



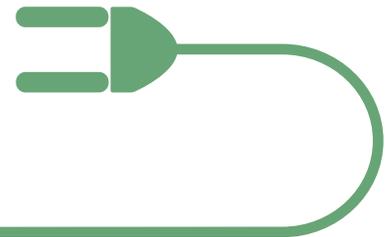
SEATTLE ZERO EMISSION FREIGHT

RESEARCH AND PARTNERSHIPS TOWARDS CLEANER TRANSPORTATION

REINVENTING DELIVERIES

ZERO EMISSION FREIGHT

CLIMATE FRIENDLY LOADING



STUDY AND RECOMMENDATIONS REPORT

MARCH 7, 2023



Seattle
Department of
Transportation

in partnership with



WALKER
CONSULTANTS

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SUMMARY

Freight and commercial goods are an important and growing part of Seattle’s economy. However, almost all of the commercial delivery activity to bring packages to residents and businesses is made by gas or diesel powered vans and medium and heavy trucks, which significantly contributes to poor air quality, congestion, and safety issues. Seattle has set ambitious goals to address the climate emergency and to explore options for freight decarbonization and is working to pursue projects that address both business and community needs.

To understand the structures necessary to advance these opportunities, SDOT is working in partnership and with support from C40 Cities, a global network of mayors working to confront the climate crisis, to create a zero-emissions curbside management system. In this study, Walker Consultants worked on behalf of SDOT to explore the pathways to implement electric vehicle and zero-emissions loading zones and e-cargo bike delivery. Through stakeholder outreach, research, interviews with peer cities, and data collection, we have identified the necessary policy, administration, and engagement considerations to begin implementation. All recommendations are informed by lessons from five peer city programs, identified business needs in our community, and the existing policy structures at play in Seattle.

Stakeholder outreach revealed that the Seattle business community is interested in and excited to move towards zero emission options, but needs program assistance from the City. A small number of companies in Seattle currently operate electric vehicles and the market is still largely developing options to enable this transition. For both potential programs, SDOT plans to be a liaison for those looking for zero emission resources to right size and electrify fleets and support those interested in testing pilots in Seattle.

The following recommendations identify pathways the City can use to partner with and incentivize the private sector to make investments in their fleets and systems, while also ensuring that small to medium businesses are supported by City programs. Implementation of these plans will be a multi-year effort, ensuring that both private sector partners and our local business community are supported in the transition and identifying pathways to fill funding gaps. Following this Study, SDOT expects to review the recommendations and begin implementation planning, incorporating other urban goods and paid parking strategies within the developing Seattle Transportation Plan Curbside Element and Seattle’s Climate Emergency Response Framework (CERF).

Zero emission vehicle commercial loading zones are one key recommendation of this Study



[Photo: location Los Angeles, CA; courtesy of Walker Consultants]

Final Recommendations

Recommendations to support zero-emission commercial delivery and incentivize companies to electrify their fleets include:

- Liaison with Seattle companies to encourage conversion to right size and electrify fleets, and identify key delivery routes where new load zones would benefit delivery efficiency.
- Prepare commercial loading zones for zero emission, developing new loading zone standards and piloting Zero-emissions Commercial Vehicle Loading Zones.
- Develop a tiered Commercial Vehicle Loading Zone permit pricing structure that encourages electric vehicle transition.
- Implement enhanced enforcement practices.

Recommendations to support e-cargo bike delivery include:

- Launch Seattle Commercial E-Cargo Bike Program, with associated new permitting structures and loading/parking infrastructure at the curb
- Pilot small-medium business e-cargo bike lending library, where businesses can rent e-cargo bikes for delivery.

Figure 1 provides an overview of the two study recommendations in further detail with outlined implementation steps. Each recommendation, if implemented, shows that these strategies could potentially eliminate between 10 and 30 million pounds of carbon dioxide emissions by 2030.

Figure 1 Zero Emissions Freight Recommendations and Implementation Steps

Recommendation #1: Incentivize Fleet Electrification and Prioritize Space for Zero Emissions Vehicles		
Supportive Policy Changes	Implementation Steps	Potential Tailpipe Emissions Reductions by 2030
Policy Step #1: Prepare commercial loading for zero emissions	<ul style="list-style-type: none"> • Liaison with companies to encourage electric fleet conversion and address barriers • Identify routes where new load zones would benefit delivery efficiency • Develop Zero Emissions Commercial Vehicle Loading Zone standards • Implement ZE loading zone pilot 	10 million pounds of CO2 avoided
Policy Step #2: Develop a Tiered Commercial Vehicle Loading Zone Permit Pricing Structure	<ul style="list-style-type: none"> • Increase the annual Commercial Vehicle Loading Zone fee • Implement regulatory changes to allow SDOT to legally charge vehicles by emission type in zone • Develop a tiered Commercial Vehicle Loading Zone Permit Pricing Structure 	
Policy Step #3: Enhanced Enforcement Practices	<ul style="list-style-type: none"> • Collaborate across City departments and with SPD on enforcement strategies • Conduct business outreach and education • Monitor zone compliance and adjust structures as needed 	15 million pounds of CO2 avoided

Figure 1 Zero Emissions Freight Recommendations and Implementation Steps (continued)

Recommendation #2: E-Cargo Bike Supportive Infrastructure and Pilot Program		
Supportive Policy Changes	Implementation Steps	Potential Tailpipe Emissions Reductions by 2030
Policy Step #1: Launch Standing E-Cargo Bike Pilot Program	<ul style="list-style-type: none"> • Develop permitting and regulations for e-cargo bikes • Implement new curb space allowance for commercial e-cargo bike loading and parking • Implement code changes in SMC • Provide subsidies and incentives (as able) • Launch paired with robust community engagement 	<ul style="list-style-type: none"> • 30 million pounds of CO2 avoided • VMT reduced by 180,000 mile
Policy Step #2: “Next Frontier Model” Launch Zero Emission Neighborhood Delivery Hubs	<ul style="list-style-type: none"> • Conduct outreach to businesses to identify prime areas for off-street hubs • Consultant procurement process for hubs management • Develop delivery hubs to provide off-street space for last mile delivery operation 	<ul style="list-style-type: none"> • 20 million pounds of CO2 avoided • VMT reduced by 365,000 mile
Policy Step #3: Support an E-Cargo Bike Lending Library Pilot Program	<ul style="list-style-type: none"> • Consultant procurement process for equipment and management • Select pilot areas through business engagement strategies to confirm interest • Provide incentives to bring down cost of purchasing an e-cargo bike • Monitor and expand lending libraries 	<ul style="list-style-type: none"> • 10 million pounds of CO2 avoided • VMT reduced by 545,000 miles

SECTION 1: INTRODUCTION

Automobiles are one of the largest contributors to greenhouse gas emissions (GHGs) in Seattle. This segment of the transportation sector is growing, spurred by the growth in e-commerce and related commercial goods delivery activity. The City of Seattle has ambitious plans to address these climate challenges. The City’s Climate Action Plan calls for decarbonization efforts to support limiting global warming to 1.5 degrees Celsius. To achieve this, the City’s Transportation Electrification Blueprint identifies six ambitious goals, including one that asks 30% of all commercial goods delivery be zero-emissions by 2030, called the “30 by 30” goal. The goal is to transition private fleets to electric and zero-emissions vehicles to transform the freight and goods movement sector by 2030.

The City of Seattle also adopted a Climate Executive Order (EO) in 2022. This Order sets forth key actions that City departments will pursue to prioritize work that equitably reduces or eliminates greenhouse gas emissions (GHG), including from transportation. One deliverable directs the Seattle Department of Transportation (SDOT) to “work with private-sector partners and others to explore ways to incentivize zero-emissions freight options at the curb.” This will include exploring best practices and the launch of new pilot offerings in which SDOT will champion zero emission freight transitions.

The electric cargo vans operated by Amazon are part of a growing fleet of zero emissions vehicles in Seattle



Commercial delivery activity also plays a role in supporting Seattle’s “Vision Zero” commitment to end traffic deaths and serious injuries on City streets by 2030. Creating adequate curb space for delivery trucks reduces the need to circle for parking and search for delivery addresses, which in turn will reduce conflicts, especially in pedestrian heavy, dense neighborhoods.

The policy structures that will support the 30 by 30 goal, the Climate Executive Order and Vision Zero relate to goods and vehicle movement at many levels, predominately at the curb but also from the point of origin and back. Each level of goods movement has different demands and policies that must be tailored to fit these needs. Figure 2 identifies target delivery categories and opportunities to reduce emissions for each category.

Figure 2 Goods Movement Category and Related Decarbonization Opportunities

Goods Movement Category	Opportunity	Common Vehicle Type
Ports to warehouse	Electric vehicle freight	Semi-truck, single-axle truck, beverage truck
Warehouse to retailer	Electric vehicle freight	Large walk in truck, box truck
Last mile delivery	E-cargo bikes, electric vehicle freight	Box truck, minivan, cargo van, step van, SUV
Business to business delivery	E-cargo bikes, electric vehicle freight	Minivan, cargo van, SUV, pickup truck, e-cargo bike, e-bike

There is an increasing demand for curb space from the growth in commercial delivery, service vehicles, disabled parking, outdoor dining, transit, and parking. Further, micromobility devices, such as dockless scooters and bikes, also need space whether on sidewalks or in the curb lane on racks. Curb management is the intentional act of defining the use, designation, and organization of this space to maximize access, advance citywide goals, and prioritize the growing demand for this valuable asset.

Seattle was one of the first cities to recognize the value of its curbs and prioritize the space to achieve broader citywide goals for mobility, equity, and economic development. SDOT has implemented performance-based parking pricing to manage parking demand, built transit-only lanes, installed bike parking corrals, and created commercial delivery and short-term loading zones throughout the city.

Now SDOT has an even more ambitious plan to prioritize curbs as climate assets that can support the 30 by 30 emission reduction goal for goods delivery. At the same time, these strategies support the City's Vision Zero goal by making curb space available for delivery drivers, reducing the need to circle to find parking and delivery addresses, which in turn improves pedestrian and bike safety. To do so, the City must develop the structures and policies that will align with and even incentivize the private sector to make a change that can be difficult and costly. Two opportunities identified include:

- Electric vehicle and zero-emissions loading zones
- E-Cargo bike delivery

To understand the structures necessary to advance these opportunities, the Seattle Department of Transportation (SDOT) is working in partnership and with support from C40 Cities, a global network of mayors working to confront the climate crisis, to create a zero-emissions curbside management system. Walker Consultants worked on behalf of SDOT to conduct a study exploring the potential for and pathways to implement electric vehicle and zero-emissions loading zones and e-cargo bike delivery. This report summarizes Walker's research, findings, and recommendations

E-cargo bicycles help volunteers deliver food and other donated items around Seattle as part of the *Pedaling Relief Project*, run by the Cascade Bicycle Club



[Photo: courtesy of Cascade Bicycle Club]

SECTION 2: STUDY METHODOLOGY

These recommendations lay the foundation for the type of structures, incentives, and systems that need to be in place to support successful fleet electrification and e-cargo bike delivery programs. The recommendations are a result of learnings from stakeholder input, peer learnings, and commercial delivery activity data, as well as our team’s existing knowledge of creating curb management strategies and commercial delivery/loading zone programs and policies. The following details the study methodology.

2A: Stakeholder and Community Outreach (for a detailed analysis see Appendix A)

Before making changes to the curb that would support zero-emissions loading zones and e-cargo bike delivery, it is necessary to learn what it would take to incentivize businesses and commercial delivery operators to make these changes. Some of the questions the study considered were how zero emission loading zones could support companies’ sustainability

goals and bottom lines, if e-cargo bikes would be suitable for their operations, as well as whether the incentives (carrots and sticks) would move the needle.

During the investigation phase of the Zero Emission Freight Study, team members from the Seattle Department of Transportation and Walker Consultants conducted interviews with electric vehicle and e-cargo bike delivery experts, freight industry experts, local businesses in Seattle, and national delivery/logistics companies. Some of the same people and groups, in addition to others, also completed an online survey about their commercial delivery needs and practices. Overall, these engagements helped the project team understand opportunities and challenges to electric and zero emission freight delivery deployment, and identify local partners who may wish to join the various pilot projects that emerge from this study. Key points from the interviews and surveys are summarized in Figure 3 and summarized on pages 9-10.

Figure 3 Findings from Stakeholder Interviews and Surveys: Opportunities and Challenges with Implementing Zero Emissions Delivery

Opportunities	Challenges
Many <u>deliveries from local businesses originate from less than 5 miles away</u> , which reduces or eliminates range anxiety for companies looking to switch to electric modes.	There are <u>not enough electric vehicles available to purchase</u> and the types of electric vehicles on the market do not cover all fleet needs; this may be due to current supply chain issues.
Pricing and other local government support to create partnerships and educate businesses <u>can “move the needle.”</u>	Many businesses contract with third-party delivery companies and <u>do not have control over the type of vehicles or the delivery process.</u>
<u>Local businesses are interested</u> in e-cargo bikes and electric vehicles, and some already use them for delivery.	<u>Cost barriers are a top issue</u> , as the purchase of an EV is still cost prohibitive in many cases, especially for small “mom and pop” delivery companies or personal delivery drivers contracted or employed with companies like Uber, Lyft, or independent restaurants. <u>Small and medium businesses will need financial assistance</u> , and large companies need to see an operational benefit.
There are examples of small and large businesses and other cities using e-cargo bikes and electric vehicles for delivery <u>that provide learnings for a Seattle program.</u>	<u>Labor costs and agreements contribute a significant portion of delivery costs and requirements</u> , so smaller electric vehicles may be inefficient.

Figure 3 Findings from Stakeholder Interviews and Surveys: Opportunities and Challenges with Implementing Zero Emissions Delivery (continued)

Opportunities	Challenges
Depending on the season, many <u>freight vehicles are not full during their delivery runs</u> , creating an opportunity for efficiencies with smaller electric vehicles and e-cargo bikes for delivery.	Deliveries with <u>bulky goods</u> or to destinations many miles across the City <u>may not be a good fit</u> for e-cargo bike delivery.
It is <u>unlikely that freight vehicles need en-route charging</u> ; overnight charging can likely cover needs	Enforcing loading zones specifically assigned to only electric vehicles can be costly and complicated.
Unused (privately owned) off-street parking can be repurposed for e-cargo bike delivery, storage and goods hubs.	There is a <u>need for more suitable bike lanes and bike parking</u> for large e-cargo bikes.
It is important to keep <u>consistency of regulations and rules</u> with other leading cities as much as possible to expedite timelines.	Companies are reluctant to co-locate at delivery hubs over concerns regarding data, privacy, and intellectual property.

Detailed Stakeholder Interview and Survey Findings

Supply chains are currently built around longstanding practices of using the largest practical vehicles for each product type and delivery location. This is due to the frequent need to haul goods long distances from ports and factories to warehouses, and warehouses to retailers and then final destinations, for which larger vehicles are more economical. Because labor costs constitute a significant portion of delivery costs and are often subject to labor agreements it is more economical to transport the most goods with the least number of drivers and loaders.

However, there is potential to convert a significant share of existing vehicle types to electric, especially for last mile and business to business delivery. A small portion of freight companies (ranging from FedEx and UPS to large regional distributors of food, furniture, and other items) operate most delivery vehicles currently on the road related to last mile and business to business delivery. These companies typically have distributions centers and fleet storage areas that could be fitted with electric charging equipment, and most of these operators say that en-route charging is unnecessary. However, many businesses contract out delivery and do

not have control over the process. Nationwide, there are thousands of small delivery operators conducting last mile and business to business delivery who may only run several vehicles, and often these vehicles are leased from larger ownership groups. It is more challenging for these small companies to cover the upfront cost of converting their fleet to electric and the installation of electric charging (often they do not have a warehouse or distribution center of their own). Personal delivery drivers contracted or employed by companies like Uber and independent restaurants are also prime candidates for electrification, as they only

Many stakeholder remarked that designated short-term commercial loading zones are very useful, but are often occupied by illegally parked personal vehicles.



[Photo: South Lake Union, Seattle]

operate one vehicle and primarily make shorter distance deliveries. However, the same cost barriers exist, as an EV is still cost prohibitive in most cases.

Some businesses see potential in using electric bikes and other small e-fleet vehicles for local deliveries and wholesale procurement, but under current conditions, this is likely to be a very small share of the overall tonnage miles in Seattle's freight supply chain. There is an increment of deliveries, though, that businesses suggest could be both quicker to deliver and most cost-effective using electric cargo bikes, electric carts, and other micro fleet vehicles.

Many local operators also identified that loading zones, curb space, loading docks, alleys, and center lane loading are congested, inconsistently available, and often occupied by prohibited users (for example a non-loading vehicle parked in a loading zone). Several businesses believe that priority loading zones for electric fleets, and the construction of more bicycle lanes and bike parking, especially for larger e-cargo bikes, could help alleviate congestion and provide more consistently available loading zones for e-fleets. These zones also demonstrate a powerful market signal to companies that the City is focused on zero emission freight solutions.

Several small businesses and delivery operators conducting last mile and business to business delivery are interested in partnerships with the City of Seattle to pilot electric delivery options. These possible partners are identified in the notes in Appendix A.

While there is also an opportunity to use zero emissions vehicles (larger trucks) for port to warehouse and warehouse to retailer delivery, those aspects of the delivery chain are not related to the curb and will inform future freight decarbonization strategies.

2B: Research Review (for a detailed analysis see Appendix B)

To understand existing policies related to curb management, commercial delivery, and emissions reduction goals, Walker researched and analyzed supportive policies that provide the framework for the City's zero-emissions freight initiatives, the data analysis and pilot programs the City has conducted, and the existing regulatory framework that might impact future program implementation. The City of Seattle has multiple strategic plans underscoring the City's commitment to reducing carbon emissions associated with goods movement including the following:

Drive Clean Seattle (2016)

Drive Clean Seattle was the City's first implementation plan that encouraged a shift from fossil fuel powered to electric vehicles for passenger cars, trucks, transit and maritime transportation. As part of Drive Clean Seattle, the City committed to reducing greenhouse gas emissions from the City's fleet by 50% by 2025.

Seattle Climate Action (2018)

In 2018, the Seattle Mayor's Office (Mayor Durkan) released "Seattle Climate Action" to strengthen the City's commitment to climate action and the goals established in the United Nations' Paris Agreement, including limiting global warming to 1.5 degrees Celsius compared to pre-industrial levels. Seattle Climate Action set the stage for the City to take bolder steps toward a fossil free future, including adopting zero-emissions urban goods delivery.

Clean Transportation Electrification Blueprint (2021)

Drive Clean Seattle (2016) evolved into the City's Clean Transportation Electrification Blueprint to decarbonize the transportation system. The Blueprint acknowledges that goods movement is a growing cause of congestion and emissions on Seattle roads, due to the increase in e-commerce and food delivery. It outlines steps Seattle is

committed to in reducing climate pollution in the transportation sector including making 30% of freight delivery zero emission by 2030.

The City aims to achieve this goal by partnering with goods delivery companies to transition fleets to electric and zero-emissions vehicles, as well as support market transformation in freight and goods delivery over the next 10 years. To do this, the City has proposed potentially using 'climate-friendly loading,' which would provide priority curb space for zero-emissions vehicles, building out charging infrastructure to support electrified freight trucks, and advocating for policies that incentivize the purchase of e-cargo bikes and EVs.

The City has also been a part of multiple studies to work toward its goal of reducing emissions associated with goods movement, including the following major findings:

- Zero-Emissions Area Data Collection (2021)
 - Delivery companies have different structures which might impact how Seattle would partner with different delivery companies to electrify their fleets. For example, USPS and UPS have a more permanent set of employees, vehicles, and routes than Amazon, which has a more gig-based workforce, making it potentially easier to electrify USPS and UPS fleets than Amazon fleets. The route patterns also vary between carriers as USPS truck routes typically connect three different USPS centers, Amazon vehicles have a larger geographic coverage, and UPS is concentrated in the Downtown area.
 - 55% to 60% of all freight trips were performed by medium-duty vehicles (box trucks).
 - 30% to 60% of light-duty trucks were identified as service vehicles (work vans, bucket trucks).
 - Freight trips of all vehicle types have relatively short trip lengths (10 miles or less).
- Urban Freight Lab Neighborhood Delivery Hub

Pilot Program (2021)

- The e-cargo bikes removed 0.65 truck miles per package delivered
- The pilot's shared cost model across partners enables piloting new technologies and operational models that otherwise would not have been possible
- The neighborhood delivery hub reduced tailpipe carbon dioxide emissions by 30% per package delivered, and networked neighborhood delivery hubs could lead to even greater carbon dioxide emissions reductions
- E-cargo bikes delivered fewer packages than traditional trucks per hour (likely due to the small scale of the program)
- In the pilot program, e-cargo bikes were primarily used on sidewalks, whereas bike lanes would have been more efficient.
- During the pilot, significant time was spent navigating building access challenges; therefore, it is important to establish reliable access to buildings.
- University of Washington Urban Freight Lab E-Cargo Delivery Pilot Program (2020)
 - The number of establishments the e-cargo bike delivered increased over time, suggesting potential for improvements in e-cargo bike efficiency
- University of Washington, College of Engineering Urban Freight Lab Downtown Cordon Count (2019)
 - Cordon Count for commercial, freight and service vehicles into greater downtown Seattle in 2019.
 - Approximately 50% of all commercial vehicles entering/exiting the Greater Downtown area were smaller commercial vehicles (i.e., vans, pick-ups, step vans), and 80% were 2- axle vehicles.
 - The largest percentage (30%) of commercial vehicles entering/leaving the Greater Downtown Seattle city were service vehicles (plumbers, electrical, etc.)

2C: Peer City Review (for a detailed analysis see Appendix C)

To understand programmatic best practices and lessons learned for Seattle’s zero-emissions freight programs, the project team reviewed the following peer city programs:

- Santa Monica Zero-emissions Delivery Zone Pilot
- Los Angeles Zero-emissions Loading Zones
- Montreal Colibri E-Cargo Bike Program
- Boston E-Cargo Bike Pilot Program (Boston Delivers)
- New York City DOT programs:
 - Commercial Cargo Bicycle Program
 - Zero Emission Freight and Green Loading Zone Market Research
 - Clean Truck Rebates Program
 - Off-Hour Deliveries Program
 - Neighborhood Loading Zone (NLZ) Program

Seattle also participated in C40’s first Curbspace Working Group, which included a series of meetings with C40 cities who are interested in tackling zero emission solutions at the curb. Each meeting featured a different topic and subject matter expert in zero emission freight, and highlighted cities that are leading work in this area. Information from these meetings also informed our findings on various freight partners and city programs. Cities participating in the workgroup included New York City, Washington DC, Portland, Austin, Santa Monica, Los Angeles, San Francisco, and Vancouver, Montreal, and Toronto, Canada.

Major findings from the peer city review include:

- Enforcement is important for successful zones.
- There must be a significant concentration of curb space dedicated to zero emission loading zones in order to incentivize delivery fleets and other partners.
- In California, one challenge is state law prohibits curb regulations enforcement via video recording and mailed citations, which is the case in Washington State.

- E-cargo bike mini hub costs are a challenge; centrally located hubs are critical for success and this is where land is more expensive to operate for this purpose.
- Fleet maintenance is important.
- E-cargo bikes are efficient to deliver many small packages, but traditional delivery trucks are more useful for large and heavy loads.
- Street design, including installing “cargo bike loading only” zones, is important for program success.
- E-cargo bike standards can make adoption difficult, especially for small businesses. For example, one of the issues New York City encountered was that New York State passed legislation that requires a maximum width of 36 inches for the cargo bicycles, which rendered some pilot participants’ cargo bicycle models non-compliant. The bill also made it difficult for smaller businesses to procure off-the-shelf models as most models are greater than 36 inches wide, matching the dimension of the US standard freight pallet of 48 inches by 40 inches.

Larger deliveries, such as multiple pallet loads to a grocery store, are more practical by truck - though many fleets could switch to electric vehicles in the near future



[Photo: food delivery to PCC Market in Columbia City, Seattle]

2D: Data Collection (for a detailed analysis see Appendix D)

Walker conducted on-site field observations of delivery and curbside activity in four Seattle neighborhoods on Wednesday, November 30 and Thursday, December 1, 2022. These observations entailed staff patrolling the study area of each neighborhood and using a spreadsheet to track delivery and loading activity, including vehicle types, a description of the goods being delivered, the location where the vehicle stopped, dwell time, and other observations.

The neighborhoods were selected by the City of Seattle for their geographic variation, the mix of business types, densities, access routes, and other factors and included South Lake Union, Capitol Hill-Broadway, Chinatown/International District, and Columbia City. The goal of the data collection effort was to provide empirical evidence to support our research and outreach findings and demonstrate factors that would determine how zero-emissions loadings zones and e-cargo bikes would operate.

Overall commercial delivery activity levels varied throughout the day and were dependent on area land uses, business concentration, and demographics. Areas with dense residential multi-story apartment and office buildings had higher levels of delivery activity.

Most deliveries were from Class 4 box trucks, with some representation from semi-trucks, smaller cargo vans, and personal vehicles. No e-cargo bikes were observed and only a few electric vehicles (primarily Amazon electric Rivian vans) were observed. Most delivery vehicles used the center turn lanes or curbside space for deliveries. Where alleys were available (for example in South Lake Union) drivers used those locations as well as the occasional parking lot connected to a business or residence. The only vehicles observed using official loading docks were large food or furniture deliveries where the items were palletized or very bulky.

The City already uses curb regulations that vary throughout the day as paid parking, loading zones, and priority food pickup spaces



[Photo: International District, Seattle]

Most parcels observed could easily fit in cargo bikes. This includes mail and packages, food ingredient deliveries, beverage packages, medical supplies, and other retail goods. Some larger deliveries including large beer kegs and pallets of bulk food for grocery stores were also observed; these items were observed to be too large, as packaged, for cargo bikes. Some activity, such as the same Amazon vehicle making six or more stops in South Lake Union all within several blocks, suggests there is an increment of dense delivery activity of small parcels that could be handled by e-cargo bikes and carts. This particular Amazon activity occurred with their electric cargo van, which suggests they already recognize the efficiency of electric vehicles for frequent stop and go driving.

Each area of study has paid on-street parking. During the entire duration of the team's field study, we observed only a handful of people paying for parking at pay stations. This does not necessarily mean that most people didn't pay but suggests either a very high utilization of pay-by-smartphone mobile apps, considerable non-payment infractions, or some combination of the two. Few occurrences of parking enforcement vehicles or officers were observed, and the team saw no examples of enforcement in action. Seattle has high utilization of pay-by-phone app parking payments.

Areas with dense residential multi-story apartment buildings had higher levels of delivery activity, but this was also dependent on demographics and economic factors. South Lake Union and Capitol Hill-Broadway both showed the most consistent daylong delivery and loading activity. This is likely due to the higher densities, and a greater mix of uses in these neighborhoods compared to Columbia City and Chinatown-International District (CID).

While the CID has a considerable residential density in low- and mid-rise housing in the area, the population is older and lower-income than Seattle overall and residents may purchase fewer products online and therefore require less personal delivery. The businesses are also small, often family-run enterprises that might use more self-delivery that can be more challenging to observe. Columbia City has a bustling commercial street (Rainier Avenue), but the land use is mostly single-story retail surrounded by a neighborhood of single-family homes. Drivers delivering to residences can easily park on a residential street and avoid Rainier Avenue.

This observation only reflects the nature of any given package to a single destination; it does not account for the unknowns of routing, larger parcels that may be in the vehicles, locations of warehouses, and other logistics factors. The above statements are based on the team's anecdotal observations, not an empirical analysis of all known delivery activity.

Major findings from data collection include:

- Commercial delivery activity levels varied throughout the day and were dependent on area land uses, business concentration, and demographics.
 - Dense residential uses seemed to drive delivery activity throughout the day.
 - Areas with dense residential multi-story apartment and office buildings had higher levels of delivery activity, except for the Chinatown-International District (CID). While the CID has a considerable

residential density, the population is older and lower-income than Seattle overall and residents may purchase fewer products online and therefore require less delivery.

- Columbia City has a bustling commercial street (Rainier Avenue), but the land use is mostly single-story retail surrounded by a single-family homes. Delivery drivers to residences can easily park on a residential street and avoid Rainier Avenue.
- Most parcels observed were smaller/medium packages that could easily fit in cargo bikes.
- Some activity, such as the same Amazon vehicle making six or more stops in South Lake Union all within several blocks, suggests there is an increment of dense delivery activity of small parcels that could be handled by e-cargo bikes and carts.
- Each area of study has paid on-street parking and the team observed only a handful of people paying for parking at pay stations. This suggests either a very high utilization of pay-by-smartphone mobile apps or considerable non-payment infractions. Few occurrences of parking enforcement vehicles or officers were observed, and the team saw no examples of enforcement in action.

Many restaurants receive daily deliveries that are small and light enough that e-cargo bikes are a practical delivery option



[Photo: Columbia City, Seattle]

SECTION 3: RECOMMENDATIONS

In the following section we describe opportunities that the City of Seattle could implement to support commercial delivery fleet electrification and e-cargo bike delivery. We also identify the necessary policy steps, administration, and engagement considerations for implementation. Recommendations are based on findings from research, outreach, and commercial delivery data collection and in support of the following program goals:

Program Goals

- Reduce GHG emissions and support the City's 30 by 30 goal to achieve 30% of all commercial goods delivery through zero-emissions methods by 2030.
- Support 2022 Climate Executive Order goal to launch zero emission freight mechanisms at the curb.
- Reduce curb congestion by replacing delivery trucks with e-cargo bikes, therefore reducing illegal and double parking and subsequent emissions from circling for available parking.
- Support Vision Zero by making curb space available for delivery users, reducing the need to circle to find parking and pullovers, which in turn improves pedestrian and bike safety.

Each recommendation presented is accompanied by a description of the barriers, challenges, opportunities, and actions, such as the appropriate code change or pilot structure, that would be best suited to guide implementation.

With the exploration and implementation of both recommendations, SDOT plans to be a liaison for companies hoping to electrify their fleets. Staff will provide expertise on fleet conversions to right size and electrify modes, charging infrastructure, city programs and logistics planning that will allow fleet managers to explore zero emission options outside of typical operations. As the City, this will also support further program development and inform where the private sector and our community partners need additional assistance in this transition.

Opening direct lines of communication with stakeholders will allow the City to work collaboratively with stakeholders when developing and launching recommendations.

The recommendations provided in the Study build on each other, allowing the City to learn and adapt based on data and outreach findings. Ultimately these recommendations identify what levers the City can use within its powers to partner with and incentivize the private sector to make investments in their fleets and systems to advance the City's climate goals. Figure 5 provides an overview of recommendation #1, including a description and the potential estimated emissions reductions. Emissions reductions are based on assumptions and are expected to be achieved by 2030. The emissions reductions estimates are conservative, as delivery trucks are also significant emitters of nitrogen oxides (NOx) and particulate matter (PM 2.5).

In 2018 the Urban Freight Lab of the University of Washington and UPS collaborated on an electric cargo bicycle pilot study.



[Photo: courtesy of University of Washington]

Figure 5 Zero Emissions Freight Recommendations #1

Recommendation #1: Incentivize Fleet Electrification and Prioritize Space for Zero Emissions Vehicles		
Supportive Policy Changes	Implementation Steps	Potential Tailpipe Emissions Reductions by 2030 ¹
Policy Step #1: Prepare commercial loading for zero emissions	<ul style="list-style-type: none"> • Liaison with companies to encourage electric fleet conversion and address barriers • Identify routes where new load zones would benefit delivery efficiency • Develop Zero Emissions Commercial Vehicle Loading Zone standards • Implement ZE loading zone pilot 	10 million pounds of CO ₂ avoided
Policy Step #2: Develop a Tiered Commercial Vehicle Loading Zone Permit Pricing Structure	<ul style="list-style-type: none"> • Increase the annual Commercial Vehicle Loading Zone fee • Implement regulatory changes to allow SDOT to legally charge vehicles by emission type in zone • Develop a tiered Commercial Vehicle Loading Zone Permit Pricing Structure 	
Policy Step #3: Enhanced Enforcement Practices	<ul style="list-style-type: none"> • Collaborate across City departments and with SPD on enforcement strategies • Conduct business outreach and education • Monitor zone compliance and adjust structures as needed 	15 million pounds of CO ₂ avoided

¹Emission reductions are projections based on estimates and assumptions including the following for Recommendation #1: Incentivize Fleet Electrification and Priority Space for Zero Emissions Vehicles and the Estimated Tailpipe Emissions Reductions:

- The study assumes that of the total freight VMT, there could be a potential VMT reduction of between 10% and 30% depending on the policy recommendation and based on study data collection and information from Cycle Freight Study, Transport for London, March 2018.
- City of Seattle total vehicle miles traveled and estimated percent of freight vehicle miles traveled from City of Seattle - Zero Emission Area Data Collection prepared for C40 Cities Climate Leadership Group & City of Seattle, September 7, 2022.
- Carbon emissions per mile for trucks from The Green Freight Handbook, Environmental Defense Fund.
- Difference in tailpipe emissions of electric trucks compared to internal combustion engine vehicles from the American Transportation Research Institute, Understanding the CO₂ Impacts of ZEVs based on the Greenhouse Gasses, Regulated Emissions, and Energy use in Technologies (GREET) model from the Department of Energy's Argonne National Laboratory, May 2022.

Recommendation #1: Incentivize Fleet Electrification and Priority Space for Zero Emission Vehicles

Many actors in the freight industry are investing in fleet electrification to support their company sustainability goals. The City has levers it can use to signal to the market that it will support and encourage these fleet electrification efforts. Recently announced private sector efforts include:

- IKEA aims to be climate positive by 2030, which includes electrifying their delivery fleet.
- UPS has committed to purchasing 10,000 electric vehicles to reach carbon neutrality by 2050 and has purchased e-cargo bikes for last mile delivery.
- FedEx plans to transform its entire parcel pickup and delivery fleet to all-electric, zero-tailpipe emissions by 2040 and is partnering with General Motors' Bright Drop to purchase electric vehicles.
- Currently DHL's fleet is 20% electric, and the company is partnering with REEF on e-cargo bikes for last mile delivery.
- Amazon currently has 1,000 electric vehicles on the road, including in Seattle.
- The United States Postal Service will purchase 66,000 electric vehicles by 2028.

Barriers and Challenges Related to Freight Electrification and Decarbonization

There are several barriers and challenges to private sector fleet decarbonization that, without support or policy changes at multiple levels of government, could hinder Seattle climate goals.

- **Rethinking delivery patterns and vehicle types.** There are several different sized freight vehicles in operation depending on delivery pattern (from semi-trucks to minivans). Logistics questions include: should each vehicle become EV on a 1:1 basis, or do companies need to rethink their distribution flows? A sprinter van (e.g., delivering beer kegs or flowers) carries about the same volume as an e-cargo bike, but

is the weight of the goods a limiting factor? Does the van travel 20 miles to its destination, which is impractical for an e-bike?

- **Control over the delivery process.** Many businesses contract with third-party delivery companies and do not have control over the type of vehicles or delivery process.
- **Sunk costs on internal combustion engine delivery.** Businesses may switch to EVs as they turn over their fleet or expand, but they have a sunk capital cost in the current fleet that will take years to overcome.
- **Manufacturer availability.** There is currently a lack of EVs available from manufacturers for immediate purchase and long wait times for vehicle delivery once ordered. This may be a temporary supply chain issue.
- **Time is money.** Ultimately efficiency and time are the most important factors for delivery. The City's current low Commercial Vehicle Load Zone (CVLZ) permit fees and lack of curb regulations enforcement will not move the needle, making it challenging to achieve decarbonization.
- **Regulatory requirements.** Currently a limited number of companies are operating using EVs, which raises concerns that dedicated load zones only for electric vehicles would be provided to a single company, which is contrary to the City's regulatory requirements that do not allow a single private business dedicated access or reservations to public right-of-way.
- **Enforcement costs.** Enforcing loading zones specifically assigned to only electric vehicles can be costly for cities, especially if using only staff resources.
- **Unused curb space.** Due to a lack of electric vehicles delivering goods on the road today, providing exclusive curb space for EV vehicles will lead to the underutilization of these spaces in the short term.

Opportunities Related to Freight Electrification and Decarbonization

The industry and the City have several available policy levers that can encourage and support the private sector in decarbonizing their fleets.

- **State and City sustainability goals.** The City may have authority to dedicate access to the public right-of-way to only serve electric vehicles because this would advance state and local goals including Washington State’s Advance Clean Cars II rule that bans the sale of gas-powered vehicles beginning in 2035 and the City’s Climate Executive Order and Transportation Electrification Blueprint.
- **Private sector sustainability goals.** Some companies have sustainability goals that support the conversion to zero-emissions.
- **Potential for smaller vehicles.** Many freight vehicles are not full during their delivery runs, creating an opportunity for efficiencies with smaller electric vehicles and e-cargo bikes for delivery.
- **City policy levers.** Pricing, permits, and other local government policies, such as including zero-emissions vehicle commercial loading zones, commercial vehicle permit pricing, and eventually curb access fees can incentivize companies to electrify their fleets. These policies will also signal to the market that the City is taking a new direction on climate policy and delivery fleets.
- **EV charging infrastructure is not a barrier.** There is no need for en-route charging; overnight charging at fleet depots can likely cover all vehicle charging needs.

Industries Best Positioned to Benefit and/or Experience Challenges

Currently, the industries/companies best positioned to benefit from these policies are those already employing electric vehicles or who have a mission towards sustainability. For example, IKEA aims to become climate positive by 2030 and Amazon has invested in Rivian electric vehicles for delivery, which

were deployed in Seattle in 2022. E-cargo bike manufacturers and e-cargo bike program operators would also benefit from these policies and be able to use the space for deliveries.

It is challenging to determine the potential uptake of zero-emissions vehicles, given the investment costs and the limited number of vehicles available for purchase. However, implementing these policies is a signal from the City to the private sector that this is the new direction, which could encourage uptake.

The industries/companies that would experience challenges related to these policies are those that do not have the resources to electrify their vehicle fleets. As more zero emission commercial vehicle loading zones are programmed at the curb, there will be less space for non-electric commercial delivery vehicles.

Policy Steps and Administrative Considerations to Implement the Recommendation

The following are levers under the City’s control and policies it can enact to support zero-emission commercial delivery and incentivize companies to electrify their fleets.

- Liaison with Seattle companies to encourage conversion to smaller truck sizes and faster conversion to EVs.
- Work with companies to identify their routes and where new load zones would benefit delivery efficiency.
- As more companies acquire electric vehicles, consider adding separate zones for zero-emissions Commercial Vehicle Loading Zones.
- Consider a tiered Commercial Vehicle Loading Zone permit pricing structure that encourages electric vehicle transition as well as pay-by-use at the curb.
- Implement enhanced enforcement practices.

Policy Step #1: Create Zero-Emissions Commercial Vehicle Loading Zones

Data collection findings show that in some neighborhoods, Commercial Vehicle Loading Zones (CVLZs) are highly utilized and often occupied, especially in neighborhoods with dense office and residential dwellings. Further, discussions with stakeholders and delivery drivers show the need for an adequate length of curb space for delivery drivers to quickly get in and out and move on to their next delivery location.

1A - Update Commercial Vehicle Loading Zone Standards

Setting loading zone standards can help drivers better navigate traffic and pull in and out for delivery, which could reduce circling and emissions. Currently, the City's loading zones are not standardized in terms of the number, position or length at the curb. Some are at the approach from an intersection and others are in the middle of the block. The City could study the location of existing loading zones and develop standards for their locations on a block (i.e., along the curb at the approach from the adjacent intersection, driveway, or alley). Given the growing demand for loading zones, the City should also set a standard for how many zones should be dedicated per block with adjacent business uses or multi-family residential buildings, such as one per block. To update these standards, the City could explore new evaluations in capital and corridor plan review and implementation, and may need to pursue additional funding to proactively update existing zones in the City to support this change.

1B - Develop a Zero-Emissions Commercial Vehicle Loading Zone Pilot

Given the growing demands for package delivery, limited curb space to make those deliveries, and overarching City climate goals, SDOT could first pilot and study Zero-Emissions Commercial Vehicle Loading Zones

by allocating some curb space only for zero emission commercial delivery vehicles (including electric vehicles and e-cargo delivery bikes). A pilot would allow the City to conduct outreach with fleets to gauge interest and determine where zones should be located, test the market demand, and collect data to understand if zero emissions loading zones encourage freight companies and small businesses to convert their fleet to zero emission vehicles.

A pilot makes sense because freight companies and businesses are just beginning to purchase and deploy electric vehicles and e-cargo bikes for delivery. There are barriers and challenges related to the sheer investment in a fleet conversion and the limited number of vehicles available on the market for purchase. Therefore, there may be a slow uptick in the number of

The e-cargo bikes used in the 2021 pilot study are the types of equipment that would be permitted at zero emissions vehicle loading zones



[Photo: courtesy of Urban Freight Lab, University of Washington]

vehicles that can use this space at least in the short-term. Due to this challenge, and because the goal of any curb management program is to effectively use the limited curb space (rather than be dedicated to a single use where it may sit empty), the City could pilot zero-emission commercial delivery loading zones in areas with dense office and residential space, where data observations showed frequent delivery activity (such as in South Lake Union). Pilots of this nature have been successful in other jurisdictions like Los Angeles, and demonstrate how curbspace mechanisms can positively encourage adoption of EVs for delivery.

Zero-emissions Commercial Vehicle Loading Zones Pilot - Implementation Steps:

- **Outreach:** Conduct outreach to freight companies and businesses to provide education on zero-emissions loading zones and changes to the existing space regulated for Commercial Vehicle Loading Zones.
- **Pilot:**
 - a. As an initial pilot, meet with companies that are currently delivering with electric vehicles to learn the EV routes and consider the best opportunities for creating zero-emissions loading zones in those areas.
 - b. Another opportunity to pilot zero-emissions loading zones is to create them in the three “low-pollution neighborhoods” as called for in Mayor Bruce Harrell’s 2022 Climate Executive Order (EO).
 - c. Based on these learnings, pilot a geography with priority zero-emissions loading zones.
- **Education and training:** Reach out to delivery companies and small businesses to provide information and training on the newly created zero emission loading zones (i.e., Amazon, FedEx, and others, small businesses such as flower and pizza delivery using e-cargo bikes).
- **Enforcement:** Establish enforcement practices for the newly created zones. An important element of this recommendation is that the spaces need to be enforced so they are reliably

available for zero-emissions commercial delivery vehicles.

- **Regulatory changes:** Zero-emission commercial loading zones are not currently permitted in the City, as SDOT can only regulate for Commercial Vehicle Load Zones (CVLZ) as currently defined in the Seattle Municipal Code. CVLZ’s were established to provide, on busy streets, a designated parking space for service delivery vehicles to stop and unload. The existing loading zone fee is \$250 annually and \$125 after July 1. CVLZs and permits are regulated under the Seattle Municipal Code Title 11 Vehicles and Traffic. Any new regulation, such as establishment and enforcement of zero-emission commercial loading zones, would need to be defined in Title 11, which requires an act of Council. For a detailed review of the municipal code, please see Appendix B. For suggested regulatory changes, please see Appendix E.
- **Build Zero-emissions Loading Zones:** Paint and sign curb for zero emission loading zones.
- **Performance monitoring:** Monitor zero-emission commercial loading zone use, and incrementally increase or decrease the number of zones over time as the need grows and changes. Key performance measures of the pilot could include:
 - More efficient delivery operations
 - Less traffic infractions (double parking, etc.)
 - Less instances of improper use by non-permitted vehicles
 - Strong utilization rate of the Zero-emission Commercial Loading Zones

Policy Step #2: Develop a Tiered Commercial Vehicle Loading Zone Permit Pricing Structure

Currently, all commercial vehicles that wish to park in a commercial vehicle loading zone are required to purchase a commercial loading zone permit or pay by phone (or pay station). The current Commercial Vehicle Loading Zone permit fee, last updated in 2019, is \$250 annually and

\$125 after July 1. Companies that operate a fleet of ten or more commercial vehicles are eligible to purchase one transferable permit for every five commercial vehicles in their fleet with non-transferable permits.

There is likely room to increase the existing permit fee for commercial loading, as \$250 is quite low compared to the value of being able to assess curb space. The permit provides a one-size fits all approach when usage across the City and across time of day varies tremendously. Strictly comparing the permit fee to hourly parking rates shows the opportunity for a fee increase. For example, the current hourly rate to park in South Lake Union during the afternoon is \$1.25 for 30 minutes. Assuming a delivery vehicle makes eight stops over an eight hour day that equals \$2,500 in parking costs over the course of the year (assuming 50 weeks). Further, other west coast cities have higher commercial loading zone permit fees. San Francisco’s commercial loading permit fee is \$2,210/annually and Portland’s fee is \$690/annually.

Walker recommends the City increase the annual commercial loading permit fee and base the price on the engine composition/emissions/fuel type, with diesel powered vehicles paying the highest fees and zero-emissions vehicles paying the lowest fees. Revenue from these fee increases could be used to help implement recommendations in this report and other zero emission freight initiatives. To encourage the adoption of e-cargo bikes for delivery, the City could consider waiving the fee for these vehicles as program costs allow, but still permit e-bikes actively loading or delivering to park in paid parking areas and all other loading zones. Once the new fees are determined, the City must update Seattle Municipal Code 11.23.030 Commercial loading permit — requirements. For detailed suggested regulatory changes, please see Appendix E.

Suggested rate levels for the updated annual commercial loading permit fee are outlined below, with diesel and gas powered vehicles paying the highest rates:

- Level 1: E-cargo delivery bicycles (To encourage the adoption of e-cargo bikes for delivery, the City could waive the fee for these vehicles and permit e-bikes actively loading or delivering to park in paid parking areas and load/unload and commercial/truck zones
- Level 2: Zero emission vehicles
- Level 5: Gas - Diesel powered vehicles

2A -Permitting E-Cargo Delivery Bicycles

If the City creates Zero-emissions Commercial Delivery Loading Zones that allow e-cargo delivery bikes, bikes will need a permit to park (even if it is a no cost permit). Currently, the City does not have a process for permitting e-cargodelivery bikes. Recommendations for developing an e-cargo bike permit are included in Recommendation #2 on page 24.

Commercial Vehicle Tiered Permit Structure - Implementation Steps:

- **Develop Fee Structure:** Develop a new commercial loading permit fee structure based on vehicle type and emissions. Work to move the payment process to a pay by use approach, where the permit provides eligibility and payment is separate and determined by area / time of day.
- **Regulatory changes:** Once the new fee and rates are determined, update SMC 11.23.030 Commercial loading permit — requirements.
- **E-cargo bike permit and fee:** See page 28 for recommendations to develop the e-cargo bike permit and program.
- **Outreach:** Conduct outreach to freight companies, e-cargo bike manufacturers, and businesses to provide education on commercial loading permit fees.
- **Enforcement:** Establish enforcement practices to address zone eligibility and payment

- **Performance monitoring:** Monitor permit uptake and track vehicle type and changes over time to determine any change in zero-emission vehicles. Key performance measures of the pilot include:
 - Number of permits sold by vehicle type/permit level
 - Changes in sales of e-cargo bike, zero-emissions, and plug-in electric hybrid vehicle permits
 - Citations issued for lack of permit
 - Annual revenue
 - Internal administrative costs
 - Estimated emission reductions based on number of electric delivery vehicles permitted

2B -Long-Term Strategy: Optimize Curb Access With Pay-Per-Use

Given the increasing need for reliable access to Commercial Vehicle Loading Zones at the curb, over time, as technology and the industry evolve, the City may want to move from an annual commercial loading permit program to a program where delivery drivers pay per use each time they park at the curb, or a hybrid of a permit/pay-per-use system.

The benefits of moving to a pay-per-use program are that the City could charge different rates for vehicle types (i.e., zero-emissions vehicles pay lower rates than gas fueled vehicles) and price the curb by location and time of day/ day of week. This could encourage deliveries at off-peak times when there is less demand for curb space. This strategy could also reduce traffic congestion and potentially encourage more efficiencies for the freight industry to consolidate deliveries. Further, an ongoing more reliable revenue source would support the increasing resources necessary to manage the curb.

Seattle currently manages some commercial loading zones to allow both annual permits or pay-per-use



[Photo: courtesy of SDOT via Flickr]

To implement a pay-per-use program, the City would need to upgrade its technology to use a camera, in-dash, or other Bluetooth based system connected to the vehicle license plate and the curb location GPS. Delivery drivers who make multiple stops per day are unlikely to pay a meter or use an app for each stop (some drivers are prohibited from using their phones during their shifts). Freight companies could be invoiced monthly based on vehicle use at commercial vehicle loading zones. Citations could also be automated and mailed for vehicles that are illegally parked in commercial and zero-emissions loading zones (this would require state legislative change).

The City is already working to digitize its curbs to the Curb Data Specification (CDS)², and in the coming years CDS would be a useful tool to communicate with freight companies for delivery and even to collect curb access fees.

²The Curb Data Specification is a way for cities to digitally represent curb regulations. It is a set of APIs (Application Programming Interfaces) to communicate curb regulations (e.g. commercial loading zone spaces) and curb activity (e.g. if those spaces are open or occupied). For more information please visit the Open Mobility Foundation at openmobilityfoundation.org

The strategy for moving to the pay-per-use system is an incremental one, as the City would need to determine the technology type and administrative resources necessary for implementation and the ongoing program support. The City would also need to approve and provide more resources for a license plate enforcement program. Further, the State of Washington would need to approve the authority of the City to issue citations by mail.

Policy Step #3: Enhance Enforcement Practices

Enforcement is important for the success of any zero-emissions loading zone or curb management strategy. When formulating a policy, it is important to understand the limitations of enforcement. Staffing levels, enforcement times, and possible coverage areas should be evaluated as well as the desired compliance. These factors can be increased, if merited, but there is an associated cost related to increased enforcement.

Both before and after the new zero-emissions commercial loading zones are implemented, the City could run an education and awareness campaign to help inform drivers, businesses, and freight companies about the new regulations. Methods could include signs, website information, news broadcasts, direct mail, email, flyering, and meetings with drivers, businesses, and freight companies.

At a suitable time after new regulations have taken place and education campaigns have been launched, the City should begin more thorough parking enforcement as able.

One successful method of enforcement is the use of License Plate Recognition (LPR) systems that could track vehicle permits and duration of stay. This would allow additional enforcement patrols to monitor for time limit infractions.

Additional enforcement methods include targeted enforcement in which enforcement is largely conducted during known busy periods in the highest-congestion areas. This can help

alleviate illegal parking that is most common during peak times. Graduated fines are another strategy that typically provide a non-fee warning notice to first-time offenders, and then institute paid tickets that increase for later offenses. Rates should be set to a level that changes behavior.

An additional benefit of increased enforcement is the positive effect on pedestrian and cyclist safety to support Seattle's Vision Zero strategies, especially if enforcement officers are monitoring Commercial Vehicle Loading Zones and issue more citations for vehicles illegally parked (for example double parked).

Currently, enforcement is conducted by the Seattle Police Department. SDOT's goal is to collaborate with other City departments on the most effective enforcement strategy.

Enhanced Enforcement Practices - Implementation Steps for SDOT:

- **Internal engagement:** Initial coordination with other agencies including the Seattle Police Department (SPD) to discuss the new program and coordinate on enforcement practices.
- **External education and outreach:** Develop and conduct an education and awareness campaign to inform drivers, businesses, and freight companies about the new regulations.
- **Performance monitoring:** Monitor enforcement data to refine target areas and track citations. Key performance measures include:
 - Number of citations issued for parking in a zero-emissions commercial loading zone
 - Number of citations issued for illegal use of a commercial vehicle loading zone
 - Areas where there are the most infractions
 - Number of drivers and companies who are issued more than one citation, based on available data
 - Time of day/week with the most infractions
 - Costs associated with enhanced enforcement

Recommendation #2: E-Cargo Bike Supportive Infrastructure and Pilot Program

Figure 6 provides an overview of recommendation #2, with a description and the estimated emissions reductions.

Figure 6 Zero Emissions Freight Recommendations #2

Recommendation #2: E-Cargo Bike Supportive Infrastructure and Pilot Program		
Supportive Policy Changes	Implementation Steps	Potential Tailpipe Emissions Reductions by 2030 ³
Policy Step #1: Launch Standing E-Cargo Bike Pilot Program	<ul style="list-style-type: none"> • Develop permitting and regulations for e-cargo bikes • Implement new curb space allowance for commercial e-cargo bike loading and parking • Implement code changes in SMC • Provide subsidies and incentives (as able) • Launch paired with robust community engagement 	<ul style="list-style-type: none"> • 30 million pounds of CO2 avoided • VMT reduced by 180,000 mile
Policy Step #2: "Next Frontier Model" Launch Zero Emission Neighborhood Delivery Hubs	<ul style="list-style-type: none"> • Conduct outreach to businesses to identify prime areas for off-street hubs • Consultant procurement process for hubs management • Develop delivery hubs to provide off-street space for last mile delivery operation 	<ul style="list-style-type: none"> • 20 million pounds of CO2 avoided • VMT reduced by 365,000 mile
Policy Step #3: Support an E-Cargo Bike Lending Library Pilot Program	<ul style="list-style-type: none"> • Consultant procurement process for equipment and management • Select pilot areas through business engagement strategies to confirm interest • Provide incentives to bring down cost of purchasing an e-cargo bike • Monitor and expand lending libraries 	<ul style="list-style-type: none"> • 10 million pounds of CO2 avoided • VMT reduced by 545,000 miles

³Emission reductions are projections based on estimates and assumptions including the following for Recommendation #1: Incentivize Fleet Electrification and Priority Space for Zero Emissions Vehicles and the Estimated Tailpipe Emissions Reductions:

- The study assumes that of the total freight VMT, there could be a potential VMT reduction of between 10% and 30% depending on the policy recommendation and based on study data collection and information from Cycle Freight Study, Transport for London, March 2018.
- City of Seattle total vehicle miles traveled and estimated percent of freight vehicle miles traveled from City of Seattle - Zero Emission Area Data Collection prepared for C40 Cities Climate Leadership Group & City of Seattle, September 7, 2022.
- Carbon emissions per mile for trucks from The Green Freight Handbook, Environmental Defense Fund.
- Difference in tailpipe emissions of electric trucks compared to internal combustion engine vehicles from the American Transportation Research Institute, Understanding the CO2 Impacts of ZEVs based on the Greenhouse Gasses, Regulated Emissions, and Energy use in Technologies (GREET) model from the Department of Energy's Argonne National Laboratory, May 2022.

Data collection findings show that many deliveries are small and medium sized packages and small envelopes, which are suited for e-cargo bike delivery. Peer city interviews and research on e-cargo bike programs and pilots across the country and in Canada, such as small business bike libraries and delivery hubs, show that with City support, these programs can be successful. Findings from stakeholder interviews show that there is a market for e-cargo bike deliveries in Seattle, especially if the City facilitated a lending library style e-cargo bike program, making resources accessible to businesses on a trial basis.

There is untapped potential across a range of businesses that would love to switch to electric delivery. They see promise in e-delivery being more cost effective, time efficient, and better for staff morale, but the upfront costs of EVs is a barrier. The City could further support e-cargo bike programs with subsidies, outreach, permits, logistics help, marketing, facilitation, guidance, legal support, and other efforts to support building partnerships.

Barriers and Challenges Related to E-Cargo Bike Delivery

There are several barriers and challenges to deploying an e-cargo delivery bicycle program and encouraging freight companies and businesses to use e-cargo bikes for delivery.

- **Investment and storage.** Upfront costs of e-cargo bikes, charging infrastructure, and storage can be a barrier for some businesses.
- **Coverage and density.** E-cargo bikes seem to be best suited for local trips in dense areas, delivering several pizzas to the same block or flowers to nearby businesses/residences. These denser neighborhoods present the best opportunities for business-to-business e-cargo bike delivery.
- **Geography.** Hills and terrain may be a limiting factor for e-cargo bike delivery. However, we heard that this can be overcome with the right drivers, route planning, and training programs.

- **Large fleet partnerships.** Companies are reluctant to consolidate their products at micro hubs or on delivery vehicles with other companies (due to security, insurance, data privacy, and logistics). For example, it is likely unrealistic to have a shared UPS/FedEx/DHL hub.
 - One pilot in London is solving this challenge by having businesses direct their deliveries to a micro hub as the final destination. At that point, the UPS/FedEx/DHL, etc. journey is complete, and the e-cargo bike operator delivers to the final leg.
- **Types of goods being delivered.** Some deliveries may be challenging to deliver in an e-cargo bike such as bulky items.
- **Enforcement costs.** Enforcing zero-emissions loading zones specifically assigned to only zero-emissions vehicles such as e-cargo bicycles can be costly, especially if only using staff.
- **Unused curb space.** Due to a lack of commercial delivery electric vehicles on the road today, regulating curb space for the exclusive use of zero-emissions vehicles could lead to the underutilization of these spaces.

Opportunities with E-Cargo Bike Delivery

The industry and City have several available policy levers that can encourage and support the uptake of e-cargo bikes for delivery.

- **Private sector sustainability goals.** There is untapped potential across a range of businesses that would love to switch to electric delivery. They see promise in electric being more cost effective, time efficient, and better for staff morale as well as to lower emissions, but the upfront costs of electric fleets are a barrier.
- **City policy levers.** Pricing, permits, and other local government policies incentivize companies to electrify their fleets including zero-emissions commercial loading zones, commercial vehicle permit pricing, and eventually curb access fees for all users. These

policies will also signal to the market that the City is taking a new direction on climate policy and delivery fleets.

- **Time is money.** E-cargo bikes can better navigate traffic and parking than trucks. Given that efficiency and time are the most important factors for delivery, quantification of the benefits of e-cargo bicycles for delivery can educate and encourage the private sector to use these vehicles.
- **Vehicle availability.** There is a wide range of e-cargo bike types available in the marketplace.
- **Underutilized off-street parking for storage.** There is a sufficient amount of underutilized off-street parking available to serve as potential mini hubs for package storage and bike parking.

- **Operators are ready.** Some operators are ready and willing to lead an e-cargo bike library program for small businesses.
- **Enhance safety and support vision zero.** E-cargo delivery bikes can enhance pedestrian and cyclist safety in support of the City's Vision Zero Program.
- **Learnings from other cities.** Several peer cities have implemented e-cargo bike pilots and provided learnings for a Seattle pilot/program.
- **Community Partnership.** Small businesses and nonprofits in Seattle are interested and willing to work with SDOT to champion zero emission freight in support of climate, equity and safety goals, including some that already have existing e-cargo bike programs.

The potential of e-cargo bicycle delivery was demonstrated in New York City in 2020 when one Whole Foods Market ramped up grocery delivery in the early months of the Covid-19 pandemic - three years later grocery delivery remains significantly more popular than before the pandemic and Whole Foods continues to use e-cargo bikes for delivery



[Photo: courtesy of The New York Times]

Policy Steps and Administrative Considerations

The following are steps the City can take to support e-cargo bike delivery:

- Launch Seattle Commercial E-Cargo Bike Program: Support fleet conversion to e-cargo bikes by developing a permitting system and providing the necessary infrastructure such as bike lanes, allowance in more curbside regulated spaces, zero-emissions loading zones, and neighborhood delivery hubs.
- Facilitate the development of neighborhood delivery hubs.
- Pilot an e-cargo bike lending library.

Figure 7 shows three steps to launching the Seattle E-cargo bike program. Each of these proposed pilot ideas can build upon each other, but do not need to be implemented in a specific order. The goal is to demonstrate increasing community support for these delivery services when considering each option and the City should remain flexible as opportunities and partnerships arise. The City will coordinate routine check-ins with pilot participants and community partners to incorporate feedback and lessons learned into the pilot as it advances and expands project work.

Step 1: Staff and launch a Seattle Commercial E-cargo Bike Program, encouraging businesses who can operate independently to bring resources to Seattle. This would include a new permit and curbside space use allowance for commercial cargo bikes and exploration of community partnerships.

Step 2: “Next Frontier Model” - Establish zero emission neighborhood delivery hubs by procuring a consultant to partner with off-street parking operators where businesses, along with small and large carriers, can benefit from locations far from warehouses for centralized loading space.

Step 3: To further assist the small/medium business community, procure a consultant to launch a public e-cargo bike lending library at neighborhood delivery hubs, allowing businesses and the public to test e-cargo bikes on a trial basis before purchasing.

Figure 7 Seattle E-Cargo Bike Pilot Program Steps

Step 1	Step 2	Step 3
Launch Seattle E-Cargo Bike Program and Begin Permit System	Introduce neighborhood delivery hubs	Pilot small/medium size business e-cargo bike lending library

Begin outreach and engagement in 2023 to inform Steps 2 and 3

Outreach and Engagement

A critical part of all steps will be outreach and engagement with fleets, businesses, and other stakeholders. The City should begin outreach as part of Step 1, to inform each step of rollout and garner community support. Because creating neighborhood delivery hubs and piloting an e-cargo bike lending library will likely take a long lead time, early input from businesses will allow the City to evaluate suitable next steps in advance.

- The City should identify neighborhoods and businesses that would like to participate in the pilot and socialize the project goals and prioritize outreach with businesses in disadvantaged neighborhoods.
- Outreach methods should include:
 - Partnering with local business improvement areas, bicycle organizations such as Cascade Bicycle Club, and/or e-bike manufacturers.
 - Visiting businesses directly to make it easier for them to provide input.

- Visiting businesses with a bike will allow the City to market e-cargo bike delivery and benefits, and allow the businesses to see and test the bikes.
- Gauge interest and learn which companies will participate to inform launching delivery hubs and a small business lending library pilot.
- Gain input from large fleets/businesses in a partnership or provide support to small businesses to purchase or use e-cargo bikes

Industries Best Positioned to Benefit

E-cargo bikes offer an alternative for e-commerce and last mile deliveries that decrease emissions and congestion and offer a streamlined delivery process for last mile deliveries. Switching viable deliveries to e-cargo bikes has shown promise for pilot projects and cities that have provided support to companies and stakeholders have seen the most success.

Currently, the industries/companies best positioned to benefit are small businesses that have a delivery element, such as flower shops, bakeries, restaurants, etc., and who are located in a dense area to generate enough local demand for short delivery trips. These businesses usually operate a small fleet of personal vehicles, and demonstrate the largest opportunity for full electric transitions. Large freight companies could also benefit from using e-cargo bikes for last mile delivery with micro hubs for packages because e-cargo bikes are easier to navigate in traffic and find parking, as long as efficiency stays constant or improves for their business model. For large freight partners, the sustainability benefits often still need to be paired with operational benefits to incentivize fleet transitions. Further, if the City does increase commercial vehicle loading permit fees and develop a tiered system based on emissions, using e-cargo bikes for delivery could lower overall costs.

While e-cargo bike delivery is growing, it is challenging to determine the potential uptake.

A pilot program would speak to public interest in Seattle and what changes at the City level are needed to support companies in this transition. If the City supported and helped market a pilot, it would signal to the private sector that this is the new direction, which could encourage uptake.

Policy Step #1: Launch an E-Cargo Bike Pilot Program and Introduce Permit System

There is a suite of initial steps that the City can take to facilitate e-cargo bike deliveries by companies who can operate these services independently. Several companies already own private fleets of e-cargo bikes and would be able to operate in Seattle if supportive City structures are in place. This model requires basic support from SDOT regarding permitting, regulations, and infrastructure to enable e-cargo bikes to legally operate in the city. Participants would likely be required to front the cost of equipment, charging, and delivery coordination.

Permitting E-Cargo Delivery Bicycles

If the City creates Zero-emissions Commercial Delivery Loading Zones, e-cargo delivery bikes would need a permit or eligibility to park (even if it is a no cost permit). Currently, the City does not have a process for permitting e-cargodelivery bikes. The City could issue an ID Card, which the driver could affix to themselves and their bike, similar to NYCDOT.

There are multiple types and sizes of e-cargo bikes, the City should determine vehicle standards in alignment with standards in other cities as well as in coordination with the e-cargo bike industry to create consistency and facilitate quicker adoption.

SDOT and Participant Roles and Responsibilities

To support companies as they convert their fleets to e-cargo bikes, the City should provide the following supportive measures and participants should undertake the following responsibilities as outlines in the table on the following page.

SDOT Responsibility	Participant Responsibility
<ul style="list-style-type: none"> Develop an education and awareness campaign on the program. Conduct outreach to businesses that can utilize the offering for delivery services website created to facilitate program and education), partner with organizations that can serve as “ambassadors” to identify, meet with, and sign up companies 	Attend meetings, sign up
<ul style="list-style-type: none"> Identify SDOT administrative needs to support the program, ideally at least one full-time staff member <ul style="list-style-type: none"> Identify the responsible department Determine budget and resources available for the program 	Respond to City inquiry and share data - As part of the permitting process, there will be a fleet roster. If the City provides any support or subsidy, it can request data sharing on origin and destinations or other trip factors for evaluation.
<ul style="list-style-type: none"> Develop permit and eligibility system. Determine if participants who wish to operate an e-cargo fleet will pay a fee, such as an annual operations fee in place of a typical Commercial Vehicle Loading Zone permit to operate in Seattle, and if the fee will be tiered depending on the size of the fleet. If implementing a fee, it should be lower than the costs that are currently associated with operating larger commercial vehicles in Seattle, providing an incentive for larger companies to consider switching to e-cargo bikes Determine permit type such as an identification card Develop process for e-cargo bike drivers to obtain permit (including application and payment process) Establish internal tracking practices to track permits sold 	Permitted under SDOT program and pay any associated fees
Code changes. New code/allowance to establish e-cargo bikes as a vehicle type in SMC and allow e-cargo bikes to load/unload on and at the curb including in paid parking areas, load/unload, commercial/truck zones	Adhere to new regulations
Determine areas where e-cargo bikes are permitted to load and unload (all commercial delivery vehicle loading zones, paid parking and zero-emissions loading zones) and the need for designated e-cargo bike corrals. City will provide clear guidance on where e-cargo bikes can/cannot travel.	Load and unload in marked areas
Provide access to bike parking and storage, and potentially on-street space for larger style cargo bikes	<ul style="list-style-type: none"> Private drivers, trained and insured by company Delivery logistics planning
Provide subsidies and incentives, and prioritize businesses in disadvantaged or low-income areas	Respond to City inquiries
Determine a robust enforcement strategy so that e-cargo delivery bikes have reliable access to zero-emissions loading zones	

Policy Step #2: “Next Frontier Model” Zero Emissions Neighborhood Delivery Hubs

Once the required supportive city structures are in place, the City can expand to offer additional support to companies that want to increase delivery presence in communities located further away from warehouses, where secondary locations for loading e-cargo bikes, charging, and storing equipment may be warranted. This approach is commonly known as the delivery hub model, providing off-street space for last mile delivery operators to pick up goods and then deliver within a designated area. This model has shown success from past work with the University of Washington Urban Freight Lab Belltown Neighborhood Delivery Hub Pilot and in the peer city Montreal Colibri Project. It can be even more useful if a network of hubs is built at key delivery points throughout the city.

Based on input from business outreach, SDOT would better understand the need for neighborhood delivery hubs and if/how they could increase efficiency, and where they should be located and how to best support their development, basing locations on delivery hotspots and working with freight partners to locate resources along delivery routes. By working directly with freight partners that are interested in using these delivery hub locations, Seattle can structure the hubs to fit the greatest number of partners while still maintaining efficiency and sustainability goals. One barrier to address is the general hesitancy to coordinate with other fleets at a single delivery hub due to privacy and sensitive proprietary logistics concerns. Open communication with businesses will allow the City to address concerns and build in protections for participants.

Through initial outreach SDOT can learn the right management approach to neighborhood delivery hubs. Some models, such as the Collaborative Urban Logistics and Transport program in Antwerp, Belgium, work because the delivery is made to the neighborhood delivery hub and from there an e-cargo bike performs the

The Neighborhood Delivery Hub in Seattle’s Belltown neighborhood provides a central location for last-mile delivery logistics, including storage and fleets-for-hire



[Photo: courtesy of Urban Freight Lab, University of Washington]

last mile delivery to the retailer. Other models, where a city has owned and managed the real estate themselves, such as in Vancouver, have not been as successful because the operation and management of real estate is outside of the typical experience of City employees. This pilot model would require SDOT to hire a consultant for management of the delivery hubs. The SDOT project manager would work closely with this partner to manage ongoing operations.

For SDOT, there is a prime opportunity to partner with off-street parking lots and utilize space that is largely unoccupied by personal vehicles due to ongoing and post-pandemic trends. By partnering with a consultant and off-street parking operators, SDOT would provide a payment to rent the space and the parking lot would ensure the space is clear for program participants. The consultant/vendor would manage day to day operations and coordinate with SDOT program staff. Participants would then pay into the program to operate delivery services out of the designated space.

Based on the study’s commercial activity data findings, these hubs would be first piloted in mixed use areas, with high presence of both commercial activity and residential e-commerce deliveries. Example mixed-use, high-density neighborhoods include but are not limited to South Lake Union, Capitol Hill, and Ballard.

SDOT Responsibility	Participant Responsibility
Procurement process to onboard consultant to manage operations and partnership with off-street parking lot operator, who will maintain a parking area for e-cargo bikes and hub storage. SDOT pays to rent and lease the space	Provide private bike fleet
Bike parking and hub storage provided to participants off-street at a cost	Private drivers, trained and insured by company
Seattle City Light provides power and charging infrastructure (TBD) if identified as a need by participants	Delivery logistics planning, charging needs covered at private warehouse or coordinated with City staff to provide chargers
Hubs located in areas with expressed interest (after engagement), where existing participants can benefit (mixed-use, high-density areas), and in priority disadvantaged areas	Permitted under SDOT program and pays any associated fees with using the space
Outreach to businesses that would be interested in using the space; could also be available to small-medium businesses that already own cargo bikes, partner with community organizations to promote offering	Data reporting on usage supplied to SDOT and participation in regular surveys to determine necessary changes to the hub structures

Policy Step #3: Support an e-cargo bike library hub pilot

To ensure that the city is supporting their small-medium business community, there is an opportunity to provide e-cargo bikes for the public to use on a pay-per-use basis. E-cargo bikes are expensive and often cost-prohibitive for small-medium businesses that need to make local deliveries. However, these customers often only operate a small fleet of personal vehicles for delivery, making them prime candidates for e-cargo bike transitions.

Lending libraries have been piloted in parts of Canada and Europe including Vancouver and Glasgow, where users can rent an e-cargo bike to make deliveries, either for personal or business purposes. The purpose of these pilots is to allow users to test out new, zero-emission delivery vehicles, e-cargo bikes in this case, to see if they can fit existing operations before committing to a purchase. The pilot project would make this technology accessible and approachable to a new audience, while giving them the time to decide how the model will work for their unique use case.

This approach would require SDOT to complete a competitive process to select a partner to operate the lending library at existing neighborhood hubs. Viable project partners that offer this service have already been identified through our outreach process (see Appendix A). Once selected, the partner will manage all day-to-day logistics of the e-cargo bike fleet for rent and communicate with participants.

It is likely there will need to be some form of a subsidy, at least initially to begin the pilot program. The idea is to start small and ramp up,

Companies have been piloting electric bike deliveries in cities including New York City, Boston, and Montreal



[Photo: courtesy of Amazon]

with no initial labor (driver) costs, as businesses would provide their own labor for delivery. Initial pilot estimates for one neighborhood could be several hundred thousand dollars, depending on the number of bikes, real estate costs, and subsidies. The City of Boston received a \$493,000 grant from the Massachusetts Clean Energy Center to pilot an e-cargo bike delivery program called “Boston Delivers” in one neighborhood, including labor costs for drivers (the pilot proposed for Seattle would not include labor costs). Boston selected a private operator to manage this program.

Leading up to the pilot, SDOT will have completed extensive community outreach during each step of program expansion to identify neighborhoods and businesses that would like to participate in the pilot and to socialize the project goals. Participants can sign up to rent an e-cargo bike (or multiple bikes) for a period of time to complete local deliveries. Participants can

either rent on a per use basis or reserve bikes for a longer period, such as over a month.

This pilot will be most successful if paired with an e-bike incentive/subsidy from the City. If an incentive is available to bring down the cost of purchasing an e-cargo bike, it is likely that more businesses will be able to purchase their own e-cargo bike for ongoing delivery needs after testing out a bike at the lending libraries.

The pilot could also permit businesses to test out a bike for a short period, and ultimately use the incentive to purchase on their own if they deem it applicable to their business operations. The lending libraries would be open to the public, allowing both businesses and any Seattle citizen that is interested in trying out a bike to do so (for example, citizens use the lending libraries in Europe to transport goods around town). SDOT and participant roles and responsibilities are detailed below.

SDOT Responsibility	Participant Responsibility
<ul style="list-style-type: none"> Determine administrative needs to manage the program, ideally at least one full-time staff member Identify costs to city Identify grant opportunities 	N/A
Partnership with off-street parking lots	Driver and goods for delivery
<ul style="list-style-type: none"> Competitive process or direct select (TBD) to select partner that will provide: e-cargo bikes, hub management, and delivery logistics Hold a stakeholder event with potential private sector operators. Present the vision for the program and gauge interest to market the selection process 	N/A
<ul style="list-style-type: none"> Select pilot area(s) with operator, based on data analysis and building on existing contract with off-street parking lot operators to provide space and storage Start in a small pilot area and expand with continued lessons learned and outreach 	<ul style="list-style-type: none"> Pay fee to use the bikes on a rental basis Provide learnings and experience back to SDOT (surveys, delivery data, etc.)
<ul style="list-style-type: none"> E-bike incentive to bring down cost of purchase for businesses 	<ul style="list-style-type: none"> Businesses are encouraged to share their experiences using e-cargo bikes for delivery on websites and social media
<ul style="list-style-type: none"> Education and outreach campaign to local neighborhoods to confirm participation in the program. Speakers should include local leaders, existing businesses that use e-cargo bikes for delivery, and e-cargo bike manufacturers. The event should have an e-cargo bike available for testing. 	<ul style="list-style-type: none"> Attend events and collaborate with the City as able

SECTION 4: PERFORMANCE METRICS, MONITORING, AND EVALUATION

As the City pilots each of the program steps, it should collect data, monitor, and make pilot adjustments, as necessary. Performance metrics include:

- Size and weight of delivered goods per kilogram of carbon emitted
- Time requirements of delivery
- Miles traveled for e-cargo bike deliveries
- Cost of delivery and marginal per-package cost
- Amortized capital costs
- Labor and Maintenance
- Fleet storage costs
- Insurance and loss claims
- Delivery operator satisfaction
- Customer satisfaction
- Transportation safety and Vision Zero
- Air pollution
- Street congestion, noise, and visual impacts

Identify signs of success including:

- Number of program participants
- Total emission reductions based on vehicle and miles driven
- More efficient delivery operations
- Better cost per parcel return on investment
- Staff morale and retention
- Continued, voluntary use of e-cargo bikes by the freight companies and businesses
- Other companies choose to self-adopt e-cargo bikes after examples of success or participating in the lending library
- Subsidies supplied to businesses in low-income or disadvantaged communities

SECTION 5: COSTS, FUNDING, AND GRANT OPPORTUNITIES

Detailed cost estimates were not developed within the scope of the study, however costs for these programs and pilots can range from lower-cost changes that are implementable sooner, such as code changes and new regulations/signs, to ongoing programmatic needs such as staffing, external engagement, data collection, and subsidies that require more resources. As a next step, the City should estimate costs to determine resources and needs and a funding plan to secure resources. Currently there are no funds allocated in the City's budget to administer and implement these changes or pilots. There are grant opportunities at the state and federal levels that could provide startup resources. However applying for grant funding takes time and could delay implementation.

Potential grant opportunities include, but are not limited to:

- Washington State Clean Energy Fund
 - The Research, Development, and Demonstration Program, which funded \$8.5 million in projects and research in 2002.
- Bipartisan Infrastructure Law
 - United States Depts. of Energy, Environment, and Transportation continue to release grant opportunities as part of the federal Bipartisan Infrastructure Law.
- Other Grants
 - Grants from organizations such as C40.

SECTION 6: KEY CONCLUSIONS

Taken together, the strategies presented in this study to create zero emission commercial delivery zones and support e-cargo bike delivery have great potential to help achieve Seattle’s ambitious Transportation Electrification Blueprint “30 by 30” goal, as well as support the 2022 Climate Executive Order (EO) and the City’s commitment to Vision Zero. Our investigation phase found there is an appetite from local businesses and large freight companies to electrify their fleets with electric vehicles and e-cargo bikes. Commercial delivery data collection shows that many of the packages delivered today in trucks could be handled by e-cargo bikes. Peer city research and interviews provide learnings for how to best implement these recommendations in the City of Seattle.

The recommendations in this Study provide an incremental process, starting with lower-cost changes that can be implemented sooner, such as permitting, to more expensive and impactful pilots. All will be guided by input from stakeholders and data collected from ongoing monitoring,

While we have attempted to quantify the climate benefits from these recommendations and estimate an annual CO2 reduction of between 10 and 30 million pounds, we also recognize that to fully accomplish reducing delivery emissions by 30% in the next seven years, it will require major moves beyond these recommendations. This includes long-term policies recommended in this document such as commercial delivery curb access fees and other demand-based management tools.

The recommendations in this report provide strategic and innovative concepts for SDOT to consider implementing in support of their zero emission freight goals. Through continued community outreach, business engagement, strategic policy design, and administrative focus, these strategies and pilots can inspire change and create opportunities for partnerships to achieve significant emission reductions.

An example electric cargo bike used in Seattle’s 2021 pilot study by the University of Washington



[Photo: courtesy of UW Urban Freight Lab]

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DATE: January 17, 2023
 COMPANY: C40 Cities / City of Seattle
 FROM: Walker Consultants
 PROJECT NAME: C40 Seattle Zero Emissions Freight Study
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 SeattleZEF_FreightPartnersSurvey_Summary.pdf



SeattleZEF_BusinessSurvey_Summary.pdf
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Appendix A: Project Outreach and Investigation

Introduction

During the investigation phase of the Zero Emission Freight Study project, team members from the Seattle Department of Transportation and Walker Consultants conducted interviews with electric vehicle and e-cargo bike delivery, freight industry experts, local businesses in Seattle, and national delivery/logistics companies. Some of those same people and groups, in addition to others, also completed an online survey about their commercial delivery needs and practices.

This information has helped the project team understand opportunities and challenges to electric freight delivery deployment and identify local partners who may wish to join the various pilot projects that emerge from this study. Key points from the interviews and surveys are summarized below.

Summary of Findings

Interviews with and surveys from delivery companies, Seattle business operators, e-delivery equipment manufacturers, and industry experts revealed mixed opinions about the viability of converting a significant amount of delivery activity to electric vehicles and e-cargo bikes, as shown in Figure 1 on page 2.

Figure 1: Findings from Stakeholder Interviews and Surveys:
Opportunities and Challenges with Implementing Zero Emissions Delivery

Opportunities	Challenges
<p>Many <u>deliveries from local businesses originate from less than 5 miles away</u>, which reduces or eliminates range anxiety for companies looking to switch to electric modes.</p>	<p>There are <u>not enough electric vehicles available to purchase</u> and the types of electric vehicles on the market do not cover all fleet needs; this may be due to current supply chain issues.</p>
<p><u>Pricing and other local government support</u> to create partnerships and educate businesses can “move the needle.”</p>	<p>Many businesses contract with third-party delivery companies and <u>do not have control over the type of vehicles or the delivery process.</u></p>
<p><u>Local businesses are interested</u> in e-cargo bikes and electric vehicles, and some already use them for delivery.</p>	<p><u>Cost barriers are a top issue</u>, as the purchase of an EV is still cost prohibitive in many cases, especially for small “mom and pop” delivery companies or personal delivery drivers contracted or employed with companies like Uber, Lyft, or independent restaurants.</p> <p><u>Small and medium businesses will need financial assistance, and large companies need to see an operational benefit.</u></p>
<p>There are examples of small and large businesses and other cities using e-cargo bikes and electric vehicles for delivery <u>that provide learnings for a Seattle program.</u></p>	<p><u>Labor costs and agreements contribute a significant portion of delivery costs and requirements</u>, so smaller electric vehicles may be inefficient.</p>
<p>Depending on the season, many <u>freight vehicles are not full during their delivery runs</u>, creating an opportunity for efficiencies with smaller electric vehicles and e-cargo bikes for delivery.</p>	<p>Deliveries with <u>bulky goods</u> or to destinations many miles across the City may <u>not be a good fit</u> for e-cargo bike delivery.</p>
<p><u>It is unlikely that freight vehicles need en-route charging</u>; overnight charging can likely cover needs.</p>	<p><u>Enforcing loading zones specifically assigned to only electric vehicles can be costly and complicated, particularly with Seattle Police Department’s Parking Enforcement staff shortage</u> ,</p>
<p><u>Unused (privately owned) off-street parking can be repurposed for e-cargo bike delivery</u>, storage and goods hubs.</p>	<p>There is a <u>need for more suitable bike lanes and bike parking</u> for e-cargo bikes.</p>
<p>It is important to keep <u>consistency of regulations and rules</u> with other leading cities as much as possible to expedite timelines.</p>	<p>Companies are reluctant to co-locate at delivery hubs over concerns regarding data, privacy, and intellectual property.</p>

Supply chains are currently built around longstanding practices of using the largest practical vehicles for each product type and delivery location. This is due to the frequent need to haul goods long distances from ports and factories to warehouses, and warehouses to final destinations, for which larger vehicles are more economical. Further, labor costs constitute a significant portion of delivery costs and are often subject to labor agreements, thus it is more economical to transport the most goods with the least number of drivers and loaders.

There are two major items to consider: one about how to electrify existing supply chains, another about how to adjust supply chains to better suit dense, urban places.

However, there is potential to convert a significant share of existing vehicle types to electric. A small portion of freight companies (ranging from FedEx and UPS to large regional distributors of food, furniture, and other items) operate most delivery vehicles currently on the road. These companies typically have warehouses and fleet storage areas that could be fitted with electric charging equipment, and most of these operators say that en-route charging is unnecessary. However, many businesses contract out delivery and do not have control over the process. Nationwide, there are thousands of small delivery operators who may only run several vehicles, and often these vehicles are leased from larger ownership groups. It is more challenging for these small companies to cover the upfront cost of converting their fleet to electric and the installation of electric charging at their own facilities (often they do not have a warehouse or distribution center of their own). Personal delivery drivers contracted or employed by companies like Uber and independent restaurants are also prime candidates for electrification, as they only operate one vehicle and primarily make shorter distance deliveries. However, the same cost barriers exist, as the purchase of an EV is still cost prohibitive in most cases.

Some businesses see potential in using electric bikes and other small e-fleet vehicles for local deliveries and wholesale procurement, but under current conditions, this is likely to be a very small share of the overall tonnage miles in Seattle's freight supply chain. There is an increment of deliveries, though, that businesses suggest could be both quicker to deliver and most cost-effective using electric cargo bikes, electric carts, and other micro fleet vehicles.

Many local operators also identified that loading zones, curb space, loading docks, alleys, and center lane loading are congested, inconsistently available, and often occupied by prohibited users (for example a non-loading vehicle parked in a loading zone). Several businesses believe that priority loading zones for electric fleets, and the construction of more bicycle lanes and bike parking, especially for larger e-cargo bikes, could help alleviate congestion and provide more consistently available loading zones for e-fleets. These zones also demonstrate a powerful market signal to companies that the City is focused on zero emission freight solutions.

Several small businesses and delivery operators the team spoke with are interested in potential partnerships with the City of Seattle to pilot electric delivery options. These possible partners are identified below in the detailed notes.

Interview Details

Interviewees: Urban Freight Lab, within the University of Washington. (Kelly Rula - Director of Policy and Partnerships; Giacomo Dalla Chiara - Postdoctoral Researcher)

Date: October 13, 2022

Key Findings

- UFL is supporting pilots and R&D with several logistics firms and fleet manufacturers.
- Initial pilots with e-cargo bikes (such as in New York City with Amazon) have not financially proven beneficial; even NYC is not dense enough to support the current stage of small-scale, local, electrified delivery.
- Europe is somewhat better via regulations: zero-emission zones, and congestion pricing - essentially the regulations prohibit internal combustion engines in some geographies.
- E-cargo bikes would need proximate micro-warehouse hubs for loading and fleet charging and maintenance.
- U.S. supply chains and land uses are challenging work for micro-delivery - it would be more impactful to carbon reduction to convert trucks to electric than to deploy new vehicle types.
- Some potential exists in refining regulations for sidewalk use and bike lane deployment; a better network on routes not within vehicle lanes could make e-bike delivery more time efficient and safer and allow closer access to destinations.

Interviewee: Sam Starr - urban freight consultant based in Vancouver, B.C.

Date: December 5, 2022

Key Findings

- There are significant efficiency gains to be had in deploying a greater variety of delivery vehicle sizes and types, especially as the typical freight vehicle is only half full on a typical run.
- Partners are challenging to solicit using pure Request For Proposals; instead, jurisdictions need to define and present a vision, sit down with potential partners, and negotiate agreements that benefit all parties.
- Competitor carriers will be very reluctant to co-locate in shared hubs; there is too much parcel security and proprietary logistics data to protect.
- Some companies are willing to deploy e-delivery out of a sense of mission towards sustainability and/or public relations benefits (even at a financial loss); find these companies and help nudge them to deploy to show “proof of concept”
- Cities can help smaller delivery firms adopt necessary routing and planning software.
- Look creatively and holistically at your areawide transportation network for unique routing solutions; Switzerland puts freight on streetcars, for example.

Interviewee: Pagliacci Pizza and Macrina Bakery (Matt Galvin - Co-owner and COO)

Date: November 18, 2022

Key Findings

- Pagliacci already performs e-bike delivery from three locations using a RAD Power Bike; they have found it is faster than using automobiles and efficient for up to four pizzas.
- Pagliacci is rare in that they employ their own delivery staff, and thus can try alternative delivery methods; Matt estimates 75% or more of Seattle small restaurants use DoorDash or UberEats for delivery, which limits their control over methods.
- Pagliacci is interested in e-trucks for larger and longer-distance routes, such as deliveries from their dough factory and wholesale bakery to retailers around Puget Sound.
- Secure storage of e-bikes and e-fleet is a challenge, only a few of their stores can handle storing vehicles.
- The City can help small businesses purchase or lease an e-fleet and can continue to build bicycle infrastructure.

Most small restaurants have no control over their food delivery, instead relying on third-party on-demand delivery companies such as DoorDash.

Interviewees: IKEA (Steven Moelk - Project Implementation Manager; Lindsay Craig - Sustainability Team; Clarisse Reiter - Sustainability Developer (InterIKEA Supply Chain); Michael Hughes - U.S. Public Affairs and Government Relations)

Date: November 1, 2022

Key Findings

- IKEA has more direct control over ports-to-warehouse freight (less over last-mile).
- Contracts with independent (often very small) local distributors who run their own vehicles and route planning for last-mile delivery.
- Inconsistency of routes day-to-day makes it challenging to position useful in-place infrastructure and green loading zones.
- Big players like IKEA, when committed, can subsidize small fleet operators to purchase EV trucks.
- EVs are only ready at scale for Type 2 (bits of Type 3) vans and small trucks. Large-volume shippers like IKEA need Type 4 or larger EVs.
- Most last-mile shipping is large goods and flat-packs - some of which could fit in e-cargo bikes but lacks economy of scale. Delivery companies wait on delivery until there is a critical mass of goods needing delivery to a neighborhood and then run a large truck shipment. Small EV fleets might be better for rush delivery of small goods.
- There might be a small market for urban IKEAs with e-cargo bike rentals and more minor delivery needs.

Interviewees: Fernhay (Peter Schenkman; Robin Haycock)

Date: November 1, 2022

Key Findings

- The straight-up logistics and economy-of-scale of micro e-delivery are only viable in certain high-density districts with constrained route options for trucks.
- E-cargo and micro-freight are also a “quality of life” improver, that perhaps can’t be monetized but can be evaluated for impacts on human wellbeing.
-

- Zero emission freight, green loading zones, and other infrastructure/policy must be clear about what delivery categories it targets - is it ports-to-warehouses, is it last-mile delivery, is it business-to-business?
- Major challenges exist in getting enough density of delivery to fill an eCube/eQuad between origins/destinations. E-delivery works either for full-capacity non-urgent delivery or for urgent delivery at low capacity and with higher costs
- Fernhay system works well on waterfronts - where eQuads can come for last-mile warehousing.
- Need to boost adoption of Cubes being loaded at warehouses, trucked to urban distribution centers, and then put on eQuads/eWalkers for delivery.
- Note: The Cube is a 73-square-foot secure container that holds packages and can be transported via the eQuad and eWalker (as well as trucks and other vehicles). The eQuad is an electric-assist four-wheel cargo bicycle that can transport a Cube and is commonly permitted to use bicycle lanes and infrastructure. The eWalker is an electric-assist four-wheel cart that an operator walks with and can transport a Cube.

Interviewees: Coaster Cycles (Ben Morris - Founder and CEO; Justin Bruce - COO)

Date: November 10, 2022

Key Findings

- Fernhay is a manufacturer and sometimes leasing partner of several e-fleet products, including a cargo bike.
- One key factor is getting existing operators to adopt e-fleets; it is very challenging to launch a new delivery/logistics company, especially one seeking to use e-fleets that are not very competitive in the current market.
- Companies are reluctant to put their product in co-mingle delivery vehicles with other companies (security, insurance, logistics, privacy - too complicated). Unrealistic to get a shared UPS/Fedex/DHL hub. Maybe some options on campuses to consolidate the delivery hub.
- The small business market has greater potential as there is less bureaucracy to adopt with smaller businesses.
- There are opportunities to work with parking operators to turn unused parking into small micro-delivery hubs.
- Electric cargo bikes have certain advantages such as nimbleness to respond to ASAP orders multiple times a day, as opposed to trucks that handle one load per day; no need to refrigerate goods as the loop times are not long enough to risk food spoilage (coolers are sufficient).
- It will be hard to promote significant e-fleet adoption unless fuel prices increase dramatically through taxes, carbon pricing, or scarcity.
- Cities can help by considering cordons, congestion pricing, and curb access fees

Meeting with Seattle Bike Stakeholder Group

Date: November 17, 2022

Key Findings

- Important to carefully locate hubs, there is neighborhood opposition to hubs that pull in larger vehicles citing safety issues, especially in dense neighborhoods.
- Potential to locate the hub in a location other than the middle of a neighborhood.
- Bike lane width: When talking to family bikers with wider bikes, existing bike facilities are challenging.
- NYC set regulations on their e-cargo bike design standards bike width, so they fit in protected bike lanes, however, there is a concern with too many constraints on the bike design.
- Sidewalk parking is not an ideal solution, especially in places where there are a lot of pedestrians

Interviewee: Freight Matters (Sandra Rothbard - Principal and Founder)

Date: December 19, 2022

Key Findings

- A program must have the infrastructure to work: Bike lanes that can accommodate e-cargo bikes
- Even in Amsterdam, it is difficult to find space e-cargo bikes because of their size
- Enforcement is a challenge, Personal vehicles parked in the commercial loading zones
- Reservation-based loading zones have not proven out for fast package delivery (unless it is a long window of time of 4+ hours for multi-hour loading). Drivers want in and out, no way to ensure the space is available
- Traditional bike share does not work for businesses. There is no guarantee a bike is available, and the basket will not hold all the products for delivery
- In Amsterdam, on a corridor, several businesses are sharing a bike for delivery
- NYC worked with one major freight company to install loading zones based on their needs, but observations showed the drivers still did not park in the zones, even if it was only 20 feet difference from their destination

Interviewee: Cascade Bicycle Club (Lee Lambert – Executive Director; Maxwell Burton – Pedaling Relief Project & Volunteer Community Engagement Program Manager)

Date: January 13, 2023

Key Findings

- CBC runs a wide range of bicycle promotion, advocacy, and event programs. The focus of this interview was on the Pedaling Relief Program, which is a volunteer-operated system in which bicycle riders make deliveries of crucial goods, such as food, medicine, and related items, on behalf of non-profit partners.
- CBC provides some cargo trailers for this work. All other equipment is provided by the volunteer rider.
- The City and CBC discussed further partnerships during the meeting. Partnerships could include support for equipment purchasing, funding for volunteer training, and outreach support to help CBC and partners connect for PRP services.
- CBC provided the below attached PDF summarizing the PRP.
- CBC provided the linked Google photos album. <https://photos.app.goo.gl/4jNCMVjghHNZ32ks7>



Survey Results

The project received responses from two freight delivery companies, Anheuser Busch and Seattle Caviar Company. Key points from their responses include:

- Anheuser Busch needs 15-30 minutes per delivery, while Seattle Caviar needs 10-15 minutes.
- Deliveries include pallets of food products, most of which is perishable and needs refrigeration.
- Anheuser Busch begins deliveries from a warehouse in Renton and drives more than 30 miles per day. Seattle Caviar uses a distribution center within the City and drives 10-15 miles per day.
- One company described overall street congestion as their biggest impediment, while the other listed Lyft and Uber occupying loading zones.

- All Anheuser Busch deliveries are conducted in-house using their own fleet of semi-trucks. Seattle Caviar uses a combination of fleet box trucks and third-party delivery through Fedex/UPS/DHL
- Anheuser Busch says their drivers frequently receive parking citations, while Seattle Caviar says they do not receive citations. Keep in mind that Anheuser Busch likely operates a larger and more prolific fleet and operates larger vehicles that are more challenging to legally park.
- Both companies say they are interested in converting to an electric fleet.

Five companies, including Pagliacci Pizza, Macrina Bakery, another bakery, a print shop, and a chain of coffee shops. Key points from their responses include:

- Most take delivery of boxes of various sizes and quantities throughout the week. One company regularly receives pallet deliveries.
- Understandably, as most respondents are in food service, they receive chilled and perishable items.
- Four of the five companies take deliveries through their front doors.
- Pagliacci Pizza delivers food to residences and businesses. These run the gamut from apartments, to detached houses, to office buildings with all manner of doors and parking/loading zone options to deal with.
- Three of the companies take daily deliveries. One takes deliveries three to four times per week, and one takes deliveries once per week.
- Deliveries occur throughout the day, with a slight preponderance to the 6am to 10am window. None of the businesses can control the time frame they receive deliveries.
- Four of the five businesses report receiving deliveries that originate from closer than five miles (in addition to other distances; it was a non-exclusive question), suggesting that local electrified delivery could be viable in some instances.
- Receiving timeframes tended towards taking only 0 to 10 minutes per incoming shipment.
- Several of the businesses report using professional delivery services (Fedex/UPS/DHL, couriers, or On-Demand such as DoorDash) for outgoing deliveries. All report also using their own fleet or personal vehicles for outgoing deliveries.
- The food service businesses tend towards outgoing deliveries of under 20 pounds per destination. The print shop has outgoing deliveries of all sizes and weights, including large orders that can be very large and hundreds of pounds.
- The print shop and bakery report already using an electric car or truck for some deliveries.
- The print shop and Pagliacci Pizza responded most favorably to being contacted by the City to explore electric delivery options.
- The print shop conducts mostly local business, which they say could be increasingly electrified or shifted to smaller vehicles. But they also mention that they frequently must travel out of the neighborhood to obtain specialized printing supplies or for non-neighborhood clients.
- Pagliacci Pizza already conducts some e-bike delivery to customers. They would like to expand the program.
- Macrina Bakery wrote about a goal to convert to at least 50% electric fleet use in the coming few years.
- The print shop, Macrina Bakery, and Pagliacci Pizza say that e-bikes could be useful for daily delivery needs. The print shop and the bakery do not envision e-bikes being useful.

Some businesses see potential to use electric cargo bikes for their deliveries but would need help buying the equipment and finding secure storage space.

Figure 2 shows the different types of goods delivered, with boxes of different sizes being the most common responses.

Figure 2: Business survey responses about delivery types received (question 3)

What type of deliveries do you receive? (select all that apply)

Answered: 5 Skipped: 0

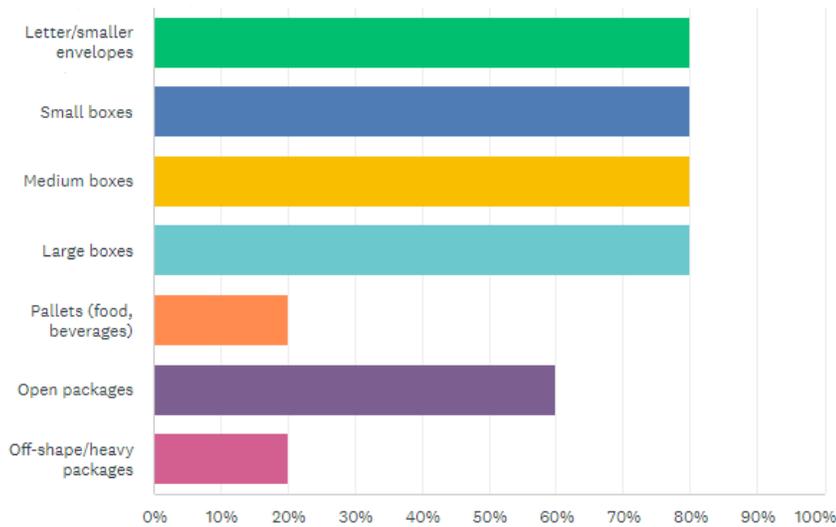


Figure shows that of the five business responses to the survey, delivery times occur throughout the day, with no true peak time.

Figure 4: Business survey responses about typical delivery time windows (question 8)

What time do you typically receive deliveries? (select all that apply)

Answered: 5 Skipped: 0

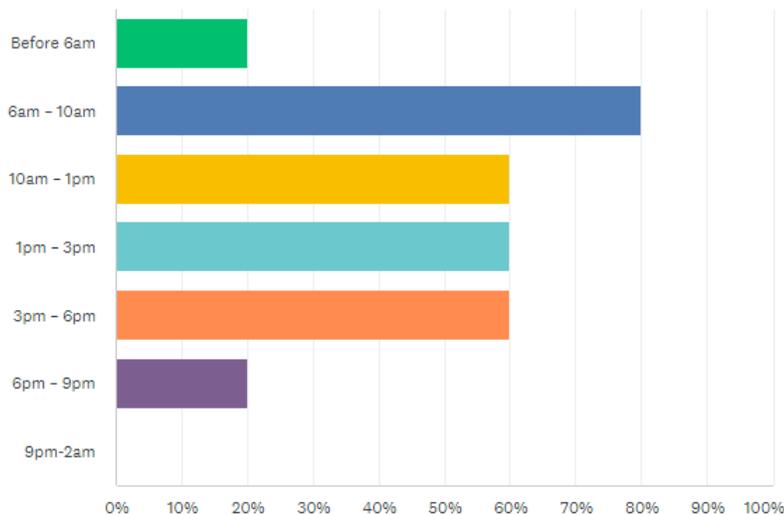
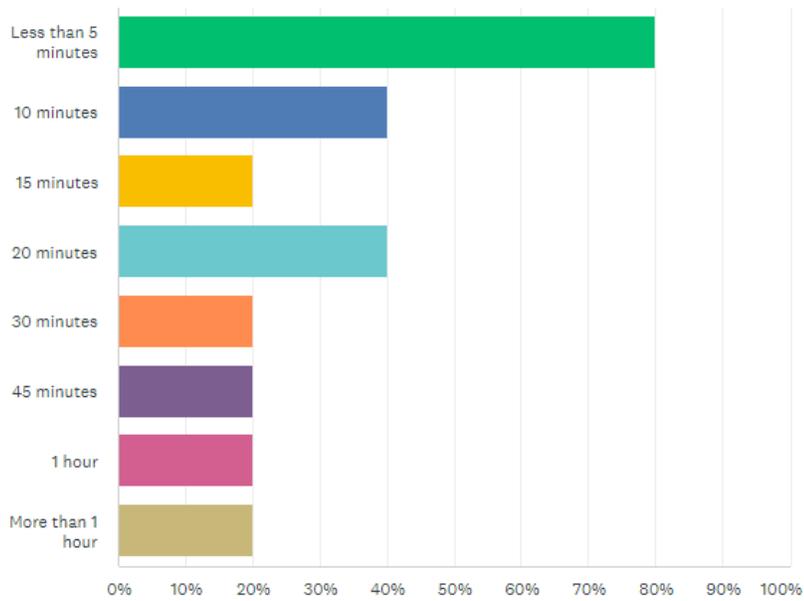


Figure 2 shows that most businesses have some deliveries that take under five minutes, and at least one of the businesses has deliveries that take over an hour.

Figure 2: Business survey responses about delivery duration (question 12)

How long do your delivery drivers typically take to complete a delivery (from the time they arrive at your business)? (choose all that apply, i.e., you may have liquor deliveries that take longer than package deliveries)

Answered: 5 Skipped: 0



DRAFT



DATE: November 1, 2022
TO: C40 Cities / City of Seattle
FROM: Walker Consultants
PROJECT NAME: C40 Seattle Zero Emissions Freight Study

Appendix B: Policy Review Summary

Introduction

The transportation sector is the leading contributor of carbon emissions in Seattle. To achieve the City’s goal of carbon neutrality by 2050, Seattle is working to transition all fossil-fuel powered transportation modes (e.g., passenger cars, freight trucks, delivery vans, service vehicles, taxis, etc.) to zero emissions. As part of this strategy, the City has an aggressive goal to reduce climate emissions related to goods delivery by 30 percent by 2030, as outlined in its Transportation Electrification Blueprint.

To understand existing policies related to curb management, commercial delivery, and emissions reduction goals, Walker researched and analyzed supportive policies that provide the framework for the City’s zero-emissions freight initiatives, the data analysis and pilot programs the City has conducted, and the existing regulatory framework that might impact future program implementation. The City of Seattle has multiple strategic plans underscoring the City’s commitment to reducing carbon emissions associated with goods movement including the following:

This memo reviews the supportive policies that provide the framework for the City’s zero emissions freight initiatives, the data analysis and pilot programs the City has conducted, and the existing regulatory framework that might impact future program implementation.

Supportive Policies

The City of Seattle has multiple policy documents underscoring the City’s commitment to reducing carbon emissions associated with goods movement including the following:

DRIVE CLEAN SEATTLE (2016)

Drive Clean Seattle was the City’s first implementation plan that encouraged a shift from fossil fuel powered to electric vehicles for passenger cars, trucks, transit and maritime transportation. As part of Drive Clean Seattle, the City committed to reducing greenhouse gas emissions from the City’s fleet by 50 percent by 2025.

SEATTLE CLIMATE ACTION (2018)

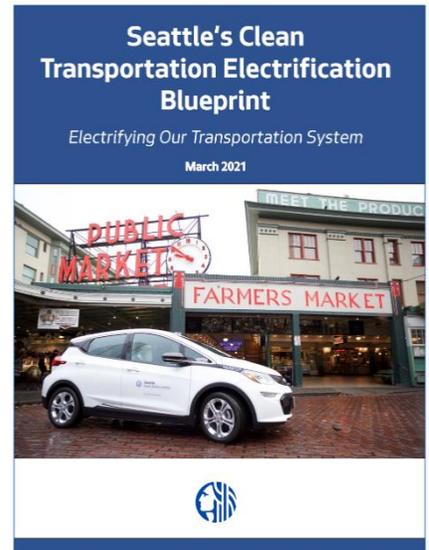
In 2018, the Seattle Mayor’s Office (Mayor Durkan) released “Seattle Climate Action” to strengthen the City’s commitment to climate action and the goals established in the United Nations’ Paris Agreement, including limiting global warming to 1.5 degrees Celsius compared to pre-industrial levels. Seattle Climate Action set the stage for the City to take bolder steps toward a fossil free future, including adopting zero-emissions urban goods delivery.



CLEAN TRANSPORTATION ELECTRIFICATION BLUEPRINT (2021)

Drive Clean Seattle (2016) evolved into the City’s Clean Transportation Electrification Blueprint to decarbonize the transportation system. The Blueprint acknowledges that goods movement is a growing cause of congestion and emissions on Seattle roads, due to the increase in e-commerce and food delivery. It outlines a series of initial steps Seattle is committed to in reducing climate pollution in the transportation sector including making 30 percent of freight delivery zero emission by 2030.

The City aims to achieve this goal by partnering with goods delivery companies to transition fleets to electric and zero-emissions vehicles, as well as support market transformation in freight and goods delivery over the next 10 years. To do this, the City has proposed potentially using ‘climate-friendly loading’, which would provide priority curb space for zero-emissions vehicles, building out charging infrastructure to support electrified freight trucks, and advocating for policies that incentivize the purchase of e-cargo bikes and EVs.



DATA ANALYSIS AND PILOT PROGRAMS

The City of Seattle has been a part of multiple studies to work toward its goal of reducing emissions associated with goods movement, including:

- University of Washington Urban Freight Lab Pilot Program (2020)
- Neighborhood Load Zone Utilization Study (2021)
- Neighborhood Delivery Hub Pilot Program (2021)
- Zero Emissions Area Data Collection (2022)

UNIVERSITY OF WASHINGTON URBAN FREIGHT LAB E-CARGO BIKE PILOT PROGRAM – UPS (2020)

The Seattle Department of Transportation (SDOT) sponsored an e-cargo bike delivery pilot in Downtown Seattle, in partnership with the University of Washington Urban Freight Lab (UFL) and the United Parcel Service, Inc. (UPS). UFL administered the pilot and conducted the data analysis. UPS operated the pilot, providing e-cargo bikes and drivers. The e-cargo bikes had a removable cargo container with 95 cubic feet of space that could hold up to 400 pounds. UPS pre-loaded cargo containers at the UPS Seattle depot, loaded them onto a trailer, and then transported the containers to a downtown parking lot for deployment. The pilot began in November 2018 and lasted for one month, and the bikes made deliveries in the Pike Place Market, Central Business District, and Belltown neighborhoods.



Urban Freight Lab
 Supply Chain Transportation & Logistics Center
 University of Washington
 August 2020
 THIS STUDY WAS SPONSORED BY THE SEATTLE DEPARTMENT OF TRANSPORTATION
 SUPPLY CHAIN TRANSPORTATION & LOGISTICS CENTER
 UNIVERSITY OF WASHINGTON
 Urban Freight Lab

To evaluate the effectiveness of the e-cargo bike pilot program, UFL reviewed pre-pilot data for all UPS truck deliveries that operated in the pilot area. It then compared the e-cargo bike pilot program data to the traditional delivery trucks that simultaneously delivered in the same neighborhoods during the pilot.



UFL made the following findings from the data obtained before the pilot program, when UPS only used traditional delivery trucks:

- On average, a delivery driver spent approximately two minutes cruising for parking for each trip, representing 28 percent of the total trip time and a total of 50 minutes per day.
- Most deliveries were about 98 feet from the vehicle stop location, which is less than the length of the average block face in Downtown Seattle (328 feet).
- Most truck dwell times were approximately five minutes.

In comparing data from traditional delivery trucks and e-cargo bikes during the pilot period, UFL found the following:

- E-cargo bikes delivered on average to five establishments per hour, representing 25 percent of the establishments visited by truck during the pilot phase.
- E-cargo bikes delivered 20 percent of the total number of packages delivered by truck during a single route.
- The e-cargo bikes experienced a statistically significantly lower failed delivery rate compared to the truck fail rate.
- The number of establishments the e-cargo bike delivered increased over time, suggesting potential for improvements in e-cargo bike efficiency.

UFL noted the following caveats in the data findings:

- The pilot coincided with the holiday season, where higher than average demand occurred.
- The pilot only lasted one month, which didn't allow enough time to get the e-cargo bike system up and running efficiently.

NEIGHBORHOOD LOAD ZONE UTILIZATION STUDY (2021)

SDOT commissioned video monitoring of select curb areas on Ballard Avenue NW (in the Adam neighborhood), 15th Avenue E (in the Capitol Hill neighborhood), and in the Little Saigon neighborhood. Video cameras were used to record curb activity between 6:00 a.m. and 11:00 p.m. on a Wednesday, Thursday, and Saturday (between November 18 - December 19, 2020). Data regarding the vehicle body, vehicle activity, vehicle use, arrival/departure time, and location were collected. From the data collected, the following key metrics were extracted:

- Number of visits per day by type of vehicle
- Number of vehicles per hour (in consolidated vehicle groups)
- Duration of stay
- Peak commercial vehicle activity

The following findings emerged from evaluating these metrics:

- Ballard Avenue (included six block faces and eight load zones) had multiple restrictions including 30-minute loading/unloading zone Monday – Saturday 7:00 a.m. to 8:00 p.m. (one loading zone was limited to truck use only), 3-minute passenger loading, and “pay to park” spaces. Data was collected over a three-day period.
 - Passenger vehicles represented 91 percent of all vehicles observed parked.



TECHNICAL MEMORANDUM

Project: Neighborhood Load Zone Utilization Study
Subject: Ballard Ave NW, 15th Ave E and Little Saigon
Date: November 8, 2021
Author: Marni C. Heffron, P.E., P.T.O.E.
 Jose Machado, Transportation Eng., Ph.D. Candidate

To better understand existing use of the load zones on Ballard Ave NW, 15th Ave E and in the Little Saigon neighborhood, the Seattle Department of Transportation commissioned video monitoring of select curb areas in these three areas. Previous studies have shown that urban delivery drivers often use whatever space might be open and available for their needs when they arrive at the curb. Delivery trucks also have fewer options than passenger vehicles since they cannot fit into most parking garages and require longer curbside spaces. If adequate load/unload space is not available, or if it is used for other functions, it affects the efficiency and reliability of the urban delivery system.

Heffron Transportation compiled the monitoring data to determine key operating metrics including the types of vehicles, when they arrived, and duration of stay. Specific information about the load zones in each study area and utilization metrics are presented herein.

1. Existing Commercial Load Zone Attributes

The City of Seattle has a variety of sign restrictions to indicate a load zone, these include¹:

- **Truck-Only Load Zone**, which is the most restrictive type allowing only commercial vehicles (formed as trucks) for delivery or pick-up of products, merchandise, or other objects. These are installed in business districts or for times of day that do not have paid parking.
- **Commercial Vehicle Load Zones** allow a broader range of vehicles but still require specific commercial vehicle truck (time) licensing or commercial vehicle load zone permits. They are only located in Seattle's business districts that have paid parking.
- ***Load and Unload Only*** zones exist in many business districts, which can be used by any vehicle (private or commercial) for expedient drop-off and load/unload of people and goods with variety of time limits from 5 to 30-minutes.

The surveyed load zones and specific restriction signage are summarized in Table 1. As shown, a total of 19 load zones were observed among all the surveyed curb areas. Specific attributes for each curb area and corresponding load zones are summarized in Table 1. Additionally, aerial screenshots of the data collection zones can be found in the appendix.

¹ SDOT, Load Zones, Seattle Department of Transportation, URL: <https://www.seattle.gov/transportation/projects-and-programs/transportation-improvement-program/load-zones/load-zones>, Accessed on 7/13/21



- Most goods movement activity was either conducted with a work van or single-unit truck. Only two larger trucks were observed performing deliveries over the three-day period.
- Two passenger cars were observed performing goods transport and five cars were observed performing service activities.
- Most service activity was conducted with a commercial pick-up truck or a work van.
- All commercial vehicles had an average duration of stay of less than 20 minutes which is lower than the posted limit for all of the loading zones. However, some commercial vehicles stayed much longer than 30 minutes.
- Passenger vehicles performing service activities had a higher average length of stay of 97 minutes, exceeding the posted time limit.
- Different segments of Ballard Avenue had peak commercial activity occurring at different times (between 10:30 a.m. – 11:00 a.m. or 2:00 p.m.).
- 15th Avenue (which included two block faces with five load zones) had multiple restrictions including 30-minute loading/unloading Monday-Saturday from 7:00 a.m. to 6:00 p.m. (one load zone was limited to truck use only) and one-hour parking spaces. For one segment, data was collected over a three-day period and for another segment, data was collected over a six-day period.
 - Passenger vehicles represented 89 percent of all vehicles observed parked.
 - Most commercial deliveries were conducted with a work van or single-unit truck. No large trucks were observed during the observation period.
 - Five passenger cars were found performing goods transport.
 - Most service activity was conducted with a commercial pick-up truck or a work van.
 - All commercial vehicles, except for work vans performing service activities, had an average duration of stay of less than 30 minutes, which is the posted limit for all loading zones. However, some commercial vehicles stayed much longer than 30 minutes. Work vans performing service activities had an average duration of stay of 42 minutes.
 - Peak commercial activity occurred between approximately 12:00 p.m. and 12:30 p.m.
- Little Saigon neighborhood (which included six block faces and six load zones) consisted of load zones only, including 30-minute truck loading only, 30-minute loading/unloading from 7:00 a.m. – 3:00 p.m. (no stopping between 2:00 p.m. and 7:00 p.m.), and 30-minute loading/unloading from 7:00 a.m. to 6:00 p.m. Data was collected over a three-day period.
 - Passenger vehicles represented 75 percent of all vehicles observed parked.
 - Most commercial deliveries were conducted with a work van or single-unit truck. Nine large trucks were observed performing goods transport during the observation period.
 - No passenger cars were found performing goods transport.
 - Most service activity was conducted with a commercial pick-up truck or work van.
 - All commercial vehicles (except for four single-unit trucks and two buses), had an average duration of stay of more than 30 minutes, above the posted limit (ranging from an average of 30-60 minutes). Work vans performing service activities had the longest average duration of stay of 60 minutes.
 - Peak commercial activity ranged significantly based on street segment.

The study included the following considerations for future data collection:

- An economics study could use business surveys and interviews to assess what happens if a load zone is not available near a business.
- Define and capture additional metrics that could help identify passenger car commercial activities (e.g. servicing and goods transport) and passenger load/unload by rideshare drivers (e.g. Uber and Lyft). This is recommended because for passenger vehicles, it is difficult to distinguish between commercial use (including goods movement, service, and passenger transport, such as Uber/Lyft) and personal use, given the limits to the resolution of the video data.
- Inventory the curb space environment at the same time data collection is conducted, as curb restrictions can change over time.
- Track the location of stop events to spaces defined in the inventory of curb space allocation. This is recommended because the survey area contained both load zone and non-load zone areas, and the data did not isolate to specifically the load zone only.
- Define surveyed areas that include the studied street segments and extend at least one city-block distance in all directions. This is recommended because Curb activity was observed adjacent to the study area (within one block), indicating the data missed curb activity serving the same commercial center(s).
- Complement the vehicle observation survey with other data collection efforts such as load zone user surveys and establishment surveys. This is recommended because vehicle observation surveys, alone, do not provide insight into urban goods flow, levels of activity for individual establishments or overall trip patterns of vehicles.

NEIGHBORHOOD DELIVERY HUB PILOT (2021)

UFL, in partnership with SDOT and other industry partners, piloted a zero-emissions last-mile delivery pilot in the City’s Uptown neighborhood. The pilot utilized a neighborhood delivery hub, which is a central drop-off/pick-up location for goods and services within neighborhoods that can be used by multiple delivery providers, retailers, and consumers. The hub was located in a parking lot contributed by REEF, one of the pilot partners. Delivery trucks traveled to the hub and packages were transferred to a fleet of e-cargo bikes to complete last-mile delivery. The pilot program ran for 3.5 months between April-July 2021.

The pilot included the following key features and partners:

- A *neighborhood kitchen* (provided by REEF) was provided at the hub, which is a modular vessel where food was prepared for mobile app or delivery orders. Neighborhood kitchens remove front-of-house operations, reducing a restaurant’s footprint and reducing overhead costs.
- *Common carrier parcel lockers* (provided by UFL) were provided at the hub. These lockers were a secure, automated, self-service storage system designed to accommodate deliveries from multiple transportation providers and a range of parcel sizes.
- An *Electric-assist cargo bike fleet* (provided by Coaster Cycles) was used during the pilot program for last-mile deliveries.
- The pilot program used *last-mile delivery routing software* (provided by AxelHire) to provide route-optimization technology for the e-cargo bike deliveries. AxelHire used the hub site to transfer packages



Prepared September 2021

By **W** SUPPLY CHAIN TRANSPORTATION & LOGISTICS CENTER
UNIVERSITY OF WASHINGTON
greenlogistics.org



from a depot to e-cargo bikes to the customer. AxelHire also shared the GPS data from the e-cargo bike routes.

- An *electric pallet (provided by BrightDrop)* was provided at the hub, which is a propulsion-assisted electric pallet designed to move goods over short distances.
- *Data collection (conducted by University of Washington Star Lab)* was conducted using cameras with vehicle recognition technology, GPS tracking sensors, and video footage of e-cargo bike delivery driver behavior. The data demonstrated infrastructure usage, speed, battery usage, interaction with other vehicles, bikes, and pedestrians, and activities at the hub site (including parking occupancy, duration, and mode distribution of vehicle types).

As part of the pilot, SDOT facilitated the use of city streets and data sharing, and leveraged the pilot to better understand e-cargo bike delivery operations.

The UFL summary report on the pilot revealed the following benefits:

- Neighborhood delivery hubs can enable productive and more environmentally sustainable urban last-mile delivery compared to traditional delivery trucks.
- The pilot's shared cost model across partners enables piloting new technologies and operational models that otherwise would not have been possible.
- The e-cargo bikes removed 0.65 truck miles per package delivered.
- The neighborhood delivery hub reduced tailpipe carbon dioxide emissions by 30 percent per package delivered, and networked neighborhood delivery hubs could lead to even greater carbon dioxide emissions reductions.

While the pilot demonstrated a number of benefits, it also showed that e-cargo bikes delivered fewer packages than traditional trucks per hour (eight deliveries per hour versus 19 deliveries per hour). It is important to note that the pilot occurred on a small scale and during a limited period. UFL researchers would expect to see improvements in this metric with refinement and expansion of the e-cargo bike delivery model including larger fleets of e-cargo bikes. UFL researchers also suggested the following to improve efficiency of e-cargo bike delivery:

- In the pilot program, e-cargo bikes were primarily used on sidewalks, whereas bike lanes would have been more efficient.
- During the pilot, significant time was spent navigating building access challenges; therefore, it is important to establish reliable access to buildings.
- Improving e-cargo bike specific routing to consider factors such as road grade changes would help improve efficiency.
- During the pilot, e-cargo bikes had to be manually locked to a nearby structure using a U-lock, whereas using faster locking e-cargo bike storage mechanisms would be more efficient.

Further, the UFL report had the following recommendations regarding future neighborhood delivery hub implementation:

- Local governments and private sector companies should partner on neighborhood delivery hub implementation to address operational efficiencies for carriers, as well as key issues including climate change and congestion.
- Cities should help make space available for hub-activities off-street.



- Complementary activities occurring at the hub can reduce operational costs and increase neighborhood amenities.

ZERO EMISSIONS AREA DATA COLLECTION (DATA COLLECTED 2018-2020, SUMMARY REPORT COMPLETE 2022)

The City of Seattle, in partnership and with funding from C40, conducted a study to provide an assessment of how new data sources and analysis can help advance freight electrification planning in Seattle and for C40 partner cities. The study helped to support the City’s goal of ensuring that 30 percent of goods are delivered by a zero emissions trip by 2030. The study sought to understand the scale and type of freight activity within Seattle and what that would mean regarding potential solutions to electrify freight. The study also sought to identify factors that can help determine priority locations to implement a zero emissions zone.

City of Seattle - Zero Emission Area Data Collection

Prepared for:
C40 Cities Climate Leadership Group & City of Seattle

9/7/2022

SEI 0708

FEHR & PEERS

To capture freight and goods movement in Seattle, the study included an analysis of video data already collected in Seattle as well as travel pattern data from cell phone and GPS devices including:

- *Traffic video data* – 24-hour video data was collected in the Greater Downtown Area and Ballard-Interbay Area (described in the Neighborhood Load Zone Utilization Study section on pages 3-4) and 12-hour video data was collected in nine locations in West Seattle, Magnolia, and the Greater Downtown Area.
- *Travel pattern data* – travel pattern data from smartphones and navigation devices in vehicles.

As a result of the data analysis, the study demonstrated the following key findings:

- Understanding the scale and geographic spread of freight activity is important before identifying zero emissions delivery zones.
- Over 50 percent of medium-duty trucks are freight related.
- Between 6 and 23 percent of light-duty commercial vehicles are freight related, with the Duwamish Valley having the highest proportion due to its distribution centers for major carriers including UPS, FedEx, USPS, and Amazon.
- Almost 60 percent of freight trips are in medium duty trucks and 20 to 25 percent are in light commercial vehicles.
- Over 60 percent of all medium-duty and heavy-duty truck trips remain within the City limits.
- Almost 70 percent of medium-duty truck trips (for freight and non-freight purposes) are under 10 miles long.
- Different delivery companies have different structures which might impact how Seattle would partner with different delivery companies to electrify their fleet. For example, USPS and UPS have a more permanent set of employees, vehicles, and routes than Amazon, which has a more gig-based workforce, making it potentially easier to electrify USPS and UPS fleets than Amazon fleets. The route patterns also vary between carriers as USPS truck routes typically connect three different USPS centers, Amazon vehicles have a larger geographic coverage, and UPS are concentrated in the Downtown area.



Regulatory Framework

Walker reviewed the regulatory framework in Seattle that might impact the implementation of an e-cargo bike program and/or climate friendly loading.

Loading Zone Regulations

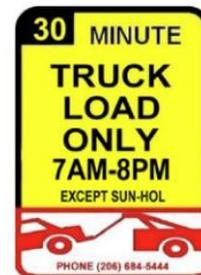
The City of Seattle has four types of loading zones for different purposes and restrictions as defined in the Municipal Code Section 11.14.140 – Curb markings:

- **Load/Unload Zones (Yellow Curb)** – Zones designated for drop-off and load/unloading from passenger/non-commercial vehicles (up to 30 minutes). Payment is required for use of these spaces in the City Center.

- **Passenger Load Zone (White Curb)** – Zones designated for quick passenger drop-off and pick-up areas (up to 3 minutes). Drivers should remain in the vehicle while parked in these zones.

- **Truck-Only Load Zone (Yellow Curb)** – Zones designated for delivery/pick-up of products, merchandise, or other objects (up to 30 minutes). Usage is restricted to vehicles licensed as trucks.

- **Commercial Vehicle Load Zone (Yellow Curb)** – Load zones (up to 30 minutes) for commercial service delivery vehicles (e.g., trucks delivering beverages, food supplies, office goods, large merchandise, etc.) within Seattle business districts with paid parking. Commercial Vehicle Permits are required to use these zones, or non-permit holders can pay at a pay station or by phone.
 - Commercial Vehicle Load Zone Permits are \$250 per year or \$125 after July 1.





Authority to Establish Loading Zones and Set Rates

In order to inform potential Zero Emissions Freight Zones, Walker reviewed the Seattle Municipal Code to better understand the regulatory authority in place for loading zones and establishment of new loading zones. Based on Walker's review the City may have the authority to establish new commercial loading zones and set rates for those zones.¹

The Seattle Municipal Code (SMC) (Title 11 Vehicles and Traffic) defines the following related to commercial vehicle loading and parking:

Definitions

SMC 11.14.113 - Commercial vehicle load zone: "Commercial vehicle load zone" means a portion of a street designated by a sign and yellow paint markings or other traffic-control devices that is reserved for the exclusive use for expeditious loading and unloading of commercial goods by commercial vehicles. Payment is required at the zone either by parking payment device or permit.

SMC 11.14.115 - Commercial vehicle: For purposes of this Code, the term "commercial vehicle" means (1) a "motor truck" or "truck" except a passenger car or (2) a station wagon or van that has been permanently modified to carry no more than three (3) seated passengers. Such vehicles shall be properly licensed as a truck and shall have the name of the business to which the vehicle is registered permanently displayed on both the left and right sides in letters no less than two inches (2") in height.

SMC 11.14.295 - Load and unload zone: "Load and unload zone" means a designated portion of the street or alley reserved for the use of vehicles for the purpose of expeditious pickup and loading or unloading and delivery of persons or property.

SMC 11.14.415 - Park or parking: "Park" or "parking" means the standing of a vehicle, whether occupied or not, otherwise than temporarily for the purpose of and while actually engaged in loading or unloading property or passengers.

SMC 11.14.425 - Parking payment device: "Parking payment device" means any device used to accept payment for parking, such as parking meters, pay station kiosks, mobile devices, or other methods approved by the Director of the Seattle Department of Transportation.

SMC 11.14.680 - Truck load zone: "Truck load zone" means a designated portion of the street or alley reserved for the exclusive use of truck-licensed commercial vehicles during the unloading and delivery or pickup and loading of property.

¹ Walker does not provide legal counsel and recommends that the City seek legal counsel to make any legal determinations.



Electric Vehicle Parking

The following defines space related to electric vehicle parking:

SMC 11.72.125 - Electric vehicle parking charging station; electric vehicles:

- No person shall stop, stand, or park a vehicle other than an electric vehicle within any space marked or signed as reserved for "electric vehicle parking while charging only."
- It is unlawful to park or permit to be parked any electric vehicle in a space with an electric vehicle charging station that is marked as "electric vehicle parking while charging only" if such electric vehicle is not in the process of charging.
- Electric vehicles may be parked in any space designated for public parking, subject to the restrictions that would apply to any other vehicle that would park in that space.
- "Electric vehicle" means any vehicle that operates, either partially or exclusively, on electrical energy from an off-board source, that is stored on-board for motive purpose. "Electric vehicle" includes battery electric vehicles and plug-in hybrid electric vehicles.
- "Electric vehicle charging station" means a public parking space that is served by battery charging station equipment that is publicly or privately owned and available.
- "Electric vehicle parking space" means any marked parking space that identifies the use to be exclusively for the parking of an electric vehicle.

Commercial Loading and Unloading

The following regulations reference loading and unloading:

According to the Seattle Dept. of Transportation Commercial Vehicle Load Zones (CVLZ) were established to provide, on busy streets, a special parking space for service delivery vehicles to stop. Regular truck loading and unloading zones do not adequately meet the needs of these vehicles. The loading zone fee is \$250 annually and \$125 after July 1.

SMC 11.72.215 - Load and unload zone.

No person shall stop, stand, or park a vehicle in a load and unload zone, for any purpose or length of time other than for the expeditious pickup and loading or unloading and delivery of persons or property, and then in no case shall the stop for such purposes exceed thirty (30) minutes.

SMC 11.23.030 Commercial loading permit — requirements. The Traffic Engineer is authorized to administer a system for the issuance of commercial loading permits or on-demand payment for authorized commercial loading and to collect fees therefor. Commercial loading permits shall only be issued to persons or entities that possess a valid City of Seattle business license, except where not required by the Seattle Municipal Code. The applicant may obtain one nontransferable permit for each truck-licensed vehicle operated by the company named in the business license, except as provided in subsection 11.23.030. B. The permit shall be permanently affixed to the lower left-hand corner of the vehicle's windshield except as provided in subsection 11.23.030.B. The applicant shall provide the license plate number, as well as other 22 vehicle identification information as determined by the Traffic Engineer.

SMC 11.72.020 Alley. No person shall stand or park a vehicle except a commercial vehicle, a vehicle displaying a valid commercial loading permit, or authorized emergency vehicle in an alley.



SMC 11.72.075 Commercial load zone. No person shall stop, stand, or park a vehicle other than a commercial vehicle or a vehicle displaying a valid commercial loading permit in a commercial load zone during the hours the zone restriction is in effect; provided, that commercial load zone restrictions are not effective on Sundays or public holidays, except where otherwise indicated by appropriate sign.

SMC 11.74.010 Loading in alleys. No person shall stop, stand, or park a commercial vehicle or a vehicle displaying a valid commercial loading permit in any alley or any purpose or length of time other than the expeditious unloading and delivery or pickup and loading of property and then in no case shall such parking for loading and unloading of property exceed thirty (30) minutes.

SMC 11.74.030 Commercial load zone — Usage. No person shall stop a commercial vehicle or a vehicle displaying a valid commercial loading permit in a commercial load zone for any purpose or length of time other than for the expeditious unloading and delivery or pickup and loading of property. In no case shall such stopping for loading and/or unloading of commercial products exceed thirty (30) minutes. Such time and loading limitations shall be in effect during the days and times displayed on the traffic signs or marking at the zone.

Indemnification: The permit holder agrees to defend, indemnify, and hold harmless the City of Seattle, its officials, officers, employees, and agents against: (1) any liability, claims, causes of action, judgments, or expenses, including reasonable attorney fees, resulting directly or indirectly from any act or omission of any permit holder, anyone directly or indirectly employed by them, and anyone for whose acts or omissions they may be liable, arising out of the permit holder's use of the public right-of-way; and (2) all loss by the failure of the permit holder to fully or adequately perform, in any respect, all authorizations or obligations under the Permit.

Establishing Parking Rates

The Seattle Municipal Code (SMC) (Title 11 Vehicles and Traffic) grants the following authority to the Director of Transportation to set parking rates:

- Establish parking rates at parking payment devices, including parking meters, up to \$5/hour, except that for large Seattle Center events, the Director can set rates up to \$12/hour. When parking rates are in effect, rates should be set no lower than \$0.50/hour.
- Parking rates can vary according to location, time of day, maximum parking time allowed, the capabilities of available parking payment devices and other factors the Director determines are pertinent.
- The Director establishes on-street parking rates and adjusts rates higher or lower in neighborhood parking areas based on measured occupancy so that approximately one or two open spaces are available on each block face throughout the day.
- Make recommendations to the City Council for permit fees.

The Seattle Municipal Code (Title 11 Vehicles and Traffic) give authority to the Traffic Engineer (under the supervision of the Director of Transportation) to:

- Determine the location of and establish time-limit regulation for parking.
- Establish areas where parking is regulated by pay-to-park signage and the time-limit for parking therein.
- Authorize additional methods of payment for parking.



- Determine the location and establish truck load zones and commercial load zones when upon investigation it appears that there are no alley entrances or other similar means of approach to the building and that congested traffic conditions require such zones for the purpose of loading or unloading.
- Establish passenger load zones and car sharing zones.

Bicycle Regulations

The Seattle Municipal Code (Title 11 Vehicles and Traffic) defines "electric-assisted bicycle" as a bicycle with two or three wheels, a saddle, fully operative pedals for human propulsion, and an electric motor. The electric-assisted bicycle's electric motor must have a power output of no more than 750 watts. The electric-assisted bicycle must meet the requirements of one of the following three classifications:

- Class 1 - an electric-assisted bicycle in which the motor provides assistance only when the rider is pedaling and ceases to provide assistance when the bicycle reaches the speed of 20 miles per hour
- Class 2 - an electric-assisted bicycle in which the motor may be used exclusively to propel the bicycle and is not capable of providing assistance when the bicycle reaches the speed of 20 miles per hour
- Class 3 - an electric-assisted bicycle in which the motor provides assistance only when the rider is pedaling and ceases to provide assistance when the bicycle reaches the speed of 28 miles per hour and is equipped with a speedometer.

The Seattle Municipal Code (Title 11 Vehicles and Traffic) permits bicycles to ride on a sidewalk or public path, but a Class 3 electric-assisted bicycle is not permitted on a sidewalk, unless there is no alternative to travel over a sidewalk as part of a bicycle or pedestrian path.

Sources:

City of Seattle – Zero Emission Area Data Collection. Prepared for C40 Cities Climate Leadership Group & City of Seattle, 9/7/2022.

Cargo E-Bike Delivery Pilot Test in Seattle. Urban Freight Lab, Supply Chain Transportation and Logistics Center, University of Washington, August 2022.

The Seattle Neighborhood Delivery Hub Pilot Project: An Evaluation of the Operational Impacts of a Neighborhood Delivery Hub Model on Last-Mile Delivery. Urban Freight Lab, Supply Chain Transportation and Logistics Center, University of Washington, September 2021.

Seattle.gov



DATE: November 17, 2022
COMPANY: C40 Cities, City of Seattle
FROM: Walker Consultants
PROJECT NAME: C40 Seattle Zero Emissions Freight Study

Appendix C: Peer City Review Summary

Introduction

Walker Consultants reviewed five cities (four in the United States and one in Canada) that have deployed programs to reduce emissions associated with freight. The purpose of the case study analysis is to understand programmatic best practices and lessons learned for Seattle’s zero emissions freight programs. The information contained in this memo was derived from online research supplemented by interviews with program leaders. The selected case studies and programs include the following:

- Santa Monica Zero Emissions Delivery Zone Pilot
- Los Angeles Zero Emissions Loading Zones
- Montreal Colibri E-Cargo Bike Program
- Boston E-Cargo Bike Pilot Program (Boston Delivers)
- New York City DOT programs:
 - Commercial Cargo Bicycle Program
 - Zero Emission Freight and Green Loading Zone Market Research
 - Clean Truck Rebates Program
 - Off-Hour Deliveries Program
 - Neighborhood Loading Zone (NLZ) Program

Key Learnings for Seattle

The following summarizes key learnings from these case study cities and programs for Seattle:

- For a successful zero emission loading zone (zero emission vehicles or e-cargo bikes), it is important to not only establish curb regulations for zero emission deliveries, but also to regularly enforce regulations.
- Zero emission loading zones (zero emission vehicles or e-cargo bikes) are most effective when curb space is highly limited, such as New York City. SDOT should consider operating a pilot program in an area where curb space is limited and highly utilized.
- Partnering with private organizations is important to the success of public programs. For example, Santa Monica had a variety of partners including private sector champions, delivery partners, technology partners, fleet partners and mobile charging partners. For Boston’s e-cargo bike pilot program, the City has partnered with Cornucopia Logistics for program implementation.

- Los Angeles and Boston demonstrated that partnering with local business organizations, such as Business Improvement Districts (BIDs) can help with program implementation.
- Financial incentives are important to promote zero emission delivery goals. For example, Quebec has a \$2,000 e-cargo bike rebate and the New York City Off-Hours Delivery Truck Pilot Program provided financial incentives for participation.
- For zero emission fleet vehicle adoption, availability of vehicle technology is a barrier to widespread adoption. Currently, electric fleet vehicles can be prohibitively expensive and the size of type of available electric fleet vehicles do not meet the needs of all businesses.
- Operating hubs or mini-hubs for e-cargo bike deliveries, such as in the Colibri Project, requires real estate management as well as logistics coordination, which is outside of SDOT’s typical functions. New staff and expertise would be needed for the City to operate this type of model. Alternatively, the SDOT could purchase the land for the mini hubs and sell it to a third party to operate or incentivize a private sector partner who owns and/or manages real estate.

Case Studies

Santa Monica Zero Emission Delivery Zone Pilot

OVERVIEW

In February 2020, the Los Angeles Cleantech Incubator (LACI) partnered with the City of Santa Monica to deploy a Zero Emissions Delivery Zone (ZEDZ) pilot program. The program is funded through a U.S. Dept. of Energy, Energy Program for Innovation Clusters grant. The pilot program covers a one-square-mile area in the commercial activity core of Santa Monica, including two primary commercial districts (Downtown Santa Monica and Main Street) that together have approximately 15,850 residents and 28,900 employees.

Approximately 15 parking spaces throughout the one square mile area have been designated for zero emissions vehicle loading. As part of the pilot program, companies are voluntarily deploying and testing zero emissions vehicle delivery.

Figure 1: Santa Monica Zero Emissions Delivery Zone Pilot Area



Source: Los Angeles Clean Tech Incubator

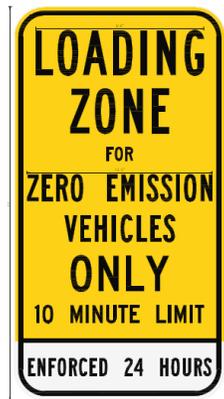
The ZEDZ is intended for companies to test a variety of technologies that facilitate zero emissions deliveries including:

- Micromobility for last-mile delivery, such as e-scooter and e-bikes equipped with cargo space for food and parcel delivery.
- Light-duty and medium-duty electric vehicles that local businesses can rent to deliver within the zone.
- Sidewalk delivery robots, which are remote operated for contactless food and parcel delivery.
- Charging infrastructure for electric vehicles.

REGULATORY FRAMEWORK

Any zero emissions vehicle is eligible to park in the loading zone for up to 10 minutes for loading and delivery. The zones are designated by signage as shown in Figure 2.

Figure 2: Santa Monica Zero Emissions Loading Zone Signage



Source: League of California Cities

GOALS

The key goals of the ZEDZ pilot program include:¹

- Provide a blueprint for cities to adopt zero emissions delivery zones and provide best practices for other zero emissions zones.
- Deliver ahead of the curve learnings to delivery companies for zero emissions delivery zone operations by working hand in hand with the project implementation team.
- Create benefits to the local community such as reduced air pollution, GHG emissions, noise, and congestion, as well as improved safety.
- Offer economic opportunity to small businesses and individuals through access to zone benefit

PARTNERS AND OUTREACH

The pilot zone brought together over 15 partners including:

- **Delivery partners** - Ikea, Axlehire, URB-E, Guayaki, AlSCO Uniforms, Foodcycle, Shopify, and REEF Technology voluntarily deployed and tested zero emissions modes for last mile delivery in the ZEDZ.
- **Technology providers** - The technology providers included LACI startups Automotus, Maxwell Vehicles, Circuit, and FreeWire as well as collaborations with Coco, Kiwibot, Tortoise, Rollo, Blue Systems, Fluid Truck, Motiv Power Systems, Nissan, ROUSH CleanTech, and Lightning eMotors.

¹ Source: <https://lincubator.org/zedz/>



- **Community partners** - The pilot program also includes community partners such as Ocean Park Association, Climate Action Santa Monica, Downtown Santa Monica, Inc, Main Street Business Improvement Association, and Santa Monica spoke.

The partners have distinct roles in the pilot program. Examples of the partners' contributions and zero emissions solutions include:

- **Video camera monitoring** – Loading zone use is monitored by video cameras (mounted on streetlights), provided by curb management technology company Automotus. Automotus also developed a mobile app for the pilot program, which allows businesses and delivery companies to locate the ZEDZs, view whether space is available or not, and reserve a space.
- **Zero emissions cargo vans for rent** - Nissan and Lightning are providing zero emissions cargo vans for small businesses to rent through the Fluid Truck vehicle renting platform.
- **E-cargo bike delivery** - URB-E is providing and operating 10 e-cargo bikes that can haul up to 800 pounds, and deliver meal kits, e-commerce orders, groceries, and subscription boxes.
- **Zero emissions fleet** - Alsco Uniforms is adding electric vehicles to their existing delivery fleet.
- **Mobile charging** - FreeWire is providing mobile vehicle charging infrastructure within the ZEDZ.

LEARNINGS

The pilot will conclude at the end of 2022. To date, major learnings include:

- Enforcement is a major factor and critical to the success of the zones.
- There must be a significant concentration of curb space dedicated to these types of zones in order to incentivize delivery fleets and other partners.
- In California, one challenge is state law prohibits curb regulations enforcement via video recording and mailed citations.

Los Angeles Zero Emissions Loading Zones

OVERVIEW

In June 2021, the Los Angeles City Council adopted an ordinance to create loading zones for zero emissions commercial vehicle loading. The Los Angeles Department of Transportation (LADOT) then established a zero emission vehicle loading pilot program, initially installing five locations throughout the City. In October 2021, the City installed its first zero emissions loading zone, shown in Figure 3 on page 5.

Figure 3: Downtown Los Angeles Zero Emissions Loading Zone



Source: Urban Movement Labs

The criteria to select locations for the zero emissions loading zones included:

- Locations that experience high commercial loading zone demands. LADOT staff relied on curbside loading activity data collected before the COVID-19 pandemic from the Southern California Association of Governments (SCAG) Last-Mile Freight Delivery Study.
- Locations that are disproportionately burdened by pollution. LADOT staff utilized the California Communities Environmental Health Screening Tool (CalEnviroScreen) to select these locations.
- Locations that are feasible and non-disruptive (i.e., they can be installed with minimal impacts to the built environment including high demand parking spaces).
- Locations that are under LADOT’s administrative authority to install, enforce, and monitor.

LADOT is partnering with Urban Movement Labs and Automotus, a curb management technology company. Automotus, a curb management technology company, is providing streetlight-mounted cameras capturing data regarding how long vehicles are parked at the curb, when a curb is busiest, violation activity (e.g., overtime, double-parking, parking in non-permitted spaces), the type of vehicle used at the curb (e.g., delivery van, truck, car, bicycle), and vehicle fuel type (e.g., gas, electric, hybrid).

REGULATORY FRAMEWORK

Each pilot zone is approximately 25-30 feet in length, with hours of enforcement between 7:00 a.m. and 6:00 p.m. LADOT manufactured and installed the signage and pavement markings to demarcate each zone (estimated cost of \$2,000 per location).



GOALS

The project aims to support the City's Green New Deal to reduce carbon emissions by expanding zero emissions vehicle use. The City has a goal to have 100 percent of urban delivery vehicles be zero emissions by 2035. The project also supports the City's Vision Zero initiatives, promoting cyclist and pedestrian safety by helping to reduce conflicts in the public right-of-way.

LEARNINGS

The zero emissions loading zones were not enforced and are considered a starting point to signal to business and provide learnings for a future program. Findings show that enforcement is key. Without enforcement, these spaces will likely be used as regular (fossil fuel) loading zones.

Los Angeles Small Business Zero Emissions Loading Zones

Separately, LADOT and the Mayor's Office of Sustainability, in partnership with the Los Angeles Cleantech Incubator (LACI), Cityfi, and through a grant from C40 Cities completed a research and demonstration program to understand how zero emissions loading zones can be deployed to benefit several types of small businesses (such as local retailers and restaurants) in Downtown LA.

LEARNINGS

This grant enabled LADOT to deliver targeted engagement with small businesses in Los Angeles. In July 2020, LACI led community and small business engagement to understand current delivery practices. Key takeaways from the engagement effort include:

- **Shared zero emissions vehicles** is a strategy that can encourage local businesses to increase their adoption of zero-emission delivery modes.
- Encouraging zero emissions delivery for certain businesses needs to focus on **larger supply patterns**, identifying opportunities for key suppliers to adopt zero-emission solutions.
- **The cost of technology and operations is a barrier** for businesses to adopt zero emissions vehicles. Businesses often have limited capacity, making it important to conduct pilots that minimize their risk.
- Drivers may be more encouraged to switch to zero emissions vehicles if they are provided with **more information** about these loading areas and the ability to reserve space.
- Downtown Los Angeles has an existing network of gig workforce bike-riders; therefore, it is important to **support the growth of zero emissions gig services** that prioritize wages and well-being for employees including protected bike lanes, secure bike storage, and rest areas.
- **Providing demonstrations** near local businesses helps promote greater engagement as businesses can see and experience the technology and vehicles.
- While business needs vary significantly, businesses in a specific geographic area, such as Downtown Los Angeles can be grouped by customer type, common suppliers, the radius of delivery, languages spoken, and other affiliations. Recommendations and pilot programs can take advantage of these **commonalities among businesses**.
- LACI recommended a formal and funded **partnership with a local business support organization**, such as a Business Improvement District (BID), which can serve as a physical hub for shared equipment, assets, and vehicle parking as well as a clearinghouse for subsidies or other financial incentives that cities can make available.

Montreal Colibri E-Cargo Bike Program

OVERVIEW

In 2019, the City of Montreal piloted an e-cargo delivery program to deliver the final leg of packages in the City Center. The City began by consulting with local businesses, restaurants, and courier companies to address the negative impact of urban deliveries. The consultation yielded 20 recommendations, with the top idea being to create a central urban warehouse where a large truck could deliver packages to be sorted and delivered by a fleet of e-cargo bikes.

In 2018, the City purchased a centrally located vacant bus station for CAD\$18 million (called Îlot Voyageur Sud) (image of the site is shown in Figure 4) and constructed a “mini-hub” for the delivery companies to store e-cargo bikes and packages. The City repaired and retrofitted the property, bringing in power, heating, and a security system. While the repairs were taking place, shipping containers were placed in the parking lot as an interim storage solution. Jalon, a local non-profit City-funded organization advancing more sustainable mobility practices, serves as the project consultant.

Figure 4: Montreal Min-Hub Site



Source: Jalon

The City offered below-market rate rent to courier companies including Purolator, Chasseurs Courier, and Courant Plus for use of the warehouse space. Purolator deployed e-cargo bikes with a capacity of up to 200 kg. Examples of e-cargo bikes deployed as part of the project are shown in Figure 5 on page 8. To test out the usage of e-cargo bikes, Purolator piloted six of their daily truck routes servicing the City Center, each delivering up to 150 parcels. Large items, such as a television, would not fit in an e-cargo bike; therefore, Purolator determined the most efficient method was to use one large truck to deliver all packages to the mini hub with five e-cargo bikes along with one small truck to cover the last-mile delivery. This replaced six large vehicles circulating through the City Center. Bike messengers were hired to provide maintenance and repair.

As a result of the pilot, there were 5,000 deliveries per week and Purolator saw a 15 percent increase in deliveries. Other benefits from the pilot overall include:

- The Colibri delivery method used five times less space than the traditional delivery method.
- It is estimated that annually, the Colibri project avoided 80 tons of carbon dioxide emissions, 130,000 km of truck travel, and 16,000 hours of truck presence in Downtown Montreal.

Figure 5: E-Cargo Bikes used for Colibri Project



Source: City of Montreal

REGULATORY FRAMEWORK

The e-cargo-bikes are permitted to operate on the street (sharing the road with cars) or on a bicycle path. Most of the time, the bikes operate on the street, and only utilize bike paths if there is traffic congestion. Navigating the bikes on City streets and in pedestrian zones presented user conflicts, as the City of Montreal permits e-cargo bikes to park on the sidewalk. The delivery companies also received permission to ride in pedestrian zones all day, while regular delivery trucks were only allowed to use these zones until 10:00 a.m. Signage was installed clarifying the e-cargo bikes were permitted to ride in these zones.

GOALS

The initiative was developed in support of Quebec's Green Economy Plan to reduce emissions and noise pollution, and improve safety for pedestrians and cyclists.

PARTNERS AND OUTREACH

The pilot is a direct result of outreach conducted in 2018 and 2019 with stakeholders, including local businesses, restaurants, and courier companies to address the negative impacts of growing urban deliveries. The City partnered with the courier companies for the pilot based on the relationships formed in the initial outreach phase.

LEARNINGS

The project yielded important lessons-learned:

- The main challenge is the cost of the program and real estate. However, offering below market-rate rent for use of the space helped incentivize companies to take advantage of the program.



- Delivery companies benefited from the efficiency of the mini-hub location and ability to navigate traffic congestion.
- Having **mini-hubs centrally located** where multiple companies can utilize the space, and have their own designated area to sort packages, was critical for the program.
- **Maintenance of the bikes** was important, as the bike fleet needed constant repairs and overnight servicing. A local Montreal company Livraison Velo Montreal (LVM) provided bike maintenance and servicing.
- While winter presents challenges for bike-deliveries, the Colibri Project demonstrated that e-cargo bikes can operate efficiently in the winter as well-maintained bikes and good wheels/tires proved to better navigate snow-covered streets than trucks. There was only a 5% reduction in deliveries by e-cargo bikes during snowstorms and overall, they were more efficient than trucks.
- Government initiatives, such as Quebec’s recent **\$2,000 e-cargo bike rebate program** assisted with the project’s growth.
- **E-cargo bikes are efficient to deliver many small packages**, but traditional delivery trucks are more useful for large and heavy loads.
- In 2021 alone the City says it has “decarbonized delivery” of some 260,000 packages. The objective of the Colibri 2.0 project is to increase this number to 500,000 packages by 2023. By comparison, the courier company Purolator, a partner in the pilot, expects to deliver 46 million parcels this holiday season nationwide.

As a result of the pilot program, the Colibri Project is evaluating opening additional mini-hubs at other strategic locations in the City. The City contributed \$322,883 to business cooperative Coop Carbone to design a second and potentially third mini-hub. Purolator has expressed interest in the additional mini-hubs and plans to deploy e-cargo bikes nationally across Canada. The City is also considering “micro-hubs” allowing cargo-bike unloading at curbside and off-street parking spaces.

Boston E-Cargo Bike Pilot Program

OVERVIEW

Many of Boston’s older streets were not designed to accommodate large commercial delivery vehicles. As a result, these vehicles often stop in bus, bike, or travel lanes, resulting in increased congestion. To address these challenges, the Boston Transportation Department (BTD) received a \$493,000 grant from the Massachusetts Clean Energy Center to pilot an e-cargo bike delivery program called “Boston Delivers.” BTD selected Cornucopia Logistics, a final mile logistics company, to oversee operations of the e-cargo bike fleet and coordinate the delivery services.

The pilot will focus on making deliveries to and from businesses in the Allston neighborhood of the City. The Allston neighborhood was chosen for the following key reasons:

- Community-based organizations supported the program and will work with BDT on outreach to businesses and the public and program evaluation.
- Allston has many environmental justice areas that are disproportionately affected by greenhouse gas emissions and would benefit from reduced emissions from commercial deliveries.



- Allston has a high concentration of college/university students who are more likely to use on-demand online delivery services.

The Boston Delivers program will deliver a variety of items (e.g., groceries, clothing, home goods, catered meals) for participating businesses within a one or two-mile radius and will accommodate deliveries between:

- A participating business and their customer
- A participating business and another business
- A supplier to a participating business

Further, businesses will be able to schedule three different types of deliveries through the Boston Delivers program:

- **Scheduled delivery** – a pick-up time and delivery time is scheduled in advance.
- **Priority service delivery** – pick-up and delivery of products within two hours within Allston.
- **Same-day delivery** – pick-up and delivery of the product on the same day.

The City is currently working on rolling out the 18-month pilot program (expected to be implemented in January 2023). The steps involved to participate in the pilot program are as follows:

- Interested businesses complete an online application.
- The Boston Delivers team reviews applications and will select eight qualified businesses that meet the following criteria:
 - Are within the Allston neighborhood or make deliveries to Allston, and
 - Have fewer than 100 employees, and
 - Be a woman owned business and/or minority-owned business and/or a non-profit.
- Each selected business meets with the Boston Delivers team to decide on a delivery plan and schedule.
- Each business will receive a monthly subsidy for deliveries as follows:
 - **Tier 1** – Three businesses will receive up to \$500/month and must indicate readiness to perform 20-80 deliveries per month.
 - **Tier 2** – Three businesses will receive up to \$1,000/month and must indicate readiness to perform at least 80 deliveries per month.
 - **Tier 3** – Two businesses will receive up to \$1,500/month and must indicate readiness to perform at least 150 deliveries per month.
- Businesses request deliveries through an online portal or by calling a customer service hotline. Participating businesses that have an online store may be able to use API integration so that customers can request a delivery when they place their order.
- A delivery associate (hired by Cornucopia Logistics) arrives at the business (or other pre-specified location), picks up the package, and delivers it to its destination via e-cargo bike.
- Participating businesses must complete a monthly survey about their experience using the Boston Delivers program.

REGULATORY FRAMEWORK

E-cargo bikes are required to display a City of Boston logo and cannot exceed a speed of 25 miles per hour. E-cargo bikes cannot be parked in such a way to impede the movement of pedestrians, cyclists, and other road users, and are not permitted to park on the street overnight. E-cargo bikes can utilize existing loading/unloading zones for delivery trucks.



GOALS

Key goals of the pilot program are to reduce congestion, support local businesses, improve safety on streets, and reduce pollution.

PARTNERS AND OUTREACH

The Boston Transportation Department is working with Allston Village Main Streets Association, which will work with the City on outreach to businesses and to the public. During the pilot program, the City will promote businesses through community partners, social media, and in publications.

New York City Freight Emissions Reduction Programs

Over the last decade, New York City has implemented numerous programs to improve safety, reduce congestion, and reduce greenhouse gas emissions associated with freight deliveries in the City. This section highlights five key programs including:

- Commercial Cargo Bicycle Program
- Zero Emission Freight and Green Loading Zone Market Research
- Clean Trucks Rebate Program
- Off-Hour Deliveries Program
- Neighborhood Loading Zone (NLZ) Program.

Commercial Cargo Bicycle Pilot Program

In December 2019, NYC DOT initiated the Commercial Cargo Bicycle Pilot Program with goals of reducing congestion, enhancing safety, and lowering greenhouse gas emissions. By January 2021, the program had six participants (UPS, DHL, Amazon, Reef, FedEx, and NPD Logistics) with over 350 bicycles. The bicycles can load/unload at the same locations as commercial vehicles (without being required to pay the parking meter) and at designated cargo bike corrals located in the public right-of-way (example cargo bike corral shown in Figure 6 on page 12). The City installs the corrals, and the pilot participant(s) are required to clear snow and debris and report derelict bicycles.

Commercial cyclists and employees utilizing cargo bikes must register with NYCDOT and take a safety course. Pilot participants are required to share GPS data for their fleets. Moving violations (violations while the bike is in motion) are enforced by the New York Police Department and other safety violations are enforced by NYCDOT's Commercial Bicycles Unit.

Figure 6: New York City Bike Corral



Source: New York City DOT

The cargo bicycles are limited to speeds of 12 miles per hour. They are permitted to share the travel lane with vehicles or ride in the bike lane. The City is increasing the network of protected bike lanes. The City viewed the pilot program as successful overall. Cargo bikes typically spent approximately five minutes loading/unloading at each location and despite providing evening deliveries, there were no recorded crashes with a cargo bike since the start of the pilot.

NYC DOT is exploring making the program permanent and is considering:

- A yearly operator permit that could scale with fleet size.
- Allowing cargo bikes to continue loading/unloading at commercial loading zones (exempt from parking meter payment).
- Implementing a “Cargo Bike Loading Only” curb regulation.
- Allowing e-cargo “bikes” of all state-compliant types, including throttle-based bikes and e-scooter + trailer combinations (not just ped-assist systems).

In August 2022, NYC DOT published a request for expression of interest (RFEI) focused on vehicle and container technology, fleet management and GPS, parking and vehicle storage and charging, safety, and security systems and solutions. Through the RFEI, there is a potential to partner with companies to create cargo bike hubs with charging and secure parking.

It is important to note that the concept of cargo bicycle delivery is not a new concept in New York City. New York City’s restaurant delivery and courier economies rely on independent cyclists who work for third party apps, courier services as independent contractors or directly for businesses.

LEARNINGS

The pilot yielded the following lessons-learned:

- The City learned that street design, including installing “cargo bike loading only” zones, is important for program success.
- One of the issues the City has encountered was New York State passed legislation that requires a maximum width of 36 inches for the cargo bicycles, which rendered some pilot participants’ cargo bicycle models non-compliant. The bill also made it difficult for smaller businesses to procure off-the-shelf models as most models are greater than 36 inches wide, matching the dimension of the US standard freight pallet of 48 inches by 40 inches.



Zero Emissions Freight and Green Loading Zone Market Research

The Urban Freight Lab in partnership with NYC DOT conducted a Zero-Emission Freight and Green Loading Zone Market Research project (completed January 2021). A Green Loading Zone (GLZ) is a curb space designated for the use of “green” vehicles, such as electric and alternative fuel vehicles. NYC DOT’s goals are to reduce emissions from last-mile deliveries and incentivize zero emission vehicle adoption.

The study included feedback from delivery companies from surveys and interviews as well as a review of best practices from other communities. Some key findings from the analysis include:

- Cities typically install specific signage showing the regulations at GLZs.
- Criteria other cities have used to determine GLZ location include equity concerns, delivery demand, and commercial density.
- While most of the companies interviewed plan to increase their EV fleet, companies cited challenges including competition in the EV market, lack of EV charging infrastructure, electrical grid requirements, and lack of government subsidies.

LEARNINGS

The study had the following conclusions:²

1. GLZs should be made available in two modes: zero emission vehicles and cargo bikes. Adequate curb space might be needed to accommodate multiple step-side vans plus a small vehicle and cargo bikes, but this should be balanced against curb utilization rates and anticipated dwell times to maximize curb use.
2. Explore piloting GLZs in Lower Manhattan and commercial areas of Midtown Manhattan, as they could be the most beneficial locations for the pilot according to survey respondents.
3. The preferred layout for GLZs is several spaces distributed across multiple blocks.
4. DOT can charge for the GLZ use. It is recommended that rates not exceed current parking prices in the selected neighborhood, but some companies are willing to pay a modest increase over that rate to avoid parking tickets.

Clean Trucks Rebate Program

Since 2012, NYC DOT has been implementing programs to reduce diesel exhaust emissions by replacing older diesel trucks with alternative fuel and new diesel trucks, including for commercial delivery fleets. The Clean Trucks Rebate program provides rebates of \$12,000 to \$185,000 for the replacement of Class 4-8 trucks. The program is funded by the Volkswagen settlement and the federal Congestion Mitigation and Air Quality Improvement (CMAQ) program funding. Program details include:

- The trucks must operate in program-approved Industrial Business Zones located throughout the City, which are located in Brooklyn, Queens, and Staten Island.
- The rebate amount varies depending on fuel type and truck class size.
- Incentives are available for electric vehicles, and lower incentive levels are available for CNG, hybrid, and diesel replacements.
- While there are limits with the other vehicle types, no limits are placed on the number of battery electric trucks a fleet can purchase.
- The rebates are available on a first-come, first-served basis.
- There is a five-year commitment for new truck replacements.

² Source: http://depts.washington.edu/sctlctr/sites/default/files/research_pub_files/ZE-GLZs-in-NYC.pdf



Since the program's inception in 2012, 619 old diesel trucks have been replaced with new vehicles as summarized below by fuel type:

- 6 battery electric trucks
- 83 CNG trucks
- 72 hybrid (diesel-electric) trucks
- 478 diesel trucks

Because electric trucks tend to be expensive, the incentive amount may need to be increased for battery electric trucks to incentivize their purchase through the program.

A variety of industries have received funding to replace their old diesel trucks including:

- Beverage distributors
- Concrete/cement haulers
- Construction demolition/equipment haulers
- Food and produce distributors
- Fuel delivery
- Goods delivery (e.g. furniture and home improvements supplies)
- Freight delivery
- Newspaper/magazine deliveries
- Office supplies
- Service vehicles
- Towing companies
- Waste/recycling haulers

LEARNINGS

A key lesson learned from the project is that more funding may be needed for battery electric bus conversion is that only six of the 619 vehicle replacements have been for battery electric buses. Because of the high cost of battery electric buses, it is likely a higher funding amount needs to be provided for battery electric bus conversion to incentivize the usage of this incentive.

Off-Hours Delivery Program

NYC DOT encourages off-hour commercial deliveries (between 7:00 p.m. and 6:00 a.m.) within the City. Off-hour deliveries have many benefits including reduced transit time and fuel costs, more predictable delivery windows, reduced delivery costs, more efficient deliveries, less congestion, safer streets, and cleaner air.

NYC DOT implemented an Off-Hour Truck Delivery Pilot Program from 2009 to 2010, funded by the United States Department of Transportation (USDOT). In total, 25 businesses and eight carriers participated in the pilot study. All were provided a financial incentive to participate. Businesses that did not have staffing available to receive off-hour deliveries used an unattended delivery solution, where delivery drivers were provided a key to the storage or walk-in refrigerator areas of a business. Double doors, delivery lockers, or container/storage pods were also used to store delivered goods. Participating carriers were given GPS-enabled smartphones and navigation software enabling the tracking of data.

An example of a NYC business (Odeko) delivering off-hours is shown in Figure 7 on page 15.

Figure 7: Participating Vehicle in New York City Off-Hour Delivery Program



Source: New York City DOT

As a result of the pilot:

- Delivery speed increased (130 percent higher during off-hours than the midday period).
- Service time decreased (from over an hour during the day to as low as 25 minutes off-hours).
- No parking fines were reported during the pilot program, reduced from approximately \$1,000 per month per truck.
- Drivers generally favored overnight deliveries due to increased ease of delivery, reduced congestion, and lower stress levels.
- Restaurant receivers preferred having products available in the morning rather than anticipating arrival time during the day.

As a result of the successful pilot program, NYC DOT is exploring incentives to help companies investigate and move to off-hour deliveries. NYC DOT has toolkits available for off-hour deliveries including a how-to guide for transporters, a how-to guide for receivers, and noise mitigation strategies.

LEARNINGS

The pilot report includes the following key learnings:

- Financial incentives to receivers will be important to encourage a shift to off-hour deliveries.
- Key considerations were not included in the pilot including noise impacts on the surrounding neighborhood.
- There can be substantial cost savings from unassisted deliveries. Public sector programs that address the liability issues of unassisted deliveries could increase the use of off-hour deliveries.
- Partnering with large traffic generators on encouraging off-hour deliveries can have the biggest impact on traffic congestion.

Neighborhood Loading Zone (NLZ) Program

NYC DOT has a NLZ program that provides designated space at the curb for passenger pick-up/drop-off, taxi/for-hire vehicle pick-up/drop-off, and commercial delivery. The program aims to reduce the amount of double parking that occurs on residential streets thereby improving safety and promoting efficiency.

Typically, NLZs are 40 feet in length and can be located in front of residential buildings or on the corner of blocks near retail uses and commercial corridors. NLZs are marked with “No Parking” signs with detailed information on how to use these spaces. An e-mail address is provided on the signage to allow for direct communication between

the City and community members. The City has also prepared outreach materials with information about the NLZ program. Examples of signage and outreach materials are included in Figure 8.

Figure 8: New York City Neighborhood Loading Zone Signage and Outreach Materials

NLZ Signage Installed



Outreach Materials

Manhattan Neighborhood Loading Zones
In Chelsea along West 15th and West 16th Streets
Curb Space for short-term loading activities

NO PARKING
Monday - Friday
7am - 7pm

Wednesday
9:30am - 11am

What We're Doing
As part of our continuing efforts to reduce double parking and improve safety and mobility in Chelsea, the New York City Department of Transportation has created Neighborhood Loading Zones along West 15th and West 16th Streets.

West 15th Street				
FROM	TO	SIDE	CLOSEST ADDRESS	
6th Ave	7th Ave	N	101 West 15th St	
6th Ave	7th Ave	S	120 West 15th St	
7th Ave	8th Ave	S	200 West 15th St	

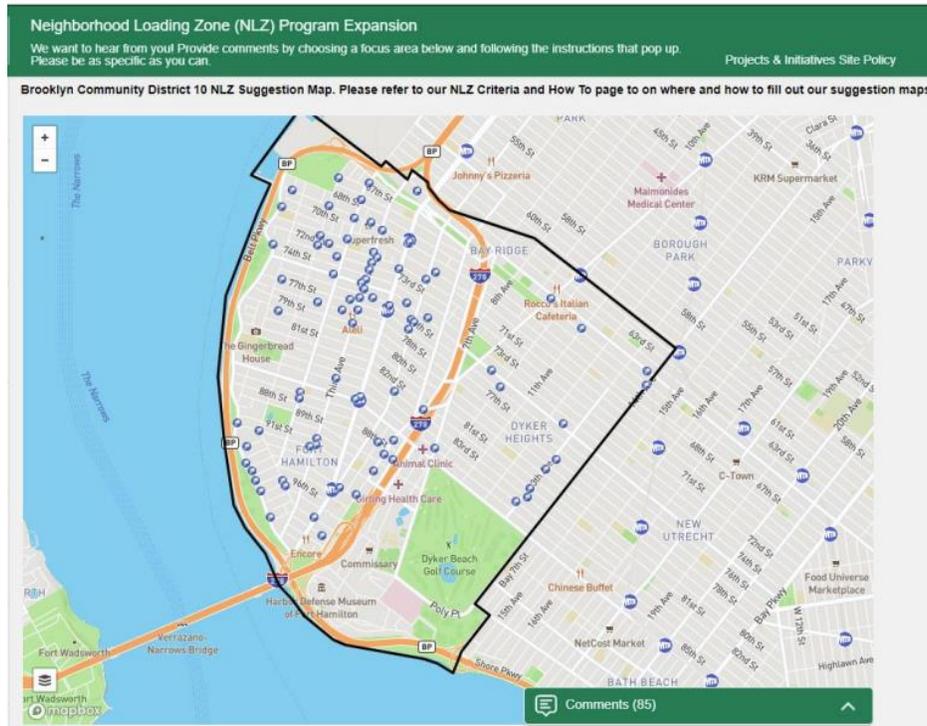
West 16th Street				
FROM	TO	SIDE	CLOSEST ADDRESS	
8th Ave	8th Ave	N	305 West 16th St	
8th Ave	7th Ave	N	201 West 16th St	
8th Ave	7th Ave	S	200 West 16th St	
7th Ave	6th Ave	N	161 West 16th St	
7th Ave	6th Ave	S	130 West 16th St	

Why We're Doing This
Provide curb space during daytime and evening hours to allow for activities such as:
• Package deliveries by commercial vehicles
• Taxi and car service pick-up and drop-off
• Active loading and unloading of personal vehicles
This program seeks to:
• Use No Parking regulation to reallocate curb space from 7 AM to 7 PM Monday to Friday
• Reduce the number of double parking incidents as well as other unwanted standing behaviors, creating a safer and more efficient environment for all road users
Please send feedback to NLZ@dot.nyc.gov

Neighborhood Loading Zones will reallocate curb space for expeditious pickup and drop-off of passengers and goods

As of January 2022, the City has installed 146 NLZs across all five boroughs. As a result of the initial NLZ installation, NYC DOT has seen success including decreased instances of double-parking. The City is planning to expand the NLZ program and is required per City ordinance to install at least 500 loading zones annually citywide. NYC DOT is conducting community outreach and receiving feedback directly from the community on the placement of new NLZs. NYC DOT has an online NLZ Program Expansion Portal (shown in Figure 9 on page 17) where participants can provide suggestions for new NLZ locations.

Figure 9: New York City Neighborhood Loading Zone Expansion Portal



Source: New York City DOT

LEARNINGS

The following includes key learnings from the NLZ program:

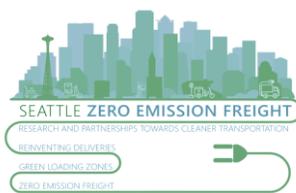
- The City passed an ordinance requiring at least 500 new loading zones per year which expedited their installation.
- However, there are challenges with establishing loading zones due to neighborhood push-back. Some residents in already parking-limited areas are frustrated with losing more parking spaces. In the past, the DOT has had trouble placing loading zones in residential areas, even those where a minority of households have access to a car, because of complaints from drivers.
- The City has worked with residents to address their concerns. In one neighborhood, the City agreed to implementing the new zones incrementally, shortening active hours on weekdays, reducing the number of sites to only one per block, conducting a public outreach campaign on the new program, implementing better signage and loading zone coloration at the curb, and releasing a data feedback report to the community board six months after installation.

E-Bike Subsidies

State and local governments have implemented e-cargo bike subsidy programs as shown in Figure 10.

Figure 10: Examples of State and Local E-Bike Subsidies

Name	Subsidy
Monterey, San Benito, and Santa Cruz Counties, CA	Up to \$1,000 for qualified low-income applicants
Contra Costa County, CA	\$150 rebate for all and \$300 for low-income households
Healdsburg, CA	Up to \$700 per resident
Santa Clara, CA	Up to a \$300 rebate
Los Angeles, Orange, Riverside, and San Bernardino Counties, CA	Up to \$7,500 based on income
Denver, CO	\$900 and up to \$1,200 for qualified low-income residents
Austin, TX	Up to \$400 for fleets
New York State	Up to \$1,400 per bike
State of California	New program that will offer up to \$1,500 for qualified applicants, \$13M has been set aside for the program
State of Colorado	\$500,000 in funding for programs in cities throughout the state for up to \$200 per bike



Sources:

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ebikes-international.com/montreals-colibri-ecargo-bike-project-is-a-rising-star-in-sustainable-mobility/
pembina.org/docs/event/session-4-victor-char-mickael-brard-jalonmtl.pdf
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MEMORANDUM

C40/SEATTLE ZERO-EMISSIONS FREIGHT STUDY

TASK 3 RESEARCH DEEP DIVE

FIELD DATA COLLECTION SUMMARY

DATE: January 10, 2023
COMPANY: C40 Cities / City of Seattle
FROM: Walker Consultants
PROJECT NAME: C40 Seattle Zero Emissions Freight Study
ATTACHMENTS: Seattle_ZeroEmissionFreightStudy_FieldObservationsData_2022.xlsx

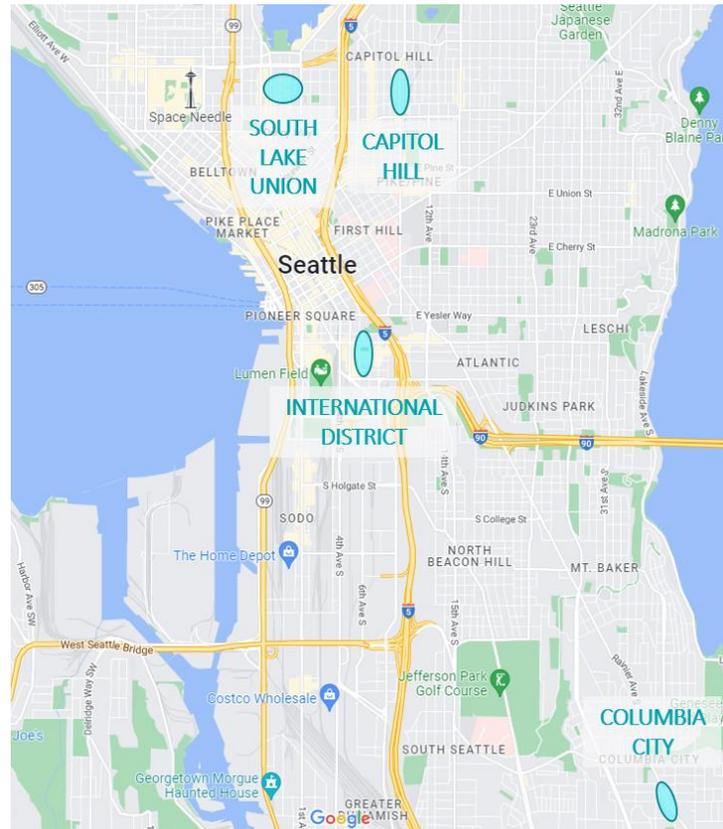
Appendix D: Field Data Collection and Summary

Introduction

Walker Consultants conducted on-site field observations of delivery and curbside activity in four Seattle neighborhoods on Wednesday, November 30 and Thursday, December 1, 2022. These observations entailed staff patrolling the study area of each neighborhood and using a spreadsheet to track delivery and loading activity, including vehicle types, a description of the goods being delivered, the location where the vehicle stopped, dwell time, and other observations. The neighborhoods were selected by the City of Seattle for their geographic variation, mix of business types, densities, access routes, and other factors and include South Lake Union, Capitol Hill, Chinatown/International District, and Columbia City (Figure 1 on page 2).

The full data collection spreadsheet with detailed information is attached to this memo. This memo provides a summary of findings for each study area location. Note that observations are a point in time on what was determined to be a typical or even higher demand delivery time (during the holiday period between Thanksgiving and Christmas). The weather was somewhat colder than average, and it snowed during our observations, but the streets, curbside, bike lanes, and sidewalks were clear of any snow.

Figure 1: Map of the Four Study Areas



Source: Google Maps; Walker Consultants illustration

Summary of Findings

Major findings from data collection include:

- Commercial delivery activity levels varied throughout the day and were dependent on area land uses, business concentration, and demographics.
 - Dense residential land uses seemed to drive commercial delivery activity throughout the day.
 - Areas with dense residential multi-story apartment and office buildings had higher levels of delivery activity, except for the Chinatown-International District (CID). While the CID has a considerable residential density, the population is older and lower-income than Seattle overall and residents may purchase fewer products online and therefore require less personal delivery.
 - Columbia City has a bustling commercial street (Rainier Avenue), but the land use is mostly single-story retail surrounded by a neighborhood of single-family homes. Delivery drivers to residences can easily park on a residential street and avoid Rainier Avenue.
- Most parcels observed were smaller/medium sized packages that could easily fit in cargo bikes.
- Some activity, such as the same Amazon vehicle making six or more stops in South Lake Union all within several blocks, suggests there is an increment of dense delivery activity of small parcels that could be handled by e-cargo bikes and carts.
- Each area of study has paid on-street parking and the team observed only a handful of people paying for parking at pay stations. This suggests either a very high utilization of pay-by-smartphone mobile apps or



considerable non-payment infractions. Rarely did the team see any parking enforcement vehicles or officers, and the team saw no examples of enforcement in action.

Overall activity levels varied throughout the day and were dependent on area land uses, business concentration, and demographics. Areas with dense residential multi-store apartment and office buildings had higher levels of delivery activity.

Most deliveries were from Class 4 box trucks, with some representation from semi-trucks, smaller cargo vans, and personal vehicles. No e-cargo bikes were observed and only a few electric vehicles (primarily Amazon electric Rivian vans) were observed. Most parcels observed could easily fit in cargo bikes. This includes mail and packages, food ingredient deliveries, beverage packages, medical supplies, and other retail goods. Some larger deliveries including large beer kegs and pallets of bulk food for grocery stores were also observed; these items were observed to be too large, as packaged, for cargo bikes.

Most delivery vehicles used the center turn lanes or curb space for deliveries. Where alleys were available (for example in South Lake Union) drivers used those locations as well as the occasional parking lot connected to a business or residence. The only vehicles observed using official loading docks were large food or furniture deliveries where the items were palletized or very bulky.

Each area of study has paid on-street parking. During the entire duration of the team's field study, we observed only a handful of people paying for parking at pay stations. This does not necessarily mean that most people didn't pay but suggests either a very high utilization of pay-by-smartphone mobile apps, considerable non-payment infractions, or some combination of the two. Rarely did the team see any parking enforcement vehicles or officers, and the team saw no examples of enforcement in action.

Areas with dense residential multi-store apartment buildings had higher levels of delivery activity. This was observed in South Lake Union and Capitol Hill, which both showed the most consistent daylong delivery and loading activity. This is likely due to the higher densities, and greater mix of uses in these neighborhoods compared to Columbia City and Chinatown / International District (CID). While the CID has considerable residential density in low- and mid-rise housing in the area, the population is older and lower-income than Seattle overall and so residents may purchase less products online and therefore require less personal delivery. The businesses are also small, often family-run enterprises that might use more self-delivery (for example the owner delivers with their own vehicle) that can be more challenging to observe. Columbia City has a bustling commercial street (Rainier Avenue), but the land use is mostly single-story retail surrounded by a neighborhood of single-family homes. Delivery drivers to residences can easily park on a residential street and avoid Rainier Avenue.

In all neighborhoods a significant share of deliveries and loading were small parcels that presumably could fit in e-cargo bikes. Some activity, such as the same Amazon vehicle making six or more stops in South Lake Union all within several blocks, suggests there is an increment of dense delivery activity of small parcels that could be handled by e-cargo bikes and carts. This particular Amazon activity occurred with their electric cargo van, which suggests they already recognize the efficiency of electric vehicles for frequent stop and go driving.

This observation only reflects the nature of any given package to a single destination; it does not account for the unknowns of routing, larger parcels that may be in the vehicles, locations of warehouses, and other logistics factors. The above statements are based on the team's anecdotal observations, not an empirical analysis of all known delivery activity.

Findings by Study Area

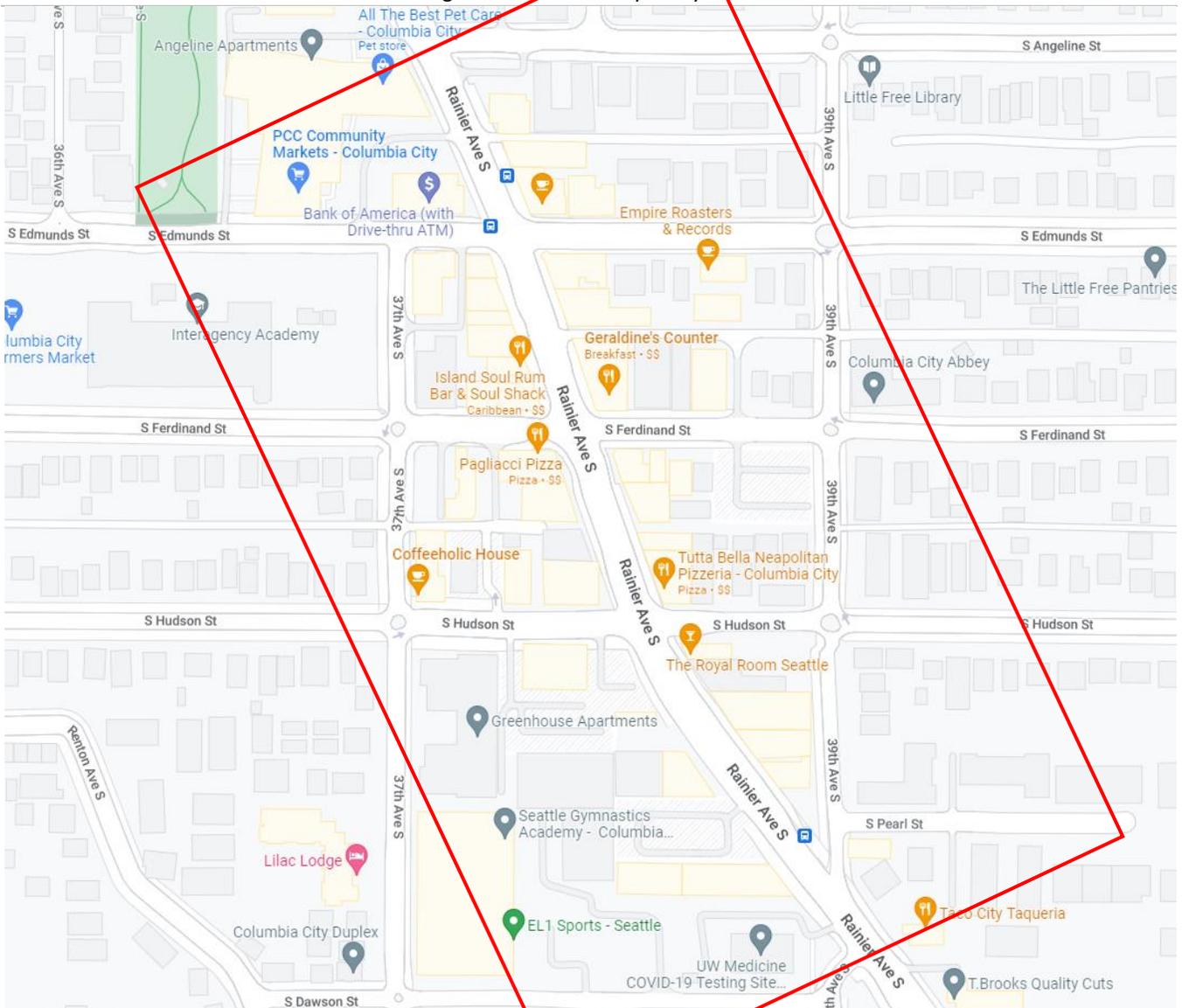
This section describes observed commercial delivery in the four study areas and interviews with area businesses.

Columbia City

Area Description

Columbia City is a traditional neighborhood of single family detached homes and some small apartments, with a main street commercial district along Rainier Avenue South, which contains many single-story small businesses. There is a light rail station five blocks west of this study area. On-street parking on Rainier Avenue requires payment and is typically limited to two hours. There are several designated loading zones in the study area. Figure 2 shows the study area.

Figure 2: Columbia City Study Area



Source: Google Maps; Walker Consultants illustration

Delivery Activity

The team observed Columbia City delivery activity during the mornings of Wednesday, 11/30/22 and Thursday, 12/1/22. In total, 15 deliveries were observed over the two-day period (approximately eight hours). Given the study area is predominantly retail and restaurants, deliveries included food and beverage deliveries to restaurants, food service paper products, bulk food delivery to the PCC grocery store from numerous vendors, on-demand food delivery activity, and an assortment of FedEx and UPS trucks delivering to businesses. The staff observed delivery vehicles driving to the residential streets outside of the study area to deliver to residential addresses. Vehicles used were mostly cargo vans and box trucks, with the occasional semi-truck at the grocery store (PCC Market on Edmonds Street). Figures 3 through 6 provide examples of observed activity.

Figure 3: Food and paper goods delivery to a restaurant



Figure 4: Wine distributor van



Figure 5: Food service paper goods delivery

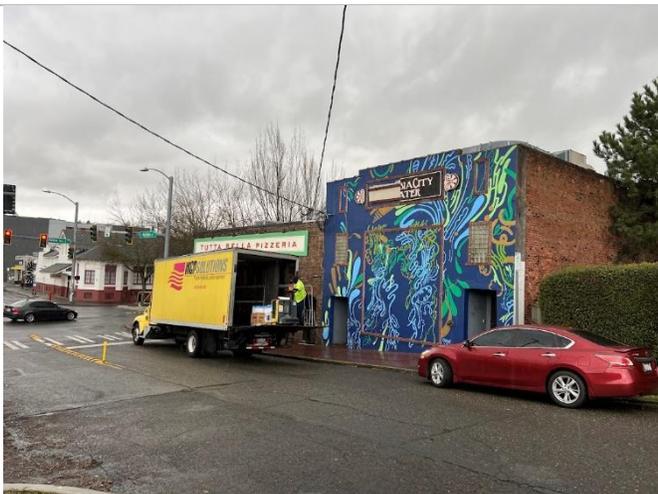


Figure 6: UPS truck in 15-minute zone



Source: Walker Consultants photos

Local Input

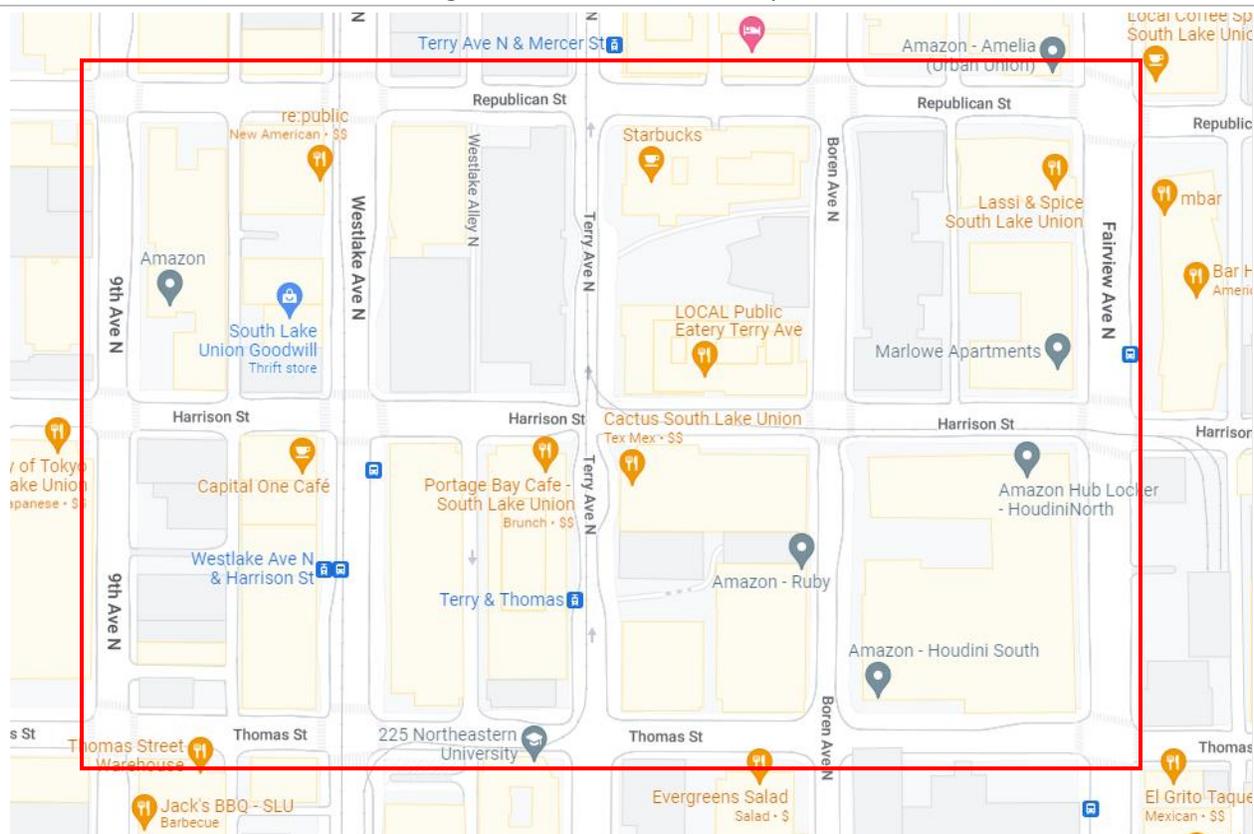
The team spoke with several area businesses. Most did not believe that electric cargo bikes would be viable for their incoming bulk deliveries. However, several responded that e-cargo bikes could be viable for their outgoing deliveries, such as pizzas, flowers, and meat from the butcher to restaurants. One concern was that most outgoing deliveries are to locations beyond the immediate neighborhood (beyond five miles) so there could be challenges using e-cargo bikes for delivery, due to lack of density and having to bike long distances, taking more time. This is likely because the adjacent land use of the immediate surrounding neighborhood is single family residential. Businesses said the lack of adjacent residential density may limit demand for multiple pizzas or flower deliveries, and request for those deliveries are to areas further away.

South Lake Union

Area Description

South Lake Union is essentially a “boomtown” within Seattle. It is a former 19th Century industrial, shipyard, and warehouse district north of downtown that has transformed into an epicenter of tech company offices, dense housing, and retail services. The street grid is rectilinear and compact. Lake Union’s waterfront defines the northern edge of the district. A streetcar line on Westlake and Terry Avenues connects South Lake Union to Downtown. Many streets have been rebuilt to modern standards and mid-rise and high-rise contemporary buildings have been constructed throughout the dozens of blocks in the district, many with their own loading docks. On-street parking requires payment and is regulated for a range of time limits depending on the subarea. Figure 7 shows the study area.

Figure 7: South Lake Union study area



Source: Google Maps; Walker Consultants illustration

Delivery Activity

The team observed South Lake Union during the morning and afternoon of Wednesday, 11/30/22 and morning of Thursday, 12/1/22. In total 36 unique delivery activities were observed (over approximately ten hours). This study area had the most activity of the four locations. Primary delivery activities include everything from food and beverage services to restaurants to furniture delivery to the dense apartment buildings to everyday Amazon delivery of consumer goods. A wide variety of delivery vehicles, including cargo vans, box trucks, and specialty vehicles (the Amazon Rivian van) operate in the neighborhood and most use curbside designated loading zones for their activities. These spaces, combined with plentiful loading docks and numerous access alleys, seem to make delivery activity in South Lake Union more orderly. The curb was also commonly used by food trucks preparing midday meals for area workers and residents. The team observed e-bike drivers picking up food for delivery at food trucks. Many of the streets had plentiful curbside zones set aside for 3-minute loading for food delivery and on-demand ride hailing. The team also observed a delivery on foot from a local sandwich shop.

Deliveries to the building at 400 Fairview Avenue N illegally parked in the travel lane at the curb and their vehicles sat for longer dwell times (up to 47 minutes). This building is a market hall with several retail shops and restaurants as well as 14 floors of office space. The team observed the drivers carting packages to each delivery location, taking time to check and sign for packages. Figures 8 through 11 show observation examples.

Most deliveries were small to medium sized packages or catering and could be delivered using an e-cargo bike.

Figure 8: Catering food delivery at the curbside



Figure 9: Loading activity from an alley



Figure 10: Liquor delivery truck blocking a travel lane for over 15 minutes



Source: Walker Consultants photos

Figure 11: Amazon's new electric Rivian truck fleet was ever-present in South Lake Union



Local Input

The team spoke with an e-bike delivery driver and front desk/security at an Amazon office building. The e-bike delivery driver worked for DoorDash and was picking up at the food truck at Republican and Harrison. The driver said when he is picking up, he typically parks bike in a secure space and locks his bike (at times he may bring his bike in a building, but that option is not always available). At home he has secure parking behind a gate. When asked if he would park in a secure bike locker during his time on the clock, the driver said he would not because it would take too long. He needs to get in and out and doesn't want to deal with a security code to lock the locker. The driver's main challenge is scooters parked in bike racks leaving no room to park his bike.

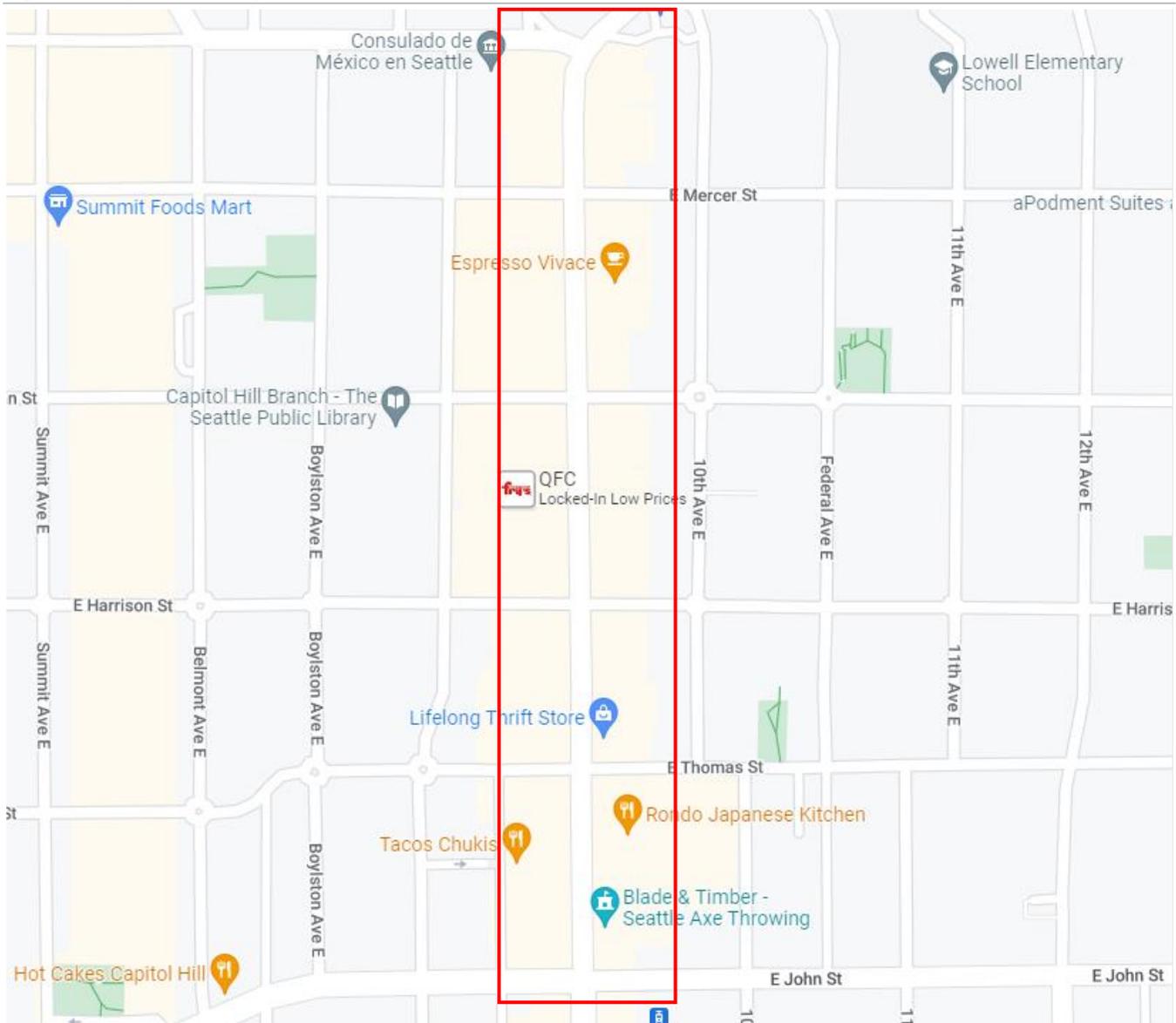
Amazon reported that deliveries to their office location typically occur in alleys or at the loading dock. Drivers do not double park on West Lake or Terry Avenues because of the streetcar lane, narrow right-of-way, and high volume of traffic.

Capitol Hill

Area Description

Capitol Hill along Broadway is a bustling commercial district that embodied Seattle grunge in the 1990s and continues to support an eclectic mix of restaurants, shops, and dense residential. Business and apartment buildings are multi-stories and tightly compacted along the street. Parking is frequently congested on-street and in lots. A light rail station opened at the south end of the study area several years ago; this has become a focal point around which new development is emerging. On-street parking on Capitol Hill requires payment and is typically regulated with a two-hour limit. There are several locations dedicated for commercial loading. Figure 12 shows the study area.

Figure 12: Capitol Hill study area



Source: Google Maps; Walker Consultants illustration

Delivery Activity

The team observed Capitol Hill during the afternoon of Wednesday, 11/30/22 and afternoon of Thursday, 12/1/22. In total, 20 unique delivery activities were reported over approximately eight hours. Primary delivery activities included food and beverage services to restaurants, move-ins to apartment buildings, and considerable on-demand food delivery and e-commerce delivery to apartment buildings.

Nearly all delivery vehicles, from beer distributors to USPS trucks and quick runs to the grocery store, stopped in the center turn lane and made one or more deliveries or pickups from this space. The team observed this “center lane delivery” activity even when curbside commercial loading zone spaces that could have easily accommodated the vehicle size sat empty. Most vehicles sat for 15 to 30 minutes in the turning lane. The team heard anecdotal stories from delivery drivers that the City of Seattle allows 30 minutes of idling in the center lane. Many people also parked in the turning lane to make a quick trip to the grocery or to pick up to-go food orders. This preponderance of center lane parking created a haphazard and seemingly unregulated delivery environment. Most deliveries, apart from bulk food pallets to the QFC grocery store and furniture to homes, were small and could fit in e-cargo bikes. Figures 13 through 16 provide observation examples.

Figure 13: Center Lane loading parking



Figure 14: Center Lane loading parking in the 300 block



Figure 15: Liquor delivery from the center lane



Figure 16: Police Department vehicle in the center lane



Local Input

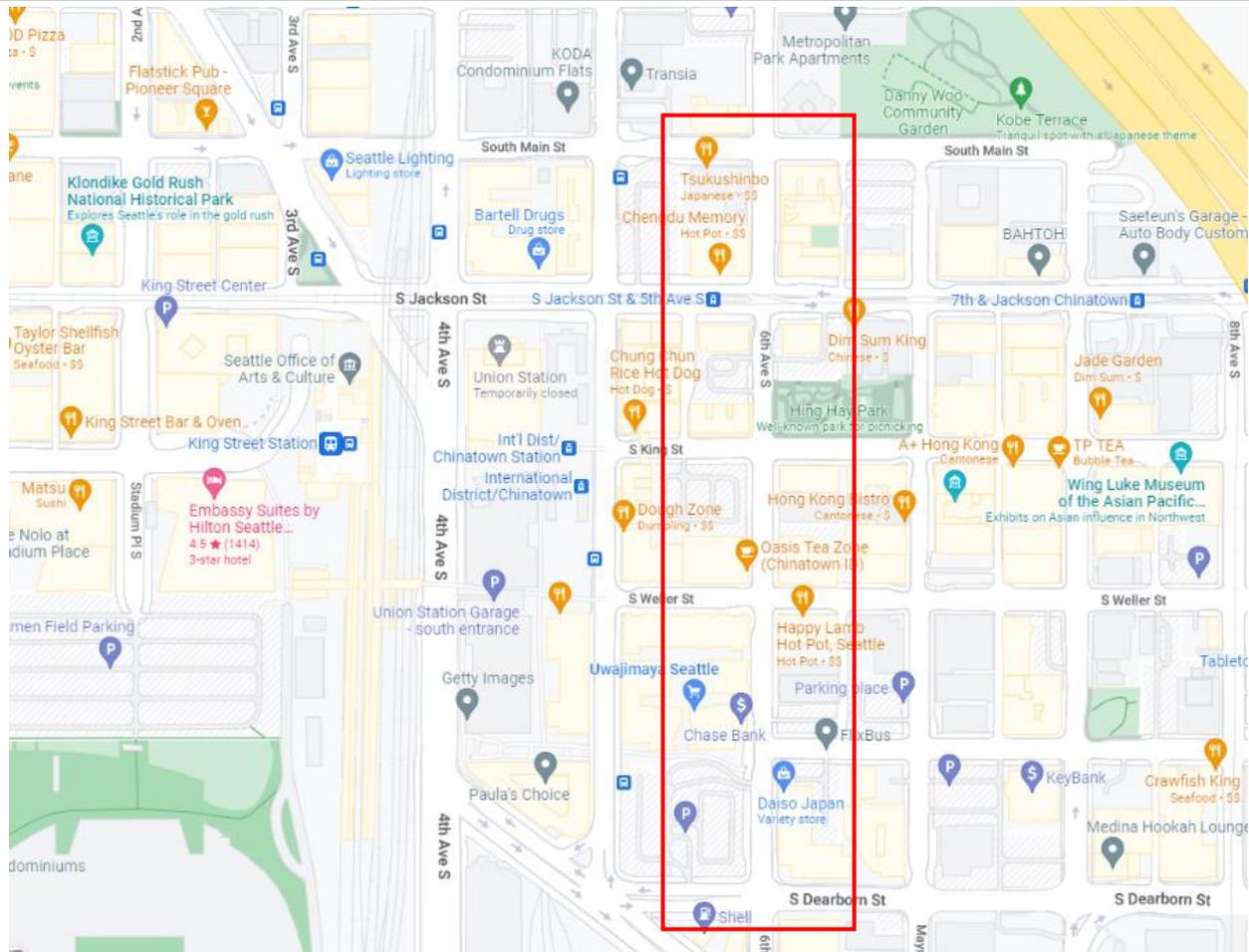
The team asked a delivery driver why he was parking in the center turning lane where there were plenty of available curbside loading zone spaces available (and enough length for him to easily pull in and park). The driver said he prefers the turning lane over the curb space because he will not get blocked in by another vehicle. He said even if the curbside commercial loading zone space fits his vehicle when he first pulls in, he's concerned another vehicle will park in front or behind and block him in at the space. He said it is legal to stop in the turn lane for up to 30 minutes (the team could not confirm accuracy of this statement).

Chinatown/International District

Area Description

Chinatown / International District (CID) is one of the older areas of Seattle. Originally Asian immigrants to Seattle had settled nearer the waterfront in the 1860-1880s. The 1889 fire destroyed much of that area and the community relocated inland and uphill into the current CID location. Many buildings remain from the late 19th and early 20th century construction boom. The area has a complete street grid, with many three-to-five story buildings offering ground floor businesses and housing above. The population is still predominantly of east Asian origin and skews older and with less car ownership. Most businesses are small family-run operations, with only a smattering of national franchises throughout. The area was designated to the National Register of Historic Places in 1986. In 1998, Uwajimaya opened as a large Asian-food-focused grocery and market. Figure 17 on page 12 shows the study area.

Figure 17: International District study area



Source: Google Maps; Walker Consultants illustration

Delivery Activity

The team observed Chinatown / International District during the afternoon of Wednesday, 11/30/22 and early morning of Thursday, 12/1/22. Delivery activity was sparse, with only nine observed activities over approximately four hours. What was observed included some self-performed deliveries to restaurants from their staff of goods including bulk food and drinks. Distribution of vehicles included box trucks from City Produce loading their food products for delivery around the region, and box trucks and semi-trucks delivering food to the Umajimaya grocery. Other activities included United States Postal Service and UPS trucks, most of which used curb space, and several examples of informal deliveries such as medical supplies and oxygen tanks to a senior living facility. Figures 18 through 21 on page 13 provide observation examples.

Figure 18: Self-delivery of kegs by a bar employee or beer distributor employee



Figure 19: Costco business food delivery in a 15-minute loading zone



Figure 20: Medical supplies and oxygen tank delivery to a senior care facility; note the double parking



Source: Walker Consultants photos

Figure 21: Paid parking and loading zone regulation sign.



Local Input

The team was not able to connect with any local businesses to discuss delivery activity.



DATE: January 24, 2023
TO: C40 Cities, City of Seattle
FROM: Walker Consultants
PROJECT NAME: C40 Seattle Zero Emissions Loading Zone

Appendix E: Draft Policy Language

This memo outlines potential policy and regulatory changes required to implement recommendations from the City of Seattle/C40/Walker Consultants Zero Emission Loading Zone Study and draft legislative language. It is recommended for review by the City of Seattle attorney.

Recommendation #1: Create Zero Emissions Commercial Vehicle Loading Zones

The following details the regulatory changes required to create Zero Emissions Commercial Vehicle Loading Zones.

City Authority to Establish Loading Zones and Set Rates

According to the Seattle Dept. of Transportation Commercial Vehicle Load Zones were established to provide, on busy streets, a special parking space for service delivery vehicles to stop and unload. The existing loading zone fee is \$250 annually and \$125 after July 1. Commercial vehicle loading zones and permits are regulated under the Seattle Municipal Code Title 11 Vehicles and Traffic. For a detailed review of the municipal code, please see Appendix B.

Potential legislative amendments to Seattle Municipal Code Title 11 to implement Zero Emissions Commercial Vehicle Loading Zones.

Title 11 Vehicles and Traffic, Subtitle 1 – Traffic Code – Part 1: General Provisions and Administration, Chapter 11.14 Definitions¹

Add and/or amend the following to the list of definitions referenced in the Code:

New SMC 11.14.716 Zero Emissions Commercial Vehicle

“Zero Emissions Commercial Vehicle” means a vehicle that produces no emissions of pollutants, toxic or contaminants, and greenhouse gases when stationary or operating as defined by the Washington State Dept. of Ecology Zero Emissions Vehicle Standards.

¹ City to confirm appropriate definition numbers (i.e., 11.14.278. Current Code definitions are alphabetical.
[https://walkerconsultants-my.sharepoint.com/personal/cmancini_walkerconsultants_com/documents/2 curb management/projects/c40/final deliverables/seattle c40_zef_draft legislaive language_appendix e.docx](https://walkerconsultants-my.sharepoint.com/personal/cmancini_walkerconsultants_com/documents/2%20curb%20management/projects/c40/final%20deliverables/seattle%20c40_zef_draft%20legislaive%20language_appendix%20e.docx)



New SMC 11.14.278 Light Electric Freight Vehicle²

“Light Electric Freight Vehicle” means an e-cargo bike, electric bike, moped, or compact vehicle with electric assistance or drive mechanism, designed for the distribution of commercial freight, goods, or parcels.

Amend SMC 11.14.005 Bicycle and Electric-Assisted Bicycle

A: "Bicycle" means every device propelled solely by human power, or an electric assisted bicycle, upon which a person or persons may ride, having two tandem wheels either of which is 16 inches or more in diameter, or three wheels, any one of which is 20 inches or more in diameter.

B: " Electric assisted bicycle" means a bicycle with two or three wheels, a saddle, fully operative pedals for human propulsion, and an electric motor. The electric assisted bicycle's electric motor must have a power output of no more than 750 watts. The electric assisted bicycle must meet the requirements of one of the following three classifications:

- "Class 1 electric assisted bicycle" means an electric-assisted bicycle in which the motor provides assistance only when the rider is pedaling and ceases to provide assistance when the bicycle reaches the speed of 20 miles per hour;
- "Class 2 electric assisted bicycle" means an electric assisted bicycle in which the motor may be used exclusively to propel the bicycle and is not capable of providing assistance when the bicycle reaches the of 20 miles per hour; or
- "Class 3 electric assisted bicycle" means an electric assisted bicycle in which the motor provides assistance only when the rider is pedaling and ceases to provide assistance when the bicycle reaches the speed of 28 miles per hour and is equipped with a speedometer.

Or

- “Light Electric Freight Vehicle” means an e-cargo bike, electric bike, moped, or compact vehicle with electric assistance or drive mechanism, designed for the distribution of commercial freight, goods, or parcels.

New SMC 11.14.717 Zero Emissions Commercial Vehicle Delivery Loading Zone

“Zero Emissions Commercial Vehicle Delivery Loading Zone" means a portion of a street designated by a sign and green paint markings or other traffic-control devices that is reserved for the exclusive use for expeditious loading and unloading of zero emissions commercial vehicles or commercial goods by zero emissions commercial delivery vehicles and light electric freight vehicles. Payment is required at the zone either by parking payment device or permit.

² 11.14.005 regulates electric bikes (Class 1, 2, and 3). Currently there is no class assigned to an e-cargo bike. Class 3 permits speeds up to 28 MPH, which is the limit the City of Los Angeles has granted for e-cargo bikes.

There are two options: Create a new e-cargo bikes definition or amend 11.14.005 to add an additional category for e-cargo bikes.



Title 11 Vehicles and Traffic, Subtitle 1 – Traffic Code – Part 7: Stopping, Standing, Parking, and Loading, Chapter 11.72 Stopping, Standing, Parking, and Loading Restrictions

New SMC 11.72.600 Zero Emissions Loading Zone

No person shall stop, stand or park a vehicle other than a Zero Emissions Commercial Vehicle and/or a Light Electric Freight Vehicle displaying a valid zero emissions commercial loading permit in a zero emissions commercial load zone during the hours the zone restriction is in effect; provided, that zero emissions commercial load zone restrictions are not effective on Sundays or parking holidays, except where otherwise indicated by signposting for the load zone.

Title 11 Vehicles and Traffic, Subtitle 1 – Traffic Code – Part 7: Stopping, Standing, Parking, and Loading, Chapter 11.74 Loading and Load Regulations

New SMC 11.74.180 Zero Emission Vehicle Loading Zone Usage

No person shall stop a zero emissions commercial delivery vehicle or a vehicle displaying a valid zero emissions loading permit in a zero emissions commercial load zone for any purpose or length of time other than for the expeditious unloading and delivery or pickup and loading of property. In no case shall such stopping for loading and/or unloading of commercial products exceed thirty (30) minutes. Such time and loading limitations shall be in effect during the days and times displayed on the traffic signs or marking at the zone.

Recommendation #2: Develop a Tiered Commercial Vehicle Loading Zone Permit Pricing Structure

All commercial vehicles that wish to park in a commercial vehicle loading zone are required to purchase a commercial loading zone permit. The current commercial vehicle loading zone permit fee is \$250 annually and \$125 after July 1. Companies that operate a fleet of ten or more commercial vehicles are eligible to purchase one transferable permit for every five commercial vehicles in their fleet with nontransferable permits.

Walker recommends the City increase the annual commercial loading permit fee and base the price on the engine composition/emissions/fuel time, with diesel powered vehicles paying the highest fees and zero emissions vehicles paying the lowest fees. To encourage the adoption of e-cargo bikes for delivery, the City could waive the fee for these vehicles. Once the new fee and rates are determined, the City must update SMC 11.23.030 Commercial loading permit — requirements.

Rate levels for the annual commercial loading permit fee, with diesel and gas powered vehicles paying the highest rates:

- Level 1: E-cargo delivery bicycles
- Level 2: Zero emission vehicles
- Level 3: Plug in electric hybrid vehicles
- Level 4: Compressed natural gas vehicles
- Level 5: Gas powered vehicles
- Level 6: Diesel powered vehicles



SEATTLE CASE STUDY FOR C40 CITIES

Business input and data analysis show how cities can support zero emissions curbside management

Freight and commercial goods are an important and growing part of the economy, but also a significant contributor to emissions and poor air quality. Cities are working to address this challenge by supporting zero emission urban goods movement, but there are barriers including policy, costs, route planning, and infrastructure. The City of Seattle set out on a research study to understand how to overcome these challenges to chart a path forward in support of zero emission freight, with a focus on zero emission loading zones and e-cargo bikes.

Background: Seattle's Climate Goals

The City of Seattle's Transportation Electrification Blueprint identifies an ambitious goal that 30 percent of all commercial goods delivery be zero-emission by 2030. The City also adopted a Climate Executive Order (EO) in 2022 that sets forth key actions to equitably reduce or eliminate greenhouse gas emissions.

To understand the structures necessary for freight decarbonization, the Seattle Department of Transportation partnered with C40 Cities and Walker Consultants to develop an implementation plan for zero emission loading zones and e-cargo bike delivery.

Zero Emissions Loading Zones and E-Cargo Bike Delivery

Opportunities	Challenges
There is an appetite from businesses and large freight companies to electrify their fleets, and some already use EVs for delivery.	Cost barriers for purchasing EVs are a top issue, especially for small delivery companies or personal delivery drivers contracted or employed with companies like Uber, Lyft, or independent restaurants.
Pricing and other local government support to create partnerships and educate businesses can "move the needle."	Small and medium businesses will need financial assistance, and large companies need to see an operational benefit.
Many deliveries from local businesses originate from less than 5 miles away, which eliminates range anxiety.	There are not enough electric vehicles available to purchase and those on the market do not cover all fleet needs; this may be due to current supply chain issues.
It is unlikely that urban freight vehicles need en-route charging; overnight charging can cover needs.	Labor costs and agreements contribute a significant portion of delivery costs and requirements, so smaller electric vehicles may be inefficient.
Many freight vehicles are not full during their delivery runs, creating an opportunity for efficiency improvements with smaller electric vehicles and e-cargo bikes for delivery.	Enforcing loading zones can be costly and complicated. The State of Washington also prohibits curb regulations enforcement via video recording and mailed citations.
Many of the packages delivered today in trucks could be delivered by e-cargo bikes.	Many businesses contract with third-party delivery companies and do not have control over the type of vehicles or the delivery process.
Unused (privately owned) off-street parking can be repurposed for e-cargo bike delivery, storage and goods hubs.	Companies are reluctant to co-locate at delivery hubs over concerns regarding data, privacy, and intellectual property.
Lessons from other cities show a path forward.	Bulky goods or long trips may not be a good fit for e-cargo bike delivery.



Study Methodology and Tips

01 Step 1: Policy Analysis and Research

- Review existing state and local regulations, past pilot data, and build on our team's knowledge.

02 Step 2: Outreach and Engagement

- Better to focus on 1:1 interviews; email surveys did not produce many responses.
- It took more time than expected to schedule interviews. Challenges with finding the right person at the company to interview and receiving a response.

03 Step 3: Peer Review

- Interviews with staff in Santa Monica, Los Angeles, Boston, New York, and Montreal.
- City of Seattle participated in C40's Curbside Management Working Group to share learnings with other cities leading on zero emissions freight.

04 Step 4: Data Collection

- A team of four conducted manual field observations of delivery and loading activity in four neighborhoods over two days from early morning to late evening.
- The team tracked vehicle types, the goods being delivered, the location of the stopped vehicle, dwell time, and other observations.
- Data collection was also an opportunity to conduct intercept surveys with businesses and delivery drivers, providing useful feedback.



Key Takeaways

- ✓ **Dense residential land uses seemed to drive commercial delivery activity. It was important to survey a range of neighborhoods that vary by density and commercial/residential makeup.**
 - Areas with dense residential multi-story apartment and office buildings had higher levels of delivery activity, except for areas where the population is older and lower-income and residents may purchase fewer products online.
 - Areas with a bustling commercial street that were surrounded by single-family homes had low delivery counts. Delivery drivers to residences can easily park on a residential street.
- ✓ **Enforcement is critical to the success of zero emissions loading zones, but is costly. Video or other tracking technology could support, but state laws that prohibit enforcing curb regulations through mailed citations would need to be amended.**
- ✓ **There are a limited number of companies currently operating using electric vehicles, which raises concerns that dedicated EV load zones would benefit a single company. This conflicts with the City's regulations that do not allow a single private business dedicated access or reservations to the public right-of-way.**
- ✓ **Aligning standards and regulations with other cities creates consistency for businesses and bike manufacturers to expedite timelines.**
- ✓ **Accomplishing a 30 percent reduction in delivery emissions in the next seven years will require major moves beyond these recommendations such as commercial delivery curb access fees based on day/time.**



Recommendations

The recommendations provide an incremental process, starting with lower-cost changes that can be implemented sooner to more expensive and impactful pilots. Each recommendation could potentially eliminate between 10 and 30 million pounds of carbon dioxide emissions by 2030. These changes will also reduce air pollution from delivery trucks, which will have an immediate positive health impact.

Support zero-emission commercial delivery and incentivize companies to electrify their fleets:

- Liaise with Seattle companies to encourage fleet right-sizing and electrification; identify key delivery routes where new load zones would create efficiency.
- Develop new loading zone standards and pilot Zero Emission Commercial Vehicle Loading Zones.
- Develop a tiered Commercial Vehicle Loading Zone permit pricing structure that encourages electric vehicle transition.
- Implement enhanced enforcement practices.

Support e-cargo bike delivery:

- Launch the Commercial E-Cargo Bike Program, with associated new permitting structures and loading/parking infrastructure at the curb.
- Facilitate the development of zero emission neighborhood delivery hubs.
- Pilot small-medium business e-cargo bike lending library, where businesses can rent e-cargo bikes for delivery.

