Eco-Friendly Downtown Deliveries Study

San Francisco
County Transportation
Authority

Final Report: October 2025

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1. Executive Summary

1.1 INTRODUCTION

The Eco-Friendly Downtown Deliveries Study brought together a working group of local merchant associations, community benefit districts, delivery companies, and environmental groups to identify and prioritize strategies to promote the use of low- and zero-emission delivery methods in downtown San Francisco. As noted in the San Francisco Climate Action Plan and San Francisco Transportation Plan, the transportation sector is estimated to account for nearly half (46%) of San Francisco's greenhouse gas emissions. The study was funded by a grant from the Carbon Neutral Cities Alliance and the Transportation Authority's local Proposition K Transportation Sales Tax program.

The study team and working group developed a framework of shared goals and reviewed low-emission delivery strategies from peer cities, then applied the shared goals framework to understand which strategies might work well in San Francisco. The study found two pilot opportunities have the potential to be effective in reducing emissions in the goods delivery sector:

1. Off-Hours Delivery Program
2. Logistics Microhub System

1.2 SUMMARY FINDINGS AND RECOMMENDATIONS

The Eco-Friendly Downtown Deliveries Study identified recommendations and next steps for each of the potential pilot projects and makes additional recommendations for advancing low- and zero-emission deliveries in San Francisco.

Off-Hours Delivery Program

An off-hours delivery program (OHD) seeks to shift delivery to off-peak hours when traffic is less intense and there is less demand for curb space. OHD has shown clear benefits in peer cities, including New York, where deliveries have a significant impact on congestion and traffic circulation. The San Francisco County Transportation Authority (SFCTA) and San Francisco Municipal Transportation Agency (SFMTA) should implement an OHD pilot on known congested commercial corridors (e.g., Chinatown, the Mission, Inner Sunset), including a scoping phase with data collection to determine potential impacts of the program and engagement with merchants to determine incentive levels. The Transportation Authority and SFMTA should also collaborate on a data collection effort to better estimate the benefits of OHD citywide.

Logistics Microhub System

A logistics microhub system (microhub for short) is a location where goods are transloaded from larger freight vehicles to smaller electric or human powered vehicles (e.g., cargo cycles, hand carts, or golf carts) for final delivery. Microhubs can

also incorporate charging infrastructure, dedicated travel lanes, and vehicle sharing programs to support delivery modes such as e-bikes or e-cargo bikes.

Microhubs could help shift deliveries to sustainable modes and San Francisco should implement a microhub system pilot. As a first step, the Transportation Authority will work with other city agencies to post a Request for Information (RFI) or Request for Expressed Interest (RFEI) to the private sector to better understand interest in and requirements for a potential transloading microhub, and how the city can support commercial e-cargo bike deliveries. Following the RFI/RFEI process, the Transportation Authority and SFMTA should develop a site suitability analysis in partnership with fleet operators that explores locations and facilities in San Francisco best suited to support a microhub pilot and identify up to 5 potential pilot locations. The site suitability analysis should also include engagement with industry partners to explore potential business plan models and features that should be included in a microhub design.

Other Recommendations

- City agencies should establish an Urban Freight Team to implement truck and other medium- and heavy-duty vehicle decarbonization strategies, including outreach to and technical assistance for small- and medium-sized fleets and develop public-private partnerships to research, test, and implement freight plans, projects, and policies.
- The Transportation Authority, SFMTA, and San Francisco Environment Department (SFE) should scope and execute an urban freight data collection program to support sector planning and demand forecasting models. Any pilot should utilize mobility data specifications that facilitate data integration with government monitoring systems and user application platforms.
- As part of the microhub site suitability analysis, the Transportation Authority and SFMTA should identify areas near proposed microhub sites where infrastructure (e.g., bike lanes, curb cuts, charging infrastructure) can be modified or added to support small last-mile delivery vehicles. In addition, SFMTA should inventory small vehicles used for deliveries (e.g., cargo bikes, golf carts, etc.) in peer jurisdictions or under development in the private sector, then identify state, regional, or local regulatory barriers to adoption of those vehicles in San Francisco.
- SFMTA should consider piloting secure bike parking lockers large enough to accommodate cargo bikes near places with high delivery volume. This infrastructure could be piloted as part of a microhub or mobility hub pilot.
- SFE and SFMTA should complete a technology review, feasibility study, and site analysis for publicly accessible micromobility charging infrastructure options other than battery swapping lockers. This infrastructure could be piloted as part of a microhub or mobility hub pilot.

2. Background, Purpose and Study Approach

The Transportation Authority led the Eco-Friendly Downtown Deliveries Study in order to explore the potential for San Francisco's growing goods delivery sector to utilize low- and zero-emission modes of transportation.

The study team brought together a working group of local merchant associations, community benefit districts, delivery companies, and environmental groups to identify and prioritize strategies for low- and zero-emission delivery. The study focused on commercial corridors in the downtown area of San Francisco.

This work builds on the following San Francisco policies and plans which provide guidance about how agencies and policymakers should engage with urban goods movement.

- **San Francisco's 2021 Climate Action Plan**[1] identified strategies and actions for San Francisco to reach net zero emissions by 2040. It organized strategies into six different sectors, including transportation and land use. The Plan is currently being updated and draft recommendations include the establishment of a citywide urban freight team and piloting e-micromobility storage and charging infrastructure.
- SFE's **Medium and Heavy-Duty Truck Electrification Blueprint**[2] adds guidance to the Climate Action Plan's electric vehicle adoption strategies by recommending detailed actions to accelerate electrification specifically of medium- and heavy-duty vehicles.
- SFE's **E-bike Delivery Pilot Case Study**[3] highlights the benefits and challenges to e-bike deliveries in San Francisco and offers policy and program recommendations to support a broader shift away from car-based delivery in San Francisco.
- The SFMTA's **Curb Management Strategy**[4] defines the framework, policies, strategies, and tools for managing the curb in San Francisco.
- The Transportation Authority's **Downtown Travel Study**[5] found significant growth of goods/food delivery services (57% increase for downtown residents and 52% increase for residents in neighborhoods outside of downtown) in the post-pandemic era via household surveys conducted in 2023.

1 https://www.sfenvironment.org/media/14441
2 https://www.sfenvironment.org/clean-transportation-strategies-and-plans
3 https://www.sfenvironment.org/media/14953
4 https://www.sfmta.com/sites/default/files/reports-and-documents/2020/02/curb_management_strategy_report.pdf
5 https://www.sfcta.org/projects/downtown-travel-study

3. Working Group Structure and process

The Eco-Friendly Downtown Business Deliveries Study working group brought together small businesses and community representatives from commercial corridors within Equity Priority Communities (EPCs), which are census tracts that include a diverse cross-section of populations and communities that could be considered disadvantaged or vulnerable now and in the future. In addition to representatives from these areas, the working group included delivery companies and environmental advocacy groups to provide input on delivery needs and operational feasibility.

The working group included a series of five meetings:

1. The first meeting focused on the policy context and existing data about goods movement within San Francisco, as well as the development of a shared goals framework. A survey was distributed to working group members prior to the meeting which offered insight to the group about the profile of participants (e.g., types of goods handled, fleet size/composition) and common challenges faced (e.g., cost of charging infrastructure, double parking).
2. In the second meeting, representatives from New York City, the city of Santa Monica, and peer departments within San Francisco presented about ongoing pilot projects which could potentially be implemented within San Francisco. Working group members were asked to consider how each of the potential pilots could advance the shared goals defined during meeting #1.
3. The third meeting involved a focused discussion of a potential logistics microhub pilot.
4. The fourth meeting involved a focused discussion of a potential off-hours delivery program.
5. The fifth and final meeting of the Eco-Friendly Downtown Deliveries Study working group focused on reviewing the final report and recommendations.

In addition to five working group meetings, the Eco-Friendly Downtown Deliveries Study convened a focus group of e-bike delivery workers to consider and provide feedback on a potential e-bike battery swapping locker pilot.

Table 3-1. Final working group roster

ORGANIZATION/BUSINESS NAME	TYPE
Yerba Buena Community Benefit District	Community Benefits District (CBD)
Tenderloin Community Benefit District	CBD
East Cut Community Benefit District	CBD
Golden Gate Restaurant Association	Merchant Association
North Beach Business Association	Merchant Association
San Francisco Council of District Merchants' Association	Merchant Association
Hayes Valley Merchants Council	Merchant Association
Tenderloin Merchants and Property Owners Association	Merchant Association
South of Market Business Association	Merchant Association
UPS	Business Group
California Trucking Association	Business Group
DoorDash	Transportation Network Company
Brightline Environmental Defense	Environmental Group
Business Council on Climate Change	Environmental Group
Stephen Cornell	Business Owner (Brownies Ace Hardware)

4. Shared Goals Framework

A key contribution of the Eco-Friendly Downtown Deliveries Working Group is a Shared Goals Framework. Staff developed a draft of this framework from existing research and shared it with working group members for discussion during the first working group meeting. Each goal applies to some or all of the stakeholders critical to goods movement in San Francisco.

The project team and working group members applied the Shared Goals Framework to each of the pilot ideas considered through this effort to understand which sustainable goods movement strategies were most likely to advance shared goals and garner the cross-sector collaboration necessary to make strategies work over the long term.

Shared Goals:

- **Public Safety:** Can the strategy reduce interactions between delivery vehicles and vulnerable road users or dangerous behaviors (e.g., distracted driving, parking across bike lanes or crosswalks,)
- **Transit First:** Does the strategy align with San Francisco's policy to prioritize the movement of people and goods with a focus on transit, walking, and biking;
- **Sustainability:** Does the strategy reduce greenhouse gas emissions? Congestion Reduction: Does the strategy reduce congestion?
- **Accountability:** Will the strategy advance city and stakeholder understanding of loading activity and needs?
- **Supply Chain Resilience:** Does the strategy improve delivery reliability or reduce the change or severity of disruptions for shippers or receivers?
- **Regulatory Clarity:** Will the strategy introduce regulations, or requirements that are onerous or difficult to navigate?
- **Accessible Curb:** Will the strategy reduce demand on oversubscribed curb?
- **Cost:** How will the strategy affect the revenues of shippers and receivers? How much will the strategy cost to implement and/or operate?
- **Worker Safety:** How will workplace safety be affected?
- **Public Health:** How will the strategy affect localized pollution, including noise pollution?
- **Disaster Resilience:** How will the strategy affect San Francisco's goods' movement system's ability to function in the event of major disruptions (e.g., a natural disaster).

5. Pilots Considered by Working Group

The following sections summarize the main findings for each of the three pilots considered by the working group. Findings include the purpose and need of each pilot program to address sustainability issues with goods movement, key strengths and challenges, discussion of recommendations and next steps, and evaluation of the pilot against the shared goals framework.

5.1 OFF-HOURS DELIVERY PROGRAM

Figure 5-1. Truck making a daytime delivery in NYC

Photo credit: NYC DOT

Figure 5-2. Truck making an off-hours delivery in NYC.

Photo credit: NYC DOT

Purpose and Need

Trucks making deliveries create congestion, emissions, and safety risks for pedestrians, bicyclists, and others. These challenges are exacerbated when trucks operate during the busiest times of day.

An off-hours delivery program (OHD) seeks to shift delivery to off-peak hours when traffic is less intense and there is less demand for curb space. This can reduce emissions by reducing the amount of time trucks spend circling looking for loading space and can reduce congestion by reducing double parking. OHD programs can shift delivery times several ways, including providing financial incentives to businesses to encourage adoption of OHD, adjusting curb access regulations, or providing technical assistance or OHD training programs.

Key Strengths

Examples of OHD in peer cities, such as New York,[1] have found different strengths for carriers, receivers, and the public. For carriers, OHD can lead to more efficient

1 https://cite.rpi.edu/wp-content/uploads/USDOT-OHD-Final-Report-sm-5.pdf

deliveries and truck utilization, as trucks spend more time making deliveries and less time in traffic. Making deliveries during off-peak times also makes it easier for drivers to find parking. Traveling during less congested hours results in fuel savings and reduced costs, as well as potential emissions reduction.

For receivers, OHD can lead to more consistent and predictable delivery times. Having goods delivered outside of store hours can mean that deliveries are ready for businesses when they open, rather than businesses receiving deliveries during the day. This improves staff productivity by reducing business hour interruptions due to deliveries. OHD can also make more sidewalk and curb space available for pedestrians and businesses during busy hours, because space is not taken up by loading or unloading goods.

OHD also has benefits for the general public by reducing conflicts between delivery vehicles and pedestrians and bicyclists during peak hours, and reducing conflicting demand for curb space between delivery and other uses. OHD can also reduce traffic congestion and emissions from delivery trucks.

In the working group, one participant shared that he and other hardware store owners started an OHD program in the 1980s. The program was well received by employees and the truck company because it allowed trucks to get into the city much faster without traffic. Other working group participants felt that shifting deliveries to off-hours or certain days of the week could enable other street changes, such as partial or temporary street closures.

Key Challenges

Examples of OHD in peer cities identified key challenges including coordination required between carriers and receivers. Receivers also need staff to work off-hours to receive deliveries or set up a process to facilitate unattended deliveries. OHD can also lead to noise complaints, particularly in residential areas. There may also be stipulations in building lease agreements or zoning regulations that restrict deliveries from occurring only at certain hours.

In San Francisco, businesses may face challenges asking employees to work during late nights or early mornings due to personal safety concerns or lack of public transit service. Working group participants also stated that coordination with the Public Works Department would be needed to ensure that off-hours deliveries do not interfere with street cleaning activities. An OHD program would also require more parking enforcement to reduce overnight parking in loading zones.

Recommendations and Next Steps

OHD has shown clear benefits in peer cities, including New York, where deliveries have a significant impact on congestion and traffic circulation. OHD programs are popular among carriers and receivers and can also lead to greater societal benefits through

reducing congestion and emissions. Working group participants generally thought that an OHD program could benefit San Francisco, but thought it was most likely to work for certain business types and felt that the City would need to play a coordinating role between receivers and potentially then support receivers in approaching shippers.

The Transportation Authority and SFMTA should collaborate on a broad data collection effort to understand the number of deliveries happening at peak hours and delivery behavior at peak hours (e.g., loading-zone capacity, circling behavior, double-parking prevalence, impacts on transit) to better estimate the benefits of OHD citywide and where an OHD program would be most beneficial. This should include a full inventory of curb space available for peak hour deliveries in coordination with SFMTA's ongoing curb digitalization effort,[1] and should be coordinated with initial outreach efforts for SFE's proposed Fleet Engagement and Technical Assistance program to support small- and medium-sized fleet electrification.[2]

Based on the findings from data collection, SFMTA and the Transportation Authority should determine whether potential changes to loading zones considered in a comprehensive update to the SF Curb Management Strategy are adequate to handle delivery needs, and the congestion and circulation impacts if loading zones are inadequate or used improperly. The data collection effort should identify leading locations to be considered for a future off-hours delivery pilot.

While there is not a good understanding of delivery behavior during peak hours citywide, there are some commercial corridors that are known to experience high levels of congestion at the curb, such as Chinatown, the Mission, and the Inner Sunset. The Transportation Authority and SFMTA should implement an OHD pilot on known congested commercial corridors, including a scoping phase with data collection to determine potential impacts of the program and engagement with merchants to determine incentive levels.

1 https://www.sfmta.com/sites/default/files/reports-and-documents/2022/01/2-1-22_mtab_item_7_digital_curb_program_handout.pdf

2 https://www.sfenvironment.org/clean-transportation-strategies-and-plans

Figure 5-3. Box truck loading in Chinatown, San Francisco.

Pilot development should begin with outreach to businesses. Other OHD pilots found that shippers are willing to switch delivery windows if businesses are willing to receive deliveries during those hours. However, there are barriers to OHD for businesses, such as staffing concerns. San Francisco should approach business consortiums either organized around location (e.g., community benefit districts), or business type (e.g., hardware stores) to identify pilot partners, incentive rates, and any infrastructure needed to support unattended deliveries (e.g., storage lockers). Chain stores with non-perishable goods appear to be the most likely to adopt an OHD program.

An off-hours delivery pilot in SF should include elements such as:

- Noise mitigation education for participating shippers
- Coordination with SF Planning to ensure zoning regulations allow for appropriate late night business operations
- Coordination with Public Works regarding street cleaning hours
- Coordination with SFMTA regarding late-night or early morning transit which serves employees who receive deliveries
- Coordination with SFMTA on enforcement of loading zones to ensure they are free of obstructions during off-peak delivery hours
- Coordination with SFMTA around potential temporary street closures enabled by off-hours deliveries.

Shared Goals Framework Alignment

Table 5-1. Off-Hours Delivery (OHD) Pilot Goal Alignment

GOAL	POTENTIAL TO ADVANCE GOAL	NOTES
Public Safety	↑	Reduced interactions with vulnerable road users
Transit First		
Sustainability	↑	Reduced fuel consumption and increased truck utilization
Congestion	↑↑	Reduces truck traffic on city streets during congested hours
Accountability	↑	Improves understanding of loading activity and needs
Supply Chain	↑↑	NYC experience suggests much faster deliveries
Regulatory Clarity	↑	Potential for additional requirements and incentive structures
Accessible Curb	↑	Provides better curb access and reduces circling
Cost	↑	NYC experience suggests cost savings for many stakeholders; improves on-time deliveries; reduced likelihood of parking tickets
Worker Safety		
Public health	↑	Reduction in idling, however potential for increased night-time noise
Disaster Resilience		

5.2 LOGISTICS MICROHUB SYSTEM

Figure 5-4. Conceptual drawings of a potential on-street and off-street microhub design.

Conceptual On-Street Hub

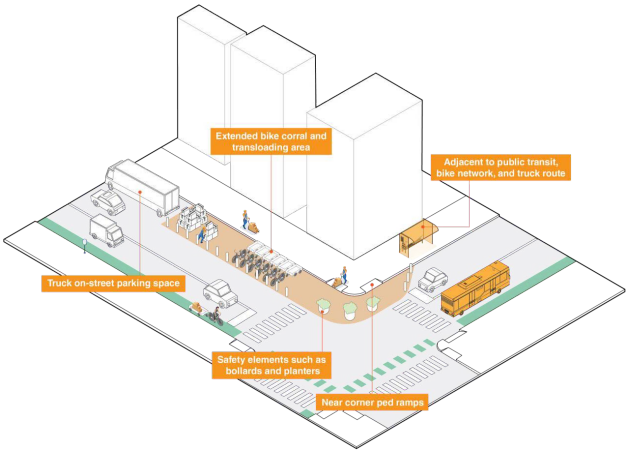

Image credit: NYC DOT

Conceptual Off-Street Hub

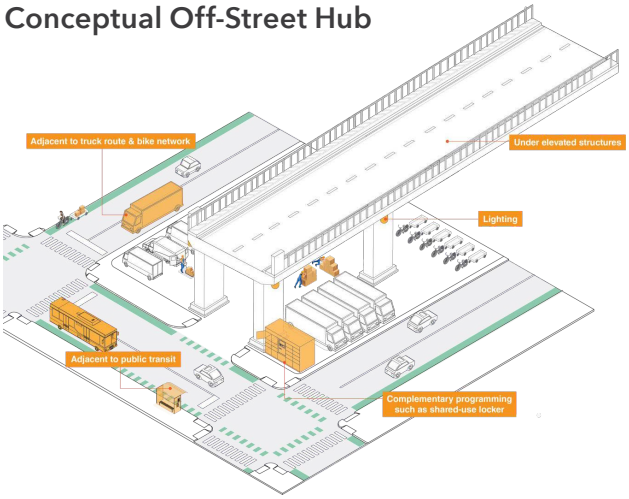

Image credit: NYC DOT

Purpose and Need

A logistics microhub (microhub for short) is a space located within the public or private right-of-way where goods are transloaded from larger freight vehicles to smaller electric vehicles or human powered modes (e.g., cargo cycles, hand carts, or golf carts) for final delivery.

Current goods distribution methods cause double parking and circling in large, loud, polluting vehicles. This has congestion, safety, and public health impacts. Microhubs could make it easier and more cost-effective to complete deliveries by sustainable modes.

Key Strengths

- For many delivery applications, a physical space is required to transload packages to small vehicles where the urban form becomes inappropriate for larger vehicles. By providing this space, a microhub enables a much wider variety of last-mile deliveries to be accomplished sustainably than would otherwise be possible.
- The concept is flexible, allowing different programming at different locations, or over time to meet diverse or changing needs. For example, working group members recommended parcel pickup lockers be included at the microhub site. That element could be included at some microhub locations and excluded from others where it is not likely to be useful.

- Microhubs could be cost-neutral or generate revenue. New York City's microhub demonstration pilot hypothesizes that shippers will realize significant operational benefits from using microhubs and will be willing to contribute financially to support the operation of the microhub.
  - » In New York, microhub operators are charged an initial permit fee of $2,350 for the first year of operations.[1] If the permit is renewed, the operator must pay the Department of Transportation an annual renewal fee of $950.
  - » In Toronto, the annual permit fee to install a microhub is CAD $6,658.[2]

Figure 5-5. Example of a neighborhood microhub in Seattle. Packages are dropped off in a storage unit and then loaded onto cargo bikes (shown in background) to go to their final location.

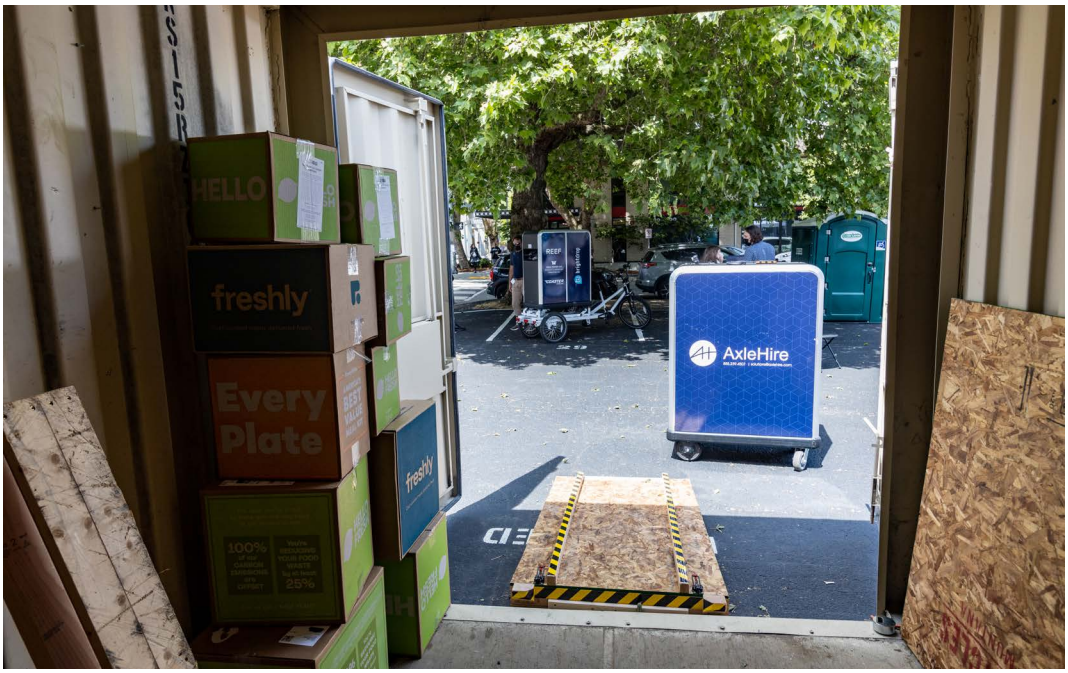

Photo credit: Urban Freight Lab

Key Challenges and Opportunities

Microhubs are likely applicable only to some business types, based on the volume and size of packages received. Businesses that receive many large packages or that receive deliveries from larger trucks may find it difficult to shift operations to a microhub. Finding an available and suitable space in the city that could accommodate a microhub

1 https://rules.cityofnewyork.us/wp-content/uploads/2025/01/Notice-of-Adoption-Microhubs-1.3.25-FINAL-with-certification.pdf

2 https://www.toronto.ca/services-payments/streets-parking-transportation/transportation-projects/mini-on-street-logistics-hubs

is also a challenge. Space in the city is limited and topography could limit the ability of deliveries to be completed by bike.

One potential opportunity to explore is partnering with the state to identify space for microhubs. San Francisco has worked with Caltrans to enable public uses of State Right of Way below or adjacent to freeway parcels, e.g., for skateparks (near Central Freeway), sports courts (near I-280 elevated segment in SoMA) and transit hubs (Salesforce Transit Center).

Recommendations and Next Steps

San Francisco should implement a microhub transloading pilot. As a first step, the Transportation Authority will work with other city agencies to post a Request for Information (RFI) or Request for Expressed Interest (RFEI) to the private sector to better understand interest in and requirements for a potential transloading microhub, and how the city can support commercial e-cargo bike deliveries. Following the RFI/RFEI process, the Transportation Authority and SFMTA should develop a site suitability analysis in partnership with fleet operators that explores locations and facilities in San Francisco best suited to support a microhub pilot and identify up to 5 potential pilot locations and planning level cost estimates to develop microhubs at these locations. The study should consider factors such as proximity to the existing bike network and the location of City-owned real estate such as vacant properties and underutilized off-street parking facilities, coordinating with SF Planning, the Real Estate Division of the City Administrator's Office, and other City agencies that track and manage City property. The study should engage with industry partners to explore business plan models for each recommended pilot location, which would include a description of roles/responsibilities for operations and financial arrangements as well as optimal site configurations and loading/unloading zones to support efficient access for smaller delivery vehicles, and any other desired features. The study should also engage with local merchants to conduct a market assessment and understand demand for microhubs to support sustainable deliveries for merchants. As part of the site suitability analysis, the study team should identify where infrastructure (e.g., bike lanes, curb cuts, charging infrastructure) can be modified or added to support small last-mile delivery vehicles.

Shared Goals Framework Alignment

Table 5-2. Microhub Pilot Goal Alignment

GOAL	POTENTIAL TO ADVANCE GOAL	NOTES
Public Safety	↑	Reduction in double parking
Transit First	↑↑	Supports transition of trips from vehicles to smaller vehicles
Sustainability	↑↑	Supports transition of trips from vehicles to smaller vehicles
Congestion	↑	Supports smaller vehicles
Accountability		
Supply Chain		Increased flexibility and complexity
Regulatory Clarity		
Accessible Curb		
Cost	↑	Increases worker efficiency, reduced fuel costs, potential to add steps to delivery process
Worker Safety	↑	Opportunity for programming, amenities, lighting
Public health	↑↑	Reduction in noise, pollutants within EPC
Disaster Resilience		

5.3 E-BIKE BATTERY SWAPPING LOCKERS

Purpose and Need

An E-Bike Battery Swapping Locker is an amenity which allows people riding e-bikes to swap empty batteries for fully charged batteries. In urban areas, e-bikes can deliver goods faster than motorized vehicles by using bike lanes and avoiding traffic congestion, parking closer to their destination, and reducing the time spent looking for parking. E-bikes are also a sustainable, zero-emission option for goods delivery.

Figure 5-6. An e-bike delivery worker taking a battery out of a battery swapping locker.

Photo credit: NYC DOT

One downside of e-bikes is that the battery charge is limited, with most e-bike models having batteries that last only 4 – 6 hrs. This poses a challenge for e-bike delivery work as, depending on the type of bike, the bike may not operate after running out of charge. Losing charge can have serious ramifications for e-bike delivery work and workers have set their schedules and work expectations to avoid this happening. Riders will end their workday and stop accepting new orders if they're low on charge. Functionally, this means they may cut their delivery day short compared to if they had a longer battery life or the opportunity to recharge while delivering.

Swapping batteries at lockers also reduces the risks of structure fires which could be sparked by improper charging or faulty batteries. This is especially important in San Francisco, where the majority of residents live in multi-family housing with limited space for storing and charging e-bikes. As of February 2024, the San Francisco Fire Code restricts charging lithium-ion batteries in multi-family dwellings to one battery per outlet (i.e., no use of power strips) and a maximum of five batteries per dwelling.[1]

Key Strengths

Findings from an e-bike battery swapping pilot in New York City indicate that this program would increase delivery worker productivity by allowing workers to complete more deliveries without worrying about running out of charge.[2] Battery swapping also improves fire safety because it reduces the need for delivery workers to charge lithium-ion batteries at home.

Key Challenges

E-bike delivery workers shared in a focus group that they were not willing to swap the battery on their e-bike for a different one at battery swapping lockers. Riders see the battery on the bike as "theirs" and are concerned about using a loaner battery because they don't know the usage history. Riders were also concerned about compatibility and swapping for a battery that fits their bike.

Findings and Recommendations

E-bike battery swapping lockers are not recommended for San Francisco at this time due to the lack of interest from e-bike delivery riders who see the battery on the bike as "theirs". This strategy could be revisited if San Francisco's e-bike delivery workforce expands, riders converge on a preferred bike/battery type, or a subscription-based or shared delivery fleet model emerges that standardizes equipment across users.

Instead, there was more interest in public e-bike charging infrastructure (e.g., open-air charging plaza). Riders in the focus group were interested in public charging facilities if they had secure places to lock their bikes, were in convenient, accessible locations, and had compatible chargers. Riders said that charging facilities should be located near frequent delivery order generators (e.g., near grocery store, commercial corridors or places with high concentration of restaurants). Riders were willing to pay a one-time fee to use chargers in case of emergency, but less willing to pay a monthly subscription for access to charging facilities. The Climate Action Plan update includes a draft recommendation to pilot e-micromobility storage and charging infrastructure. There is also the potential to co-locate this type of facility with a logistics microhub.

1 https://sfgov.legistar.com/LegislationDetail.aspx?ID=6412796&GUID=D67DCCB0-2D48-4BD2-A449-23421E78F14F&Options=&Search=

2 https://www.nyc.gov/html/dot/downloads/pdf/safer-charging-safer-deliveries.pdf

Shared Goals Framework Alignment

Table 5-3. E-bike Battery Swapping Lockers Goal Alignment

GOAL	POTENTIAL TO ADVANCE GOAL	NOTES
Public Safety		
Transit First	↑	Supports transition of trips from vehicles to bikes
Sustainability	↑	Supports transition from vehicle trips to bikes
Congestion	↑	Supports smaller vehicles
Accountability		
Supply Chain		
Regulatory Clarity		
Accessible Curb		
Cost	↑	Increases worker efficiency
Worker Safety	↑	Could provide safe congregation area for delivery workers
Public health	↑↑	Reduction in noise, pollutants within EPC, Reduces risks of structure fires from battery charging
Disaster Resilience		

6. Additional Findings and Conclusions

6.1 PLANNING FOR GOODS MOVEMENT IN SAN FRANCISCO IS FRAGMENTED ACROSS MULTIPLE AGENCIES WITH NO CLEAR ORGANIZING FORUM.

This study found that goods movement in San Francisco happens at many different scales, is extremely varied, and has many important stakeholders. Deliveries are made by large multinational corporations such as Amazon, FedEx, and UPS, by small shipping companies that may only have a single vehicle, and by individuals using their personal cars, bicycles, scooters, or mopeds. Deliveries also happen at different time scales, with food and grocery deliveries being more time sensitive than parcel deliveries. Shippers and receivers can have competing needs and demands.

Meanwhile, goods movement solutions often require active buy-in and coordination between multiple parties. These realities lead us to the conclusion that San Francisco would benefit from more clear leadership and organized response across city agencies. SFE's recent E-Bike Delivery Pilot and Medium/Heavy-Duty Truck Electrification Blueprint report as well as the draft Climate Action Plan update both call for the City to establish an Urban Freight Team to develop public-private partnerships to research, implement, and test urban freight plans, projects and policies. This conclusion is supported by findings from this study as well.

6.2 SAN FRANCISCO LACKS QUALITY, COMPREHENSIVE DATA ABOUT GOODS MOVEMENT WITHIN OUR CITY.

This study looked at various sources of data on goods movement in San Francisco. In general, data sources are limited and fragmented. The 2023 – 24 Bay Area Household Travel Diary Survey included questions about package deliveries and the Transportation Authority's Downtown Travel Study found significant growth (over 50% increase compared to pre-pandemic) in delivery trips for households across the city. The 2021 Climate Action Plan used emissions and travel modeling to quantify the greenhouse gas emissions associated with medium- and heavy-duty trucks in San Francisco. In 2018, SF Planning conducted observations of loading zones as part of an update to the loading demand methodology contained within SF Planning's Transportation Impact Analysis Guidelines for Environmental Review. Observations highlighted the complexity and variance of loading needs across different land uses. In 2019, a team of data analysts built Safe Lanes, an app allowing users to report illegal parking activity in bike lanes. This crowdsourced data suggests that double parking of delivery vehicles in bike lanes creates safety hazards. Finally, a survey of on-demand delivery drivers conducted by the Local Agency Formation Commission (LAFCO) found that delivery drivers have a hard time finding parking and most have received parking tickets. The study also found that workers are interested in shifting trips from their private vehicles to electric bicycles, which would mitigate many of the concerns highlighted in other data sources.

These data suggest growth in the delivery sector but also form an incomplete picture of goods movement in San Francisco. Data gaps still remain to understand how loading zones are used post-COVID, types of loading activities, loading behavior outside of designated loading zones, number and duration of deliveries by geography, mode, and time of day, common delivery routes, collisions as a result of deliveries, fleet composition (including fuel type and personal vs. commercial vehicles), identities of fleet owners/managers and labor groups/associations, and data on residential deliveries and e-commerce. Sound decision-making about how to address issues related to goods movement and loading requires better data about current conditions.

San Francisco should execute a data collection effort which seeks to provide a clear and comprehensive picture of goods movement within San Francisco in order to support sector planning and demand forecasting efforts. The Urban Freight Working Group can provide technical support and guidance to agencies leading the data collection effort. Data collection can also be conducted as part of the microhubs site suitability analysis or the off-hours delivery pilot scoping phase. All pilots should also utilize the Mobility Data Specification and other data exchange standards as appropriate to support monitoring by government agencies and facilitate integration with user application platforms.

6.3 SAN FRANCISCO SHOULD CONTINUE TO MONITOR AND IMPLEMENT EMERGING BEST PRACTICES TO SUPPORT SMALLER GOODS DELIVERY VEHICLES ON OUR ROADWAYS

Deliveries in San Francisco are made by many different vehicle types and form factors with different needs, everything from medium- and heavy-duty trucks to passenger vehicles to e-bikes and mopeds.

Peer cities are making changes to ensure that city infrastructure can support a wide variety of sustainable vehicle types and form factors. Table 6-1 below summarizes research on infrastructure approaches in peer cities and current approach in San Francisco. This research suggest four ways that San Francisco can build on SFMTA's ongoing efforts to prepare the city for an expanded e-bike delivery workforce and more diverse delivery fleet:

1. As part of the microhub site suitability analysis recommended in this study, SFMTA and the Transportation Authority should study the bike network near proposed microhub sites to identify places where infrastructure adjustments (e.g., bike lane width, intersection accommodations, curb changes) can be made to better accommodate cargo bikes and other small last-mile delivery vehicles.

2. SFMTA should complete an inventory of small vehicles used for deliveries (e.g., cargo bikes, golf carts, etc.) and identify state, regional, or local regulatory barriers to adoption of these vehicles in San Francisco, and potential impacts to other road users. This includes clarifying what types of vehicles are allowed to use bike lanes in San Francisco as well as the width of bike lanes to facilitate small delivery vehicle use.
3. SFMTA should consider piloting secure bike parking lockers large enough to accommodate cargo bikes and e-bikes near places with high volumes of deliveries (e.g., grocery stores).
4. SFE and SFMTA should complete a technology review, feasibility study, and site analysis for publicly accessible micromobility charging infrastructure options other than battery swapping lockers. This would identify different technological approaches to publicly accessible charging infrastructure required, potential locations, agency responsibilities, and implementation cost.

Figure 6-1. Example of cargo bike parking in Copenhagen

Photo credit: Urban Freight Lab

Table 6-1. Small electric vehicle and cargo bike supportive infrastructure policies

SMALL ELECTRIC VEHICLE AND CARGO BIKE SUPPORTIVE POLICY	BEST PRACTICE IN PEER CITIES	APPROACH IN SAN FRANCISCO
Increasing number of bike lanes	Peer cities see the need to provide more bike lanes to reduce the likelihood that delivery e-bikes use the sidewalk and reduce bike/pedestrian conflicts.	SFMTA Bike and Roll Plan includes a goal that all residents live within a quarter mile of All Ages and Abilities bikeway facilities.
Wider bike lanes Wider bike lanes can accommodate wider cargo e-bikes. Also allow bikes traveling at different speeds to pass each other. Wider bike lanes may result in more vehicles parking in bike lanes. Protected bike lanes can prevent this behavior.	7.5 – 8.5 ft bike lane width recommended (NACTO Urban Bikeway Design Guide) 7.5 – 13 ft bike lane width recommended (The Cargo Bike Friendly City Guide)	Class II: 4 ft minimum, 5 ft if adjacent to parking. 6 – 8 ft preferred. Class IV: 5 ft minimum, 7 ft preferred. Per SFMTA engineering: SFMTA tries to include the widest possible bike lanes. Larger cargo e-bikes are allowed to use the vehicle lane if bike lane is too narrow or blocked.
Design considerations at intersections Wider and longer e-bikes require more space at intersections.	Minimum inner turn radius 5 ft, sweeping radius 9 ft (NACTO Urban Bikeway Design Guide) Wider bike boxes (The Cargo Bike Friendly City Guide)	Minimize use of bollards or space out bollards enough to allow larger bikes to fit through Bike queuing areas are 6.5 ft deep, but 10 ft or more may be needed to accommodate bike trailers, cargo bikes, and high volumes.
Statutory or vehicle code changes and subsequent planning for new vehicle types Changes to the vehicle code or existing law may be needed to allow different form factors to operate on San Francisco roads or use bike lanes	NYC proposed changes to state traffic rules to increase the maximum allowable length and height of cargo bikes, and to allow bikes to have up to four wheels In 2022, State Assembly Bill 2432 authorized the county of Los Angeles or any city in the county to plan, adopt, and implement a Neighborhood Electric Vehicle (NEV)[1] plan In 2024 the Western Riverside Council of Governments identified NEV strategies in the areas of land use, infrastructure, policy, and programs.	None planned right now San Francisco has not identified any desired vehicle types or infrastructure which would require code changes
Curb changes Cities can allocate curb space for e-bike and e-cargo bike deliveries. Cities can also add mountable curbs or add more frequent curb cuts to allow delivery bikes to access businesses more easily.	NYC allows cargo e-bikes to use commercial curb space NYC is also exploring the possibility of a “cargo bike loading only” curb space	San Francisco has already designated curb space for bike parking and bike share. SFMTA is open to considering designating curb space for cargo e-bikes used for deliveries. San Francisco should use the standardized Open Mobility Foundation Curb Data Specification to monitor and manage curb space.
Bike parking Cargo bikes may necessitate a different style of bike rack because these bikes tend to be wider and lower to the ground.	Copenhagen has examples of cargo bike parking. (Photo in the Cargo Bike Friendly City Guide)	SFMTA’s Bike and Roll Plan recommends that San Francisco should attempt to make 25% of bike lockers large enough to accommodate larger bikes.
Facilitating the installation of small vehicle and cargo bike supportive infrastructure in public right-of-way Examples include battery swapping lockers or charging infrastructure and building out bikeway networks.	NYC authorized property owners and tenants to install e-bike battery swapping and charging cabinets on public sidewalks in front of their properties.	SFMTA’s Accessibility Strategy Needs Assessment includes a recommendation to install publicly accessible charging stations for personal mobility devices (e.g., electric wheelchairs).[2] Some interest for this exists in San Francisco, e.g., the tenant at 1200 Market Street has asked SFMTA for e-bike charging infrastructure at this location. This concept could be combined with microhubs or mobility hubs.

1 NEVs are low-speed, four wheeled vehicles similar in appearance to golf carts but which require a standard driver’s license to operate

2 https://www.sfmta.com/accessibility-strategy-needs-assessment-2024/streets-capital-projects/16-parking-and-charging-of-personal-mobility-devices

7. Funding and Implementation Plan

The table below summarizes the main recommendations of the study, estimated cost, potential funding sources, and suggested lead agency and potential partners.

Table 7-1. Funding and Implementation Summary

RECOMMENDATION	ESTIMATED COST	POTENTIAL FUNDING SOURCES	LEAD AGENCY AND POTENTIAL PARTNERS
Off-Hours Delivery Pilot Including data collection phase, engagement with merchants, meetings of urban freight team, and pilot deployment (including incentives for merchants)	$400 – 600k for data collection phase $1.6 – $2.4M for pilot deployment	• Prop L TDM • OBAG County Program • Transit-Oriented Communities Grant • Climate Program Implementation Grant • SMART Grant	• SFCTA, SFMTA (leads) • SFE (Partner)
Microhubs Site Suitability Analysis Including initial RFI/RFEI, data collection tasks (infrastructure improvements needed, inventory of small vehicles used for delivery and regulatory barriers), meetings of urban freight team Final deliverable: up to 5 potential microhub sites identified, with planning level cost estimates.	$200 – 500k	• Prop L TDM • SB 1 Caltrans Sustainable Transportation Planning Grant • Carbon Neutral Cities Alliance	• SFCTA, SFMTA (leads) • SFE (Partner)
Bike Parking Lockers Bike parking lockers large enough to accommodate e-bikes, e-cargo bikes	$5 – 7k per bike locker	• Prop L Safer & Complete Streets • TFCA	• SFMTA

7.1 LOCAL SOURCES

Proposition L Half-cent Sales Tax

In 2022, San Francisco voters approved Proposition L (Prop L), the Sales Tax for Transportation, which directs half-cent sales tax funds to a 30-year Expenditure Plan that identifies projects and programs to be funded by the sales tax. The Expenditure Plan describes the types of projects eligible for funds under each of its 28 programs. This project's recommendations, which support projects that have high potential to shift deliveries to more sustainable modes and less congested times of day, may be eligible under the following program:

- **Safer and Complete Streets:** This program funds improvements to the transportation system to make it safer for all users and helps achieve the City's Vision Zero goals. Eligible projects include bike parking lockers.

- **Transportation Demand Management:** This program covers TDM improvements intended to shift trips to sustainable modes (e.g., transit, biking, and walking) and shift travel to less congested times.

Transportation Fund for Clean Air (TFCA)

The TFCA is funded by a $4-per-vehicle registration surcharge in the nine-county Bay Area. The Bay Area Air District administers the program and makes 40% of the revenues available to each county. The Transportation Authority is San Francisco County's designated TFCA manager and dedicates approximately $700,000 annually to projects that support bicycle, pedestrian, and other transportation projects that help clean the air by reducing motor vehicle emissions. TFCA has funded SFMTA bike parking projects in previous funding cycles and could fund lockers that accommodate e-bikes and cargo bikes.

7.2 REGIONAL/STATE/FEDERAL SOURCES

One Bay Area Grant (OBAG) Program

The One Bay Area Grant (OBAG) Program guides how the Metropolitan Transportation Commission (MTC) distributes federal transportation funding from the Federal Highway Administration to projects and programs that improve safety, spur economic development, and help the Bay Area meet climate change and air quality improvement goals. Federal grants included under OBAG include Surface Transportation Program and Congestion Mitigation and Air Quality Improvement (CMAQ) funds. The latter funded the extension of the off-hours delivery pilot in New York City.

The third round of OBAG funding (OBAG 3) was adopted by MTC in January 2022 and provides federal funding for projects from 2023 to 2026. The OBAG 3 program is divided into a Regional Program comprised of a suite of grant programs managed by MTC, and a County Program, managed by MTC in partnership with the nine Bay Area County Transportation Agencies (CTAs), including the Transportation Authority. Discussions are underway on OBAG 4, with funds expected to be available for projects in 2027 through 2030. While MTC plans to adopt the OBAG 4 framework by the end of 2025 and issue a call for projects for the OBAG4 County program in early 2026, guidelines for the various regional grant programs may not be known for months, if not a year or more later, as their roll out is typically staggered. Based on information currently available, we anticipate the following grant programs (or their successors) as potential fund sources for this study's recommendations:

- **OBAG County Program:** MTC plans to continue the OBAG County Program, which is anticipated to fund planning studies for priority development area and other growth geographies, complete streets and road safety projects, climate projects (including trip reduction), and multimodal projects such as transit capital improvements and mobility management services. The off-hours delivery pilot is likely to be eligible for funding from this program. For

this grant program, the Transportation Authority recommends San Francisco's project priorities to MTC who ultimately selects which projects to fund.

- **Transit-Oriented Communities (TOC) Grants:** Under OBAG3, MTC established regional TOC Planning and Implementation grant funding opportunities focused on supporting TOC Policy implementation. Grants and technical assistance were available to help local jurisdictions develop plans and policies that comply with the four components of MTC's TOC Policy: New Residential and Commercial Office Development Densities, Housing Policies, Station Access and Circulation, and Parking Management. This last component aims to reduce automobile trips and prioritize the limited land area near transit for other shared transportation modes and active transportation, and has funded projects such as curb and parking management. We anticipate that this program or a similar one will continue under OBAG 4.
- **Climate Program Implementation Grant:** This was also a regional grant program under OBAG 3 that helped implement Climate Program Strategies identified in Plan Bay Area 2050. In 2024, the grant distributed about $40 million of funding through four grant programs: 1) Regional Mobility Hubs; 2) Parking Management; 3) Charging Infrastructure; and 4) Active Transportation Capital Design Technical Assistance. The Parking Management Program furthers sustainable parking and curb management approaches that can balance parking and curb uses.

SMART Grant

The U.S. Department of Transportation administers the Strengthening Mobility and Revolutionizing Transportation (SMART) discretionary grant program. The SMART Grant program funds demonstration projects focused on advanced smart community technologies and systems in order to improve transportation efficiency and safety. This program is not currently accepting applications and future cycles are to be determined.

Senate Bill 1 (SB 1) Sustainable Communities Grants

California Senate Bill 1 (SB 1) was signed into law on April 28, 2017. SB 1 provides $5.4 billion annually toward transportation in California, funding a wide variety of transportation projects through many different grant programs. Among those, SB 1 provides approximately $25 million in funds for Sustainable Communities Grants each grant cycle, which are intended to support and implement strategies to achieve the state's greenhouse gas reduction target of 40 and 80 percent below 1990 levels by 2030 and 2050, respectively.

7.3 OTHER POTENTIAL FUNDING SOURCES

Carbon Neutral Cities Alliance (CNCA) Game Changer Fund

This study was funded by the CNCA Game Changer Fund. The Game Changer Fund was launched in 2021 and awarded funding over a three-year period to support the development, adoption, and implementation of policies that aggressively shift the fundamental attributes of the systems that have caused the climate crisis toward carbon neutrality. Future RFPs for the Game Changer Fund will be released as funding becomes available.

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