PEMBINA institute

Cargo e-bikes for urban deliveries

Regulatory approaches and standards

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November 2021

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Recommended citation: Stout, Mark and Saeed Kaddoura. *Cargo e-bikes for urban deliveries for urban deliveries: Regulatory approaches and standards*. The Pembina Institute, 2021.

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About the Pembina Institute

The Pembina Institute is a national non-partisan think tank that advocates for strong, effective policies to support Canada's clean energy transition. We employ multi-faceted and highly collaborative approaches to change. Producing credible, evidence-based research and analysis, we consult directly with organizations to design and implement clean energy solutions, and convene diverse sets of stakeholders to identify and move toward common solutions.

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Acknowledgements

We want to thank Emma Cotten for her research contributions as well as background research from Heba Al-Junaidi, a 2021-22 Graduate Fellow of the Urban Policy Lab, Munk School of Global Affairs and Public Policy.

Contents

List of Figures

List of Tables

Executive summary

Urban mobility is changing both in the movement of people and the delivery of goods. What was once the domain of vans and medium-duty trucks is now also that of cargo cycles. Cargo cycles are a type of micromobility that takes the form of bicycles, trikes, and quadricycles, and can be human-powered or electric. Electric cargo bikes, called cargo e-bikes in this report, are gaining popularity in Toronto and other cities in Canada as well as internationally.

Toronto has proactively amended its by-laws to allow pedal-assisted cargo e-bikes for personal and commercial delivery purposes, but emerging issues regarding vehicle and pedestrian safety highlight a need to examine how best to regulate cargo e-bikes. As the City of Toronto starts to update and/or create new municipal by-laws and practices for cargo e-bikes for personal and commercial use, and also develop a cargo e-bike pilot project, there are several important considerations to address that will inform policy decisions.

To inform the City of Toronto's policy and pilot program development, the Pembina Institute identified the specifications and features of commonly used cargo e-bikes; reviewed and analyzed regulatory approaches and frameworks employed by jurisdictions across North America and Europe; and sought input from stakeholders on several important issue areas: cargo e-bike specifications, operating parameters, parking parameters, and safety considerations.

Key takeaways

- **Cargo e-bikes are an effective and efficient mode of urban delivery.** Recent research based on active cargo e-bike operations shows that, in city centres, cargo e-bikes can be approximately 60% faster on average at delivering goods compared to vans, and without generating tailpipe carbon emissions and pollution.
- **Diversity of models:** North American and European markets offer a range of unique cargo e-bike models. Two-wheeled and three-wheeled cargo e-bikes are common in North America, and four-wheeled cargo e-bikes are used in Europe as well. The advantage of the variance in sizes is that businesses and consumers can purchase cycles that best suit their needs and also existing infrastructure.
- **Cargo e-bikes operated for commercial use or passenger travel are generally larger than those for personal use.** While there are some

exceptions, commercial use cargo e-bikes are typically wider and heavier than personal use cargo e-bikes, and as such can be differentiated for regulatory purposes. They can feature flatbed designs to transport cargo in a variety of shapes and sizes.

- **Cargo e-bike specifications:** Features and specifications of cargo e-bikes are vastly different from one model to another. There is no one standard for maximum widths, lengths, weight (unladen or loaded) or power output. Consequently, policy-makers in North America and Europe vary in their approaches to setting regulations and standards. Germany is the only jurisdiction that has published a national safety and testing method standard for cargo e-bikes (2020). It includes a larger width of up to two metres for multi-track (three- and four-wheeled) cargo e-bikes.
- **Cycling operating infrastructure:** Cargo e-bikes are generally allowed on most streets and cycling facilities, including painted bike lanes and protected/separated cycle tracks, with some exceptions such as popular shared-use pathways in various cities. Allowing cargo e-bike to be used in as much operating infrastructure as possible, with the exception of sidewalks for reasons of pedestrian accessibility and safety, would help promote cargo bikes as a viable means of transporting urban goods and would help reduce congestion and emissions, among other outcomes. Toronto will need to determine where cargo e-bikes can operate while taking into consideration any associated risks to either pedestrians, other cyclists, or drivers of the cargo e-bikes.
- **Responsive policy and design:** As cargo e-bikes grow in popularity and increasingly widespread use, new models are coming onto the market such as cargo bikes that are even wider to accommodate more goods per delivery. Consequently, policy-makers and urban planners are beginning to consider widening bike lanes and cycle tracks. As the City of Toronto expands bike lane networks and rolls out other means of encouraging non-vehicle traffic in the city, policies, planning and guidelines will need to be responsive to changing micromobility options.
- **Parking:** A key issue that emerged from our research and stakeholder discussions concerning parking policies was the conclusion that cargo e-bike parking should not be over-regulated. Parking policies elsewhere varied widely from minimal intervention in some European cities such as Berlin to designating on-street vehicle parking for cargo bikes in Chicago to applying commercial vehicle parking rules to cargo bikes in New York City (although with a parking meter payment exemption). Likewise, Toronto will need to draft parking policies for cargo e-bikes and decide whether permits will be required, while considering

risk levels of the different parking options to all street users. Cargo e-bikes present many benefits and ample, safe, secure parking options should be encouraged. As such, over-regulating and prohibiting parking in many locations may minimize the opportunity of cargo e-bikes.

- **Safety:** Cities are handling safety considerations like commercial permits, insurance requirements, and necessary safety equipment in different ways. Based on our scan of regulatory frameworks, there is no single consistent approach to regulating e-bikes, cargo e-bikes and/or bicycles as it is highly dependent on the geographic, and social and cultural context.

1. Introduction

Urban mobility is changing. In the delivery of goods, cycles are now entering the market to do what vans and medium-duty trucks traditionally did. Further, the technology of propulsion of urban goods delivery is changing from diesel and gasoline internal combustion engines to electric zero-tailpipe-emission vehicles and bicycles, unleashing strong potential to reduce the *38%* of Toronto's total carbon emissions coming from transportation.[1]

While there is a wide variety of the types of electric cargo cycles -- cargo electric bikes, electric cargo bikes, pedal-assisted cargo bicycles, cargo power-assisted bicycles, low-speed delivery bikes and more --we simply use the term "cargo e-bikes" in this report.

Cargo e-bikes are becoming increasingly widespread in Toronto, other cities in Canada and internationally. The Ministry of Transportation of Ontario has defined cargo e-bikes as "cargo power-assisted bicycles" in Ontario Regulation 141/21.[2] In general, a cargo e-bike is a pedal-driven bicycle that runs on batteries and has a cargo carrying area attached to the front or back of the bicycle.

A growing body of research, along with the results coming out of a number of pilot projects, show that using cargo e-bikes for commercial deliveries is efficient and comes with significant environmental benefits. According to an August 2021 study conducted in the U.K., within the city centre, cargo e-bikes can make deliveries approximately 60% more quickly compared to vans. this is because cargo bikes move at faster than average speeds and deliver more parcels per hour.[3] A study out of Austria found that up to 51% of all freight trips in urban areas could be done using cargo e-bikes.[4] Further, in places where microhubs were created in addition to using cargo e-bikes, tailpipe emissions were eliminated; cost savings were also realized in some cases, as microhubs facilitate the whole process of urban delivery and make it easier to use cargo e-bikes with shorter

[1] City of Toronto, *Electric Vehicle Strategy* (2019). https://www.toronto.ca/wp-content/uploads/2020/02/8c46-City-of-Toronto-Electric-Vehicle-Strategy.pdf

[2] Government of Ontario, *O. Reg. 141/21: Pilot project – cargo power-assisted bicycles* https://www.ontario.ca/laws/regulation/210141

[3] Possible, *The Promise of Low-Carbon Freight: Benefits of cargo bikes in London,* prepared by the Active Travel Academy (2021), 5. Available at https://www.smarttransport.org.uk/whitepapers/reports-1/the-promise-of-low-carbon-freight

[4] Susanne Wrighton and Karl Reiter, "CycleLogistics – Moving Europe Forward!" *Transportation Research Procedia* 12 (2016), 951. https://doi.org/10.1016/j.trpro.2016.02.046

distances from microhub to delivery destination.[5] With successful examples of cargo e-bike deployment in Vancouver and Montreal, it is timely that the City of Toronto's Freight and Goods Movement Strategy seeks to "promote the use of cargo bicycles, including e-assist, to reduce the impact of freight and goods movement" on congestion and emissions in the short term (one to two years).[6]

1.1 Background

The Ministry of Transportation Ontario recently passed Regulation 141/21 to establish a five-year cargo e-bike pilot program for bikes that weigh more than 55 kg. Municipalities that want to participate in the program must pass a local by-law to do so.

In response, and to advance other initiatives, the City of Toronto is preparing a micromobility strategy for lightweight transport modes such as power-assisted bicycles, cargo e-bikes, and other small electric vehicles by late 2021. As a part of the strategy, City staff will start planning the design and implementation of a municipal pilot project for large cargo e-bikes (more than120 kg unladen).

While Toronto has already amended regulatory guidelines to allow for the use of pedal-assisted cargo e-bikes for personal and commercial delivery purposes, subsequent concerns have emerged associated with larger cargo e-bikes and safety issues. The new issues highlight a need to re-visit regulatory approaches to this relatively new way of getting around the city.

1.2 Study purpose and methodology

Purpose

The research upon which this report is based was undertaken in order to provide an overview of the options among cargo e-bike models and an assessment of relevant regulations in other jurisdictions to assist staff at the City of Toronto in developing comprehensive and effective policies to guide best practices in maximizing the use of cargo e-bikes.

[5] Janelle Lee, Carolyn Kim, Lindsay Wiginton, *Delivering Last-Mile Solutions* (Pembina Institute, 2019). https://www.pembina.org/pub/delivering-last-mile-solutions

[6] City of Toronto, *Freight and Goods Movement Strategy* (2020). https://www.toronto.ca/legdocs/mmis/2020/ie/bgrd/backgroundfile-157033.pdf

Specifically, the objectives were to: (1) distinguish among commonly used cargo e-bikes highlighting unique specifications and features to inform policies going forward; (2) identify effective regulatory approaches and frameworks in used in other jurisdictions; and (3) secure stakeholder feedback on key issue areas that will contribute to by-law development and the implementation of an e-cargo bike pilot project.

Methodology

Step 1

The Pembina Institute undertook a literature review of cargo e-bikes and a jurisdictional scan of regulations in North America and Europe, and had direct communications with New York City, the City of Copenhagen, and the City of Berlin to answer the following:

- What are the top selling cargo e-bike models in Canada, the United States, and the European Union?
- What are the typical dimensions, features, and other key specifications of the top selling cargo e-bikes?
- What are the key regulations and/or policy guidelines used in jurisdictions of similar size and density to effectively determine the best ways to allow for cargo e-bike specifications, operating/parking e-cargo bikes, safety concerns, and associated issues?

Step 2

The Pembina Institute validated and complemented desktop research findings with primary research. A small-group workshop was held on October 1, 2021 to collect feedback on the needs and use cases of cargo e-bikes, top-of-mind concerns, and ideal outcomes from a pilot program in Toronto for large (more than 120 kg) cargo e-bikes. Discussion was structured by themes: bike specification maximums; operating and parking parameters; and safety considerations. Stakeholders included environmental and civil society groups, bike advocacy groups, micromobility policy experts, bike retailers that sell cargo e-bikes, and academics. The City of Toronto conducted consultations directly with delivery companies.

2. Cargo e-bike benefits, policy rationale

2.1 Replacing vans and trucks with bikes

As a means of delivering goods, cargo e-bikes can replace vans and trucks in many instances. A 2016 study estimated that 51% of freight deliveries can be replaced by cargo e-bikes in European cities.[7] The researchers determined that e-bikes are a feasible alternative for light freight and for freight trips under 7 km. Cargo e-bike deliveries could increase even more by setting up microhubs that facilitate last mile of deliveries.

Microhubs are small distribution centres in neighbourhoods or near city centres. Small-scale distribution centres have been piloted in Seattle and Montreal to successfully replace delivery vehicles for the final leg, or "last mile" of the delivery with cargo e-bikes. Although traditional delivery vehicles are still required to deliver goods to the microhub, e-bikes can be efficiently used for the slowest and most costly part of the delivery journey. It has been shown that the last mile of a delivery is often responsible for over 50% of the delivery costs,[8] largely due to fuel and labour costs that are racked up through time spent idling in traffic often near the destination, circling blocks in search of parking, and other inefficiencies. Montreal's 2019 pilot program set up a single, centrally located, hub and was able to replace six Purolator truck routes with five cargo e-bikes, plus one small truck for larger freight items.[9] An additional finding from the pilot program in Montreal was that cargo e-bikes were able to deliver year-round with the addition of snow tires, and consistently outperformed delivery trucks in making more deliveries over the same time period even in winter.

[7] "CycleLogistics – Moving Europe Forward!" 951.

[8] McKinsey & Company, *Parcel delivery - the Future of last mile* (2016), 6. https://www.mckinsey.com/~/media/mckinsey/industries/travel transport and logistics/our insights/how customer demands are reshaping last mile delivery/parcel_delivery_the_future_of_last_mile.ashx

[9] Barry Lyster, "Montreal's Colibri eCargo Bike Project is a Rising Star in Mobility Solutions," *ebikes International*, April 1, 2021. https://ebikes-international.com/montreals-colibri-ecargo-bike-project-is-a-rising-star-in-sustainable-mobility/

2.2 Efficiency of cargo e-bikes

In an August 2021, the University of Westminster released a study in which cargo e-bikes outperformed vans in the number of business-to-consumer (e.g. grocery and courier service) deliveries per hour in London's city centre. By using routes that allowed for single pickup locations and multiple drop-offs in one trip, cargo e-bikes were able to make deliveries 1.61 times faster than trucks.[10] This was mainly attributed to two factors. The first is that although capable of higher speeds, vans were only travelling at an average of 15 km/h on congested downtown streets, which is roughly the same speed as the cargo e-bikes.[11] The second factor was that vans take, on average, an additional nine minutes in downtown London to find legal parking spots.[12]

Establishing microhubs as part of Seattle's four-month pilot project in 2021, the city concluded that one e-bike mile could replace 1.4 truck miles, and each package travelled half the number of miles compared to traditional delivery methods.[13] This was mostly because parking for cargo e-bikes was much easier than for large vehicles. Other factors included the use of bike lanes, avoiding congestion, and using shortcuts accessible only to bikes.

Similarly, by using one central hub in Montreal, researchers found this approach was 30 to 40% more efficient in terms of deliveries per hour[14], which resulted in 15% more deliveries overall.[15]

2.3 Reduction in emissions and air pollution

By introducing a zero-emissions last-mile delivery system, Seattle's greenhouse gas emissions dropped by 30% in their pilot project. Researchers estimated that the decrease

[10] *The Promise of Low-Carbon Freight,* 33.

[11] *The Promise of Low-Carbon Freight,* 16.

[12] *The Promise of Low-Carbon Freight,* 19.

[13] Supply Chain Transportation and Logistics Center, *The Seattle Neighborhood Delivery Pilot Project: An Evaluation of the Operational Impacts of a Neighborhood Delivery Hub Model on Last-Mile Delivery* (University of Washington, 2021), 5. https://depts.washington.edu/sctlctr/sites/default/files/research_pub_files/UFL-Sea-Neighborhood-Delivery-Hub_Final-Report.pdf

[14] Emily Chung, Alice Hopton and Tashauna Reid, "Parcel delivery companies are trading trucks for bikes in some Canadian cities. Here's why," *CBC*, November 28, 2020. https://www.cbc.ca/news/science/parcel-delivery-trucks-e-bikes-1.5819378

[15] "Montreal's Colibri eCargo Bike Project is a Rising Star in Mobility Solutions."

in emissions could increase by as much as 40-50% through the strategic planning of the number and the location of additional microhubs.[16]

Research out of the United Kingdom found that a freight van can produce up to eight times more carbon emissions compared to a cargo e-bike over the lifetime of the van. Replacing diesel-powered vans with e-bikes in London could eliminate 1,633 kg of nitrogen oxide pollution per year.[17]

[16] *The Seattle Neighborhood Delivery Pilot Project*, 5.

[17] *The Promise of Low-Carbon Freight,* 17. Nitrogen oxides (NO_x) are pollutants formed by burning fossil fuels. NO_x can cause health damage, and is a major contributor to smog formation.

3. Cargo e-bikes

3.1 Cargo e-bike models and specifications

There is a wide range of cargo e-bike manufacturers and models on the market in Canada, the United States, and the European Union, with new models coming onto the market regularly. Table 1 presents common cargo e-bikes and their specifications and singular features. The listed cargo e-bikes represent the 20 best-selling models, or models used frequently by delivery companies.

Table 1. Common cargo e-bikes and specifications

Make	Model	Bike dimensions (LxWxH, cm)	Unloaded bike weight (kg)	Gross vehicle weight rating (kg)	Number of wheels	Location of cargo area	Retail price ($ CAD)*
Larry vs Harry	Bullitt e6100	243 x 46 x 76	28	181	2	Front	$9,600
Centaur Cargo	Trike XL	225 x 87 x 105	N/A	200	3	Front	$13,500
Nihola	Posterbike	180 x 89 x 110	30	200	3	Front	$5,650
Nihola	Family Disc E-Assist	200 x 89 x 110	36	200	3	Front	$8,700
Rylte	MovR	270 x 120 x 200	134	314	3	Back	N/A
Rad Power Bikes	RadBurro	134 x 86 x 137	103	318	3	Back	$7,181
ESTER	Cargo Delivery trike	N/A	N/A	N/A	3	Back	N/A
Urban Arrow	Cargo L Flatbed	274 x 70 x 110	47	275	2	Front	$8,500
Urban Arrow	Tender	294 x 114 x 110	100	400	3	Front	$11,515
Urban Arrow	Family	260 x 70 x 110	51	200	2	Front	$8,500
XCYC	Pickup Work 4.0	290 x 100 x 170	N/A	300	3	Back	$12,171
GLEAM	ESCAPE	250 x 82 x 130	70	270	3	Back	$9,963
Riese and Müller	Load 75	265 x 49 x 110	36	200	2	Front	$12,299

Riese and Müller	Packster 70 Vario	249 x 56 x 110	42	200	2	Front	$13,200
Babboe	Carve	216 x 85 x 110	65	245	3	Front	$10,000
Muli	Steps	195 x 60 x N/A	32	383	2	Front	$6,910
Bakfiets	CargoBike Classic Long	253 x 63 x 115	42	N/A	2	Front	$5,792
Winther	Cargoo	207 x 89 x 114	43	N/A	3	Front	$10,000
Johansson	Oscar S	215 x 72 x 120	39	224	3	Front	$5,859
Butchers & bicycles	Mk1-E	225 x 91 x 106	49	249	3	Front	$8,172

N/A: data are unavailable

* Prices are estimates for reference only; actual price varies depending on the vendor

3.2 Characteristics of cargo e-bikes

Many cargo e-bike models sold in Europe and North America can be categorized based on three characteristics: the number of wheels, the loading configurations, and the shape of the cargo area

Number of wheels

	
Riese & Müller Load 75[18]	Centaur Cargo Trike XL[19]
The Load 75 is one of the narrowest models on the market making it optimal for maneuverability in urban environments.	The 850L cargo box on the Centaur Cargo Trike XL is optimal for transporting high volumes and trips with many items.

Figure 1. Examples of two- and three-wheeled cargo e-bikes

Two-wheeled cargo e-bikes are similar in shape to conventional bikes except that behind the front wheel there is enough room to carry packages. The lighter weight and slimmer frame compared to three- and four-wheeled cargo e-bikes make this model easy to maneuver. However; that may result in reduced stability. The absence of a third wheel requires the rider to maintain balance, which makes two-wheeled cargo e-bikes difficult to operate at lower speeds or when loading and unloading.[20]

[18] Riese & Müller, "The Load 75. Even more space for your freedom." https://www.r-m.de/en-ca/bikes/load-75/

[19] Centaur Cargo, "Centaur Cargo Trike XL: high volume transporting." https://www.centaurcargo.com/en/cargo-bikes/centaur-cargo-trike-xl/

[20] Babboe, "Is a cargo bike with 2 or 3 wheels best for you?" https://www.babboe.co.uk/which-cargo-bike/2-wheel-cargo-bike-or-3-wheel-cargo-bike

Three-wheeled cargo e-bikes (also known as cargo trikes) offer greater stability, and do not need the operator to balance the bike. Although cargo trikes are heavier on average than two-wheelers, they have the advantage of larger cargo areas and are easier to load and unload.

Figure 1Loading configurations

	
Butchers & Bicycles Mk1-E[21]	Rytle MovR[22]
The Mk1-E is equipped with a tilting technology that improves safety and ease of riding.	The ability to handle heavy cargo has made the MovR the cargo e-bike of choice for global shipping company UPS.

Figure 2. Front-loading and rear-loading configurations

The location of the cargo area on cargo e-bikes can differ by design, as shown in Figure 2. All two-wheeled cargo e-bikes that are used to carry commercial cargo are designed with the cargo area between the front wheel and the rider, and are referred to as front-loading cargo bikes. While rear-loading cargo bikes, also known as long-tail cargo bikes, exist, they have a smaller loading space and are mainly used for personal travel, carrying children, and/or personal items like groceries.

Historically, cargo trikes have a reverse tricycle configuration with two wheels in the front, a cargo box sandwiched between the two wheels, and the rear half that looks like a traditional bicycle with a single wheel in the back.[23] More recent cargo-trike designs

[21] Butchers & Bicycles, "Mk1-E Gen. 3 Automatic." https://www.butchersandbicycles.com/mk1e-automatic

[22] Rytle, "MOVR." https://rytle.com/movr/; Rytle, "UPS launches custom-made cargo e-bikes," June 21, 2018. https://rytle.com/ups-launches-custom-made-cargo-e-bikes/

[23] Cargocycles, "Babboe Cargo Bikes – Should you get a two or three wheeled cargo bike?" November 22, 2018. https://cargocycles.com.au/babboe-cargo-bikes-two-or-three-wheels-on-your-cargobike/

have adopted a rear-loading configuration to allow the operator to carry larger loads without compromising the operator's sightlines.

Shape of the cargo area

	
Urban Arrow Tender[24]	GLEAM ESCAPE[25]
The Tender 2500 offers the largest flatbed space (2.6 m^2) of all the best-selling models.[26]	The ESCAPE offers 16 customization options making it a fit for a broad range of uses.

Figure 3. Cargo e-bikes equipped with a flatbed

The cargo area on cargo e-bikes is not always a box shape. Some cargo e-bike manufacturers offer cargo e-bikes with a flatbed design, which allows business operators to circumvent the dimension limitations with box-shaped cargo areas. Flatbeds can be used with front-loading or rear-loading cargo e-bikes and e-trikes. Some manufacturers offer customization options for cargo areas where flatbeds can be replaced with a cargo box. Flatbed cargo e-bikes are shown in Figure 3.

[24] Urban Arrow, "Tender." https://www.urbanarrow.com/en/tender

[25] GLEAM, "Configure your bike." https://gleam-bikes.com/product/gleam-escape/

[26] Urban Arrow, "Specification Sheet Urban Arrow Tender." https://www.urbanarrow.com/data/default/2020-04/Tender%202500%20Specs%20EN%202020.pdf

4. Regulatory approaches and standards

4.1 A varied landscape

The regulatory landscape for cargo e-bikes and e-bikes varies considerably among cities both in North America and in Europe. As new bike technologies and products are introduced to the market and the adoption of e-bikes, cargo e-bikes, and traditional bicycles grows, regulations continue to evolve. Based on our scan of regulatory frameworks, there is no single consistent approach to regulating e-bikes, cargo e-bikes and/or bicycles as each one is contingent on the local geography, and social and cultural contexts. Cycling and the use of cargo bikes and e-bikes are generally more prevalent in Europe than some North American cities, and consequently there are differences in regulatory approaches.

Policy-makers have taken different approaches in the following ways:

- **Terminology and classification:** The definitions and terminologies used to describe bicycles with electric-assist capabilities range from "pedal cycles with pedal assistance" and "powered cycles" to "bicycle with electric assist." Many jurisdictions in the United States have adopted the People for Bikes (an American bike advocacy organization) Model Electric Bicycle Law for state usage with the three classes of e-bikes.[27] In Europe, cargo e-bikes are generally categorized into one of two groups: they are either under 250 watts and excluded from European Union approval requirements as per Regulation 168/2013, or they have a greater than 250 watts capacity and are grouped into category L1e-A "powered cycle" under Regulation 168/2013. The latter group is subject to more regulation.
- **Setting operational requirements:** Regulating the allowance of cargo e-bikes, e-bikes and bicycles on roads, trails, and path systems also varies across Europe and North America. Some jurisdictions have specific regulations for cargo e-bikes, such as a maximum speed limit and bike width allowances, but most do not. Where none exists, e-bike regulations, and commercial cyclist regulations

[27] People for Bikes, *Model Electric Bicycle Law with Classes* https://peopleforbikes.cdn.prismic.io/peopleforbikes/3686d20b-5695-47c1-b0c7-ffe06402be55_Model-eBike-Legislation-Jan2020.pdf

where relevant, would apply. For e-bikes, most jurisdictions regulate a maximum speed and power.

- **Defining regulatory roles and responsibilities:** There is no single approach to determining the roles and responsibilities accorded to local, state, and national regulators. For example, New York State stipulates maximum e-bike width and power output; meanwhile, the municipal codes in New York City are largely silent on these operational matters. In contrast, the State of Illinois' e-bike laws are silent on maximum widths, while the City of Chicago's Municipal Code regulates the maximum width and speed for a "low-speed delivery" e-bike.

  Berlin and Copenhagen have not issued any regulations on cargo e-bikes. .[28] Instead, regulations on e-bikes of two, three, and four wheels are determined either by the European Union or at the national level. The European Union has also set standards for safety-related specifications and testing methods of e-bikes. Only Germany has a national safety specifications and testing methods standard for cargo e-bikes.

The regulatory landscape is varied across many jurisdictions; there is challenge and opportunity to learn from the different perspectives and to continue to adapt and refine the regulations toward a vibrant cargo e-bike environment in Toronto.

4.2 Spotlight on selected cities

To better understand how U.S. states and cities regulate cargo e-bikes, we examined relevant municipal codes in New York City, Chicago, and Seattle. These cities were selected as they have existing or past pilot programs for cargo e-bikes and, similar to the City of Toronto, have drafted municipal codes that regulate the use of cargo e-bikes/e-bikes/bicycles. Given that many European cities simply follow EU regulations, we have excluded them from this analysis. In consultation with the City of Toronto, four issue areas pertaining to cargo e-bikes were considered: cargo e-bike specifications, operating parameters, parking parameters, and safety considerations. Results are summarized in the tables on the following pages.

[28] Julius Menge, City of Berlin, personal communication, September 15, 2021.

Table 2. Issue area 1 | Cargo e-bike specifications

Parameter	New York City	Chicago	Seattle
Width limit	No more than 36 inches according to NY State Laws. Proposal at NY State to increase to 55 inches width max per Senate Bill S9004. Section 102-C VAT NY State: "§ 102-c. Bicycle with electric assist. A bicycle which is **no more than thirty-six inches wide** and has an electric motor of less than seven hundred fifty watts, equipped with operable pedals, meeting the equipment and manufacturing requirements for bicycles adopted by the Consumer Product Safety Commission under 16 C.F.R. Part 1512.1 et seq. and meeting the requirements of one of the following three classes." Senate Bill S9004: "A bicycle which is **no more than fifty-five inches wide** and has an electric motor of less than seven hundred fifty watts, equipped with operable pedals, meeting the equipment and manufacturing requirements for bicycles adopted by the Consumer Product Safety Commission under 16 C.F.R. Part 1512.1 et seq. and meeting the requirements of one of the following three classes"	No more than 4 feet. 9-4-010 Municipal Code of Chicago: ""Low-speed electric delivery bicycle" means a bicycle, except equipped with an electric motor that provides assistance only when the rider is pedaling and that ceases to provide assistance when the bicycle reaches a speed of 15 miles per hour, that is **not more than 4 feet wide**, whose electric motor disengages when the rider stops pedaling, and that meets such other requirements and specifications as the Commissioner provides by Rule."	No mention of maximum dimensions requirements for cargo e-bikes in municipal regulation, the Seattle cargo e-bike pilot, or the Revised Code of Washington. Section 46.04.169 of the Revised Code of Washington and Section 11.14-055 Municipal Code: "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 seven hundred fifty watts."
Length limit	-	-	-
Height limit	-	-	-
Weight limit	-	-	-

Table 3. Issue area 2 | Operating parameters

Parameter	New York City	Chicago	Seattle
Cycling Facilities (Bike lanes and/or cycle tracks)	Permitted Permitted to the same extent as bicycles. NYC Pilot report Article 34 of NY State VAT Section 10-157 and Section 4-12 of The Rules of City of New York	Permitted Permitted to the same extent as bicycles. No additional restrictions noted in the Municipal Code of Chicago for low-speed electric delivery bicycles. 9-52-125 and 9-52-20 Municipal Code of Chicago	Permitted Permitted to the same extent as bicycles. No additional restrictions noted in Seattle Municipal Code. Chapter 11.44 and Section 11.14-055 of Seattle Municipal Code
Roadways	Permitted with exceptions Permitted to the same extent as bicycles. Operation of bicycles on roadways is permitted. The Rules of The City of New York permit bicycles on roadways but prohibit them on expressways, drives, highways, interstate routes, bridges, and thruways. They also prohibit the use of bicycles on parkways. Section 4-12 of The Rules of The City of New York Cargo e-bikes wider than 48 inches shall use travel lane. NYC pilot report	Permitted Permitted to the same extent as bicycles. No additional restrictions noted in the Municipal Code of Chicago for low-speed electric delivery bicycles. 9-52-125 and 9-52-010 Municipal Code of Chicago	Permitted Permitted to the same extent as bicycles. No additional restrictions noted in Seattle Municipal Code. Section 11.44.040 of Seattle Municipal Code
Multi-Use/Shared Trails/Paths	Permitted Permitted to the same extent as bicycles. NYC Pilot report Section 10-157 and Section 4-12 of The Rules of The City of New York	Permitted Permitted to the same extent as bicycles. No additional restrictions noted in the Municipal Code of Chicago for low-speed electric delivery bicycles. 9-52-125 Municipal Code of Chicago	Permitted with exceptions Operation of Class 1 and Class 2 electric-assisted bicycles is permitted on public paths. Section 11.44.120 of Seattle Municipal Code All Classes of electric-assisted bicycles not allowed on trails that are specifically designated as nonmotorized and that have a natural surface tread with no added surfacing materials. Section 46.61.710 Revised Code of Washington
Sidewalks	Not permitted Operation of bicycles with electric assist are not permitted on sidewalks according to New York State Vehicle and Traffic Law. The Rules of The City of New York prohibit riding bicycles in general on sidewalks unless permitted by an official sign. Article 34 of NY State VAT Section 4-07 of The Rules of The City of New York	Not permitted "(e) No person shall operate or park a low-speed electric delivery bicycle upon any sidewalk." 9-52-125 Municipal Code of Chicago	Permitted with exceptions Operation of Class 1 and Class 2 electric-assisted bicycles is permitted on sidewalks. Operation of Class 3 electric-assisted bicycles on sidewalks is prohibited, except if there is no bicycle or pedestrian path available. Section 11.44.120 of Seattle Municipal Code
Speed limits	12 miles per hour NYC pilot report	15 miles per hour 9-4-010 Chicago Municipal Code	

Table 4. Issue area 3 | Parking considerations

Parameter	New York City	Chicago	Seattle
Parking permissions in vehicular curbside parking spaces, on-street bike corrals	Permitted Commercial vehicles may park curbside in New York City and pay commercial parking rates ($5 to $8 per hour). Commercial cargo e-bikes are allowed to park anywhere a regular commercial vehicle is allowed to park, but they are exempt from meter payment. NYC pilot report 4-08 Parking, Stopping, Standing of the Rules of the City of New York	Permitted “No person shall park a bicycle upon a street other than upon the roadway against the curb or upon the sidewalk against a rack, parking meter or sign pole to support the bicycle or against a building or at the curb in such manner as to afford the least obstruction to pedestrian traffic.” 9-52-070 Municipal Code “The cargo bikes would also be banned from using the city’s on-street bike corrals and would instead have to use a designated vehicular parking spot.” Streetsblog Chicago	Permitted Bicycles may not be parked on the road unless specifically indicated by signage. “No person shall park a bicycle upon a sidewalk or public path in such a manner as to obstruct traffic thereon; or within, against or adjacent to a bus patron shelter in a manner which restricts or eliminates the use of such a shelter by pedestrians who are waiting for public transportation; or upon a roadway except in locations designated by official traffic-control devices.” 11.44.280 Seattle Municipal Code
Parking in commercial vehicle zones (loading) allowed	Yes NYC pilot report	Unclear*	Unclear*
Exempt from parking meter payment	Yes NYC pilot report	Unclear*	Unclear*
Parking permit required	No A parking permit requirement is being developed by New York City as they transition from the pilot to a permanent cargo e-bike program, per communication with the DOT. This permit system will act as a payment method for curbside use, so cargo e-bikes will continue to be exempt from ongoing meter payment when the program becomes permanent. Further details of the permit program were not provided by the DOT.	No Similar treatment to bicycles. 9-52-125 Municipal Code	No Similar treatment to bicycles. Chapter 11.44 and Section 11.14-055 of Seattle Municipal Code
Dedicated on-street or off-street parking areas	Yes New York City Department of Transportation designed and installed cargo bike corrals at the curbside that could be used by both cargo and regular bikes. NYC pilot report	No Similar treatment to bicycles. 9-52-125 Municipal Code	Yes Seattle’s bicycle parking guidelines dictate that on-street bicycle corrals must be designed to be able to incorporate cargo bikes (approximately 7 to 9 feet in length). Seattle Bicycle Parking Guidelines
Sidewalk parking allowed	No Article 34 of NY State VAT	N€(e) No person shall operate or park a low-speed electric delivery bicycle upon any sidewalk.” 9-52-125 Municipal Code	Yes Bicycles may be parked on sidewalks or adjacent to bus shelters so long as they do not obstruct pedestrian flow, traffic, or access to public transportation.

			During the Seattle cargo e-bike pilot, bikes were allowed to park on the sidewalks. Cargo e-bikes were given a Class 2 e-bike permit to operate in the Seattle pilot. This allowed parking on shared-use paths including sidewalks and bike lanes. 11.44.280 Seattle Municipal Code

* Unclear items require further research, likely through correspondence with the local jurisdiction, because the regulations do not provide explicit guidance on the issue parameter and applicability of the regulation can only be inferred.

Table 5. Issue area 4 | Safety considerations

Parameter	New York City	Chicago	Seattle
Permit/license required of business/cyclist doing delivery (with or without parking privilege)	No Letter of understanding required for pilot participants. NYC pilot report	Required "(f) A low-speed electric delivery bicycle may only be used for bicycle messenger services and may only be operated by a bicycle operator, as these terms are defined in Section 4-168-010." 9-52-125 Municipal Code "(a) No person shall engage in the occupation of providing bicycle messenger services without having secured a license issued under this chapter. The license shall be in addition to any other license required by law." 4-168-020 Municipal Code	No No mention of permitting requirement for commercial deliveries by bicycles or electric-assisted bicycles in Seattle's Municipal Code. A driver's license is not required for the operation of electric assisted bicycles. Additionally, registration is not required for electric-assisted bicycles. "(3) No driver's license is required for operation of an electric-assisted bicycle. Persons under sixteen years of age may not operate a class 3 electric-assisted bicycle." Section 46.20.500 of the Revised Code of Washington "The following vehicles are not required to be registered under this chapter:...(2) Electric-assisted bicycles;" Section 46.16A.808 of the Revised Code of Washington
Unique identification of bike operation and/or cyclist	Yes "A business using a bicycle for commercial purposes must assign to each of its bicycle operators a three digit identification number, except that the department of transportation may promulgate a rule to require an identification number with four or more digits. Such business must **issue to each of its bicycle operators an identification card that contains the name, identification number and photo of the bicycle operator and the name, address and telephone number of such business.** A bicycle operator shall carry such identification card while making deliveries or otherwise operating a bicycle on behalf of any such business. A bicycle operator shall be required to produce such identification card upon the demand of an authorized employee of the police department or department of transportation or any other person authorized by law." 10-157 New York City Administrative Code	Yes Every bicycle operator is assigned a unique identification number or letter. "Every licensee shall maintain records of all bicycle operators operating on the licensee's behalf. The records shall include the name and address of each bicycle operator and the identification number or letters required under Section 4-168-070for each operator. **The identification number or letters assigned to a bicycle operator shall not be assigned to or used by any other operator unless such transfer is necessary because of a change in employment status.** The records required by this section shall be made available to the commissioner at his or her request and shall be maintained for at least two years." 4-168-060, 4-168-080 and 4-168-070 Municipal Code	No No mention of bike/cyclist identification requirement for commercial deliverers by bicycles or electric-assisted bicycles in Seattle's Municipal Code. However, every electric-assisted bicycle should display a label containing the bike's classification, speed, and wattage. "A manufacturer or distributor of new electric-assisted bicycles, where electric-assisted bicycles are defined in RCW 46.04.169, offered for sale or distribution in Washington state must: (a) Beginning July 1, 2018, permanently affix, in a prominent location, a label printed in arial font and at least nine-point type that contains the classification number, top assisted speed, and motor wattage;" Section 46.37.690 of the Revised Code of Washington
Insurance required of business or cyclist doing delivery (also indemnification of municipality if found)	No	Yes "(a) Each applicant for a bicycle messenger service license shall provide proof that the applicant and each bicycle operator engaged by each applicant has commercial general liability insurance coverage with limits on not less than $300,000.00 per occurrence for bodily injury, personal injury and property damage arising in any way from the license or activities conducted pursuant to the license. In addition, worker's compensation coverage must be provided as required by state law."	No No mention of insurance requirements for bicycle and electric-assisted bicycles delivery in Seattle's Municipal Code or the Revised Code of Washington.

		4-168-050 Municipal Code	
Training required of cyclist/business	Yes. Each bicycle operator shall complete a bicycle safety course prior to making deliveries. Bicycle safety course shall mean information provided by the department of transportation regarding safe bicycling and adherence to traffic and commercial bicycle laws. 10-157(3)(e.3 and 4) New York City Administrative Code	No mention of training requirements for bicycle messenger services in the Municipal Code Chapter 4-168 Municipal Code	No The Revised Code of Washington prohibits operation of class 3 electric-assisted bicycles for anyone under the age of sixteen but doesn't stipulate training requirements. Additionally, there is no mention of training requirements for the use of bicycles or electric-assisted bicycles for commercial deliveries in Seattle's Municipal Code. Section 46.20.500 of the Revised Code of Washington

4.3 Regulatory analysis

Cargo e-bike specifications

The different kinds of cargo e-bikes with typical dimensions and payloads are shown in Figure 4.

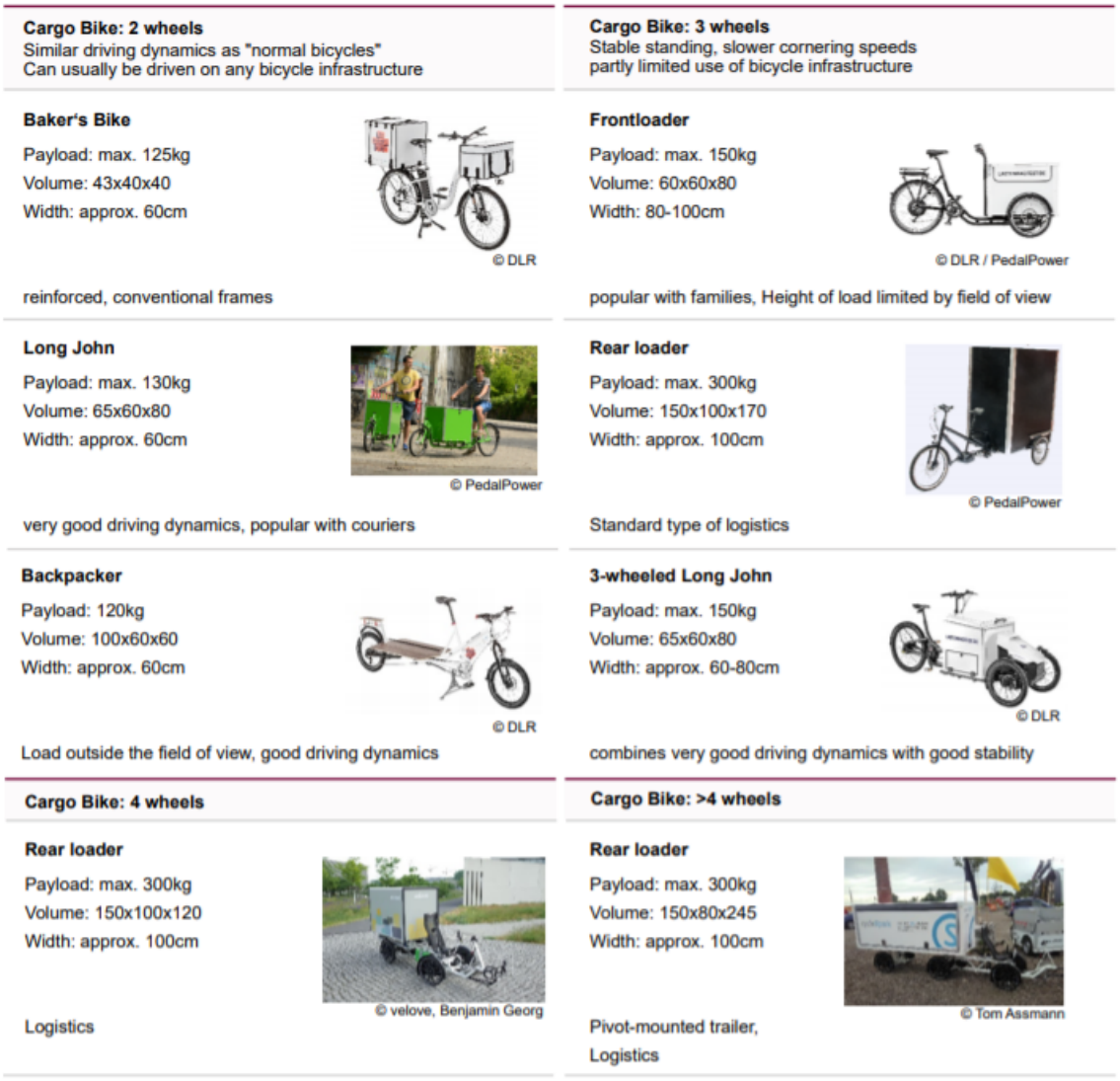

Figure 4. Examples of cargo e-bikes and typical dimensions and payloads

Source: Assmann et al.[29]

[29] Tom Assmann, Florian Müller, Sebastian Bobeth, Leonard Baum, *Planning of cargo bike hubs: a guide for municipalities and industry for the planning of transshipment hubs for new urban logistics concepts* (Universität Magdeburg, 2020). http://cyclelogistics.eu/sites/default/files/downloads/Hub%20Planning%20Brochure_EN_Web_final.pdf

Maximum cycle widths

Maximum permissible widths of cargo e-bikes vary among jurisdictions in North America and Europe. There is no single standard for the maximum width.

For example, the maximum width of a "bicycle with electric assist" is set at 36 inches in accordance with New York State's Vehicle and Traffic law.[30] However, a proposal to increase the maximum width to 55 inches is moving through New York State's legislative process e as of summer 2021.[31]

City of Chicago regulations allow for amaximum width of 4 feet.[32] [33]

In Europe, a key consideration that influences the maximum width of cargo e-bikes is the number of cycle wheels. In Denmark, "a bicycle may not have a width greater than 1 metre in either loaded or unloaded condition, however, *a bicycle with more than two wheels* may have a width of up to 1.25 metres. Operating levers and mirrors are not included in the width of the bicycle." "On a two-wheeled bicycle, the width of the handlebars must not exceed 70 centimetres. Operating levers and mirrors are not included in the width of the handlebars."[34]

The City of Berlin hasn't drafted regulations relying el instead on the national standard requirements for cargo e-bikes, Germany DIN 79010, published in 2020.[35] This standard applies to single-track (two-wheeled) cargo e-bikes up to 1 metre wide and multi-track (three- and four-wheeled) cargo e-bikes up to 2 metres wide.

[30] Government of New York State, *Vehicle and Traffic Law*, Consolidated Laws of New York, Chapter 71 https://www.nysenate.gov/legislation/laws/VAT/102-C

[31] Ben Morris, "Opinion: State Legislature Must Pass Jessica Ramos's Bill to Allow for Wider Cargo Bikes," *Streetsblog NYC*, May 26, 2021. https://nyc.streetsblog.org/2021/05/26/opinion-state-legislature-must-pass-jessica-ramoss-bill-to-allow-for-wider-cargo-bikes/

[32] City of Chicago, *Municipal Code of Chicago*, section 9-4-010. https://codelibrary.amlegal.com/codes/chicago/latest/chicago_il/0-0-0-2645076

[33] Courtney Cobbs, "Electric cargo delivery bikes could be coming to a bike lane near you," *Streetsblog Chicago,* October 2, 2020. https://chi.streetsblog.org/2020/10/02/electric-cargo-delivery-bikes-could-be-coming-to-a-bike-lane-near-you/

[34] Government of Denmark, Danish Transport Authority*, BEK no. 976 of 28/06/2016 Executive Order on bicycle fittings and equipment, etc.* https://www.retsinformation.dk/eli/lta/2016/976, https://www.fstyr.dk/da/Krav-til-koeretoejer/Regler-for-koeretoejer/Krav-til-cykler

[35] Beuth publishing, *DIN 79010:2020-02 Cycles - Transportation bikes and cargo bikes - Requirements and test methods for single- and multi-track cycles.* https://www.beuth.de/en/standard/din-79010/315466805

Cycle lengths including trailer combinations

As with maximum widths, the maximum permissible length of a cargo e-bike varies from one jurisdiction to another and in some cases isn't regulated. Denmark regulates length with and without trailers: "A bicycle must not be longer than 3.5 m in a loaded or unloaded condition. A trailer for a bicycle may not have a width greater than 1 m in either a loaded or unloaded condition. The total length of a bicycle and trailer in a loaded or unloaded condition must not exceed 3.5 m."[36]

Cycle weights

Few cities regulate weight limitations for cargo e-bikes. New York City did not set a maximum device weight in its commercial cargo e-bike pilot program with delivery companies.[37]

Germany is the only European Union member state with a specific standard for cargo e-bikes including single-track bikes that are allowed a maximum total permissible weight of 250 kg and multi-track bikes a maximum total permissible weight of 300 kg: "This standard specifies general requirements and test methods for single-track transport and cargo bicycles with a maximum width of 1 m and a permissible total weight of a maximum of 250 kg, also with electric motor support (with a rated continuous output of max. 250 W and up to a speed of 25 km/h) for the transport of goods and people." The standard also applies to multi-track transport and cargo bicycles with a maximum width of 2 m and a permissible total weight of a maximum of 300 kg (with nominal continuous power of maximum 250 W and up to 25 km/h).[38]

However, the German standard also says in the introduction: "Due to the skills and experience of this working group, the scope of this document was limited to permissible total weights of 250 kg for single-lane and 300 kg for multi-lane transport and cargo bikes. The employees expressly welcome the latest developments in the logistics and mobility sector and the development of heavy transport and cargo bikes with permissible total weights of over 250 kg and 300 kg, respectively. This standard does not prevent the development of heavy transport and cargo bikes with dimensions larger than those specified in this document or with a higher permissible total weight."

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[36] *BEK no. 976 of 28/06/2016 Executive Order on bicycle fittings and equipment, etc.*

[37] Eugenia Tang, New York City Department of Transportation, personal communication, September 9, 2021.

[38] *DIN 79010:2020-02 Cycles - Transportation bikes and cargo bikes - Requirements and test methods for single- and multi-track cycles.*

Further, there is ongoing work to include cargo e-bikes in the existing European e-bike standard EN 15194 (EPAC – Electrically Power Assisted Cycles). This would bring a cargo e-bike standard to all of Europe and help to encourage standardization elsewhere.

In Germany, the rules for e-bikes, registration and licence plates are determined by the wattage of an electric bike. There is ongoing discussion as to whether the rules can and should be changed as heavy commercial cargo bikes come on the market.

Operating parameters

> "Anne Goodchild, the director of the University of Washington's Supply Chain Transportation and Logistics Center, pointed out that cargo bikes are smaller, nimbler, and easier to maneuver than trucks and emit no greenhouse gases. While a delivery truck may have to circle the block a few times before finding parking, a cargo bike can just park by the door of the building receiving the delivery, she said. '**That's one of the underlying big questions for it to be an improvement over the van: Where are you allowed to operate it and where can you park it?**' Professor Goodchild said. 'If you can use a bike lane when there is congestion on the travel lane, you can continue moving while a box van wouldn't.'"
>
> — *The New York Times*[39]

Cities are taking a relatively permissive approach in drafting regulations that determine where cargo e-bikes are allowed to go. Cargo bikes are often permitted on most streets and cycling facilities including painted bike lanes and protected/separated cycle tracks, with some exceptions noted on sidewalks and on popular shared-use pathways in various cities. Allowing cargo e-bikes to use bike lanes and similar urban transport infrastructure helps prioritize cargo e-bikes on urban streets. Permitting cargo e-bikes on urban streets strengthens the business case for using cargo bikes to make commercial deliveries: the upfront investment and maintenance costs are minimal, and operational costs incurred by the delivery service plummet as less time is spent idling in traffic congestion.

The City of Toronto's Freight and Goods Movement Strategy includes the implementation of a cargo e-bike pilot program and recommends that the city promote using cargo e-bikes to reduce the environmental impacts of urban goods movement on

[39] Winnie Hu and Matthew Haag, "Park it, trucks: Here come New York's cargo bikes," *The New York Times*, December 4, 2019. https://www.nytimes.com/2019/12/04/nyregion/nyc-cargo-bikes-delivery.html

city streets.[40] Allowing cargo e-bikes to use as much operating infrastructure as possible would help achieve this objective.

However, and as noted in European cities where cargo e-bikes are widely used, an extensive network of quality cycle lanes, tracks, and other infrastructure is a prerequisite if the city and the private sector are to add cargo bikes onto the road and to encourage the continued uptake of the bikes.

> "The groundwork for Europe's embrace of cargo bikes was laid by 'countries that have invested significantly and for a long period of time in the engineering and construction of bike-friendly roadways.' Europe is now so far ahead of the U.S. on cargo bikes that the company would have to ship equipment from overseas to do an American deployment, adding 'significant costs associated with transportation and import,' according to the spokesperson."
>
> — *DHL spokesperson, as cited in Bloomberg CityLab*[41]

An additional reason to allow widespread use of cargo e-bikes on streets and bike facilities is to limit their use on sidewalks. According to a forthcoming research paper from the University of Washington, the delivery cyclists in the Seattle cargo e-bike pilot rode on sidewalks approximately 40% of the time.[42] This could create significant challenges in dense urban areas, affecting accessibility and pedestrian safety, especially for people with disabilities or maneuvering strollers and the like.

Worth noting at this stage of regulatory development in Toronto is that the high number of cargo e-bikes in some European cities, plus the trend toward wider cargo e-bikes to carry more packages, is starting to create infrastructure and planning issues. Bikes up to 1.2 metres wide require cycling facilities that are at least 1.5 metres wide, and ideally wider, but this width is not the standard in most areas.[43] For instance, the amount of space between two larger, commercial cargo e-bikes of 1.2 metres width each, plus mirrors, would be extremely narrow when passing each other in opposite directions in a 3.0 metre wide bidirectional and barrier-protected cycle track.

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[40] City of Toronto report to city council, *Additional background on cargo e-bikes and proposed by-law amendments,* June 7, 2021. https://www.toronto.ca/legdocs/mmis/2021/cc/bgrd/backgroundfile-167829.pdf

[41] David Zipper, "We are going to need a lot more electric delivery bikes," *Bloomberg CityLab*, September 1, 2021. https://www.bloomberg.com/news/articles/2021-09-01/how-to-pave-the-way-for-more-electric-delivery-bikes

[42] Cited in "We are going to need a lot more electric delivery bikes."

[43] "We are going to need a lot more electric delivery bikes."

Parking parameters

Parking policies play an important role to ensure that cargo e-bikes remain a competitive and desirable zero-emission delivery mode. There is a need to set some rules to facilitate cargo e-bike parking and to ensure that cargo e-bikes can safely and efficiently park by the entrance of buildings — without over-regulating where they can park within the right-of-way or off-street on public and private properties. Cargo e-bikes present many benefits public and private and ample safe parking options should be encouraged. As such, over-regulating and prohibiting parking in many locations may minimize the opportunity of cargo e-bikes.

There are different approaches and strategies on regulating cargo e-bike parking in North America. In New York City, commercial cargo e-bikes are allowed to park anywhere a regular commercial vehicle is allowed to park, [44] [45] but they are exempt from parking meter payment, which is $5 to $8 per hour.[46] A commercial vehicle parking permit is not needed to park curbside in New York City.[47] New York has also built special cargo e-bike corrals throughout the city to use for parking, as part of the city's pilot project.

Ottawa allows cargo e-bike parking for personal and commercial use in all bicycle parking facilities. Commercial cargo e-bike users have an additional parking option: apply for a short-stay permit to use loading zones and no-parking zones for up to15 minutes. The operator must be actively engaged in delivery activities.[48]

[44] New York City Department of Transportation, *Commercial cargo bicycle pilot, a new mode for last mile deliveries in NYC, evaluation report,* May 2021. https://www1.nyc.gov/html/dot/downloads/pdf/commercial-cargo-bicycle-pilot-evaluation-report.pdf

[45] City of New York, *the Rules of The City of New York.* https://codelibrary.amlegal.com/codes/newyorkcity/latest/NYCrules/0-0-0-63614

[46] Paul Berger, "New York City offers free parking to delivery firms' cargo bikes," *The Wall Street Journal*, December 4, 2019. https://www.wsj.com/articles/new-york-city-offers-free-parking-to-delivery-firms-cargo-bikes-11575481818

[47] City of New York, "Commercial vehicle parking information." https://www1.nyc.gov/nycbusiness/description/commercial-vehicle-parking-information

[48] City of Ottawa, *2021 Report E-Cargo Bike Pilot Project,* September 1, 2021. https://app05.ottawa.ca/sirepub/mtgviewer.aspx?meetid=8332&doctype=agenda&itemid=413780

In Chicago, cargo e-bikes must park in regular parking spaces only.[49] Cargo e-bikes in Chicago are prohibited from parking on sidewalks or in on-street bike corrals.[50] [51]

On the other hand, Berlin does not have specific rules and guidelines for cargo e-bike parking, beyond their new design specification to allow conversion of curbside parallel vehicle parking into three cargo e-bike spaces at a 45-degree angle (Figure 5).[52] Berlin has also tested a microhub in a public parking lot with DHL, UPS, and others.[53] [54]

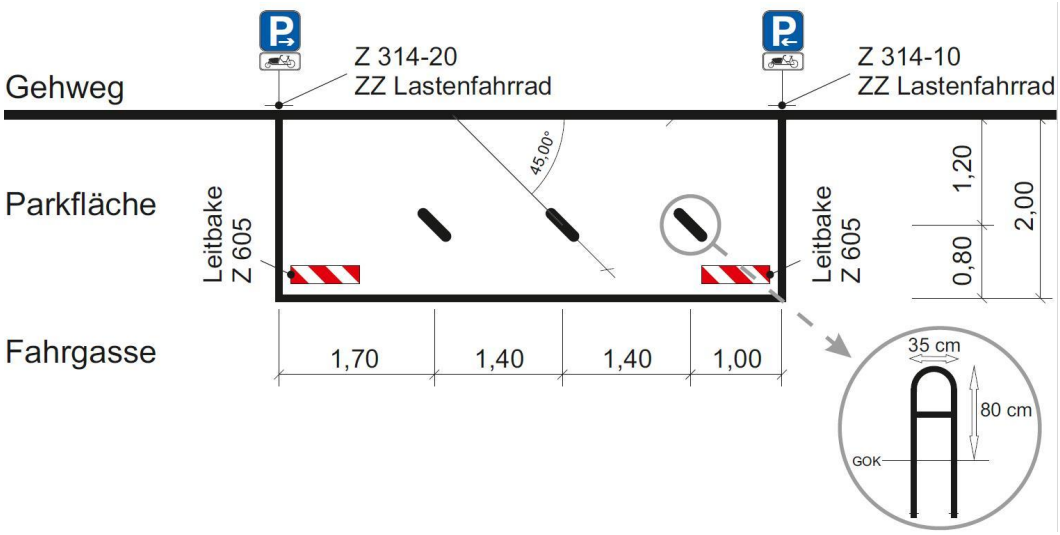

Figure 5. The City of Berlin's regulating standard for cargo bike parking

Source: City of Berlin[55]

[49] Supply Chain Transportation and Logistics Center, "The electric bike that could change delivery as we know it," December 7, 2020. https://depts.washington.edu/sctlctr/news-events/in-the-news/electric-bike-could-change-delivery-we-know-it

[50] "Electric cargo delivery bikes could be coming to a bike lane near you."

[51] City of Chicago, *Municipal Code of Chicago*. https://codelibrary.amlegal.com/codes/chicago/latest/chicago_il/0-0-0-2594411

[52] "Berlin: Senate adopts regulation plan for cargo bike parking spaces," *Cargobike.jetzt,* November 20, 2019. https://www.cargobike.jetzt/regelplan-cargobike-parkplaetze-berlin/

[53] Philip Oltermann, "Four wheels bad, but three sehr gut. Germans climb aboard cargo bikes," *The Guardian,* August 25, 2019. https://www.theguardian.com/world/2019/aug/25/cargo-bikes-berlin-four-wheels-bad-transport

[54] Giuseppe Aiello, Salvatore Quaranta, Antonella Certa nd Rosalinda Inguanta, "Optimization of Urban Delivery Systems Based on Electric Assisted Cargo Bikes with Modular Battery Size, Taking into Account the Service Requirements and the Specific Operational Context," *Energies* 14 no. 15 (2021). https://www.mdpi.com/1996-1073/14/15/4672

[55] City of Berlin, "Senate administration issues new regulation plans for the parking of cargo bikes and e-scooters," November 8, 2019. https://www.berlin.de/sen/uvk/presse/pressemitteilungen/2019/pressemitteilung.863628.php

Safety considerations

Permits

Requiring a permit to operate commercial cargo e-bikes varies across jurisdictions. Cities can use permits to track cargo e-bikes with individual identification numbers – like licence plates – encouraging safe behaviour and allowing municipal enforcement of the traffic and parking rules. Permits can also be used to ensure adequate insurance coverage and other ancillary purposes like parking privileges.

Until recently, New York City did not have a permit system for their commercial cargo e-bike pilot program, although commercial operators were required to place a sticker/unique identification number on their bikes during the pilot project. Now that the program has been announced as permanent,[56] the city is creating a permit system. While details are still being finalized, "the permit system will more or less be the payment method for curbside usage though [the city doesn't] intend on making the permit fee costly to help incentivize companies to use cargo bikes more."[57]

In contrast, the City of Chicago requires commercial cargo e-bike operators to have a licence, while permits are required for bike messengers.[58] The license requirements are described in the Municipal Code.[59]

Illinois State law includes label requirements for cargo e-bikes which list the "classification number, the bicycle's top assisted speed, and the bicycle's motor wattage".[60]

Insurance

In Chicago, the licence for commercial cargo e-bike operators (as noted above) includes a commercial general liability insurance requirement of $300,000.

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[56] City of New York, *Twitter*, May 5, 2021. https://mobile.twitter.com/NYC_DOT/status/1389978593086877699

[57] Tang, personal communication.

[58] "Electric cargo delivery bikes could be coming to a bike lane near you."

[59] City of Chicago, *Municipal Code of Chicago*.

[60] Government of the State of Illinois, *Bill SB0396 on veh-low-speed electric bicycle.* https://www.ilga.gov/legislation/BillStatus.asp?DocNum=396&GAID=14&DocTypeID=SB&SessionID=91&GA=100

Neither New York City nor Seattle appear to require any insurance coverage. In the European Union, some e-bikes are excluded from insurance obligations.[61] This includes e-bikes that are "pedal cycles with pedal assistance which are equipped with an auxiliary electric motor having a maximum continuous rated power of less than or equal to 250 W, where the output of the motor is cut off when the cyclist stops pedalling and is otherwise progressively reduced and finally cut off before the vehicle speed reaches 25 km/h".[62] E-bikes not meeting this definition may be required to have insurance subject to European Union and/or member state regulations.

Other requirements

In New York City, all commercial bicyclists must complete a commercial bicyclist safety course.[63] Commercial cargo e-bikes in New York City may not be left on-street overnight and businesses must provide overnight storage for their fleet.

[61] European Parliament, "Deal reached on new rules to better protect road accident victims," June 22, 2021. https://www.europarl.europa.eu/news/en/press-room/20210617IPR06467/deal-reached-on-new-rules-to-better-protect-road-accident-victims

[62] European Parliament and Council, "Regulation (EU) No 168/2013 of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles." https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32013R0168&from=EN#d1e527-52-1

[63] City of New York, "Commercial bicycling." https://www1.nyc.gov/html/dot/html/bicyclists/commercial-cyclists.shtml

5. Stakeholder input on City of Toronto regulations and pilot

The Pembina Institute and the City of Toronto held a small-group virtual discussion on October 1, 2021. The purpose of the session was to obtain insights and input on regulatory and infrastructure considerations for cargo e-bikes for personal and commercial use. To help the City develop parameters for a municipal pilot for large cargo e-bikes over 120 kg unladen, the session focused on four issue areas: cargo e-bike specifications, operating parameters/infrastructure use, cargo e-bike parking, and safety and implementation considerations. The Institute also facilitated a general discussion to define success and challenges. The input would help to update and/or create new municipal by-laws and practices for safe and efficient operations.

The small-group discussion included environmental and civil society groups, bike advocacy groups, micromobility policy experts, bike retailers that sell cargo e-bikes, and academics. The City of Toronto conducted sessions with the business community separately to gather feedback from this stakeholder group.

The following sections summarize the feedback received under the topic areas as presented in the group discussion.

5.1 Cargo e-bike specifications

What are the pros/cons of differentiating personal from commercial use? What criteria could/should be used to differentiate? What thresholds could/should be used? What parameters should be set for commercial use and why? Should Toronto add any more restrictions over and above the Ontario regulation, and why?

- The stakeholders agreed that distinguishing between personal and commercial cargo e-bikes makes sense; however, they believe it might be challenging to license and enforce.
- Many stakeholders also see value in simplifying the rules for personal use while applying more complex regulations for commercial usage.
- Many stakeholders find the 32 km/hr speed limit a reasonable limit for cargo e-bikes.

- Some stakeholders believe that applying a 25 km/hr speed limit may be challenging, given Canada's link to American markets where 32 km/h is typical. In contrast, others think the city could enforce a 25 km/hr speed limit without significant resistance since they will have the authority to issue commercial operator licenses.

5.2 Operating parameters

Where should larger cargo e-bikes be permitted to operate in Toronto? Indicate support (or not) for different facilities (e.g., roads/streets, bike lanes, cycle tracks, multi-use trails and paths, sidewalks). What are the potential impacts, if any? How might risks be mitigated? What are the policy considerations? How can large cargo e-bikes integrate well with other road users?

Sidewalks

- One stakeholder believes that sidewalks shouldn't be considered for use by cargo e-bikes, given their size.
- Other stakeholders recognize that the cycling infrastructure in Toronto is insufficient and foresee that cargo e-bike operators will often find themselves in situations where they need to use sidewalks to ensure their safety.

Multi-use pathways

- There were a variety of viewpoints regarding allowing cargo e-bikes on multi-use pathways.
- Some believe that commercial cargo e-bikes shouldn't be permitted on multi-use pathways. Others think they should be allowed if the paths are certified by the city for sufficient width and connectivity.
- Some stakeholders were concerned about allowing cargo e-bikes on multi-use pathways, given that these pathways are predominantly used for recreational purposes and tend to have more children and older adult users.
- Other stakeholders were less concerned because they believed that cargo e-bikes downtown would likely use the road network because it's more efficient, while pathways will be used more often in the suburbs.

Cycle tracks

- The main point raised was increasing the minimum widths of cycle tracks and updating the city's design guidelines to justify larger widths.

5.3 Parking cargo e-bikes

Indicate support (or not) for cargo e-bike parking in different facilities (e.g., on-street commercial loading zones and delivery vehicle parking zones, on-street regular parking, sidewalks in furniture zone, no-parking zones for a time limit, other) What are the potential impacts, if any? How might risks be mitigated? What are the policy considerations?

- The stakeholders agree that creating designated parking zones for cargo e-bikes makes sense. It would be unsafe to stop on the cycle tracks, considering cargo e-bikes' average sizes and the cycle tracks' current minimum widths.
- Until the cycle track widths are increased to accommodate stopped cargo e-bikes while maintaining a safe distance for other cyclists, stakeholders see value in designated parking spaces.
- The stakeholders raised safety concerns regarding using no-parking zones for cargo e-bikes given the proximity to high-speed traffic on some streets. One stakeholder believes that the city should look at the issue holistically and potentially investigate street conversion instead of arbitrarily re-designating no-parking zones for cargo e-bike usage.
- Additional concerns were raised regarding allowing cargo e-bikes to park on the sidewalk, given space limitations. Although parking in the furniture zone may provide an incentive, one stakeholder believed that space restrictions can't be ignored.
- Stakeholders agree that secured parking for cargo e-bikes is essential. One stakeholder believes that parking and loading may be a key area where the city can create incentives for cargo e-bike usage absent safer and more connected cycling infrastructure.
- Stakeholders recommend that the city legislate requirements for multi-unit residences to have proper cargo e-bike parking in addition to working with the Toronto Parking Authority to free up parking spaces for cargo e-bikes.

5.4 Safety considerations

Provide feedback on permit requirements, accountability measures to ensure safety, how liability should be handled, data collection, and managing complaints and enforcement.

- Although the stakeholders agreed that issuing permits for commercial cargo e-bikes in the long term is important, there was no apparent consensus between the stakeholders regarding how the pilot should start in terms of permitting requirements.

- One stakeholder thinks that predictability for commercial operators is critical for them to plan and operate their fleets over many years. The same stakeholder thinks that if permits can't be issued at the start of the pilot, clarity regarding the permitting parameters should be communicated as much as possible and as early as possible.
- Another stakeholder believes that starting the pilot without issuing permits makes sense. They don't foresee a large influx of cargo e-bikes at the start of the pilot. They believe that if commercial operators disagree with the permitting rules, they have the flexibility of moving their fleets to other cities, and potentially introducing new fleets into Toronto if/as required.

5.5 Desired outcomes and potential pitfalls

What are the biggest challenges with large cargo e-bikes in the short, medium and long term? How could these issues be resolved? How do you define success of a large cargo e-bike pilot program? What would failure look like? How would you evaluate and measure success or failure? How often should progress be evaluated? What role can external entities play in evaluation?

- Stakeholders had similar perspectives in terms of what the pilot's success or failure could look like.
- Many believe that success would be the increased adoption of cargo e-bikes, fewer trucks on the road, a clear modal shift and no accidents or collisions.
- Other forms of success shared by the stakeholders include expanding supporting infrastructure, and seeing the use of cargo e-bikes become the new norm to the extent of being comparable to car-share programs.
- The stakeholders shared several challenges they anticipate with the introduction of larger cargo e-bikes, including negative public perceptions towards cyclists due to disruptions as well as public concerns and conflicts regarding the use of shared infrastructure such as sidewalks and multi-use trails.
- Lack of secured parking and unclear communication regarding the pilot's rules and objectives were also highlighted as potential challenges.
- The stakeholders think that failure, on the other hand, would manifest in low adoption and safety concerns.
- Additionally, one stakeholder emphasized the need to collect data to measure the progress and success of the pilot and noted that this might be challenging to do.

6. Conclusion

The Pembina Institute has identified common cargo e-bikes and their specifications and features; sourced and reviewed key regulations in select jurisdictions; and engaged stakeholders and documented their feedback on relevant issue areas and how they define the success, failure, and challenges of a large cargo e-bike pilot program.

As the City of Toronto begins to update and/or create new by-laws and practices for cargo e-bikes, considerations should be given to the following:

- **There is a range of unique cargo e-bike models** on the market in North America and Europe for personal and commercial use.
- **Cargo e-bikes operated for commercial use for urban delivery or passenger travel are generally larger than those for personal use.** While there are some exceptions, commercial use cargo e-bikes are typically wider and heavier than personal use cargo e-bikes.
- **Specifications of cargo e-bikes differ from one model to another.** There is no one standard for maximum widths, lengths, and weight (unladen or loaded) and as such, policy-makers in North America and Europe are taking different approaches to setting regulations and standards. Germany is the only jurisdiction that has published a national safety standard for cargo e-bikes.
- **Cycling operating infrastructure:** Cargo e-bikes are often allowed on most streets and cycling facilities, including painted bike lanes and protected/separated cycle tracks, with some exceptions on popular shared-use pathways in various cities. Allowing cargo e-bike use in as much operating infrastructure as possible, with the exception of sidewalks for accessibility, would help promote this mode of urban goods transport.
- **Adaptive policy and design:** Given the opportunities that cargo e-bikes present and the fact that wider cargo e-bike models are coming on to the market, policy-makers are considering widening bike lanes and cycle tracks in their planning and urban design work. The need to widen cycling facilities was a strong message heard from several stakeholders in the small-group discussion.
- **Parking:** Parking policies play an important role to keep cargo e-bikes competitive and a desirable zero-emission delivery mode, and as such cargo e-bike parking should not be over-regulated. Different approaches and strategies on regulating cargo e-bike parking are used in North America.
- **Safety:** Cities are handling safety considerations such as commercial permits, insurance requirements, and safety equipment in different ways. Based on our

scan of regulatory frameworks, there is no single consistent approach to regulating e-bikes, cargo e-bikes and/or bicycles as it is highly dependent on the geographic, and social and cultural context.