LIGHT ELECTRIC VEHICLES IN BOGOTÁ: CITY ROADMAP

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ABOUT

This document describes the roadmap to achieve electrification of light electric vehicles

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Light Electric Vehicles in Bogotá: City Roadmap

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Executive Summary

Bogota has made great strides in the development of sustainable mobility policies and projects. Since the decade of 1990, its improvements have included the creation of a mass transit system that spans throughout the city, a network of currently 500+ kilometers of bikeways, and several hundred thousand square meters of new public space and sidewalks. In terms of mobility in smaller vehicles, the city has increased the use of bicycles from 0,6% of mode share since 1995 to over 6% in 2019, and this has been accompanied by the deployment of a wide array of services and systems in the city.

One of the topics that has received little attention in Bogota has been the improvement of conditions of Light Electric Vehicles, that has started to happen through the application of national level regulations, private sector involvement, and pilot projects for issues such as e-cargo bicycles, shared e-scooters and e-bicycles, and in general the deployment of a nascent market for light electric vehicles and their operation in private and public services.

Though there are some key national government regulations that provide orientation to cities on what types of vehicles can circulate on the street, there is little detail about how they can operate, where they can circulate, and what thresholds exists for these vehicles. Local-level government agencies have made an effort to regulate some of these operations properly, but they are in need of a more robust framework that can be established through the implementation of a roadmap for the city.

The goal of this roadmap is to increase the successful uptake of LEV in non- micromobility users (e.g. from cars, trucks) while preserving mode share of public transport, cycling and strengthening the regulatory conditions for the safe deployment of those vehicles in Bogota.

More specifically, its objectives are:

- To increase presence of LEV in private sector endeavors
- To improve regulatory approaches (circulation, infrastructure guidelines)
- To reduce proliferation of banned vehicles that are sometimes confused with LEVs (ciclomotores, bicitaxis).

In order to do this, the roadmap establishes short, medium and long term goals to address the obstacles to achieve these objectives and to implement specific actions to move forward in filling the existing gaps for this service. To get there, it presents six focus areas:

Focus area 1: Urban Planning: The city has recently published its “POT” (a land policy plan for the years 2022-2035) that has some mention of sustainable transport but does not address e-mobility for light electric vehicles, deployment of these vehicles to improve freight and logistics, or to actively promote mode shift. Addressing these issues through the development of actions geared towards better zoning, location of cargo zones in key areas, and incentives to deploy services that use light electric vehicles can improve their probability of success. The implementation of mobility hubs can become key milestone of this effort.

Focus Area 2: Regulatory measures: While the national government has issued several laws, resolutions and recommendations towards the operation of light electric vehicles and the local government has complemented those with specific indications for their operation as public and private services, there are several gaps that the roadmap shall address: determining how to define specific vehicles, and what thresholds exist and how they'll interact with the different rules around circulation, curbside management and other issues.

Focus Area 3: Economic and Financial measures: There are currently no economic or financial incentives for the operation of light electric vehicles in Bogota, though the city's Bicycle Policy can be used partially for this purpose. The roadmap defines how these incentives could work and what sources of financing could be used to strengthen the amount and diversity of funds to deploy Light Electric Vehicles for use in private and public services.

Focus Area 4: Charging (and other) infrastructure: Bogota is devoid of charging infrastructure (only very few private initiatives exist, and in a large majority they are aimed at automobiles), and other infrastructure for light electric vehicles is lacking. The roadmap defines with greater clarity the needs for charging infrastructure, the steps to deploy a network of charging stations and mobility hubs around the city with support from the private sector.

Focus area 5: Partnerships and public awareness: While Bogota is known to be a cycling city, the use of Light Electric Vehicles is not so well known, especially the benefits that come from shifting to that vehicle from larger ones in the case of freight and other types of operation. The roadmap describes the activities that can increase awareness in the private sector and citizenry, and the potential partnerships that can be sought to strengthen the use of these vehicles for commercial services.

Focus area 6: Road Safety policies: protecting the users of these vehicles is paramount in reducing risks from their use and in improving the interaction with larger vehicles. The roadmap establishes actions to reduce risks by defining communication needs towards drivers of larger vehicles while also improving knowledge of safe riding for riders of Light Electric Vehicles.

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1 Introduction

1.1 Why focus on Light Electric Vehicles (LEVs)

Light Electric Vehicles (LEVs) have been recognized more recently as having a significant potential role in urban mobility. They are more versatile than their non-electric counterparts, have lower energy consumption than the larger electric vehicles (cars or others) and have created a new "niche" in transport services. All of this makes it relevant to develop clear actions to assess their potential and provide indications for their adequate inclusion in the urban setting, to be part of a harmonic arrangement in mobility.

Technology and digitization of transportation services and operation has been beneficial, and more so in the case of smaller vehicles that have arrived with a considerably greater array of technological functions to cities. This has increased the flexibility of service provision, but has also created new challenges of its own (privacy concerns, tracking and monitoring citizens, etc).

The fact that these vehicles exist and are already riding along city streets has considerable implications for the definition of street design parameters, dimensions of infrastructure currently dedicated to bicycles and pedestrians, curb management and regulations relating to vehicle use and, in general, to the integration of LEVs within a city and its different transport services.

There are several related terms that must be clarified:

- **Light Electric Vehicles** are electric vehicles, with a number of wheels greater than or equal to 1 and less than or equal to 4, designed for personal mobility, transport of passengers or goods in an urban setting, propelled by electric motor(s) in pedal assistance mode or in exclusive mode. Their maximum continuous power is fifteen (15) kilowatts (kW) and is reduced or interrupted when the vehicle reaches a maximum speed of 45 kilometers per hour (km/h) (maximum values).
- **Micromobility** (based on ITDP's definition [1] and that of SAE [2]), refers to vehicles that are human-powered or (partially or totally) electric; privately owned or shared; have a curb weight ≤ 500 lb (227 kg); have a top speed ≤ 30 mph (48 km/h).
- **Active travel / mobility** is defined as "all travel in which the sustained physical exertion of the traveller directly contributes to their motion"[3];
- **Non–motorized transport / mobility** is a legacy term used for cycling and walking, and by extension to refer to all small vehicles that are human-powered [4].

Several of these categories overlap (see Figure 1 for one proposed differentiation showing that overlap). This roadmap will address LEVs and will use literature relating to other terms when it provides useful insights for the development of this roadmap.

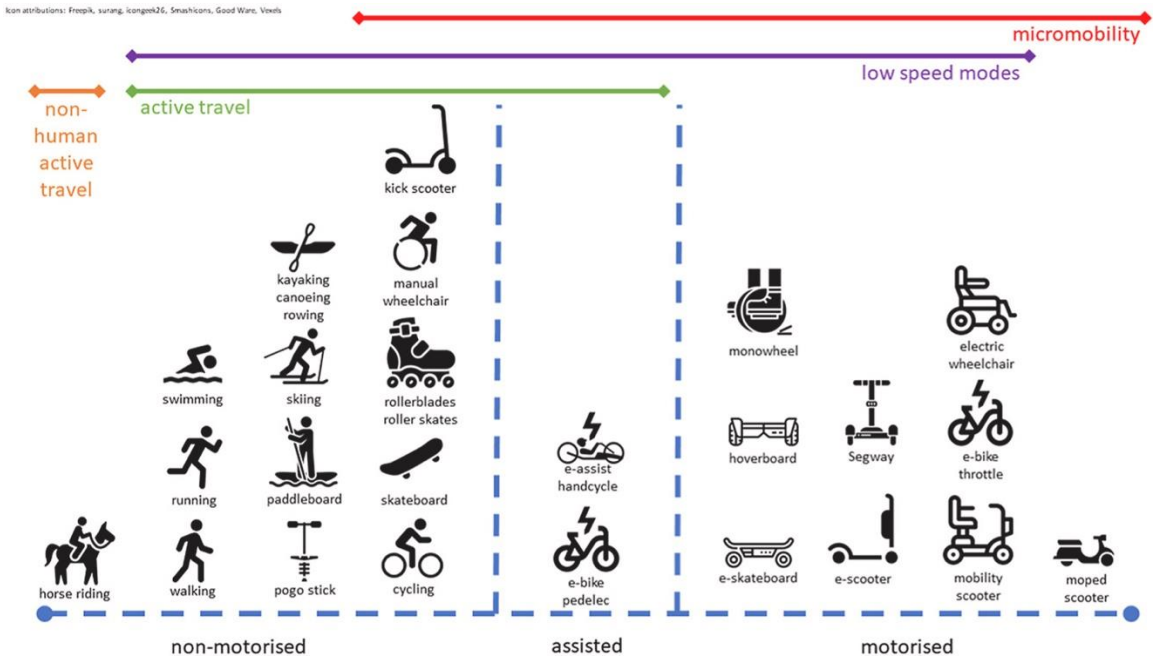


Figure 1. A comparison between terms and how they overlap [3].

Also, this roadmap will address "**ciclomotores**" (two stroke two- and three-wheelers that operate as bicycle taxis) as a small vehicle that is not desirable in city streets and should be phased out of operation to increase safety and reduce pollution. Those vehicles are not included in any of the terms described above.

1.2 This report

This report provides a roadmap for the successful regulation of LEV operation in Bogotá, specifically for the following modes:

- Cargo bicycles and tricycles (electric and "acoustic"[1]) as part of company fleets;
- Cargo bicycles and tricycles (electric and acoustic) as private vehicles;
- Electric scooters in shared mobility services;
- Electric scooters used as private vehicles;
- Undefined/emergent small vehicles.

The report begins by providing background on current mobility conditions in the city (and, when relevant, the country), specifically in the case of LEV operation. It also describes related initiatives and projects at the local level and some international examples. It identifies obstacles that are identified for successful deployment. The report then describes the approach followed to arrive at the roadmap, followed by the roadmap itself, the implementation plan and its focus areas. It concludes with indications of next steps.

[1] This term is a proposal to differentiate "non e-bikes" from traditional bicycles, as explained in https://discerningcyclist.com/acoustic-bikes/

2 Background – Where are we now?

2.1 Urban mobility context in Bogotá

The latest study describing Bogotá's travel characteristics is its 2019 **Origin-Destination Study** [5]. Some of the key insights of that report as they relate to this roadmap are the following:

- Total trips in Bogota are more than 15 million a day (15,831,826), 13.3 million when eliminating the walking trips that are shorter than 15 minutes. The trip's average per person is 1.81.
- 6.9 million daily trips are made by women.
- 37% (4.6 million) of those belong to public transportation, 6.6% (880 thousand) cycling, 14.9% (2 million) by car, and 5.5% using motorcycles.
- The average travel time is 51.9 minutes.
- There are 237.9 motorized vehicles on average per thousand inhabitants, which means that there are 147.9 cars and 53.7 motorcycles on average per thousand inhabitants.
- Public transportation, motorcycle, and bicycle are mainly used by people between 19 to 40 years old, meanwhile, cars and taxis are more used by older people.
- The three main trip purposes are 44.7% to return home, 32.1% to work, and 16.9% to study, other purposes like access to health, leisure, etc., have less participation.
- Bogotá has three peak hours, the most significant at 6:00, followed by the peak from 17:00 to 18:00, and the peak of noon.
- The origins of approximately 12,700,000 of the trips are in the peripherical zones of Bogota, and the main destinations match with the city center.

Bogota has also published a **Mobility Master Plan** in 2006 [6] and is currently updating it. The current version includes a chapter on "non-motorized transport" (related to identifying the benefits of walking,

increasing, and enhancing of cycling infrastructure), and logistics (related specifically to freight and consolidation nodes) [7].

Its update has undergone several stages, one of which was published in 2019, summarizing the evaluation process of the original plan. This update emphasizes eco-efficiency, incorporating electric mobility and light vehicles as key strategies.

Probogota, a local NGO, has a prospective study named **Bogota smart region 2051**, featuring a roadmap that highlights a smart regional mobility system. Goals include emission reductions, developing a MaaS-oriented platform, and consolidating active and last-mile mobility through technology.

Probogota has also analyzed the multimodal parameters of the current mobility system, reviewing seven variables for five modes (bike, BRT, cable car, metro, and train): investment, urban impact capacity, speed, operation, flexibility, and frequency. The analysis reveals that Bogota lags behind in planned versus built infrastructure, suggesting the inclusion of more shared vehicles.

A local thinktank composed of several private organization members, “Bogotá Cómo Vamos”, publishes annual citizen satisfaction surveys that review how people feel regarding changes and policies in the city. Two key insights from the latest report that are relevant to this roadmap are as follows:

- More people (56.2%) now perceive that they spend more time traveling compared to last year.
- Satisfaction with cycling infrastructure and bike-sharing increased, with 86% of citizens expressing full satisfaction, up from 80% the previous year.

2.2 Current Policy Framework and Market Readiness for deployment of e-mobility

In Bogotá (and Colombia), Light Electric Vehicles (LEVs) have been defined to an extent, with both city and country governments recognizing their importance and operation. The most relevant policies are described below.

Colombia has established a **National Strategy for Electric Mobility (ENME)**, a roadmap from 2018 to 2050 that includes five action lines with descriptions of their regulatory and policy instruments, economic and market strategies, technical and technological approaches, infrastructural plans, and projected investments. These measures aim to accelerate the transition to electric mobility, with a target of incorporating 600,000 electric vehicles by 2030.

Bogotá has a "**Plan de Ordenamiento Territorial**" [8] which was approved in 2022. This urban planning document sets rules and regulations for sustainable mobility. This includes future train and cable car projects articulated with a reinforcement of walking and cycling establishing green corridors is the strategy to consolidate a proximity network.

In terms of cycling, the city has published a **Bicycle Public Policy for 2021-2039** [9]. This policy is organized around five pillars: personal safety, road safety, more and better cycling trips, bikes for everyone, and

Bogota as a bicycle manufacturing hub. It also allocates specific budgets for each pillar with milestones from 2021 to 2039.

In terms of the operation of smaller vehicles with an electric motor, the city has issued several documents:

First of all, a "circular" was issued in 2018 to attempt a clarification on the operation of scooters, equating them to e-bikes as per National Government regulations. The Circular 006 del 12 de diciembre de 2018**, "Recomendaciones de tránsito para vehículos tipo patinetas con o sin motor"** [10], addresses topics like road safety, establishing the speed limit for these vehicles at 20km/h, suggesting the use of helmet and reflective materials, and forbidding the use of phones while driving. Also, it addresses some restrictions linked to parking and circulation of these vehicles.

In addition, the **Resolution 209 of 2019** [11] establishes the conditions under which an e-scooter or bicycle can provide a shared service while paying for the exploitation of public space, and this was further clarified by the **Resolution 86572 of 2021** [12] which extends the resolution to shared micromobility vehicles, not just e-scooters and bicycles. Further, **resolution 030 of January 2021** [13] includes the renting of micromobility vehicles as an activity allowed in certain public spaces.

All of these resolutions are summarized and explained in **technical document of 2022**, explaining the regulatory framework and the potential demand and modal shift derived from these vehicle offerings. It also defines specific city zones where these vehicles can operate.

Resolution 137609 of 2023 is related to mopeds ("ciclomotores")**,** reiterating the existing **National Resolution 160 of 2017** [14]. It establishes road circulation restrictions for these vehicles, limiting them to sidewalks and cycling infrastructure. As complementary material, the **ABC ciclomotores** guide offers implementation guidelines for this resolution.

In 2019, the New Urban Mobility Alliance also produced its own document with recommendations for Bogotá's micromobility deployment. The suggestions covered various topics, including:

- Making clear the vehicle classifications, considering that micromobility is more than bikes and scooters.
- Setting indemnification and minimum insurance requirements for operators.
- Specifying necessary characteristics and equipment to guarantee safety and proper operation.
- Defining zones for vehicle occupancy.
- Enhancing fleet distribution, availability, and parking spaces.
- Addressing financial issues, managing and collecting data.
- Establishing penalties and enforcement related to the exploitation of public space and citizen penalization.

There are no comprehensive estimates differentiating smaller electric vehicle fleets to help estimate the size of LEVs in the city. However, in 2020, when Muvo, Voom, and Grin were active in the city, there were 35,117 scooters registered. Also, in 2018, the ANDI reported approximately 2,600 electric motorcycles and mopeds in the Colombian market.

At the national level, Colombia has issued several documents related to climate change and transportation, the main being their **National Low Carbon Development Strategy (EDBC)** [15] and the related Action Plan. The goals of this strategy are to identify and evaluate the actions aimed at curbing emissions growth, develop action plans to mitigate emissions in each productive sector, and create tools for implementing, monitoring, and reporting the strategy.

Moreover, the country has issued a **NAMA on Active Travel and Demand Management** called **"TAnDem"** [16], which has the goal to increase the use of cycling and the responsible use of motorized vehicles to improve the urban quality of life and contribute to climate change mitigation. TAnDem is composed of several measures:

- Parking management schemes for automobiles.
- Low speed zones
- Bicycle parking facilities in multimodal nodes
- Bicycle parking facilities, on streets
- Construction and rehabilitation of bicycle lanes
- Formal bicycle taxis services
- Electrically assisted bicycles

The sole regulation related to small electric vehicles that could be useful for LEV regulation is the **Resolution 160 of 2017** issued at the national level by the Ministry of Transport [14]. This regulation defines e-bikes and differentiates them from "ciclomotores" (ICE-powered two- and three-wheelers).

In terms of market readiness, Bogotá has a robust market of electric vehicles that includes e-scooters of several sizes and power, e-bikes and e-motorcycles, and other similar vehicles. However, this subsector is not thoroughly documented.

Some of the current challenges related to the deployment of small electric vehicles and LEVs in general is the proliferation of ICE-powered two- and three-wheelers, mostly for deliveries (in two wheels) and biketaxis (three-wheel vehicles) which have not been effectively banned from the streets due to a lack of comprehensive enforcement.

The topic of ICE two- and three-wheelers is of grave concern, and is also associated to a precarious labor model as associated with gig-economy workers providing their labor to mobile application companies with no respect for their social security and working rights as employees.

There are some regulations associated to the operation of some of these vehicles, though there has been no follow up in that regard:

National resolution 3256 of 2018 [17] about bike taxis, which has as objective authorize and generate a regulatory base to use three and two wheelers, non-motorized and assisted, as a part of the public transportation offer. This resolution addresses the service conditions, operation, equipment and drivers, and vehicle registration.

There is a study of 2020 oriented to **Creating regulations around micromobility of passengers and freight** developed by Despacio to KFW and the National Government of Colombia, the document

established some micromobility principles and defines the vehicles subscribed under this category, finally, suggests a normative scenario, that includes modifications of the current resolutions and the introduction of new parameters oriented to data, public space, and environment.

The Ministry of Transport 2016 published the **Cycling infrastructure guide** that has been a reference document for urban and transport planning in Colombia, this guide considers a variety of vehicles and users, that could be wider in the current scenario, in this way, suggest the basic requirements related to ciclo-infrastructure, and some physical strategies to ensure these requirements.

It is also relevant to note that NACTO published a working paper in 2023, **Designing for Small Things with Wheels**, which recapitulates some measures and suggestions to adapt and build infrastructure considering the integration of micromobility and its variety in sizes, speeds, capacity, and others.

2.3 Existing initiatives and efforts

The city has currently a logistic pilot oriented to delivery using e-cargo bikes (2 and 3-wheelers), testing two operational models, one centralized and the other based on a collaborative delivery platform. This project established seven indicators to evaluate the pilot performance: total distance traveled, orders delivered, goods delivered, financial savings derived from fuel replacement, CO2 emissions saved, energy consumption, and improvements in road safety (e.g. less risk imposed to others due to smaller and slower vehicles than typical operation in trucks. Some of the results achieved so far are:

- The number of deliveries grew by 67% per hour, also the effectiveness of deliveries went from 93% to 97%[2].
- The pilot vehicles have an advantage over conventional motorcycles and bicycles due to their higher capacity and showed that two trucks can be replaced by three e-tricycles.
- The second operational model, a collaborative cross-docking platform in a strategic area of the city where distribution is not centralized but via a cross-docking platform where cargo bikes would collect goods and distribute them, shows more potential for cost saving and therefore, more potential for emissions reduction.
- The possibility of solar charging could generate more environmental benefits (because of the scope, budget and timeline of the project, solar charging was not tested in that project but was assessed initially).
- Stage 2 of the project shows that is possible to deliver freight that requires refrigeration using e-cargo bikes.

in July 2023 the Mobility Secretary of Bogota as part of the promotion of cycle-logistics delivered e- cargo bikes to city markets that will be used for small businesses to make their daily deliveries.

[2] Effectiveness measured as the percentage of packages sent that were not returned by recipient due to problems in delivery.

3 Approach – Methodology

This roadmap addresses the improvement (and creation) of regulations for LEVs including its relation to vehicles under the micromobility, non-motorized and active mobility definitions (see the introduction of this roadmap for those definitions).

The roadmap development is based on three main sources of information:

- **Local documentation** including government regulations and policy documents, as well as analysis of LEVs and related vehicles from local sources;
- **International documentation** that presents international case studies of LEV operation, which includes specific cases of local implementation (e.g. the BiciCargo case);
- **Discussions with key stakeholders** and validation of the roadmap measures, where they reviewed the roadmap and provided their insights as to the relevance and content of each of the focus areas, suggestions for local and international examples to be included, and comments on the overall content? of the roadmap and its vision, objectives and timeline.

The following pages show the results of a consultation with key stakeholders related to two aspects: measures (with regards to their relevance and feasibility, see Figure 2) and stakeholders (with regards to their power and position, see Figure 3).

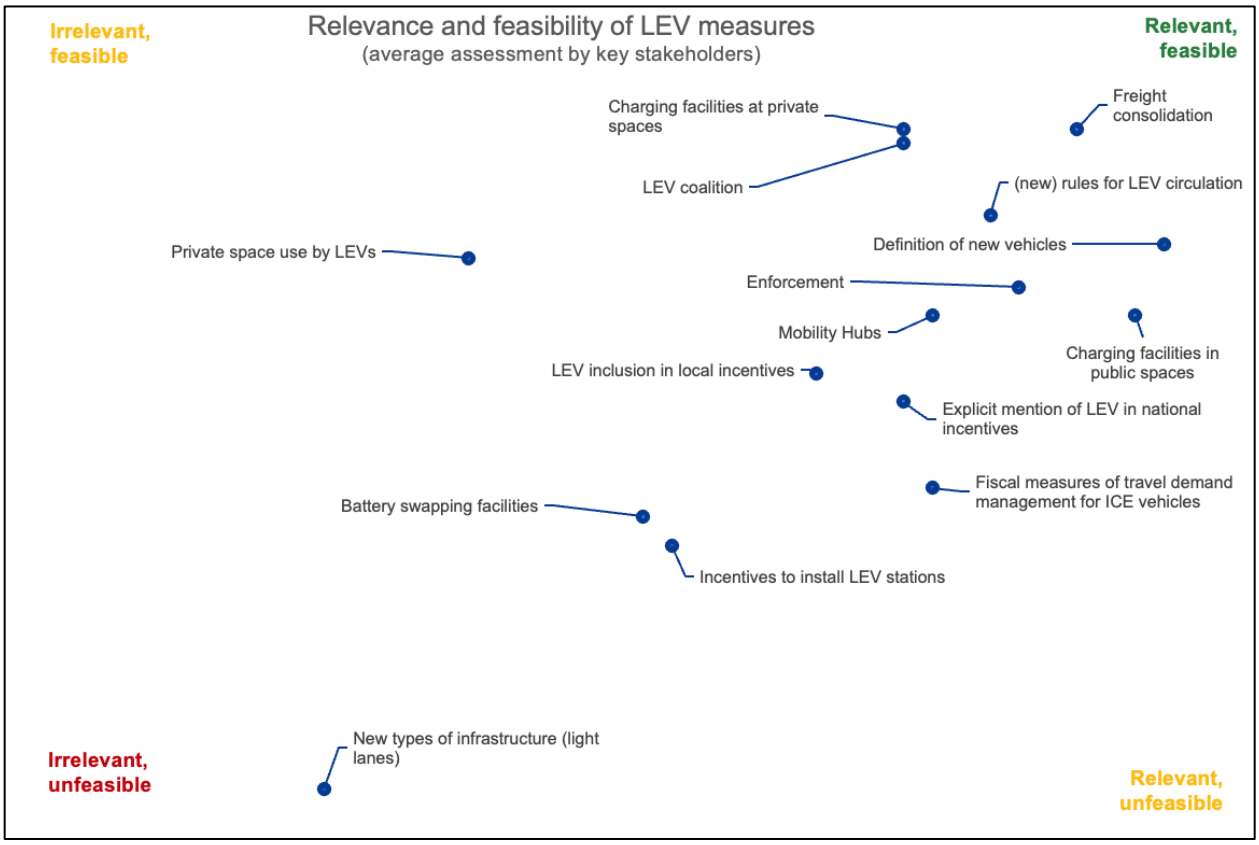


Figure 2. Assessment of measures as to their relevance and feasibility, according to key stakeholders.

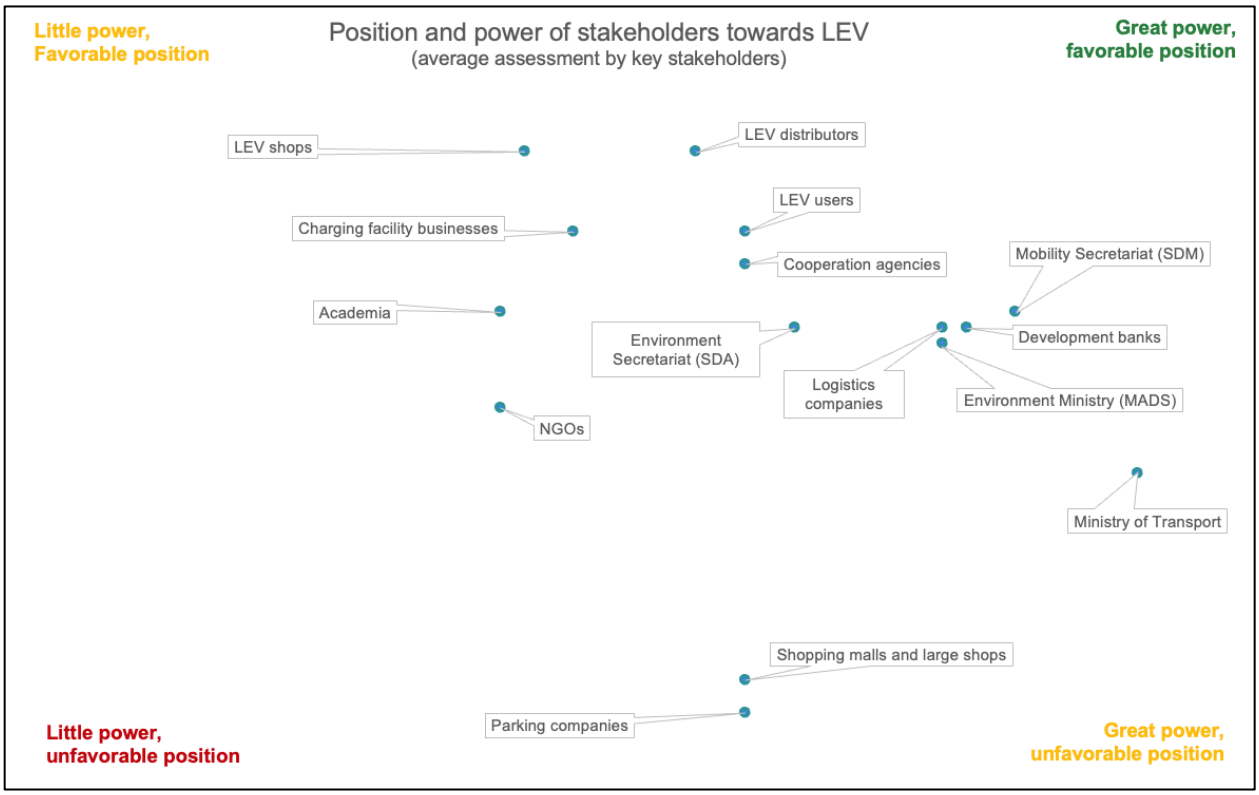


Figure 3. Assessment of stakeholders as to their power and position, according to key stakeholders.

4 The Roadmap – Where are we going?

4.1 Vision

The vision of this roadmap is to establish Light Electric Vehicles as a legitimized form of transportation for people and goods in Bogota, by reducing obstacles in their deployment and providing incentives for their accelerated and safe operation on city streets. the roadmap will enable a scenario with lower emissions and improved conditions, while also serving as:

- A demonstration of the usefulness of “Avoid” strategies by means of better urban planning;
- An effective “shift” strategy towards the use of sustainable modes for a wide array of transport purposes;
- The materialization of an “improve” strategy for the deployment of cleaner vehicles.

As a byproduct, the roadmap will also act in reducing the proliferation of “ciclomotores”, ICE biketaxis, and ICE motorbikes given that Light Electric Vehicles will serve the same purposes while being accessible to the same population.

4.2 Objectives

The goal of this roadmap is to increase the successful uptake of LEV in non-users (e.g. from cars, trucks) while preserving mode share of public transport, cycling and strengthening the regulatory conditions for the safe deployment of those vehicles in Bogotá.

More specifically, its objectives are:

- To increase presence of LEV in private sector endeavors
- To improve regulatory approaches (urban planning, circulation, infrastructure guidelines)
- To reduce proliferation of banned vehicles that are sometimes confused with LEVs (ciclomotores, bicitaxis).

4.3 Timeline

The roadmap will be implemented in the timeline presented in Table 1 . It is organized by Focus areas as are described in the following section, and has milestones in the short, medium and long term. This table is a synthesis of measures, and details of each of these is provided in the implementation plan section according to each focus area. The table also indicates with signs those measures which were deemed very relevant and feasible ($^{++)}$ and irrelevant/unfeasible (**) by stakeholders in the consultation.

Also, monitoring will be done for all measures and their effectiveness will be assess periodically. Thereafter, this is not specified in this table.

*Table 1. Timeline for roadmap deployment - Bogotá LEV (++= assessed with very high relevance and feasibility by stakeholders; ** = assessed with very low relevance and feasibility by stakeholders)*

Phase	***Demonstration (2023-2024)***	***Scale-Up (2025-2028)***	***Mainstream (2028-onwards)***
Target/ Focus area	*Preparing regulation, LEV coalition and first pilot activities for LEV deployment.*	*Actions from pilot to full implementation, scaled-up deployment of incentives.*	*LEVs are the default choice due to better performance and lower costs*
Focus area 1: Urban Planning	- *Define guidelines to determine the most suitable locations for integration of LEVs;* - *Identify five key locations for mobility hubs and freight consolidation++;*	- *Engage land owners in the private or public sector who own land in sites that are suitable for the deployment of charging stations and encourage their involvement (through land value capture or other regulatory mechanisms);* - *Choose the sites with highest probability of success, and define their implementation, financial plan and pilot scale-up.* - *Implement and monitor level of success (first sites)*	- *Deploy full network of mobility hubs*
Focus Area 2: Regulatory measures	- *Definition of (new) vehicles++* - *Defining rules for circulation of LEVs++* - *Requirement of private spaces for LEV-related purposes*	- *Creation of (new) types of infrastructure (light vehicle lanes)*** - *Curbside rules and monitoring standards++*	- *Agreements with national government in regulatory improvements for LEV*

Phase	Demonstration (2023-2024)	Scale-Up (2025-2028)	Mainstream (2028-onwards)
	- *Discussions with national government for nationwide regulation improvements*		
Focus Area 3: Economic and Financial measures	- *Inclusion of LEVs in local-level incentives as chosen during implementation* - *Travel demand management measures for ICE vehicles* - *Rebates for LEV parking and charging stations***	- *Explicit mention of LEVs in national-level incentives*	- *Monitor implementation of incentives*
Focus Area 4: Charging and other infrastructure	- *Deployment of charging stations in private and public spaces (pilot deployment)*	- *Pilots for Battery Swapping (when deemed relevant)* - *Scale-up of charging in private and public spaces (where deemed relevant)* ++	- *Full network deployment of all charging-related infrastructure*++
Focus area 5: Partnerships and public awareness	- *Stakeholder analysis* - *Forming an LEV coalition of stakeholders*++ - *Developing a public awareness campaign*	- *Coalition follow-up on agreements and roadmap implementation, integrating new members and strengthening strategies and campaigns*	- *Continue Coalition follow-up on agreements and roadmap implementation, integrating new members and strengthening strategies and campaigns*
Focus area 6: Road Safety	- *Define target groups and prioritize, create first messages;* - *Implement road safety audits in locations of greater relevance for LEV operation;*	- *Implement communications campaigns to prioritized target groups;*	- *Continue implementation of communication campaigns and expand to other target groups;*

Phase	*Demonstration (2023-2024)*	*Scale-Up (2025-2028)*	*Mainstream (2028-onwards)*
	- *Collect information on existing LEV vehicle safety standards;* - *Diagnose driver training needs in existing LEV operation, and create training programs for pilots.*	- *Define and implement infrastructure improvements;* - *Create and implement driver training in scaled-up operation.*	- *Assess road safety changes due to infrastructure improvements and define new ones;* - *Assess driver training and implement in full-scale operations.*

5 Implementation plan – How do we get there?

There are six focus areas in the roadmap, as were summarized in the timeline. These focus on providing details of the measures that will be taken, and further details shall be confirmed in the actual implementation as it falls outside of the scope of this roadmap. These include:

- Scope of each of the measures, with their own workplan;
- Stakeholders in charge of each measure;
- budget and financing mechanisms for each of the measures (e.g. local government, national government[3], overseas development funding, international NGOs, among others).

5.1 Focus area 1: Urban Planning

Urban planning is a major component of transportation improvements, given it can encourage mixed land use and compact cities which reduces the frequency and length of trips, which in turn improves the likelihood of using sustainable modes of transport such as walking and cycling and LEVs.

Specifically, the first focus area relates to the implementation of Bogotá's POT (a 2022-2035 plan that establishes the city's guidelines in terms of how land should be developed). This recent POT has on the target of "greening" Bogotá, with an explicit emphasis on sustainable mobility. An important part of the POT is the establishment of "mobility hubs" in key locations of the city, in combination with electric mobility.

The roadmap will complement the content of the POT in demonstrating specifically how these mobility hubs can be deployed, and where they could be implemented to achieve a general goal of greater coverage of transport services as a result of two functions of LEVs:

1. Increase the share of public transport by increasing its catchment area and flexibility so users can combine a trip in a public transport service with an e-bicycle, e-scooter, e-bike taxi or other LEV, with a mobility hub as a node to change these services.
2. Act as a last-mile solution for freight services by establishing freight consolidation hubs where LEV will distribute merchandise more efficiently.

In order to achieve this, the following actions are necessary:

1. Define guidelines to determine the most suitable locations for integration of LEVs;
2. Identify five key locations for mobility hubs and freight consolidation;
3. Engage land owners in the private or public sector who own land in sites that are suitable for the deployment of these locations and encourage their involvement (through value capture or other regulatory mechanisms);
4. Choose the sites with highest probability of success, and define their implementation, financial plan and pilot deployment.

[3] As this is specific to the case of Bogotá, there is no state-level funding given that Bogotá is a Capital District. If other cities were to implement measures like these, state-level funding could be assessed and sought.

5. Implement and monitor level of success.

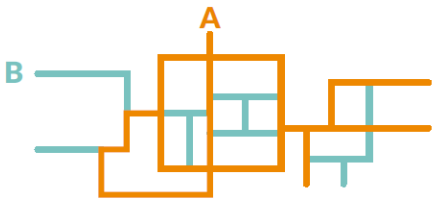
5.2 Focus Area 2: Regulatory measures

Regulation is a cross-cutting area that will increase the probability of success of the increased uptake of LEVs in Bogotá. While the national government has issued several laws, resolutions and recommendations towards the operation of light electric vehicles and the local government has complemented those with specific indications for their operation as public and private services, there are several gaps that the roadmap addresses. This focus area defines the specific improvements that need to be made to the current regulatory landscape and how to move forward.

Definition of (new) vehicle types: Currently, the closest definition to an LEV is that of the Resolución 160 de 2017, where e-bikes are defined specifically as complying with the following: 350W engine, speed-limited at 25 km/h, and being electric assist and not having a throttle [14]. While this is a welcome first step, it is not sufficient for the large-scale deployment of LEVs in Bogotá. A broader, more overarching framework is needed to include all other vehicles. A study developed for the Ministry of Transport and funded by KfW provided some guidance as to how to move forward in this regard, and this roadmap would take this guidance and convert it into specific legislation, either as more detailed recommendations for the national level or as adaptations of the Resolución 160 to the local context by widening its scope. This would mean that LEVs would be defined in such a way that:

- They include all small vehicles with two, three and four wheels;
- They provide more detailed guidance on engines that surpass the current power (350W);
- They indicate new categories (or subcategories) of vehicles that include LEVs;
- They reconfirm speeds and other thresholds that allow vehicles to be considered as LEVs.

Creation of (new) types of infrastructure (light lanes): Colombia has determined several typologies of roads and streets, most of which relate to cars, trucks, buses and larger vehicles. There is one category for bicycles ("ciclo-infrastructura") that includes seven different typologies that are defined in its Guía de Ciclo-infraestructura para Ciudades Colombianas". These typologies have been very useful in cities across the country to implement their own infrastructure for bicycles, where currently pedelec-type e-bikes are allowed to circulate.



Ciclorred	Subtipo	Forma de segregación o adaptación
A Vías ciclistas	Ciclorruta	Física (cambios de altura o instalación de elementos físicos permanentes)
	Ciclobanda	Cambio de pavimento Dispositivos de canalización de tránsito (hitos, balizas o elementos similares) Demarcación
B Vías ciclo-adaptadas	Prelación de bicicleta	Banda ciclopreferente Carril ciclopreferente
	Autorizadas para el tránsito de bicicletas	Carril bus-bici Contraflujo ciclista Calle peatonal
	Calle con tránsito calmado	Uso compartido de calzada

Figure 4. Example cycling infrastructure typologies.

[18]In order to improve the usability and effective deployment of LEVs, having an additional type of infrastructure that is specifically aimed at these vehicles will be beneficial. This question has become more widespread in the literature [19], [20] in the definition of "light lanes" or "slow lanes", and more specifically NACTO has developed a manual on "designing for small things with wheels" [21].

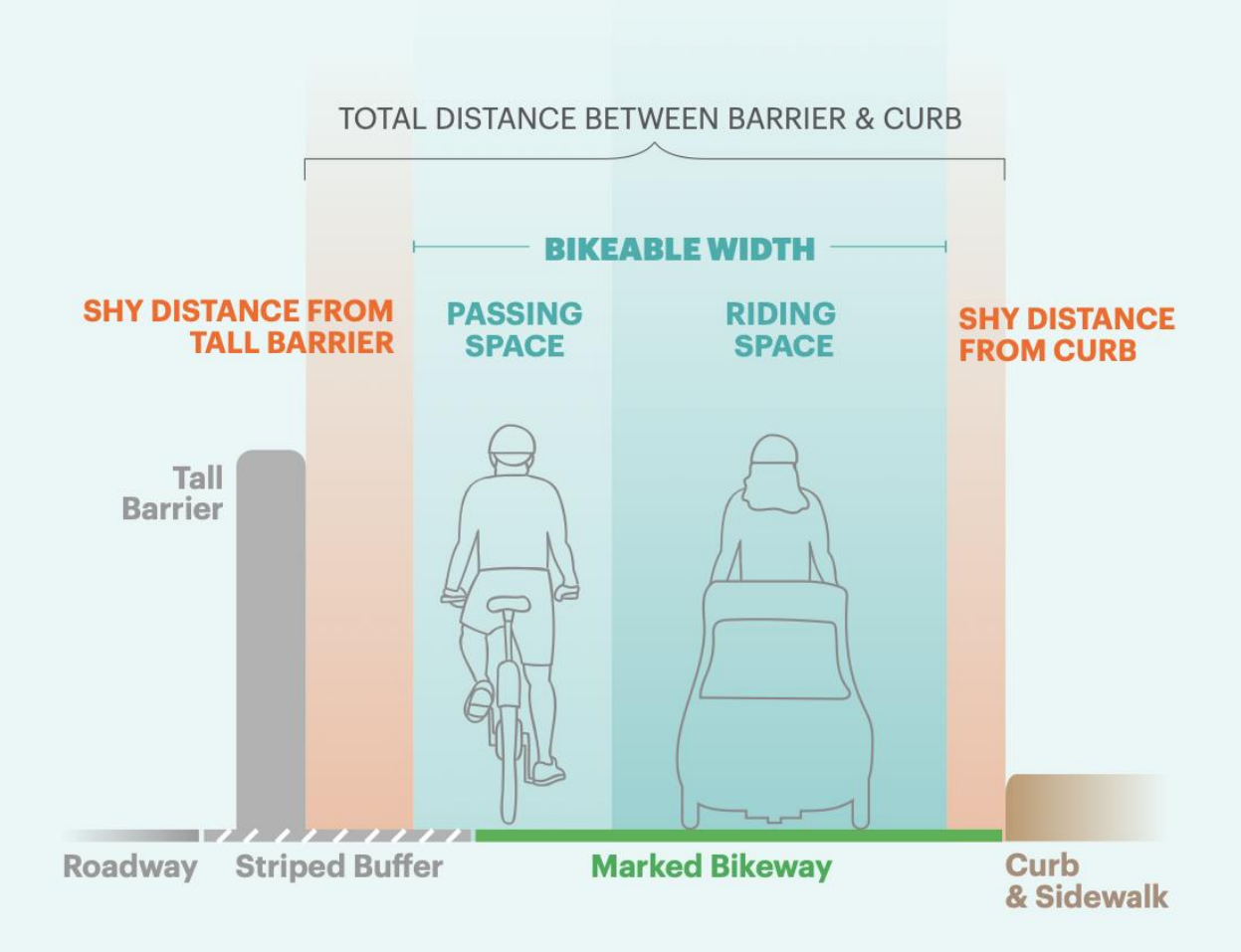


Figure 5. Example of how infrastructure for LEVs can be designed as per NACTO guidance [21]

Defining rules for circulation of LEVs: Current regulation provides some guidance in the form of allowing pedelec-type e-bikes to circulate along bikeways (according to Resolución 160 de 2017), but the broader array of LEVs are only allowed on mixed traffic lanes where they are generally in harsh conditions as they ride alongside trucks, buses and high-speed vehicles. While the creation of new types of infrastructure will be a useful step to improving conditions for those vehicles and the definition of vehicles will also allow for greater clarity, there must be specific indications with regards to where LEVs are allowed to circulate. For instance, it should be clear that (e.g.):

- E-scooters can ride on cycling-infrastructure as long as they are speed-capped according to rules in Resolución 160 de 2017 (25 km/h);
- LEVs larger/faster/heavier than pedelec-type ebikes are not allowed on cycling-infrastructure unless there are geofencing mechanisms to automatically reduce speeds along those routes;
- Conversely, all LEVs are allowed on “light lanes”;
- A general enforcement of larger vehicles giving way to smaller and slower vehicles along “light lanes” (similar to “car tu gaste” rules in Netherlands).

Curbside rules and monitoring standards: the curbside is not regulated in detail in Colombia and this should become a priority for the effective deployment of LEVs, both in the case of mobility for people and goods. While curbs have specifications as to what is and is not allowed in certain places, a more detailed approach is needed where:

- Pick-up and drop-off (of people or goods) is recognized as a valid form of stopping along the curb, and criteria should be defined to determine where this is possible, desirable and approved;
- Locations to park and load/unload should be better defined and its rules become clearer, especially giving greater priority to LEVs operating as part of a public service.
- Prices to stop, wait or park should be established and defined according to location or level of demand;
- Data standards should be implemented, following existing open-source initiatives. This enables most of the previous rules to be communicated and enforced effectively;
- A monitoring body (within e.g. Secretary of Mobility) should be defined and funded.

Use of private spaces for LEV-related purposes: LEVs have a small footprint, and small areas such as "antejardines" and parking spaces can be repurposed for LEV charging and services. Using private spaces requires regulatory changes (or clarifications from government) as current rules are very strict with regards to the use of antejardines and parking. Antejardines are currently not allowed for "vehicle parking" but this regulation clearly relates to larger vehicles such as automobiles, and modifying (or clarifying) that LEV parking can be allowed could be a useful change that could increase the potential availability of charging stations and amenities for LEVs.

5.3 Focus Area 3: Economic and Financial measures

Financial incentives for LEVs and disincentives for ICE vehicles are a strong form of promotion. There are currently no economic or financial incentives for the operation of light electric vehicles in Bogotá, though the city's Bicycle Policy can be used partially for this purpose and there are some incentives for electric mobility in general at the national level (through fiscal incentives) and at the local level (through regulatory incentives such as not having plate restrictions).

With regards to the funding of incentives, they should be established in such a way that they can operate as closely as possible as a cross-subsidy where "push" measures will fund "pull" measures. This will entail creating an earmarked fund for the specific purpose of LEV deployment.

Specifically, the following measures can be implemented: **Explicit mention of LEVs in national-level incentives**:

While the National Strategy for Electric Mobility provides some incentives for purchasing electric vehicles, these do not apply to LEVs, or at least they do not do so explicitly and citizens who have an interest in purchasing an LEV are not allowed to make use of any such incentives.

In addition, an incentive program such as that of several states in the United States would be useful, in which the government provides a purchase subsidy for the purchase of electric bicycles and cargo bicycles according to their price and to the level of income of citizens.

This could have several sources of funding, which could include climate-change-related funds or national programs such as Sistema Nacional de Regalías [22].**Inclusion of LEVs in local-level incentives**:

Some incentives exist to include electric vehicles in Bogotá in regulatory incentives, such as parking spots always available for those vehicles, and an exemption from license plate restrictions. While LEVs do not carry license plates necessarily (it would depend on revised regulation of vehicle definition to confirm which would have them), regulatory incentives could work, such as:

- Requiring all parking lots to have a minimum number of spots for LEVs and charging stations;
- Defining a requirement of minimum density of charging stations and requiring buildings in the city to install these;
- Providing tax exemptions for businesses that include LEVs in their fleet, either for commercial services or for their own company transport.

Travel demand management measures for ICE vehicles:

As a complement to the measures described above (which would be the "pull" or "carrot" policies), travel demand management measures (the "push" or "stick" measures) would be needed to have a comprehensive and effective approach. Two measures that could be established are:

- **Higher parking charges for larger vehicles**: Bogotá has historically had a cap on their parking prices despite the known benefits of establishing improved mechanisms for demand management through market-based rates. Implementing a market-based rate would be beneficial in terms of reducing the excessive demand for parking and in turn reducing travel by car as a result of price signals.
- **A gasoline (or parking) surcharge**: Implementing a carbon-based instrument in the form of an additional gasoline surcharge or a parking surcharge that would be used for a fund to pay for the "pull" measures described above.

5.4 Focus Area 4: Charging and other infrastructure

The successful deployment of LEVs will require a well-established charging (or battery swapping) network. Unfortunately, despite Colombia having a relatively well defined regulation for electric automobile charging stations, there is no standard or applicable regulation for LEV charging infrastructure, nor any substantial deployment of charging networks. There is also no swappable battery network in the city, though some pilot stations have been deployed.

The experience of “City Charging” in Bogotá can be used as a basis for further deployment of charging infrastructure. A partnership between two private sector companies, this initiative has deployed a relatively small charging network of ten stations for small electric vehicles (escooters and ebikes).

The massive deployment of public charging stations in public space in Bogotá will require efforts from the private sector (in providing charging stations and suitable locations near public space, be it buildings, companies that sell charging stations, shops, shopping malls, power suppliers and others), the public sector (by defining conditions for deployment and facilitating access to the power network and allocating public land for charging) and joint efforts (in promoting charging stations throughout the community). The same is true for swappable charging locations.

The allowance of private parking to become charging stations from Buenos Aires is a good example of how to increase the availability of suitable locations for these purposes.

Further, the development of mobility hubs is a great opportunity to complement a standalone charging network as they are not only a small spot to charge but a larger site for deployment of a suite of services, including charging stations.

5.5 Focus area 5: Partnerships and public awareness

In order to strengthen the implementation of all activities described in the four focus areas above, strong partnerships between different stakeholders are necessary. This will be achieved through the following activities:

- **Implementing a stakeholder analysis:** identifying stakeholders and finding out about their perceived problems, their interests, mandate and power is a crucial first step to have a good understanding of who to address and how in subsequent activities. An initial list must include at least government agencies in charge of transportation (SDM, Mintransporte), planning (SDP, DNP) and environment (SDA); distributors and retailers of LEVs; businesses associated to EV charging; companies that could benefit from having LEV fleets; associations related to the industry (like Andemos); academia (UniAndes, UniLaSalle, UJaveriana, and others); experts; NGOs (C40, CFF, Despacio, Logyca, and others); development banks and cooperation agencies (GIZ, USAID, IADB, World Bank, CAF, UN agencies and others) and LEV users.
- **Forming an LEV coalition of stakeholders**: Based on results from the stakeholder analysis, a coalition of stakeholders from different sectors should be formed, using this roadmap as a basis for future work. This coalition would review this roadmap, define the roles and responsibilities of each stakeholder , and reconfirm that they are sensible and adding any other stakeholders or activities that would be relevant. It will be necessary to reconfirm the potential overlap with other coalitions or working groups, and synergies with those that work on sustainable mobility, road safety, climate change and related topics.
- **Arriving at agreements for deployment of the roadmap**: The LEV coalition should agree on roles and commitments, reviewing the roadmap timeline and moving forward with its implementation, following up periodically on achievements, obstacles and solutions.
- **Developing a public awareness campaign**: While Bogotá is known to be a cycling city, the use of Light Electric Vehicles is not so well known, especially the benefits that come from shifting to that vehicle from larger ones in the case of freight and other types of operation. To complement the work of the LEV coalition, there should also be a campaign that presents the benefits of LEVs and how they can be deployed for personal use, transportation services and freight / logistics operation.

5.6 Focus area 6: Road Safety policies (protecting users of these vehicles)

Protecting the users of these vehicles is paramount in reducing risks from their use and in improving the interaction with larger vehicles, especially because the goal of the roadmap is to increase their use and to insert the operation of LEVs into new areas where these vehicles were not used previously.

Actions aimed at increasing road safety are related to communication, infrastructure improvements, vehicle safety standards and training.

Communications: after defining target groups (e.g. if they are defined by transport mode, it would be divided at least into car drivers, bus drivers, motorcycle drivers, cyclists, pedestrians) and understanding the characteristics of each (for instance, their position, perceived problems and proposed solutions, mandate and resources), these groups will be prioritized in terms of which are those who would have a higher probability to change their attitude and behavior, and which changes would result in greater road safety (e.g. if car drivers respect those who ride LEVs, there is a higher probability of increasing road safety). Thereafter, specific messages can be developed for each of the prioritized target groups. While this document cannot go into details, some documents provide more thorough explanations of how to implement such campaigns [23]–[26].

Infrastructure: A road safe ty audit of current infrastructure where LEVs can travel is a first step to understand where road safety risks can be improved. This should be followed by an identification of

measures to reduce risks (e.g. improving crossing designs, implementing cycling-inclusive infrastructure and others are some of the most relevant improvements) and their implementation [27], [28].

Vehicle safety: Linked to the definition of new vehicle types (described earlier) is the definition of clear homologation standards for vehicles so that these are designed and built to ensure safety in occupants and . Unfortunately, there are few experiences with sufficient experience in vehicle safety for LEVs and Colombia requires significant progress in safety standards for all their vehicles including light duty vehicles [20].

Training: Training people who will drive LEVs can increase road safety, but the experience in LEV operation in Bogotá has not always include these exercises. Other experiences from commercial services can be taken as an example to create training programs where operators of LEVs can learn how to drive LEVs with lower risk for themselves and others [29].

6 Conclusion and next steps – what do we need?

This roadmap has presented an overview of existing knowledge related to sustainable mobility, electric mobility, micromobility and LEV deployment in Bogotá, and provided a timeline and focus areas to achieve the overall goal of increasing the successful uptake of LEV in non- micromobility users (e.g. from cars, trucks) while preserving mode share of public transport, cycling and strengthening the regulatory conditions for the safe deployment of those vehicles in Bogotá. It has presented six focus areas to move forward in the achievement of this goal, organized into short, medium and long term.

In order to move forward, a champion within government should be established, as well as one that can support the roadmap implementation and its followup from the private sector (or from academia, NGOs or another non- government organization). Funding must also be secured in order to begin the implementation of activities, at least in the form of salaries and core expenses of an implementation team to continue the work that has begun in other initiatives and has been integrated and expanded in this roadmap.

7 References

[1] Institute for Transportation and Development Policy, “Defining Micromobility,” 2021. https://www.itdp.org/multimedia/defining-micromobility/ (accessed Oct. 24, 2021).

[2] SAE, “J3194: Taxonomy and Classification of Powered Micromobility Vehicles - SAE International,” Nov. 20, 2019. https://www.sae.org/standards/content/j3194_201911/ (accessed May 24, 2020).

[3] S. Cook, L. Stevenson, R. Aldred, M. Kendall, and T. Cohen, “More than walking and cycling: What is ‘active travel’?,” *Transp Policy (Oxf)*, vol. 126, pp. 151–161, Sep. 2022, doi: 10.1016/j.tranpol.2022.07.015.

[4] W. Hook, *Non motorised transport training document*. Eschborn: gtz, 2004.

[5] Secretaría Distrital de Movilidad de Bogotá, “Encuesta de Movilidad 2019.” 2019. [Online]. Available: https://www.movilidadbogota.gov.co/web/sites/default/files/Paginas/20-12-2019/resultados_preliminares_encuestamovilidad_2019-20191220.pdf

[6] Alcaldía Mayor de Bogotá, “Decreto 319 de 2006. Por el cual se adopta el Plan Maestro de Movilidad para Bogotá Distrito Capital, que incluye el ordenamiento de estacionamientos, y se dictan otras disposiciones,” pp. 26037–26037, 2006.

[7] Steer Davies Gleave, “Revisar y actualizar el Plan Maestro de Movilidad para Bogotá,” 2018, Accessed: Jun. 28, 2023. [Online]. Available: https://www.movilidadbogota.gov.co/web/plan-maestro-movilidad

[8] “POT - Bogotá Reverdece 2022-2035,” 2022. https://bogota.gov.co/bog/pot-2022-2035/ (accessed Jun. 28, 2023).

[9] Secretaría Distrital de Movilidad, *POLÍTICA PÚBLICA DE LA BICICLETA 2021-2039*. Bogotá, 2021. Accessed: Jun. 28, 2023. [Online]. Available: https://www.sdp.gov.co/content/politica-publica-de-la-bicicleta-2021-2039

[10] Secretaría Distrital de Movilidad, *Recomendaciones de tránsito para vehículos tipo patinetas con o sin motor.* 2018. [Online]. Available: https://www.movilidadbogota.gov.co/web/sites/default/files/Paginas/2018-12-17/Circular 006 de 2018.PDF

[11] Secretaría Distrital de Movilidad, *Resolución 209 de 2019*. 2019. Accessed: Jun. 28, 2023. [Online]. Available: https://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?dt=S&i=84143

[12] Secretaría Distrital de Movilidad, *Resolución 86572 de 2021*. 2021. Accessed: Jun. 28, 2023. [Online]. Available: https://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=116778&dt=S

[13] Departamento Administrativo de la Defensoría del Espacio Público, *Resolución 030 de 29 de enero 2021*. 2021. Accessed: Jun. 28, 2023. [Online]. Available: https://www.dadep.gov.co/comision-intersectorial-del-espacio-publico-ciep/resolucion-030-de-29-de-enero-2021

[14] Ministerio de Transporte, *Resolución 160 de 2017*. Bogotá, Colombia, 2017. Accessed: Jul. 06, 2017. [Online]. Available: http://www.alcaldiabogota.gov.co/sisjur/normas/Norma1.jsp?i=68085

[15] Ministerio de Ambiente y Desarrollo Sostenible, *Estrategia Colombiana de Desarrollo Bajo en Carbono ECDBC*. 2012. Accessed: Jun. 28, 2023. [Online]. Available: https://www.minambiente.gov.co/cambio-climatico-y-gestion-del-riesgo/estrategia-colombiana-de-desarrollo-bajo-en-carbono-ecdbc/

[16] Transport NAMA Database, "NAMA TAnDem – NAMA for Active Transport and Demand Management," 2017. https://changing-transport.org/publications/nama-tandem/ (accessed Jun. 19, 2017).

[17] Ministerio de Transporte de Colombia, *Resolución 3256 de 2018*. 2018. Accessed: Jun. 28, 2023. [Online]. Available: https://web.mintransporte.gov.co/jspui/handle/001/10364

[18] M. de Transporte de Colombia, *Guía de Ciclo-Infraestructura para Ciudades Colombianas*. Ministerio de Transporte de Colombia, 2016. [Online]. Available: http://www.despacio.org/portfolio/guia-de-ciclo-infraestructura-de-colombia/

[19] G. Klein, "How Slow Lanes Can Speed Up New Mobility (And Save Lives)," *Forbes*, Dec. 04, 2018. https://www.forbes.com/sites/gabeklein/2018/12/04/how-slow-lanes-can-speed-up-new-mobility-and-save-lives/?sh=618706bdc5fa (accessed Feb. 16, 2022).

[20] OECD / ITF, "Safe Micromobility," Feb. 2020. Accessed: May 24, 2020. [Online]. Available: https://www.itf-oecd.org/sites/default/files/docs/safe-micromobility_1.pdf

[21] NACTO, "Designing for Small Things With Wheels," Bogotá, 2023. Accessed: Jun. 27, 2023. [Online]. Available: https://nacto.org/publication/designing-for-small-things-with-wheels/

[22] Ministerio de Hacienda de Colombia;, "Sistema General de Regalías - SGR," 2023. https://www.minhacienda.gov.co/webcenter/portal/SGR (accessed Jun. 27, 2023).

[23] C. Pardo, *Sustainable mobility: getting people on board (Module 1e GIZ Sourcebook on Sustainable Transport for Policy Makers in Cities)*. Eschborn: GIZ, 2018. [Online]. Available: https://www.sutp.org/publications/sustainable-mobility-getting-people-on-board/

[24] C. Pardo, "Cuatro campañas para reducir el machismo en las vías - La Silla Vacía," *La Silla Llena - Red Cachaca*, 2021. https://www.lasillavacia.com/historias/historias-silla-llena/cuatro-campañas-para-reducir-el-machismo-en-las-vías/ (accessed Jul. 27, 2021).

[25] C. Pardo, "Promoting sustainable mobility – key theoretical and practical issues EcoMobility Dialogues / Technical Paper," Bonn, Alemania, 2016. [Online]. Available:

http://www.ecomobilityfestival.org/wp-content/uploads/2016/01/Promoting-Sustainable-Mobility.pdf

[26] T. Hoekstra and F. Wegman, “Improving the effectiveness of road safety campaigns: Current and new practices,” *IATSS Research*, vol. 34, no. 2, pp. 80–86, 2011, doi: 10.1016/j.iatssr.2011.01.003.

[27] NACTO, *Global Street Design Guide*. Island Press, 2016.

[28] CROW, *Design Manual for Bicycle Traffic*, vol. 28. 2016.

[29] Pedal Me, “Cargo Bike Rider Training - Pedal Me,” 2023. https://pedalme.co.uk/training (accessed Jul. 06, 2023).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