Quality Infrastructure for Electromobility

Safe and Sustainable Micromobility

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About this publication

The Global Project Quality Infrastructure (GPQI) of the German Federal Ministry for Economic Affairs and Climate Action (BMWK) enables technical policy dialogues with Germany's key trading partners worldwide. In cooperation with Brazil, China, India, Indonesia and Mexico, the project is implemented with the support of the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

This publication was developed under the framework of the German-Mexican Dialogue on Quality Infrastructure, established between BMWK and the Mexican Ministry of Economy. This bilateral dialogue is a platform that brings together representatives from the relevant ministries, quality infrastructure institutions, companies, industry associations and chambers from the two countries to address cooperation topics of mutual interest in the field of quality infrastructure.

This publication is the result of a collaboration that has been taking place since 2019 between stakeholders of the bilateral expert group within the project line 'Strategic cooperation on electromobility: standardisation, certification and technical regulation', which was agreed in the joint work plan of the German-Mexican Dialogue on Quality Infrastructure.

This is the fourth document in a series of four publications on quality infrastructure in the field of electromobility. This series addresses four priority topics: 1) charging infrastructure, battery safety and disposal; 2) heavy-duty vehicles for transporting passengers and goods; 3) fundamentals of electric vehicles and specifics for passenger vehicles; 4) micromobility (two-wheelers).

1. The importance of safety and sustainability in promoting micromobility

Micromobility encompasses transportation modes that involve small, lightweight and usually single-occupant vehicles designed for short-distance travel, which are often powered by human effort, electricity or a combination of both. Micromobility has gained increased popularity as a more convenient and cost-effective means of transportation that eases traffic flow in congested urban areas, facilitates first and last-mile connectivity and offers environmental benefits from lower pollution levels. This rising trend in popularity is mirrored in growth projections for the global micromobility market, which reached a value of USD 49.3 billion in 2021 and is estimated to achieve a market size of USD 186.2 billion by 2030[1].

In Mexico, bicycle use soared 220% during the first year of the COVID-19 pandemic[2], and cycle lanes in Mexico City saw record expansion between 2019 and 2022, with 206.3 km of additional infrastructure created[3]. However, the lack of regulation concerning the design and use of new micromobility modes of transport has introduced new safety risks for both users and bystanders and contributed to a 120% increase in the number of traffic accidents in the country between 2020 and 2021[4]. These new safety risks arise, for example, as a result of lane sharing between cars and light vehicles, but may also be inherent in a design fault, inadequate braking system or in the near-silent motorisation that turns light electric vehicles into a threat for pedestrians. To ensure that vehicles are safe from the moment they enter the market and to increase consumer protection and trust, it is crucial that the relevant quality infrastructure (QI) is strengthened, with a particular focus on technical regulation, standardisation and conformity assessment for both traditional and novel micromobility modes of transport.

This factsheet brings together the key international, European and US technical regulations and standards applicable to the vehicle categories of conventional bicycles, e-bikes, e-scooters, e-mopeds, and electric motorcycles. By contrasting the international experience with the QI landscape in Mexico, it then offers recommendations for strengthening Mexican QI to promote a safe and efficient expansion of micromobility in the country.

Row of electric scooters parked in the city.

2. Technical regulations and standards

Mexico

Despite the surge in the number of bicycle users during the pandemic, micromobility in Mexico is in its early stages. Consequently, the framework of technical regulations (NOMs) and standards (NMX) for these modes of transport is still under development.

Under the draft technical regulation **PROY-NOM-034-SCT2/SEDATU-2021**[5], non-motorised vehicles are classified as 'human-powered vehicles such as bicycles, unicycles, tricycles, quadricycles and skateboards, including those assisted by low-power engines incapable of reaching speeds greater than **twenty-five (25) kilometres** per hour'. The definition thus applies both to bicycles and pedelecs up to speeds of 25 km/h, but excludes fast s-pedelecs, e-scooters and electric mopeds

that are capable of reaching greater speeds.
The Mexican standards series **NMX-D-198/ Autotransport – Bicycles**[6] provides a more detailed definition of bicycles, safety requirements and the relevant testing methods. Since the definition of bicycles includes only such cycles that are 'driven solely by muscular energy', e-bikes are not considered under this standard, which dates back to 1985.

However, as this standard's use is voluntary, there are currently no mandatory technical regulations specific to the safety features of bicycles. The same holds for e-bikes, e-scooters or electric mopeds or motorcycles and their equipment, with the exception of **NOM-206-SCFI/SSA2-2018**[7], which provides specifications, testing methods and commercial information and labelling requirements for safety helmets intended for users of motorcycles and other motor vehicle. **NOM-194-SCFI-2015**[8] defines mandatory safety devices for new light vehicles and explicitly excludes vehicles under 400 kilograms and motorcycles. It therefore does not cover any of the micromobility modes of transport.

Several technical regulations and standards are relevant to electrified micromobility modes of transport without addressing them specifically. These include **NOM-001-SEDE-2012**[9] for electrical installations, which establishes the relevant technical specifications and safety guidelines and also covers EV charging equipment. **NOM-003-SCFI-2014**[10] defines safety specifications for electrical products in Mexico. It covers protection against risks, guidelines for safe product functioning and usage information. Compliance with NOM-003-SCFI involves meeting the requirements of specific referenced Mexican standards (NMX), including those relating to personal protection systems for electric vehicle supply circuits (**NMX-J-668/1-ANCE-2013** and **J-668/2-ANCE-2013**[11]). **NOM-024-SCFI-2013**[12] defines in its scope commercial information for packaging, instructions and warranties for electronic, electrical and household appliance products, including light electric vehicles such as e-scooters and e-bikes.
In addition, the private standardisation body ANCE has published standards (NMX) for voluntary use which apply to both charging infrastructure and the corresponding electric vehicle. These include the **NMX-J-678-ANCE-2020**[13] and **NMX-J-683-1-ANCE**[14] series on plugs, socket outlets and couplers, and **NMX-J-677-ANCE-2020**[15], which focuses on specifications and testing procedures for the power transfer of electric vehicle equipment.

In summary, **there are no mandatory safety requirements for new bicycles, e-bikes, e-scooters, e-mopeds or electrified motorcycles placed on the Mexican market.** Although NOM-001-SEDE-012 and NOM-003-SCFI-2014 specify safety requirements for the electric components of these means of transport and their charging infrastructure, these regulations are not designed to take into account specific features of electric micromobility.

International

At the international level, **UNECE regulations and UN Global Technical Regulations (UN GTRs)** define safety and durability requirements for some micromobility modes of transport, particularly for Category L vehicles, which includes motor vehicles with fewer than four wheels and some lightweight four-wheelers[16]. Category L includes only motor vehicles, thus excluding bicycles.

The UNECE regulations are based on the **1958 Agreement** concerning the **Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles**, while UN Global Technical Regulations are based on the **1998 Agreement on UN Global Technical Regulations**. UNECE regulations are automatically binding for the 58 signatory countries to the 1985 agreement, while UN Global Technical Regulations require transposition into national law to become binding.

The following table provides an overview of the UN Global Technical Regulations and UNECE Regulations that are relevant to s-pedelecs, e-scooters, electrified mopeds and/or motorcycles.

Furthermore, international standardisation bodies, most prominently the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), have published numerous voluntary standards specifying safety provisions for bicycles, e-bikes,

UN GTR	UNECE regulations
UN GTR No. 3[17]**:** Motorcycle brake systems – based on UNECE 78 and FMVSS 122. Compilation of test procedures and performance requirements.	**UNECE 74:** This regulation applies to vehicles in Category L1[18] with regard to the installation of lighting and light signalling devices.
UN GTR No. 20: Electric Vehicle Safety (EVS). This contains requirements regarding isolation of electric circuits, warning labels, location of high-voltage electrical components, among others.	**UNECE 78:** Uniform provisions concerning the approval of Category L vehicles with regard to **braking**[19]. It is not specific to electrified light vehicles but includes them. Two-wheeled vehicles in Category L1, which includes s-pedelecs and mopeds, must be equipped with either two separate service brake systems or a split service brake system. For faster two-wheelers, including electrified motorcycles, more detailed safety requirements and relevant testing methods and parameters are defined.
UN GTR No. 21: Determination of Electrified Vehicle Power (DEVP). This standard provides a globally harmonised method to determine a system power rating for electrified light-duty vehicles. It is comparable to traditional measures of system power for vehicles with an internal combustion engine and also applies to two-wheelers.	**UNECE 136:** Uniform provisions concerning the approval of Category L vehicles with regard to specific requirements for the electric powertrain. It includes the minimum safety requirements for approval of a light vehicle type with regard to its electrical safety, and for the approval of a Rechargeable Electrical Energy Storage System (REESS).

Table 1: UN GTR and UNECE regulations relevant to light vehicles.

e-scooters, electrically powered mopeds and electrified motorcycles. The most comprehensive list of standards exists for safety requirements for bicycles and bicycle components. This list comprises the ISO 4210 series, ISO 6742 series and standards ISO 6692-6699, a selection of which is listed in Table 2. This table gives an overview of the relevant ISO and IEC standards for bicycles, e-bikes, electric scooters, electrified mopeds and motorcycles. They specify safety requirements for operation of the vehicles as well as for the manufacturing of different components, including brakes, lighting and – in the case of electrically propelled modes of transport – protection against electric shock.

Bicycles	E-Bikes
ISO 4210 Part 1-9:2023 **Cycles — Safety requirements for bicycles.** The parts included in this series cover requirements for city and trekking, young adult, mountain and racing bicycles, braking test methods, steering test methods, pedal and drive system test methods, among others.	**ISO/TS 4210-10** **Cycles – Safety requirements for bicycles – Part 10: Safety requirements for electrically power-assisted cycles (EPACs)**. This document outlines safety and performance criteria for designing, marking, assembling, and testing two-wheeled electrically power-assisted cycles (EPACs). It covers fully assembled EPACs, sub-assemblies, and guidelines for manufacturer-supplied information. Additionally, the document specifies requirements and test methods for engine power management systems and electrical circuits, including chargers, focusing on EPACs with a Safety Extra Low Voltage (SELV) maximum voltage up to 60 Vdc, considering tolerances.
ISO 6742; part 1-5:2023 **Cycles — Lighting and retro-reflective devices.** The parts included in this series cover safety requirements for lighting and light signalling devices, retro-reflective devices, installation and use of lighting and retro-reflective devices, lighting systems powered by the cycle's movement and lighting systems not powered by the cycle's movement.	
ISO 14878:2015 **Cycles — Audible warning devices —** Technical specification and test methods.[20] ISO 14878:2015 lays down the technical specifications, such as for sound pressure level and durability, and specifies the corresponding testing method for audible warning devices (AWDs) which may be fitted to cycles.	
ISO 8098:2023 **Cycles** — Safety requirements for bicycles for young children. This document specifies safety and performance requirements and test methods for the design, assembly and testing of fully assembled bicycles and sub-assemblies for young children. It also provides guidelines for instructions on the use and care of the bicycles.	

e-Scooters	Electrically propelled mopeds and motorcycles
IEC Technical Committee 125: for the standardisation of e-Transporters: Develops standards for electrically powered transport devices for use on public roads or in public spaces, including e-scooters, with regard to their electrical and mechanical safety, performance and durability, and functional safety. **This committee published:** **IEC 63281-2-1 ED1** **e-Transporters – Part 2-1:** Safety requirements and test methods for personal e-Transporters	**ISO 13063-1:2022** **Electrically propelled mopeds and motorcycles Safety specifications Part 1:** On-board rechargeable energy storage system (REESS) This document specifies safety requirements for rechargeable energy storage systems (RESS) of electrically propelled mopeds and motorcycles for the protection of persons. **ISO 13063-2:2022. Electrically propelled mopeds and motorcycles. Safety specifications Part 2:** Vehicle operational safety

e-Scooters	Electrically propelled mopeds and motorcycles
IEC 63281-3-1 ED1 **e-Transporters – Part 3-1:** Performance test method for total run time of e-scooters with consideration to environmental conditions of actual use. TC 125 standards exclude electric bicycles, conventional bicycles, motor bikes or cars.	This document outlines safety requirements for operational safety and protection against failures in electrically propelled mopeds and motorcycles under normal conditions. It applies when the maximum working voltage of the on-board electrical circuit is up to 1000 volts AC or 1500 volts DC. **ISO 13063-3:2022. Electrically propelled mopeds and motorcycles. Safety specifications. Part 3:** Electrical safety. This document sets safety requirements for electric propulsion systems and connected auxiliary systems in electric mopeds and motorcycles, with the aim of preventing electric shock and thermal incidents under normal conditions. The specified standards apply to a maximum working voltage of 1000 volts AC or 1500 volts DC.

Table 2: UN GTR and UNECE regulations relevant to light vehicles.

In addition, there are international standards published by the International Electrotechnical Commission (IEC) that are relevant for all electrically powered modes of transport and thus apply to e-bikes, e-scooters, electrified mopeds and motorcycles, as well as to electric cars. These include the **IEC 62660** series on safety requirements, performance testing and reliability testing for secondary lithium-ion cells for the propulsion of electric road vehicles, the **IEC 61851** series on charging system standards, and the **IEC TS 62840** series on electric vehicle battery swap systems[22].

European Union

The European Union (EU) has been a pioneer in developing technical regulations and standards for different micromobility modes of transport. Technical regulations in the EU come in the form of **regulations** or **directives**. In contrast to technical regulations in other countries, these do not include detailed technical specifications, but instead set out general rules which a product must observe. Manufacturers can make use of different technical solutions to show compliance with these rules. Importantly, the use of so-called harmonised standards published in the Official Journal of the European Union (OJEU) has the advantage of a presumption of conformity with the regulation or directive in question, reversing the burden of proof away from the manufacturer to the relevant market surveillance authorities.

In the EU, all of the micromobility modes of transport included in this factsheet, with the exception of e-scooters, are covered by specific technical regulations and standards that take into account the different safety risks relating to bicycles, e-bikes, e-mopeds and electrified motorcycles.

While there are no technical regulations in the EU specific to **bicycles**, these are regulated by the **General Product Safety Directive (GPSD)**. GPSD requires manufacturers or importers to provide risk assessment reports, user instructions, a technical file, traceability labels and test reports for their products.

The European Committee for Standardization (CEN) also has a specific technical committee, TC333, which defines European standards for cycles. While the TC has published its own bicycle safety standards, following CEN's mandate for international harmonisation the standardisation body has **adopted ISO 4210 series Parts 1:9** (see above) **on bicycle safety as EN ISO 4210 1:9**. Today, this series is harmonised under GPSD, meaning that use of these standards in bicycle manufacturing provides a presumption of conformity with GPSD[23].

E-bikes are subject to various regulations and safety standards in the European Union. These cover everything from the mechanical safety of the bike frame to battery safety and electrical compliance requirements, and vary depending on the type of e-bike, based on maximum speed and the distinction between pedelecs and s-pedelecs.

In addition to compliance with General Product Safety Directive 2001/95/EC, **pedelecs up to 25 km/h and with a maximum continuous rated motor output of 250 watts** must comply with **Machinery Directive 2006/42/EC, Electromagnetic Compatibility Directive 2014/30/EU** and the **Restriction of Hazardous Substances Directive (RoHS) 2011/65/EU + (EU)2015/863**[24].

CEN 15194:2017: Cycles - Electrically power assisted cycles - EPAC Bicycles is the harmonised European standard for e-bikes under the Machinery Directive. Its use provides presumption of conformity with the safety requirements stipulated in the Machinery Directive to e-bike manufacturers. However, to show compliance with the mandatory requirements of the other applicable directives, other standards must additionally be used[25]. CEN 15194 includes requirements and testing methods to cover common risks associated with e-bikes, particularly the engine power management systems, electrical circuits and charging system. To show compliance with CEN 15194:2017, most Member States allow for self-certification by manufacturers.

All other electric bicycles, including pedelecs with a maximum speed greater than 25 km/h and/or motor output greater than 250 watts and s-pedelecs are subject to type approval under **Regulation 168/2013** on the approval and market surveillance of two- or three-wheel vehicles and quadricycles. Th also applies to electrified mopeds.

For the different light vehicles included, the regulation specifies safety requirements for different vehicle components such as braking systems and lighting, which in most cases are based on the relevant UNECE regulations to promote global harmonisation. For Category L1e-B vehicles, which includes e-bikes and **mopeds** (see Figure 1), requirements for lighting and light-signalling devices are based on UNECE Regulation No. 74 Rev. 2, which requires the lighting system to be turned on automatically. L1e-B vehicles must also be fitted with a service brake system, where at least two brakes on different wheels are operated by actuating a single control.

Type approval must be carried out by a technical service which has been designated by the approval authority of a Member State either as a testing laboratory authorised to carry out tests or as a conformity assessment body.

Regulation 168/2013 also covers motorcycles, including electric motorcycles. Motorcycles are divided into two broad categories: L3e-AxE (x = 1, 2 or 3, depending on the power of the vehicle), referring to two-wheel Enduro motorcycles, and L4e which includes two-wheel motorcycle with sidecars. In contrast to the s-pedelecs covered by the regulation, both mopeds and motorcycles (electric or not) are required to be equipped with audible warning devices, driver-operated controls including identification of controls, tell-tales and indicators and are required to have rearward visibility. Both s-pedelecs and mopeds need to include a maximum continuous rated or net power and/or vehicle speed limitation by design.

In addition, Regulation 168/2013 stipulates that all vehicles with electric powertrains that fall within the scope of the regulation must be designed so as to avoid any risk to electrical safety, using the relevant requirements of UNECE Regulation No. 100 and ISO 13063. This applies to all the aforementioned vehicles, including s-pedelecs, e-mopeds and electrified motorcycles.

Regulation 168/2013 excludes **electric scooters** in its current form[26]. Although these do come under the Machinery Directive 2006/42/EC, the EU regulatory framework currently lacks a common regulatory approach to e-scooters, including speed limits, obligatory safety equipment, and others[27]. In this regard, the regulatory picture for e-scooters remains mixed, with considerable variations across Europe.

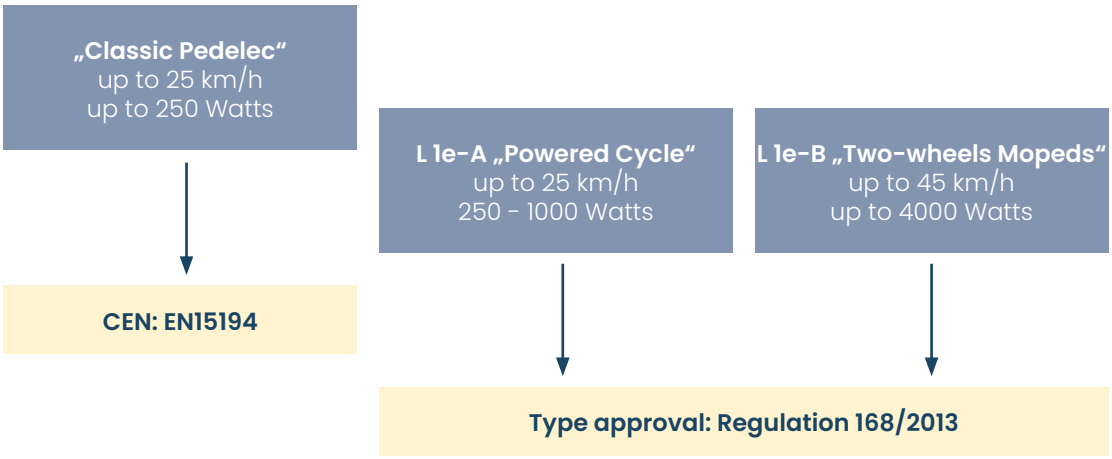

Figure 1: EU-applicable e-bike regulations and standards Source: Sensitivus, n.d.

In February 2023, **the Parliamentary Advisory Council for Transport Safety (PACTS) and the European Transport Safety Council (ETSC)** issued recommendations for EU technical standards and common regulations for e-scooters. The proposals include setting private e-scooters to a maximum speed of 20 km/h and a maximum rated power of 250 watts. Shared e-scooters by providers should have lower speed limits in pedestrian zones, enforced via GPS. The report suggests prohibiting tampering with e-scooter settings and advocates for in-built anti-tampering mechanisms. A minimum wheel size of 30.5 cm is recommended for stability, along with independent front and rear wheel braking devices. The report also proposes that e-scooters should feature independent front and rear lights and audible warning devices[28].

Finally, all electrically propelled micromobility modes of transport fall under the new **EU Battery Regulation**[29], in force since July 2023. This regulation introduces the specific category of light means of transport (LMT) batteries which provide electric power for traction to two-wheeled vehicles such as electric scooters and bicycles. The regulation lays down requirements for these batteries with the aim of promoting their sustainability and circularity.

The requirements applicable to LMT batteries include:

- mandatory disclosure of carbon footprints with declarations and labelling;
- minimum percentage levels for recycled materials used in the manufacture of new batteries; these are to increase gradually;
- removability and replaceability of LMT batteries and individual cells;
- use of a digital ‘battery passport’ from 2026, to include battery data, material composition, carbon footprint data, supply chain data and other information.

United States

The **U.S. Federal Highway Administration (FHWA)** defines micromobility based on Society of Automotive Engineers International’s Taxonomy and Classification of Powered Micromobility as ‘any small, low-speed, human- or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters and other small, lightweight, wheeled conveyances’. The FHWA also takes into consideration other definitions of micromobility which focus primarily on powered micromobility devices and characterise these devices as partially or fully motorised,

low speed (typically less than 48 km/h), small in size (typically less than 1 metre in width and weighing less than 230 kg)[30].

Bicycles were among the first products to be regulated by the Consumer Product Safety Commission (CPSC), established by the U.S. Congress in 1972, which defined rules for their assembly, braking and structural integrity. In 2003, the CPSC updated the federal safety standard to include low-speed electric bicycles, such as those used for ridesharing. These electric bicycles must comply with the mandatory federal safety standard for bicycles, outlined in 16 CFR part 1512[31]. The CPSC defines a bicycle as a two-wheeled vehicle that is solely human-powered or a two- or three-wheeled vehicle with operable pedals and an electric motor under 750 watts. This definition allows electric bicycles to exceed 20 mph when powered by both a motor and human effort.

Unlike bicycles, **electric scooters** currently lack specific federal regulations. While they can still be subject to corrective actions under the Consumer Product Safety Act (CPSA), there is no mandatory federal safety standard tailored to scooters. Additionally, electric scooters, especially those with a top speed below 20 mph, are not classified as 'motor vehicles' under the National Highway Traffic Safety Administration (NHTSA) regulations, thus they are not required to comply with Federal Motor Vehicle Safety Standards (FMVSS).

The **National Highway Traffic Safety Administration (NHTSA)** regulates the safety of motor vehicles and related equipment. Its technical regulations and operational rules come in the form of **Federal Motor Vehicle Safety Standards (FMVSSs). FMVSS 122, 123** and **108** cover different safety aspects of motorcycles, including requirements for their brake systems, controls and displays and lighting systems. **FMVSS No. 218** introduces a definition for 'motorcycle helmet' and amends the current performance requirements by incorporating new dimensional and compression requirements. These additions, along with corresponding test procedures, aim to identify helmets that may not meet existing performance standards based on their physical characteristics.

While FMVSSs also include some regulations that are specific to electric vehicles, most of them are only applicable to cars or heavy-duty vehicles. For example, **FMVSS No. 141** addresses the minimum sound level requirements for low-speed operation of hybrid and electric light vehicles to protect pedestrians and bicyclists from low-speed crashes, but it does not apply to motorcycles, e-mopeds, or e-bikes.

With regard to nationwide voluntary standards, Underwriters Laboratories (UL) offers important safety standards for different micromobility modes of transport, covering primarily e-bikes and e-scooters.

UL 2849 provides fire safety certification by assessing the electrical drive train, battery, charger system combinations and other potential electrocution hazards specifically in **e-bikes** and their charging systems. Covering electrical energy storage assemblies (EESAs), **UL 2271** oversees battery packs, combination battery pack-electrochemical capacitor assemblies and the subassembly/modules for use in light electric-powered vehicles (LEVs) such as e-scooters and hoverboards. **UL 2272** applies to the same vehicle categories as UL 2271, but in contrast outlines safety criteria for the complete device, covering design, construction and testing across the electrical system, mechanical structure and battery pack. Use of the three aforementioned standards is already mandatory for e-bikes and e-scooters sold, distributed, leased or rented in New York[32].

3. Recommendations

Based on the mapping of technical regulations and standards in the EU, the US and at the international level, it is possible to identify several recommendations to strengthen quality infrastructure for the safe promotion of micromobility in Mexico. These include:

Topic	Recommendation
Classification schemes	Introduce a **classification scheme** for the different micromobility categories, including differentiation between e-bike types, as a necessary step to define adequate safety requirements for each vehicle category. The classification should follow a logic of consumer protection and be aligned either with EU or US classifications to avoid the creation of new barriers to trade. Motor power and maximum reachable speed are proposed as the main classification criteria.
Electrical safety	Adopt **specific electrical safety requirements** for the powertrains of the different vehicle types (based on international standards ISO 4210:10 for e-bikes, IEC 63281 for e-scooters and ISO 13063 for mopeds) to prevent hazards such as liquid leakage or electric shock. These international standards could be referenced in NOM-003-SCFI-2014 as specific requirements for these vehicles.
Maximum speed	Establish **maximum speed limits** for different vehicles and introduce higher safety requirements for faster vehicle types. In order to avoid the creation of technical barriers to trade, we recommend using maximum speed limits established in the US for the different vehicle types (see above). In the case of e-scooters, which are yet to be appropriately regulated both in the US and the EU, the recommendation is to await determination of a maximum speed limit before aligning an appropriate Mexican regulation.
Lighting	Introduce a regulation around lighting systems for light vehicles. This could be based, for example, on UNECE 74, which applies to vehicles of Category L1 with regard to the installation of lighting and light-signalling devices. Ensuring that adequate lighting systems are integrated in two-wheelers from the moment they are placed on the market reduces the risk of night-time accidents due to improper installation.
Minimum sound emission	Initiate discussions on **Acoustic Vehicle Alerting System (AVAS)** requirements for electric mopeds and e-scooters, taking into consideration safety concerns for pedestrians, especially the elderly or visually impaired. A definition of minimum sound levels could be integrated into existing regulations, such as NOM-082-ECOL-1994, which establishes the maximum permissible noise emission limits for new motorcycles. However, the recommendation is to wait for international AVAS regulations in the US and EU in order to align Mexican rules and avoid barriers to trade.
Maintenance and repair	The maintenance and repair of e-bikes, e-scooters and electrified mopeds requires adequately trained personnel. To ensure the necessary competence, the recommendation is to develop a new specific **competence standard CONOCER** and relevant certification process on the maintenance of different types of e-bikes, e-scooters, electrified mopeds and motorcycles.
Charging stations	A key element for the proliferation of electrified micromobility is the availability of safe charging stations. Therefore, **NOM-001-SEDE-2012**, which governs electrical installations, should be updated to include new guidelines for the safe and functional installation of electric vehicle (EV) charging infrastructure for e-mopeds, e-scooters and e-bikes.

Topic	Recommendation
Charging stations	Develop a specific **CONOCER competence standard** for the installation and maintenance of electrified micromobility charging stations to ensure that these activities are carried out by qualified personnel. This could be included in an overall CONOCER for EV charging stations, with specific sections aimed at charging stations for different micromobility modes of transport. Regulate charging adapters to facilitate vehicle charging at home.
Battery swap systems	Adopt an international **safety standard on battery swap systems**, for example IEC TS 62840. Compared with the relatively lengthy charging time, the battery swap process takes only a few minutes, alleviating range anxiety and enabling longer-distance travel. Basing the roll-out of battery swap stations on international standards ensures their safety and functionality.
Labelling	Given the difficulty in finding suppliers who offer **replacement parts for vehicle maintenance and repair**, manufacturers could be asked to share the relevant information for sourcing these vehicle components (e.g. suppliers, recommended websites) alongside the product. This information requirement could be integrated into NOM-024-SCFI-2013, which defines required commercial information to be included on packaging labels, warranties and instructions or user manuals for electric, electronic, and household appliances.

Table 3: Recommendations to strengthen the quality infrastructure for micromobility in Mexico.

In addition to strengthening the QI framework in Mexico, facilitating the expansion of micromobility modes of transport requires complementary actions. These may include facilitating the transportation of lightweight vehicles within public transport systems to encourage their use in cities, and creating secure and enclosed facilities specifically designed for vehicle storage to prevent both complete and partial theft.

Scooter and a helmet as a means of safe movement.

Conclusions

The growth in popularity of micromobility modes of transport – small, lightweight and often single-occupant vehicles designed for short-distance travel – offers opportunities to reduce congestion and pollution in large urban areas and cut GHG emissions in the transport sector. At the same time, we may see the development of new modes of transport, bringing new safety risks for both users and bystanders and therefore requiring regulation of their design and use. Strengthening quality infrastructure to address these risks, by incorporating adequate and specific safety requirements and developing the relevant standards and conformity assessment, is a key element in ensuring a safe and sustainable shift towards micromobility. Here, Mexican authorities can benefit from the use of IEC and ISO standards and experiences in the EU and the US. These have already started to develop specific safety and sustainability regulations for different types of e-bikes, e-scooters, electrified mopeds and motorcycles. Basing Mexican quality infrastructure for micromobility on internationally harmonised standards will promote the fast and efficient proliferation of micromobility modes of transport, based on the highest safety standards yet developed and regularly reviewed by international experts.

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Footnotes

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