the second cohort of e-bike riders (Cohort 2) launched in September 2023 and wrapped in March 2024. The driver control group ran on a rolling basis from June 2023 to December 2023.

Before receiving their e-bikes, participants were required to attend a two-part e-bike safety and maintenance training facilitated by SF Bike. The trainings covered an introduction to e-bikes including charging best practices, theft prevention, and an overview of rules of the road. GRID also provided ongoing case management and support to participants throughout the duration of the pilot. They hosted several meetups and "office hour" pop-ups throughout the city to support participants and offer a communal space for them to share their experiences. GRID provided troubleshooting for participants that were encountering various issues with delivery, their bikes, and other program-related concerns.

DATA COLLECTION AND ANALYSIS (APRIL-AUGUST 2024)

The project team gathered and compared data from all participants to assess the project's performance. Although SF Environment sought data-sharing partnerships with on-demand delivery companies, these requests were declined. Ultimately, the data relied upon for the pilot's findings came from a combination of qualitative data collected through surveys, informational interviews, and listening sessions, while also using quantitative data collected via the Driver's Seat app and screenshots from delivery workers' activity.

Data collection via Driver's Seat

All pilot participants (e-bike riders and drivers) used the Driver's Seat platform to track their deliveries. Driver's Seat enabled detailed data collection to compare outcomes for e-bike riders and drivers.

Delivery metrics captured through Driver's Seat include:

- Timestamped delivery origin and destination
- Gig platform used
- Delivery miles and duration
- Per delivery earnings, including tips
- Mode of transportation (car, e-bike)
- Vehicle make/model

Findings

The sections below evaluate the performance of e-bike deliveries compared to car deliveries across four key areas: delivery efficiency, earning potential, bike safety, and environmental impacts. The data reveals both distinct advantages and challenges associated with each mode of transport.

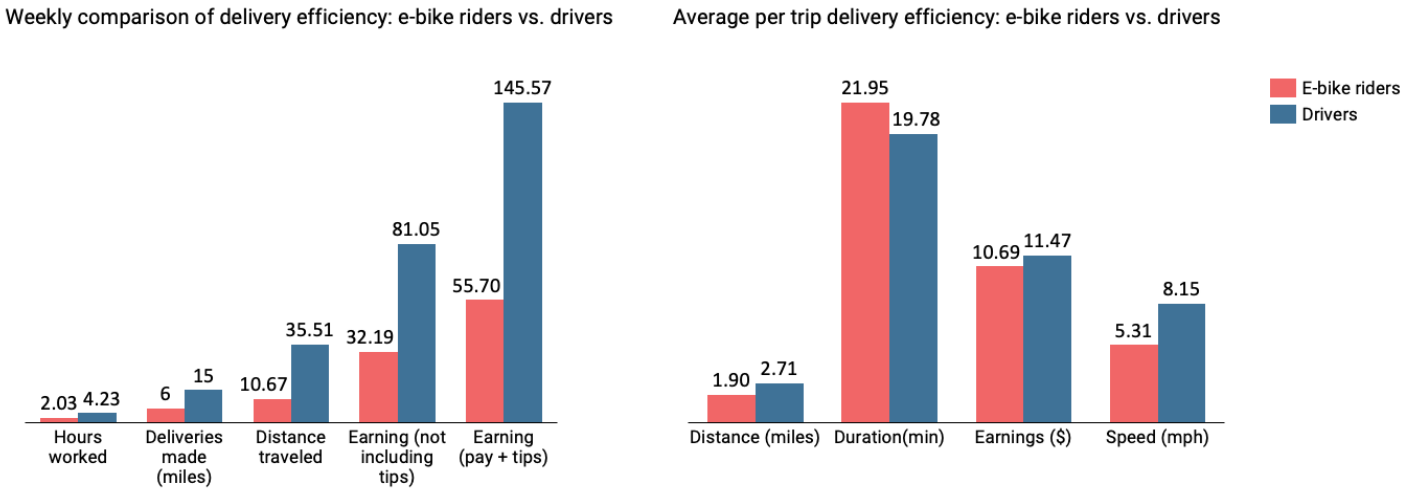
Note on data limitations: This pilot involved a small sample size. After excluding participants who left the program early, either due to personal reasons or other constraints that prevented them from completing the full program, the final sample size for the survey and data analysis in this section is 17 e-bike riders and 30 car drivers. While these are relatively small groups, the analysis still incorporates a substantial amount of quantitative data: 1,033 e-bike deliveries and 2,428 car deliveries over the study period, after excluding outliers and incomplete data.

It is also important to note that participants were not necessarily selected to develop a representative sample of app-based delivery workers based on demographics or prior delivery experience. They likely had varying motivations for joining the pilot, so factors beyond delivery mode may have impacted the results.

Delivery efficiency: E-bike participants worked fewer hours but offered more urban efficiencies

The pilot's e-bike participants worked fewer hours and completed fewer deliveries than car couriers, averaging 2.03 hours and 6 deliveries per week compared to 4.23 hours and 15 deliveries for car couriers. As described further below, several e-bike participants reported that they received fewer deliveries per shift compared to when they previously used a car for delivery and/or reported long wait times that disincentivized them from completing longer shifts. Despite e-bike couriers receiving less deliveries compared to car couriers, there are several efficiencies that e-bikes offer, particularly in urban environments where parking is limited and traffic congestion is prevalent. E-bikes can easily navigate through traffic, utilize bike lanes, and park in smaller spaces, thereby reducing the need for double parking and mitigating the risk of parking violations. This not only improves delivery times but also minimizes disruptions to traffic flow and demand on curbside spaces. When asked about the impact of traffic on their work while using the e-bike, one participant said, "I spend less time in traffic" and another reported that "traffic was never an issue."

Figure 2. **Weekly and per trip comparison of delivery efficiency: e-bike riders vs. drivers**



Earning potential: Car participants earned more per delivery, but e-bike participants benefitted significantly from lower operating costs

Earnings data collected through Driver's Seat shows that the e-bike participants earned less per delivery compared to their car delivery counterparts. On average, e-bike couriers earned $32.19 per week excluding tips and $55.70 with tips. On average, e-bike couriers made $10.69 per delivery. Earnings data reflects the lower number of hours worked and lower number and size of deliveries made by e-bike couriers. Car couriers, on the other hand, earned an average of $81.05 per week excluding tips and $145.57 with tips. On average, car couriers made $11.47 per delivery. Despite higher per delivery earnings, maintenance costs for cars are substantially higher, with two-thirds of car participants reporting spending over $200 per month compared to minimal expenses for e-bike couriers. With lower maintenance and fuel costs, e-bike couriers have the potential to increase their profit margins.

Table 3. **Cost and profit comparison: e-bike vs. gas car**

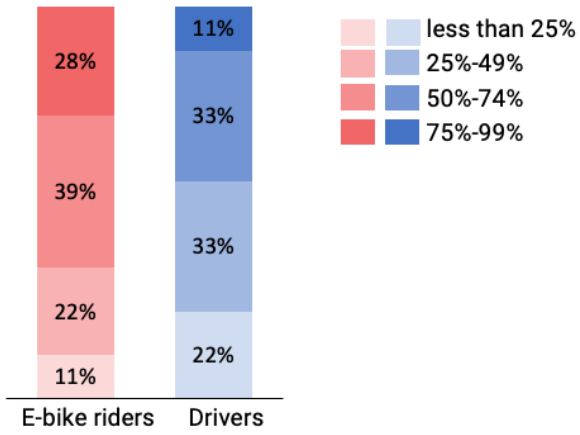
Category	E-bike	Gas Car
Purchase Price	$1,500	$24,500
Maintenance	$200/year	$800/year
Fuel/Energy	$21/year	$1,117/year
Insurance	$200/year	$1,200/year
Depreciation (15%)	$225/year	$3,675/year
Earning per Delivery	$10.69	$11.47
Number of Deliveries	6/week	15/week
Total Annual Cost	$646	$6,792
Annual Earnings	$3,335	$8,947

Net Profit	**$2,689**	**$2,155**

Earning potential: E-bike participants reported fewer orders and longer wait times, leading to lower earnings compared to car drivers

At least 7 e-bike participants reported receiving fewer orders on e-bikes compared to cars. At least 6 also noted that there are often long wait times between short and low-paying orders which discouraged them from working longer shifts. When asked about delivery allocations during their shift, one e-bike participant said, “I invested double digit hours of my time to only receive 1 or 2 orders.” Another e-bike participant said, "there wasn't much activity so I kind of stopped being available for orders." When asked what percentage of their time was spent waiting for delivery jobs, 67% of e-bikers said more than half of their time was spent waiting for jobs compared to 44% of car-based participants. Because on-demand delivery workers are not paid for their time waiting to receive a delivery job, this imparity in delivery allocation between cars and e-bikes likely led to lower earnings for e-bike couriers.

Figure 4. **Percentage of unpaid time waiting for delivery jobs among pilot participants**



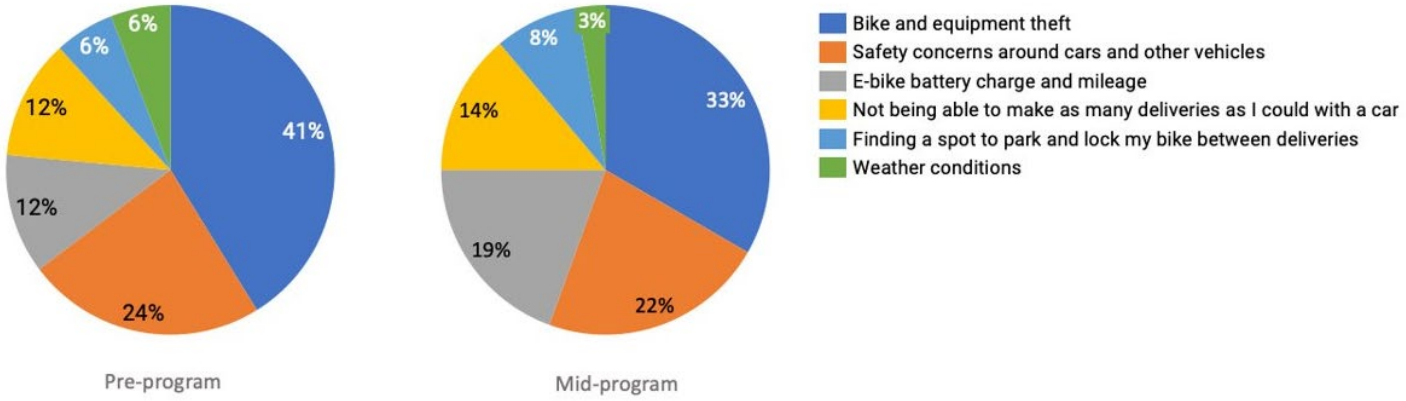
Post-program survey question: What percentage of your time working on app-based delivery platforms do you estimate is unpaid time (e.g., time spent on the app waiting for orders, etc.)?

Bike safety: E-bike participants gained confidence and maneuverability from safety trainings but remain concerned about adequate bike infrastructure and bike theft

Bike safety concerns were evident in pre-program survey responses with 24% of e-bike participants identifying biking next to cars as their main concern when asked about mode shift. In mid-program sessions, participants were also asked to flag areas where they felt it was unsafe to make deliveries, either due to personal safety concerns (such as theft) or a lack of bike infrastructure. However, surveys showed that 88% of e-bike participants felt more confident after participating in the training sessions facilitated by the San Francisco Bicycle Coalition. One e-bike participant said, "the maneuverability that the bicycle offers allows nimbleness in the face of traffic obstacles. I have more grip and control on the bike compared to a regular bike." As the pilot progressed, e-bike participants’ concerns shifted from bike safety to personal safety as it relates to bike theft, with 41% of participants citing bike theft as their main concern. Out of the 30 bikes deployed to delivery workers, 6 were stolen from participants. Out of the bikes stolen, half of them were taken through confrontations and the other half were stolen through defeated

locks. Despite geolocation tracking efforts by the project team and the San Francisco Police Department, bike recovery was ultimately not feasible.

Figure 5. **Biggest concerns about using an e-bike for deliveries among e-bike cohort participants**



Pre-program and mid-program survey question: What is your biggest concern about using an e-bike to make deliveries?

Environmental impact: E-bike deliveries generate almost no GHG emissions compared to car deliveries

The environmental impact of e-bikes is overwhelmingly positive. Throughout this pilot program, e-bikes eliminated 2,296 vehicle miles traveled. Furthermore, e-bike deliveries produce a fraction of carbon dioxide-equivalent (CO2e) emissions compared to car deliveries, with e-bikes emitting just 1.6 grams of CO2e per mile (3.4 grams of CO2e per trip) using the current state electricity mix versus 390 grams CO2e per mile (897 grams per trip) for cars using gasoline. This approximately 99% reduction in emissions underscores the potential of e-bikes to advance urban sustainability and help cities achieve their climate goals.

Challenges of current on-demand delivery market

Across the board, participants responded positively to using an e-bike for deliveries. Eighty two percent of the participants at the end of the pilot, reported that they would continue to use their e-bike for deliveries and every participant said they would continue to use it for other activities including travelling around the city, commuting to work, and for general exercise and leisure. Despite the overall positive response, e-bike participants identified several logistical and operational challenges that inhibited their ability to fully use the e-bike for on-demand delivery work.

Challenge 1: Cargo capacity and order size

E-bike participants faced challenges due to the limited cargo capacity of their Class 2 commuter bikes, which came with a rear basket and insulated food bag. While this setup worked for most deliveries, it was insufficient for larger orders. This issue was worsened by how delivery apps categorize items. For example, one participant accepted a grocery order listed as a single item but found it included multiple cases of water bottles that wouldn't fit on the bike, forcing them to cancel the order. Cancellations often go unpaid and can lower a courier's rating, impacting future job opportunities. To improve the experience for e-bike couriers, delivery apps should continue working to better tailor job assignments to the vehicle's cargo capacity. Additionally, future e-bike programs and rebates should consider providing cargo e-bikes to handle larger deliveries more effectively.

Challenge 2: Account deactivations

Throughout the study period, 25% of e-bike pilot participants experienced deactivations, with more than half feeling their cases were handled unfairly, and 75% receiving no explanation. Speed limit rules also created confusion: three workers were warned by apps for exceeding typical bicycle speeds, despite e-bikes reaching up to 28 mph. Delivery apps typically classify vehicles as either manual bikes or motorized vehicles (e.g., mopeds, cars), and these classifications don't account for the faster speeds of e-bikes, putting workers at risk of deactivation. To keep e-bikes a viable delivery option, apps should add e-bikes as a distinct vehicle type with accurate speed limits that ensure both safety and fair treatment of riders.

Challenge 3: Long wait times and unpredictable wages

E-bike participants reported longer wait times between deliveries compared to car-based couriers. Half of the e-bike participants identified long wait times as a barrier, with 67% saying they spent over half of their time waiting for jobs, compared to 44% of car-based participants. Two e-bike participants left the program due to insufficient orders. One e-bike participant reported waiting "30 minutes to one hour depending on the location" and that wait times are even longer when they were not in a hotspot delivery area.

This wait time imparity may suggest that e-bike couriers receive fewer delivery opportunities than their car counterparts. Wait times were compounded by California's Proposition 22 (2020), which classifies gig workers as independent contractors. While it guarantees 120% of minimum wage during active delivery time, it does not account for unpaid wait times, which disproportionately impact e-bike couriers. To promote low-carbon delivery modes, app companies should consider adjusting job allocations. E-bike couriers could be prioritized for shorter, urban trips while car-based couriers handle longer trips outside city centers. Collaboration between app companies, workers, and local governments could help improve wage predictability and support the shift toward e-bike deliveries.

Recommendations to address barriers to e-bike deliveries

Recommendation 1: Pilot multimodal curbside charging for micromobility devices

E-bike couriers often struggle with limited battery range, particularly during four-hour-plus shifts. One-third of participants reported needing to charge their bike multiple times a day. A typical e-bike can travel 20-50 miles on a

full charge, with charging times ranging from 3-6 hours. Charging mid-shift can reduce time spent on deliveries and impact earnings. Additionally, many participants faced difficulties storing and charging their bikes in multi-unit buildings, where elevator access was limited. Recent fire code updates have further restricted indoor micromobility charging and, in some cases, property owners prohibited charging due to fire safety concerns.

San Francisco should consider piloting multimodal curbside charging for micromobility devices, building on lessons from the City's Curbside Electric Vehicle (EV) Charging Feasibility Study. The pilot could explore community-selected curbside charging locations and technologies, address space and electrical constraints, and assess demand for both EV and micromobility charging—especially in environmental justice communities. Mobility hubs, which may combine public transit connections, bikesharing, EV charging, and more, could also support e-bike charging as part of broader transportation infrastructure improvements.

Recommendation 2: Implement secure parking solutions

Bike theft posed a significant challenge for e-bike couriers, with 6 of the 30 bikes deployed stolen. To further combat theft and enhance bike security, the City should prioritize the installation of secure bike parking options, such as bike lockers and staffed bike valets. These solutions should be strategically located in high-traffic areas, transit hubs, and other key locations where couriers frequently operate. Additionally, co-locating bike lockers near multifamily housing units would provide residents with secure, convenient long-term storage options at home, further reducing the risk of theft and increasing the feasibility of e-bike use.

Recommendation 3: Address safety hazards for bicycle deliveries

E-bike couriers often face difficult street conditions, navigating congested streets, pollution, and hazards like cars blocking bike lanes. The rise in on-demand deliveries post-COVID has worsened curb congestion, leading many e-bike couriers to feel that their work poses greater safety risks compared to car-based deliveries. A quarter of e-bike participants cited "safety concerns around cars" as their top issue, with parked cars in bike lanes being a common hazard. Similarly, when asked if they would consider making the switch to an e-bike, 36% of car-based participants cited safety concerns as a reason for hesitancy, particularly due to the lack of dedicated and connected bike lanes.

To improve safety, the SFMTA should expand the citywide network of protected bike lanes, loading zones, and curb cutouts mid-block off bike lanes, especially on busy commercial corridors. Establishing safe pick-up/drop-off zones can prevent double parking in bike lanes. The City should also prioritize repaving high-injury corridors in support of San Francisco's Vision Zero goals.

Recommendation 4: Expand e-bike rebate programs

LAFCo's 2019 Emerging Mobility Labor Study found that 39% of app-based food delivery workers were interested in switching to an e-bike, with 31% willing to switch if incentivized. Similarly, SF Environment's survey showed that 36% of car-based participants would switch to an e-bike, and to 41% would make the switch with an incentive. E-bike participants described their e-bike as a "game changer" for both work and personal life. However, the cost of an e-bike, which can range from $1,500 to $5,000+, remains a significant barrier for many delivery workers. Identifying a need for e-bike incentives, the SFPUC launched the *Electrify My Ride* rebate program in 2024, offering $1,000 rebates

for low-income SFPUC customers to purchase e-bikes. While $1 million in rebate coupons were issued, only $369,000 was redeemed, with upfront costs cited as the main barrier to redemption.

To promote e-bike adoption, the City should expand funding for an e-bike rebate program and include cargo bikes, safety-certified e-bike conversion kits, adaptive bikes, and potentially used e-bikes in the program to accommodate delivery workers and reduce financial barriers.

Recommendation 5: Create a designated Urban Freight Team

C40's Zero Emission Freight Program indicates that approximately 40% of global carbon emissions are tied to transportation related to urban goods movement, with large freight vehicles also contributing significantly to fine particulate pollution and poor air quality. The World Economic Forum forecasts a 78% increase in last-mile delivery demand by 2030, leading to more delivery vehicles in cities worldwide. Despite these pressing issues, San Francisco lacks a dedicated urban freight planning team. To create a coordinated approach, the City should consider establishing an Urban Freight Team to develop public-private partnerships to research, implement, and test urban freight plans, projects, and policies.

Recommendation 6: Pilot City-led microhub

E-bike deliveries serve a valuable function in the City's transportation mix. However, the business structure of app-based delivery companies continues to present challenges that limit the earning potential of all on-demand delivery workers, regardless of their vehicle type. To further test and demonstrate the benefits of e-bike deliveries in San Francisco, the City should explore implementing a microhub pilot. A microhub is a small-scale, strategically located facility equipped with basic storage facilities and loading docks that acts as an intermediary point for the consolidation and distribution of goods. Microhubs are typically located at parking garages, vacant lots, curbside parking spaces, or repurposed buildings and situated to minimize the distance between the hub and final delivery points, facilitating the use of low carbon transportation modes like e-bikes for commercial last-mile delivery. A preliminary feasibility study drawing on examples from New York City and Seattle could be conducted to help the City identify appropriate locations and partnership models with logistics partners or other interested businesses with a salaried workforce.

Conclusion

The e-bike pilot for app-based delivery workers spearheaded by SF Environment in partnership with a diverse array of partners effectively demonstrated the benefits and gathered lessons learned on the challenges of transitioning last-mile delivery services from cars to e-bikes. The project team's comprehensive approach, which included providing no-cost e-bikes, safety equipment and training, and ongoing support to app-based delivery workers, offered valuable insights into the financial, logistical, and environmental advantages and disadvantages of e-bike deliveries. The project team met its goals by collecting and analyzing real-world delivery data from e-bike riders and car drivers. The data collected throughout the pilot, facilitated by the Driver's Seat app and supplemented with surveys and interviews, enabled the project team to assess the economics of using e-bikes for food delivery including comparing gross earnings and reduced operational costs.

Key partners including GRID Alternatives and the San Francisco Bicycle Coalition played essential roles in the pilot's success, providing equipment, safety training, and ongoing support to participants. Collaboration with local bike shops ensured that the e-bikes were well-maintained, while engagement with other City agencies helped align the pilot with broader transportation objectives and policies.

Findings from the pilot highlighted several barriers to the widespread adoption of e-bikes for delivery workers, including concerns regarding safety, bike infrastructure, and the availability of secure bike storage and charging facilities. Participant surveys emphasized the need for improved bike lanes, safer riding conditions, and more robust infrastructure to support the growing number of e-bike deliveries. Additionally, feedback from participants underscored the importance of ongoing incentives and support to encourage more delivery workers to make the switch from cars to e-bikes.

For local governments, the pilot's findings offer a compelling case for developing policies and incentives that can further decarbonize urban delivery services. The insights gained can inform future initiatives aimed at reducing the carbon footprint of last-mile deliveries, improving working conditions for delivery workers, and enhancing urban mobility. For app-based food delivery companies, the results suggest that critical improvements to their platforms such as reducing vehicle-type bias and right-sizing orders to match vehicle capacity, in addition to incentives for e-bike use, can reduce operational costs for their workers and also contribute to broader sustainability goals.

In conclusion, the pilot has laid a strong foundation for scaling up similar initiatives in San Francisco and beyond. The lessons learned from this project will be invaluable as the City and County of San Francisco continue efforts to achieve a 100% electric transportation system by 2040, contributing to a cleaner, more sustainable future for all.

References

Aventon Bikes. (2024). *Ebike range: How far can you go on one charge?* https://www.aventon.com/blogs/aventon_bikes/electric-bicycle-battery-range-explained

California Air Resources Board. (2024, January 23). *Low carbon fuel standard annual updates to lookup table pathways.* https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/2024_elec_update.pdf

CleanPowerSF. (2024). *Residential rates for CleanPowerSF customers residential rates.* https://static1.squarespace.com/static/5a79fded4c326db242490272/t/6682e7d7ce3ed77e201173f7/1719855063807/CPSF_ResidentialRates2024_v02_PB.pdf

Electrify My Ride. *Electrify My Ride e-bike rebate program handbook 2024 part 1.* CleanPowerSF and Hetch Hetchy Power Customer. Retrieved September 23, 2024, from https://sfpuc.org/sites/default/files/documents/Electrify%20My%20Ride%20Program%20Handbook.pdf

EPA. (2022, June 23). *Greenhouse gases equivalencies calculator - Calculations and references.* US EPA. https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references

Price, M. (2024). *Curbside EV charging feasibility study & pilot.* SFMTA. https://www.sfmta.com/projects/curbside-ev-charging-feasibility-study-pilot

San Francisco Board of Supervisors. (2024). *Ordinance No. 0034-24: An ordinance amending the Police Code to authorize the Department of Emergency Management to establish an emergency notification system for commercial building owners, and to provide for penalties for failure to comply with emergency notification requirements.* https://sfbos.org/sites/default/files/o0034-24.pdf

San Francisco Local Agency Formation Commission. (2020, May). *Preliminary recommendations: How to address problematic labor, safety, health and transportation issues among ride-hail and food delivery workers.* https://www.sfgov.org/lafco/sites/default/files/lfc051520_item6.pdf

Text of proposed laws Proposition 22 continued. https://vig.cdn.sos.ca.gov/2020/general/pdf/topl-prop22.pdf

Vision Zero SF. (n.d.). *Vision Zero SF.* http://www.visionzerosf.org/

World Economic Forum. (2020). *The future of the last-mile ecosystem: Transition roadmaps for public-and private-sector players.* https://www3.weforum.org/docs/WEF_Future_of_the_last_mile_ecosystem.pdf

Zero Emission Freight Programme - C40 Cities. (2024, August 12). *C40 Cities.* https://www.c40.org/what-we-do/scaling-up-climate-action/transportation/zero-emission-freight-programme/

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