RFI: E-CARGO BIKE DELIVERY SOLUTIONS IN THE CITY OF BOSTON

Post Solicitation Report

MARCH 2021

INTRODUCTION

Changes in how people and goods move throughout Boston have increased competition for limited curb space. There are more transportation options available than ever before, and the explosive growth in e-commerce and on-demand delivery services has led to growing pressures at the curb. The delivery of goods and services plays an oversized role in how our streets and curbsides function. It doesn't take long when traveling around the city to see a delivery vehicle stopped double parked, blocking a bike lane, or overstaying the time limit in a commercial loading zone. At the same time, the City recognizes the many challenges commercial operators face. Through this RFI the City aims to better understand how light electric vehicles, e-bikes, and e-cargo bikes could solve these challenges, and provide solutions that address the goals spelled out in Go Boston 2030 and the Climate Action Plan.

DEFINING TERMS

- **Light Electric Freight Vehicle: (LEFV)** is a bike, moped or compact vehicle with electric assistance or drive mechanism, designed for the distribution of goods in public space with limited speed (max 28 mph).
- **E-bikes** are bicycles that use an electric assist motor that allows riders to travel farther distances with less effort than traditional bikes.
    - There are a few different types of e-bikes:
    - Class 1: Pedal Assist: The electric drive on the e-bike is only activated by pedaling and ceases to provide assistance once the e-bike reaches 20 mph. These e-bikes use a motor system and sensor to detect how fast you are pedaling, and provide a boost of power based on that. Unless otherwise specified the term e-bike refers to Class 1 pedal-assist e-bikes.
    - Class 2: Throttle on Demand: Throttle on Demand: The electric drive on the e-bike can be activated through a throttle element and may also be activated through pedaling with top speeds limited to 20 mph. These e-bikes work similar to a twist throttle like motorcycles or mopeds use.
    - Class 3: Speed Pedelec: The electric drive system on the e-bike is activated by pedaling which ceases to provide assistance once the e-bike reaches 28 mph.
    - Class 4: Motorcycle/Moped: Motorcycle/Moped: The electric drive system is activated by pedaling or throttle. These e-bikes can reach top speeds above 28 mph.
- **E-cargo bikes** are e-bikes that are designed to carry heavy loads, including additional people, or goods. E-cargo bikes typically have a payload of up to 770 pounds. Suitable for mail and parcel delivery services, food delivery and for services in which small volumes are delivered. E-cargo bikes have max speeds of 28 mph.
- **Electric cargo mopeds** operate at speeds over 28 mph, and have a payload of up to 1,100 pounds. Suitable for heavier loads such as bulky food deliveries. No effort is required from the driver (unlike the e-cargo bike). The driver is also not protected from the elements (as opposed to drivers of the small electric distribution vehicles).
- **Small electric distribution vehicle** is a mini van with a payload of up to 1,675 pounds. Suitable for catering, street cleaning and waste collection.

WHY WE ARE INTERESTED IN E-CARGO BIKES AS A SOLUTION

In order to reduce our emissions from transportation, which accounted for 29% of our community-wide emissions in 2017, we must support electrification across all travel modes and we must think creatively. Go Boston 2030, and the Climate Action Plan Update lay the framework for prioritizing policies and programs that support sustainable personal travel habits for our residents, and ensure that public transit, active transportation, and shared trips are the mode of choice. Competition for the curb is increasing, with more and more interactions occurring at our curbs: from ride-hailing companies, to the promotion of shared services like car share and our Bluebikes system, to protected bike and bus lanes. The City is currently establishing curb management principles, strategies and framework to direct the distribution of curbspace among modes and services.

In addition to the way we travel, we need to adapt the way we get goods delivered. Parcel delivery services must be reconstructed to support our goal of carbon neutrality, get goods to our residents in a more efficient manner, and optimize the use of our curbspace. A growing number of consumers would like fast home deliveries. Consumers also heavily factor in cost of the delivery. Last-mile deliveries make up a significant share of the total delivery cost - often more than 50% of the total cost of the delivery. Cost can drive the market, and without influence or interference could result in more vehicle miles travelled, higher noise levels, and potentially more deliveries by automation, resulting in zero-occupancy vehicles crowding our streets. Currently, projections show that bike couriers will only make up 2% of parcel deliveries in the next 10 years. The City's tactical and organized support of e-cargo bikes is necessary to ensure that this delivery method is successful and adopted.[1]

OUR MESSAGING

- **Our curbs are a precious commodity.** Boston has been testing new curb use rules, including new curbside parking and pull-over restrictions, and using curb space for different purposes at different times of day to accommodate for emerging trends. E-bikes are one opportunity that we are considering for how goods get transferred at the curb.
- **Our transportation carbon neutrality goal cannot just focus on the movement of people.** In 2017, Mayor Martin J. Walsh committed to make Boston carbon neutral by 2050. Over the past 10 years, deliveries of online purchases in Boston's metro region have surged, contributing to congestion and air pollution.
- **During the COVID-19 pandemic, many residents have turned to online delivery** to get groceries and many other essential goods, in order to remain physically distant and healthy, further increasing the stress on our curbspace.
- **E-cargo bikes may be a solution for Boston.** Electric cargo bikes are more cost effective than delivery trucks for journeys under 6-miles in high density residential areas with low delivery volumes (Sheth & al., 2019). 20% of inner city deliveries could be undertaken by cargo bikes (Amsterdam University of Applied Sciences, 2018).

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1 https://www.mckinsey.com/~/media/mckinsey/industries/travel%20transport%20and%20logistics/our%20insights/how%20customer%20demands%20are%20reshaping%20last%20mile%20delivery/parcel_delivery_the_future_of_last_mile.ashx

MARKET OPPORTUNITIES

Researchers investigated the potential of LEFVs for different cargo flows within city logistics (Balm et al, 2018) and found four key opportunities:

Opportunity	Motivation
Small and light shipments	LEFV have limited loading capacity
High network density	LEFVs can be parked easily
Time critical shipments	LEFVs manoeuver quickly through the inner city and are reliable because they are hardly affected by congestion
Growth and innovation	Customer demand and degree of competition affecting the transition to new concepts such as LEFVs[2]

SEGMENTS OF THE MARKET

Deliveries vary in many ways including urgency, size, refrigeration requirements, weight, and shape. The differences in deliveries of different market segments require different solutions. Below are the trends, opportunities, and challenges for how e-cargo bikes could integrate into different segments of the Boston market, and existing programs.

PARCEL DELIVERY

- **The Numbers:** Online purchases in Boston's metro region have caused deliveries to increase by more than 90 percent from 2010 to 2018.[3]
- **Opportunity**: Shipments are generally small, and are delivered within a high density network.
- **Challenges**: Some delivery rounds are too heavy to be replaced with an LEFV due to the smaller capacity, though segments of the trips could be augmented by an alternative delivery solution.
- **Case Study:** In 2019, New York City launched a Commercial Cargo Bike Program in partnership with Amazon, DHL, and FedEx, which added 100 cargo bikes to the streets of Midtown and downtown Manhattan.

FOOD LOGISTICS

- **The Numbers:** Many institutions, universities, large employers, and restaurants in Boston get food delivered on a daily or weekly basis.
- **Opportunity:** Smaller orders such as back orders or order corrections may be suitable for a LEFV.
- **Challenges:** The initial food delivery is typically done in a truck, and travels a substantial distance on a highway network and is not suitable for being replaced by a LEFV.

[2] City Logistics: Light and Electric
[3] Seeing Red: Ride-hailing, Deliveries and Traffic

- **Case Study**: Boston Organics offers deliveries by subscription of CSA-style boxes of fresh vegetables, pasta, mile and eggs. Weather permitting, Boston Organics uses e-cargo bikes to deliver produce boxes close to their warehouse and in areas that are difficult to access with a van.

RESTAURANT DELIVERY

- **The Numbers:** For each month from September 2017 to July 2018, for example, the total sales of the main food delivery companies in Boston grew more than 60 percent compared to the same month in the previous year, according to figures from Second Measure.
- **Opportunity**: These are typically small deliveries - of a maximum of a few meals. E-bikes can sometimes even be a solution, with deliveries being fit into a backpack or panniers.
- **Challenges**: Often the burden of the cost of the traditional bicycle, e-bike or other vehicle and even the delivery bag is put on the delivery worker, rather than supplied by the company.
- **Case Study:** In select cities, including Boston, Caviar hires couriers as independent contractors to deliver food from DoorDash, a phone based food delivery application, provided that they own a bicycle. Some of these bikes are e-bikes.

RETAIL LOGISTICS

- **The Numbers:** Over 8% of all U.S. retail sales - $395 billion -took place online in 2016. Growth in U.S. online sales has averaged more than 15% year-over-year since 2010.[4]
- **Opportunity:** While a small segment of the market, retail stores are beginning to ship increasingly from a local store directly to a consumer.
- **Challenges:** For restocking a store, retail locations typically use a fully loaded truck coming from a location that requires highway travel.
- **Case Study:** Bufvelo operated their e-cargo bike delivery service for six years in Boston specializing in scheduled routes and bulk deliveries. They recently shifted operations to Buffalo, New York where they continue to work “through rain, sleet, and snow.”

PROGRAMS IN OTHER CITIES

New York City

The Commercial Cargo Bike Program, introduced in time for the holiday shopping season in 2019, was NYC’s six month pilot program offering 100 e-cargo bikes from major delivery companies in midtown and downtown Manhattan. The program’s goal was to better understand if e-cargo bikes can successfully fit into the City’s existing activity.[5] New York created a Letter of Understanding with various companies and offered the companies free on-street parking, use of commercial parking space, and loading and staging space. They also adapted their existing Commercial Licensing and Safety program to include e-cargo bike requirements.

Madison

Madison, Wisconsin launched a focus group with delegates from several City departments to better understand how e-cargo bikes could fit into existing City operations. Following the focus groups,

[4] The Final 50 Feet of The Urban Goods Delivery System
[5] Mayor de Blasio Announces Commercial Cargo Bike Program to Reduce Delivery Congestion

each department took the bike for 2-3 weeks, trialing the bike for several jobs and tasks. The City collected surveys and daily logs including mileage data and route data. They are currently developing a training curriculum specific to municipal employees for fleet management for preventative ongoing maintenance.

Miami

Miami partnered with shipping company DHL Express and mobility logistics hub Reef Technology to pilot four e-cargo delivery bikes. Each morning, a DHL truck will carry up to nine cargo containers for the bikes, which will be sent to the Reef Hub. Those same containers can be reloaded in the afternoon for outbound shipments. Training is mandatory for the DHL couriers to operate the bikes to ensure compliance with applicable laws.[6]

Switzerland

In Switzerland, around 15,000 people have registered with the online platform carvelo2go, which hires out electric cargo bikes. Despite strong growth in member numbers, there are still fundamental barriers. A study was conducted and indicated ways that sharing providers and public authorities can promote the use of environmentally friendly cargo bikes. The study indicates ways e-cargo bike sharing could be made more user-friendly including additional stations, increased number of cargo bikes at busy locations and a more flexible pick-up and return structure. The study found that the city could help reduce concerns by investing more in bicycle infrastructure including wider, safer bike paths and allocating parking spots for cargo bikes.[7]

London

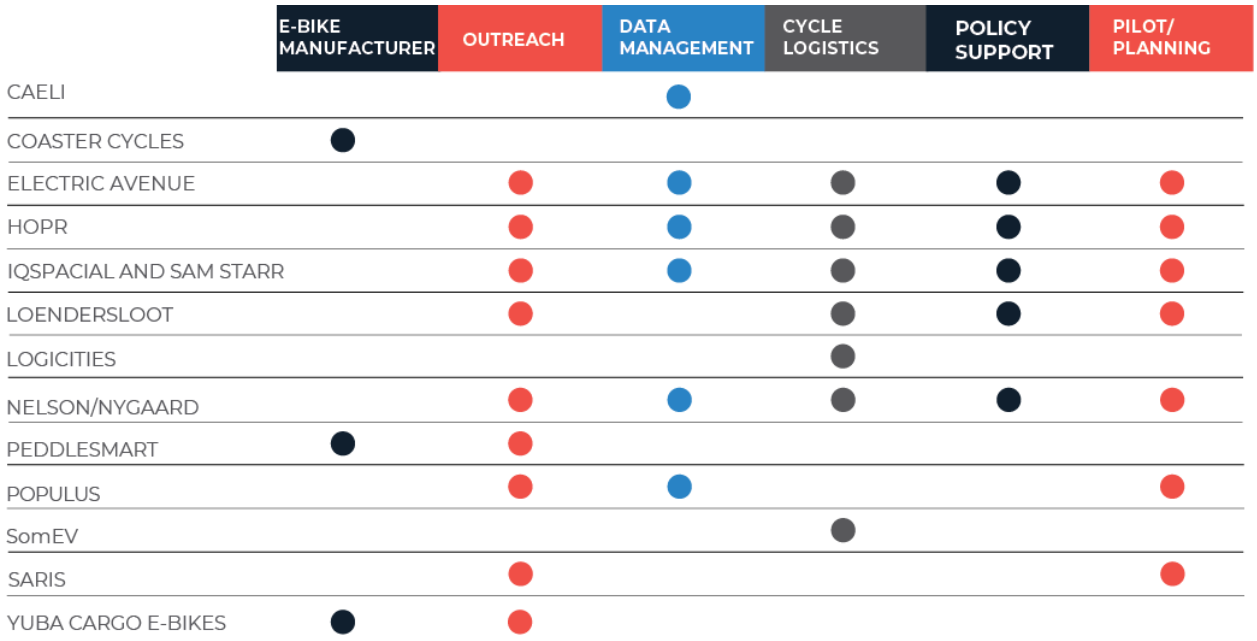
London's world-first ULEZ (Ultra Low Emission Zone) excludes polluting vehicles from the downtown core by imposing financial penalties, in effect promoting cleaner and more efficient vehicles. To offer an alternative to a penalty, the UK government's Department for Transport has made 2 million dollars of funding available for the purchase of e-cargo bikes, to support last mile deliveries by England's private sector. This funding is to cover 20% of the total cost of the bike. Additionally, the Mayor of London and Transport for London unveiled a plan to work with boroughs, businesses and the freight and servicing industry to transform how deliveries are currently made, with one of the key proposals allocating land for micro-distribution centers in key locations to support sustainable last mile deliveries by e-cargo bike and LEFV style vehicles.[8]

WHAT WE LEARNED: RFI

Response Overview

Between July 20th, 2020 to August 24th, 2020, we received 13 responses to the e-cargo bike delivery solutions Request for Information. Many of the responses we received were from consultants seeking to support the launch of a program, and e-cargo bike manufacturers. There were no responses from delivery providers or existing programs.

[6] Miami Pilots e-Cargo Bikes to Reduce Congestion, Pollution
[7] https://www.sciencedaily.com/releases/2019/07/190710121536.htm
[8] E-cargo Bikes Get Official Backing in UK; Start of True Electric 'Last Mile' Delivery?



Manufacturer Responses

E-cargo bikes come in many different forms. Some can look similar to a traditional bicycle with the addition of a rear or front mounted cargo carrier, and some are similar to a smaller, light duty vehicle. Many manufacturers build bikes for a specific purpose or partner in mind - and alter the bike based on the cargo that it is carrying.

Different manufacturers have tackled the challenges of battery charging in creative ways. Some manufacturers recharge batteries with solar powered canopies directly on the e-cargo bike. Solutions also included a battery swap system to aid in fleet management, or in public asset management. Battery swap facilities (permanent or semi-permanent) were suggested to improve charging efficiency, decrease charging costs by detecting off-peak demand windows, and maximize battery lifetime. Battery swap facilities were suggested to have adjacent staging operations to ensure that trips were not required for restocking. It was suggested that these hubs be an addition to a GoHub!. One response also included information about battery lifetime, which is 12-18 months, and an average cost of $500. Additionally, there are concerns of battery flammability, which could be addressed by battery swap facility technology.

There were strong suggestions regarding a hybrid solution of both e-cargo bikes, as well as other light-duty electric vehicles including e-mopeds, light electric delivery vans, and e-tuk-tuks in order to integrate seamlessly within an existing distribution network in a way that additional delivery hubs do not need to be created.

We also learned that some companies have not yet scheduled their US market deployment, as they are unsure of the appetite in the US compared to their existing international markets.

Outreach

We saw a trend in responses suggesting the importance of stakeholder engagement and in forming an advisory council. The advisory council can help contribute resources, own the solutions, and shape the program. The advisory council can also develop the business case for this concept to ensure cost savings, carbon reduction, and speed of delivery improvements. This council can also conduct a more detailed barrier analysis, and build off of the lessons learned from other cities. The following partners were recommended:

- **Local and regional agencies**: These included MassDOT, MAPC, and neighboring municipalities including Cambridge, Somerville, and Brookline. Additional advocacy organizations were suggested including LivableStreets Alliance, Boston Cyclists Union, and WalkBoston.
- **Delivery and mobility providers**: This includes food pick-up, goods deliveries, and TNCs.
- **Researchers**: Including academic institutions such as John Hopkins, University of Southern Florida, Massachusetts Institute of Technology, UC Berkeley, University of Washington, and UC Davis. It is suggested that this work can not only support Boston's long-term goals but also the mobility sector as a whole. This information should be disseminated to stakeholders in this space.
- **Consulting firms**: Many of the responses were from consultants interested in partnering with the City on this project. In addition to the responses, we heard suggestions to partner with Alta Planning and Kittelson.
- **City Departments**: Suggestions included a cross-departmental collaboration including representatives from the Mayor's Office of New Urban Mechanics, Boston Planning and Development Agency, Public Works, Boston Transportation Department, and the Environment Department.
- **Providers**: Suggestions for engagement included UPS, FedEX, Amazon, and DHL.
- **Neighborhood and Resident Groups**: While no groups were specifically suggested, it was a recommendation to engage with these groups.
- **Main Streets, Business Improvement Districts, Transportation Management Associations**: All of these can be valuable in forming, implementing and encouraging the success of an e-cargo bike delivery program.
- **Investors**: Investors, including the Volpe Center, the Barr Foundation and/or the Boston Foundation, potentially interested in contributing resources should be notified and involved.

Cycle Logistics, Pilot Planning

Many responses suggested a landscape analysis to understand the current programs. Research questions included information about vehicle type, origin and destinations, road safety, maintenance, and the trips that e-cargo bikes are currently replacing.

Loading Zones & Parking Hubs

One short-term action suggestion included creating tactical dedicated loading zones. By designating loading zones, this would improve the safety, efficiency and accessibility. This would likely take up 1-2 parking spaces in high priority locations, such as in front of businesses, or large apartment buildings without existing mailrooms. These loading zones could also have secure parking hubs for bikes near businesses that are commonly delivered to.

Solutions suggested partnering with a provider that has a delivery facility in the urban core. If a provider does not have a facility in the urban core, it is suggested that packages are loaded from a delivery van at a central location in the urban core, where it remains parked all day. Additionally, there are newly vacant retail locations which could work as mini-distribution centers.

It is suggested that e-cargo bikes should be able to use parking spaces open to commercial vehicles. In addition to commercial loading zone use, it is suggested that additional on-street bike corrals be offered to support e-cargo bikes. Private garages could be incentivized for charging and parking for e-cargo bikes. In the current climate, there is an excess of off-street parking which could be considered.

Bike Ownership
There was variation of responses in terms of bike ownership. Some suggested private and personal bike ownership. Another suggestion included building an e-bike library by engaging bike manufacturers to donate consumer-model e-bikes or sell them to the City at cost. The bikes would then be leased or made available to small businesses. This could augment food deliveries currently made by car. The third concept was a public-private partnership for a bike share system for both commercial goods, delivery services and public use.

Bike Definitions
It is suggested that e-cargo bikes be defined as bicycles, and not as vehicles. This would allow the e-cargo bikes to be able to park on sidewalks during delivery sessions. The nuance of this definition can hinder or support the success of this program. If defined as commercial vehicles, e-cargo bike drivers in Boston may be required to maintain commercial driving licenses. If defined as a bicycle, this would eliminate that obstacle.

Location Suggestions
Three pilot locations were suggested:

South Boston/Seaport
- Could benefit new developments and existing neighborhood
- The Amazon distribution facility coming online this fall/winter makes a perfect pilot
- Actions Needed: Enhance existing bike network

Downtown Crossing
- There is a limited-use access pedestrian zone
- Frequent delivery and loading access needs
- Build on repeated studies on curbside loading management and signage
- High density of activity nodes
- Actions Needed: Collaborate with Downtown Business Improvement District

Kenmore Square/Fenway
- There is a very high level of activity and mixed use
- There are major new developments in the Fenway area
- Mixture of commercial activity and high-density residential
- High student population areas
- Actions Needed: Focus on safety enhancements or goals as the Fenway is a high-crash location

Winter Biking Solutions

Solutions were suggested for winterization of bikes, as well as road service and maintenance. These included conversations with the stakeholders to better understand how snow impacts parking locations, vehicle accessories, uniforms, and street, sidewalk, and bike lane salting, plowing and sweeping.

Policy Suggestions

Policy levers to encourage e-cargo bike deliveries, or to discourage higher polluting delivery vehicles were suggested. These included:

- Restrictions on daytime freight delivery for medium- and heavy-duty trucks, while exempting electric trucks
- Establish low-emissions delivery zones, in which a boundary area will not allow internal combustion engine vehicles conduct deliveries.
- Implement congestion pricing for designated zones, which can apply to all vehicles and can have varying price levels according to the time of day and vehicle class
- Tax incentive, stipend or direct subsidy to delivery couriers to buy, retrofit, or maintain a personal e-bike, if primarily used for deliveries.
- Incentives for restaurants to offer accessible secure parking
- Incentivize building owners to establish a program to incentivize e-cargo bike deliveries at their properties including designating e-cargo bike parking and delivery zones, installing e-cargo bike charging, and offering preferred status for tenants who chose e-cargo bike delivery for shipments.
- Requiring companies over a certain size or delivery volume to adopt the Mobility Data Specification and report on delivery activity on a continuous basis.
- Dynamic curb space pricing and regulations.
- Waiving parking fines to incentivize companies to participate in e-cargo bike programs.

Data Collection

Responses included a strong theme around data collection to plan, measure and evaluate the e-cargo bike program. All responses highlighted a general trend of consolidating data sources to streamline access into one general format in the form of a dashboard.

Data collection from mobility operators, in industry standard formats including General Bikeshare Feed Specification, Mobility Data Specification, and CurbLR was suggested to determine:

- Location of available vehicles, including aggregation over time and space
- Trip origins and destinations, including across custom spatial geographies
- Trip routes, including aggregated volumes
- Parking events, durations and dwell times
- Vehicle types

It was suggested that we work together to develop key metrics to measure the success of the program based on the provided information. Metrics of success responses were generally around carbon reduction, cost, and safety outcomes. KPIs employed by other cities include:

- Truck replacement ratios
- Stops per day
- Change in VMT
- Change in the number of tickets and summons
- En route travel speeds by time of day

- Travel time reliability
- Emissions reduction (suggested monitoring through satellite monitoring)

It was suggested that delivery providers over a certain size should be required to report their deliveries to the city with specific data insights including: frequent truck parking areas and delivery clusters; time spent idling during deliveries; time of day, week, and year patterns; overlap between different carriers, frequent travel routes, and total vehicle miles travelled, including deadheading.

Battery swap facilities were suggested as data collection points to help with research purposes to advance battery technology, and track how much electricity is required for e-cargo deliveries at scale.

Zone Selection
Responses stated that deliveries were most successful in areas of greatest demand, where the transportation network is congested, and complicated for cars to navigate. Suggestions included data to support zone selection for a pilot though evaluation of parking demand. There is also an existing platform that establishes equity priority zones. Spatial analysis was also suggested for zone determination including factors like population density, delivery density, bike infrastructure network, and current distribution centers. Other things to consider included density of intersections, land use mix, congestion levels, crash rates, proximity and completeness of bike network, width of sidewalks, presence of hollow sidewalks, and presence of existing loading zones. Based on these criteria, traditional freight corridors were stated to not be the best candidate for e-cargo bike deliveries, but rather zones where deliveries are made, specifically in business districts.

The zones could subsequently be geofenced on a web-based software application. This information of curb, street, or zone policies could be communicated to all consumers of mobility data, and delivered through APIs.

NEXT STEPS

The City of Boston, through the Bloomberg Philanthropies American Cities Climate Challenge, has contracted with Nelson/Nygaard to design and potentially launch an e-cargo bike delivery pilot program. Over the next few months the City will work to identify the potential regulatory, administrative, and operational challenges to e-cargo bike delivery within the City of Boston, and establish a strategy to address those challenges. The City is targeting spring of 2022 for the launch of an e-cargo bike delivery pilot program.

CONTACT INFORMATION

For more information contact the Boston Transportation Department - BTD@boston.gov or 617-635-4680.

RESOURCES

- E-Cargo Bikes - City of Boston's Request for Information
- Hidden and in Plain Site: Impacts of E-Commerce in Massachusetts