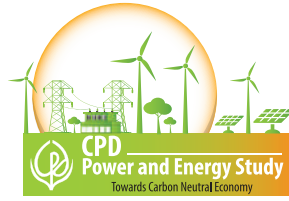


# Electric Three-Wheelers in Urban Transport Networks

## *Challenges and Way Forward*

Khondaker Golam Moazzem  
Md. Khalid Mahmud





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## Executive Summary

Electric three-wheelers (E3Ws) have become a widely used mode of urban transport in Bangladesh, responding to the growing demand for affordable and accessible mobility in densely populated cities. However, despite their considerable potential, the rapid and largely unregulated expansion of E3Ws has created substantial challenges for urban public transport systems. These include increasing traffic congestion, heightened road safety risks, weak institutional oversight, and serious health and environmental impacts, most notably those arising from the improper handling and recycling of used lead-acid batteries (ULABs). The absence of standardised manufacturing, licensing, and operational frameworks has further intensified these problems, enabling E3Ws to operate beyond designated corridors and outside formal regulatory control.

Currently, an estimated six million E3Ws are operating across Bangladesh, with a growing tendency for these vehicles to enter arterial roads, posing severe safety concerns. E3Ws account for approximately 78 per cent of national lead-acid battery consumption, which has driven the rapid expansion of informal battery recycling facilities. More than 1,100 informal lead-acid battery recycling units are now operating, causing widespread contamination of air, soil, and water and posing significant risks to human health. In addition, a large proportion of E3Ws are charged through unauthorised electricity connections. According to this study, there are about 48,136 illegal charging points in Dhaka compared to only 3,300 government-approved stations, resulting in an estimated annual revenue loss of around BDT 4,000 crore.

Regulatory and policy gaps have equally played a critical role in enabling this unregulated growth. At present, Bangladesh lacks a comprehensive and coherent policy framework specifically addressing E3Ws. This study reviews key legal and policy instruments including the Bangladesh Road Transport Act 2018, Electric Vehicle Charging Guidelines, EV Registration and Operation Policy 2023, EV Industry Development Policy 2025, and the Ordinance on Battery Rickshaw Operation 2025 to assess their relevance to E3Ws. Although these documents address electric vehicles broadly, their provisions for E3Ws are limited and inconsistent, resulting in regulatory uncertainty.

In response to these challenges, this study adopts a mixed-method approach to examine E3Ws from an urban transport policy perspective, integrating policy and institutional analysis with technical, socio-economic, health, and environmental assessments. Using a structured analytical framework that links institutional and organisational functions with core urban transport system functions, the study identifies critical governance gaps and technical shortcomings of existing E3W designs in Dhaka and other major cities. While E3Ws provide important mobility services and livelihood opportunities, the findings indicate that their current mode of operation undermines traffic management, road safety, and environmental sustainability. The study, therefore, proposes a set of comprehensive, evidence-based recommendations aimed at integrating E3Ws into a regulated and sustainable urban transport system through strengthened governance, standardised technical requirements, improved safety management, and environmentally responsible battery and charging practices.



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## Acronyms

ADB	Asian Development Bank
Ah	Ampere Hour
BEPRC	Bangladesh Energy and Power Research Council
BIDA	Bangladesh Investment Development Authority
BITAC	Bangladesh Industrial Technical Assistance Center
BLDC	Brushless Direct Current
BLL	Blood Lead Level
BREB	Bangladesh Rural Electrification Board
BRT	Bus Rapid Transit
BRTA	Bangladesh Road Transport Authority
BSTI	Bangladesh Standards and Testing Institution
BUET	Bangladesh University of Engineering and Technology
CO <sub>2</sub>	Carbon Dioxide
DCC	Dhaka City Corporation
DHUTS	Dhaka Urban Transport Network Development Study
DMP	Dhaka Metropolitan Police
DNCC	Dhaka North City Corporation
DSCC	Dhaka South City Corporation
DTCA	Dhaka Transport Coordination Authority
E3Ws	Electric Three Wheelers.
E-TukTuk	Electric Tuk Tuk
FLM	First and Last Mile
GDP	Gross Domestic Product
HSEV	High Speed Electric Vehicle
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
IEDCR	Institute of Epidemiology Disease Control and Research
JICA	Japan International Cooperation Agency
kWh	Kilowatt Hour
LEV	Light Electric Vehicle

LiFePO <sub>4</sub>	Lithium Iron Phosphate
LRT	Light Rail Transport
LSEV	Low Speed Electric Vehicle
LSV	Low-Speed Vehicle
MoE	Ministry of Environment
MORTB	Ministry of Road Transport and Bridges
MW	Mega Watt
PM	Particulate Matter
PSU	Power Supply Utilities
STP	Strategic Transport Plan
THD	Total Harmonic Distortion
ug/dL	Micrograms Per Deciliter
ULAB	Used Lead Acid Battery
UN	United Nations
UNEP	United Nations Environment Programme
URSTP	Updating Revised Strategic Transport Plan
WHO	World Health Organization



# Introduction

Electric three-wheelers (E3Ws), commonly known as electric easy bikes, have emerged as a prominent mode of urban mobility and are often perceived as an environmentally friendly alternative to conventional fossil-fuel-based transport. Owing to their battery-powered operation, low operating cost, and accessibility, E3Ws have gained widespread public acceptance and are popularly referred to as ‘Banglar Tesla’. Their rapid expansion reflects unmet demand for affordable and flexible transport services in dense urban environments. However, in recent years, E3Ws have also become a subject of growing policy concern in Bangladesh perspective. The largely unregulated expansion of these vehicles has raised critical issues related to urban traffic management, road safety, environmental sustainability, and public health particularly due to the improper handling and recycling of used lead-acid batteries (ULABs). Weak regulatory enforcement has allowed E3Ws to operate beyond designated low-speed corridors, including on highways, thereby exacerbating congestion and increasing safety risks for both passengers and other road users. Furthermore, the absence of standardised manufacturing, licensing, and operational frameworks has contributed to inconsistent vehicle quality and informal market practices.

Given these multidimensional challenges, the governance of E3Ws now requires a comprehensive policy approach that balances mobility needs with environmental protection, public safety, and sustainable urban planning. Recognising this importance, this study aims to assess E3Ws from an urban transport policy perspective where it examines the sector through four interlinked dimensions: (i) technical and operational standards, (ii) health and environmental implications, (iii) economic and livelihood impacts, and (iv) safety and social considerations. By placing E3Ws within the broader urban transport and regulatory framework, this study aims to deliver evidence-based recommendations for integrating electric three-wheelers into a sustainable and well-governed urban mobility system.

## 1.1 Background

The urban public transport system encompasses a coordinated network of shared mobility services, supporting infrastructure, and regulated traffic flows designed to facilitate the efficient movement of people and goods within a city. Developing countries are currently undergoing major transformations driven by rapid economic growth, population expansion, urbanisation, and increasing motorisation, all of which are intensifying the demand for sustainable urban public transport systems. In Bangladesh, about 41 per cent of the population now lives in urban areas, further amplifying the need for effective and accessible transportation solutions (Asian Transport Outlook (ATO), 2024). The infrastructure within urban transport is generally divided into two categories: infrastructure for high-speed and low-speed vehicles. Low-speed vehicles (LSVs) play a crucial role in ensuring connectivity to first and last mile destinations. Among these, electric easy bikes commonly known as electric rickshaws have emerged as a dominant mode for first and last mile (FLM) transport in Bangladesh. Although these vehicles are classified as LSVs and are not permitted to operate on highways, weak enforcement of rules allows many electric three-wheelers to run freely on both arterial and sub-arterial roads. Their popularity is driven by their speed, comfort, and easy availability; however, their rapid and unregulated expansion has led to uncontrolled production and declining vehicle quality, congestion in roads, and creating significant challenges for urban areas.

In Bangladesh, approximately 4 million electric three-wheelers are actively serving around 112 million people every day (Berg, 2025). According to the Dhaka City Corporation, nearly 90 per cent of these vehicles are now manufactured locally, except for components such as the motor, controller, charger and differential, which are mostly imported from China. Due to the absence of standard manufacturing guidelines, these vehicles are often produced without adherence to any technical or safety standards, which significantly affects the urban public transport ecosystem. The existing E3Ws exhibit several technical deficiencies, including poor body balance relative to speed, inadequate braking systems, the absence of indicator lights for nighttime driving, etc. These issues frequently lead to accidents. According to the Bangladesh Road Transport Authority (BRTA), about 16.5 per cent of road accidents in 2024 were caused by electric three-wheelers (Bangladesh Road Transport Authority, 2025a). Furthermore, in the same year, these vehicles consumed nearly 5 per cent of the country's total electricity generation capacity, approximately 750 MW per day and the unregulated consumption is believed to be even higher ('Three-wheelers consume 5pc of country's electricity', 2024). The primary concern lies in the unauthorised charging practices, where many operators draw electricity directly from local lines instead of approved charging stations. Although the Bangladesh Rural Electrification Board (BREB) has set specific tariffs for charging E3Ws, most operators do not comply with these regulations. As a result, power supply utilities (PSUs) face difficulties in meeting the required electricity demand.

Majority of vehicles use lead-acid batteries due to their low initial cost. These batteries pose several health, environmental, and economic challenges. Studies indicate that around 60 per cent of children in South Asian countries suffer from lead poisoning, and about 35 million children in Bangladesh have dangerously high levels of lead exposure ('Battery boom drives Bangladesh lead poisoning epidemic', 2024). This situation primarily results from the informal recycling of used lead-acid batteries. In Bangladesh, only about 20 per cent of used batteries are recycled through formal channels, while the remaining are processed informally or indiscriminately discarded. Consequently, the government incurs an estimated annual tax revenue loss of around USD 91 million (Sustainable Manufacturing and Environmental Pollution Programme, 2024). Moreover, in 2019, the combined (Cardiovascular and IQ loss) economic cost of lead-related health impacts in Bangladesh was estimated at USD 28,633 million, equivalent to approximately 6–9 per cent of the country's GDP (Das, 2023). The informal recycling of used lead-acid batteries causes several environmental impacts, including soil and water contamination, which reduce soil fertility and pollute the air through the release of sulfur dioxide. There are no designated dumping zones for these batteries, and they are often discarded indiscriminately, severely affecting ecosystems and posing serious risks to human health. In Bangladesh, lead-acid batteries are now being fully manufactured by several local companies; however, concerns remain regarding whether proper manufacturing standards and environmental safety procedures are being maintained.

On the other hand, the electric rickshaw industry was valued at approximately USD 871 million in 2022, comprising around 3 to 4 million vehicles (Islam, 2025). These vehicles represent the most affordable mode of transportation in Bangladesh, costing about BDT 0.97 per kilometre, 9 times cheaper than a sedan car (BDT 8.60/km) and nearly half the cost of bus services (BDT 2.15/km per person). Around four million drivers and their families depend on these vehicles as their primary source of livelihood (Hasan M., 2024). In Dhaka city, a driver typically earns about BDT 1,500 per day, from which BDT 400 is paid to the garage owner as a daily rental fee. On average, a driver can earn around BDT 30,000 per month from operating these vehicles (KIIs). Therefore, any attempt to phase out these rickshaws without proper alternatives would significantly impact on the income and well-being of millions of families. However, increase of these vehicles recently reduces the income of all kinds of three-wheelers such as E3Ws, CNG three-wheelers, and traditional non-motorised rickshaws.

Due to unregulated expansion and frequently running on main arterial roads, the BRTA has imposed several bans on electric rickshaws from highways at different times. In response, electric rickshaw drivers have frequently protested these decisions, causing disruptions and uncertainty in urban areas during the demonstrations. Interestingly, neither party, the Easy Bike Samity nor the government authorities, has been able to reach a feasible and sustainable solution to the issue. Recently, a specialised team from Bangladesh University of Engineering and Technology (BUET) developed an improved design of the easy bike, funded by the Bangladesh Energy and Power Research Council (BEPRC). Following this initiative, Dhaka North City Corporation (DNCC), in collaboration

with BEPRC and BUET, began working towards establishing a standardised and regulated transport system for electric rickshaws, with plans to officially launch the new models by the end of 2025. Under this initiative, the DNCC has developed five training zones for drivers of the new easy bikes and started issuing driving licenses. As of October 8, 2025, approximately 8,000 drivers have been trained by DSCC and DNCC (KIIs). However, deficiencies in the planning and execution of new vehicle introduction raise critical questions about whether the transition can be achieved in a sustainable and equitable manner.

## **1.2 Research Objectives**

The main objective of this study is to identify the drawbacks of present urban public transport system for electric rickshaws in Bangladesh, along with some other dimensions named technical, social, economic, health and environmental consequences. The core objectives of this study are given below:

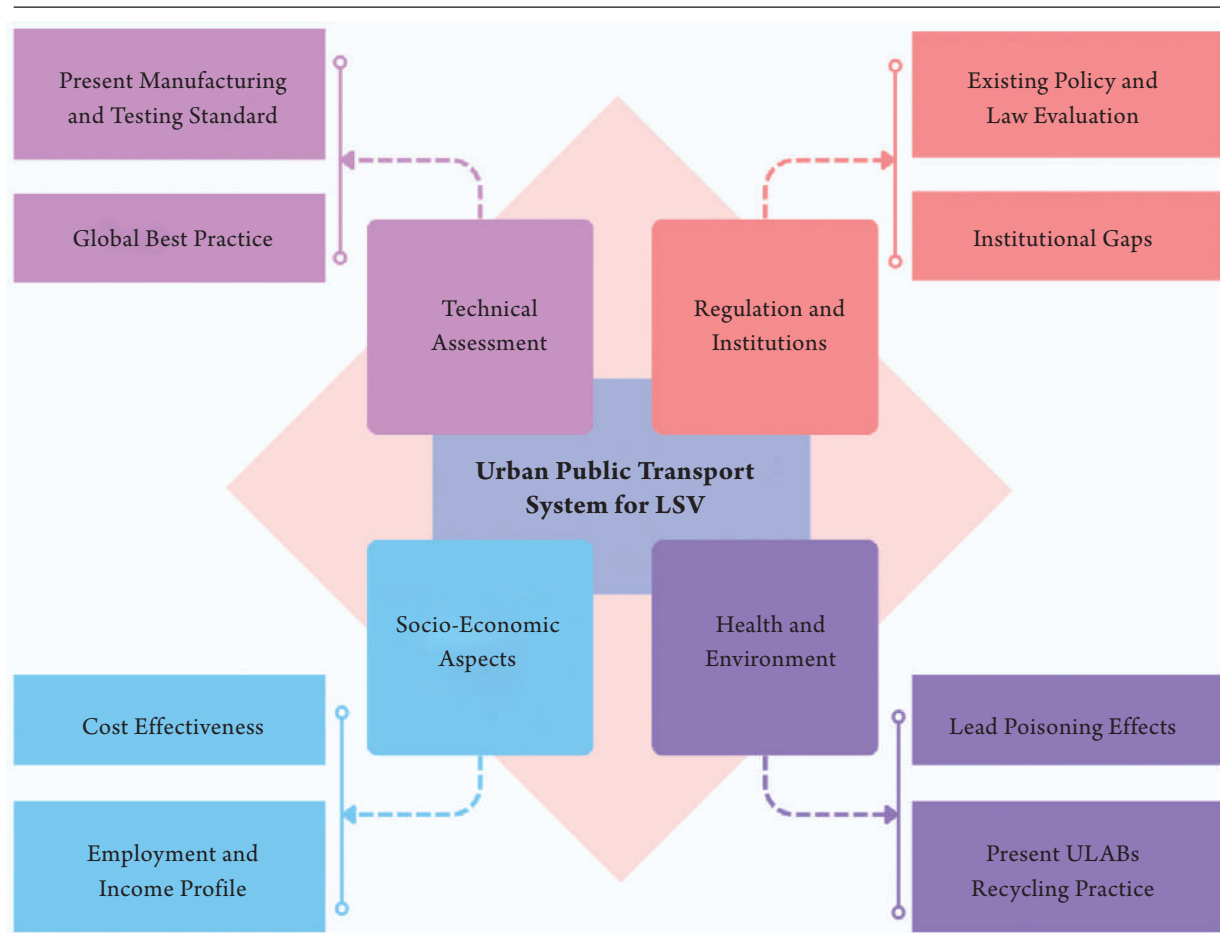
- To review and identify the gaps in Dhaka and other major cities' urban public transport systems, especially the slow-moving motorised rickshaws with their policy, law, institutions, authorisations, etc.
- To undertake critical analysis on technical and structural feasibility of existing electric rickshaws.
- To analyse social and economic aspects related to the battery rickshaws in Bangladesh.
- To analyse environmental and health related consequences of battery rickshaws in Bangladesh.
- To put forward a set of comprehensive recommendations of battery rickshaws which will comply with urban transport system, required standard for technical aspects, and cover the social, economic, health and environmental aspects.

## Analytical Framework

### 2.1 Analytical Framework of the Study

The analytical framework of this study provides a structured approach to examine the multifaceted dimensions of urban public transport systems, particularly focusing on battery-operated rickshaws. It is organised into four major components: urban public transport system management for E3Ws, technical assessment, socio-economic aspects, health and environmental aspects. Each component includes specific indicators such as policy and institutional review, operational management, manufacturing and testing standards, charging infrastructure, social implications, and environmental impacts (Figure 1). This framework serves as the guiding structure for analysing how policy,

**Figure 1: Analytical Framework of the Study**



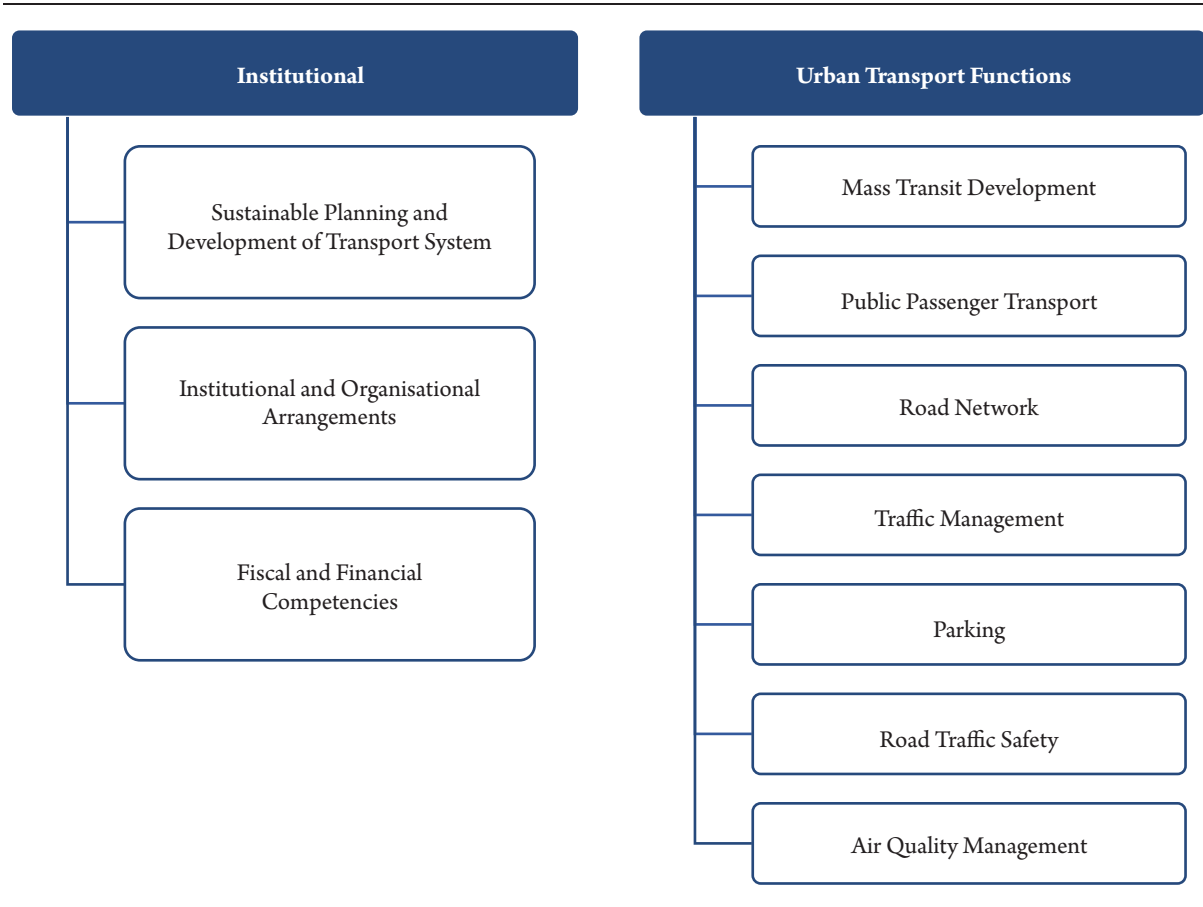
Source: Authors' compilation.

technical standards, and socio-economic and environmental factors interact to influence the sustainability and regulation of motorised rickshaws in Bangladesh’s urban context.

## 2.2 Analysis Frame of Standard Urban Transport System

The Standard Urban Transport Analysis Frame provides a comprehensive diagnostic structure for evaluating an urban transport system, dividing its functions into two essential, interconnected dimensions: Institutional/Organisational Functions and Urban Transport Functions. The former dimension focuses on the governance, policy, and financial structure, encompassing key areas like Policy and Planning, Financing and Funding, Coordination and Regulation, and Institutional Capacity, which are foundational for system sustainability. The latter dimension addresses the operational aspects and physical infrastructure, covering the practical elements of Infrastructure Provision and Management, Traffic and Demand Management (e.g., through intelligent transport system and road pricing), Public Transport Operations (including service planning and subsidies), and critical considerations for Safety, Security, and Environment (Figure 2). This integrated framework ensures that any intervention or project design addresses both the physical needs (transport) and the underlying management and governance issues (institutional), leading to more effective and sustainable urban mobility solutions.

**Figure 2: Analysis Frame of a Standard Urban Transport System**



Source: (The World Bank, 2012).

The description of institutional dimensions is as follows:

- **Sustainable Planning and Development of Transport System:** The formulation and implementation of long-term, environmentally sustainable, and socially inclusive transport strategies to ensure efficient urban mobility.

- **Institutional and Organisational Arrangements:** Institutional structures, mandates, and coordination for effective urban transport governance and management.
- **Fiscal and Financial Competencies:** The capacity of institutions to mobilise, allocate, and manage financial resources required for planning, operating, and maintaining the urban transport system.

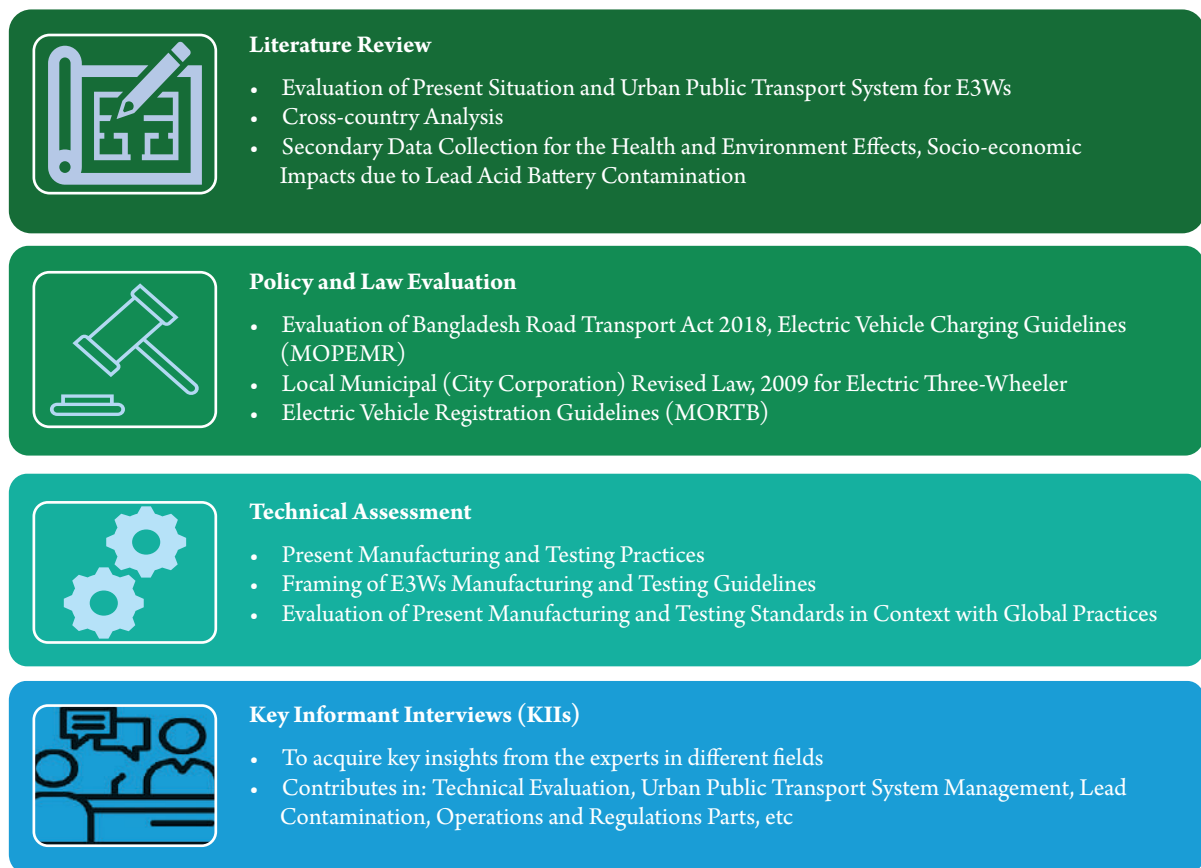
The description of urban transport functions is as follows:

- **Mass Transit Development:** Planning and management of high-capacity public transport (metro, BRT, commuter rail) to accommodate large passenger volumes.
- **Public Passenger Transport:** The oversight regulation, and provision of services that enable safe, affordable, and reliable mobility for the public through buses, minibuses, or other shared transport modes.
- **Road Network:** Development and maintenance of urban roads and infrastructure for smooth traffic and pedestrian flow.
- **Traffic Management:** The techniques and regulations are used to control vehicle flow, reduce congestion, and enhance safety through signal systems, lane management, and traffic control measures.
- **Parking:** The planning, regulation, and administration of on street and off-street parking facilities to ensure efficient land use and reduce traffic congestion.
- **Road Traffic Safety:** The policies and interventions aimed at reducing road crashes, injuries, and fatalities by improving infrastructure, enforcement, and user behaviour.
- **Air Quality Management:** The monitoring and regulation of emissions from the transport sector to minimise air pollution and protect public health and environmental quality.

## Methodology

The study follows a mixed-method approach, integrating qualitative analysis of policies, institutions, and stakeholder perceptions with quantitative assessment of technical, social, and environmental indicators (Figure 3). The study begins with an extensive literature review to understand the problems and issues are ongoing with E3Ws in Bangladesh. Then, this study examined the existing policies and laws to find the gaps which are responsible for unregulated operations of these vehicles. The second phase of literature review was conducted for technical assessment of E3Ws, and it also covers the urban public transport system for E3Ws, cross-country analysis, socio-economic, health and environmental. The study also employed Key Informant Interviews (KIIs) to gather qualitative insights from the experts on different fields.

**Figure 3: Methodology of the Study**



Source: Authors' illustration.

## Urban Public Transport System of Dhaka and E3Ws

### 4.1 Overview of Dhaka's Transport System

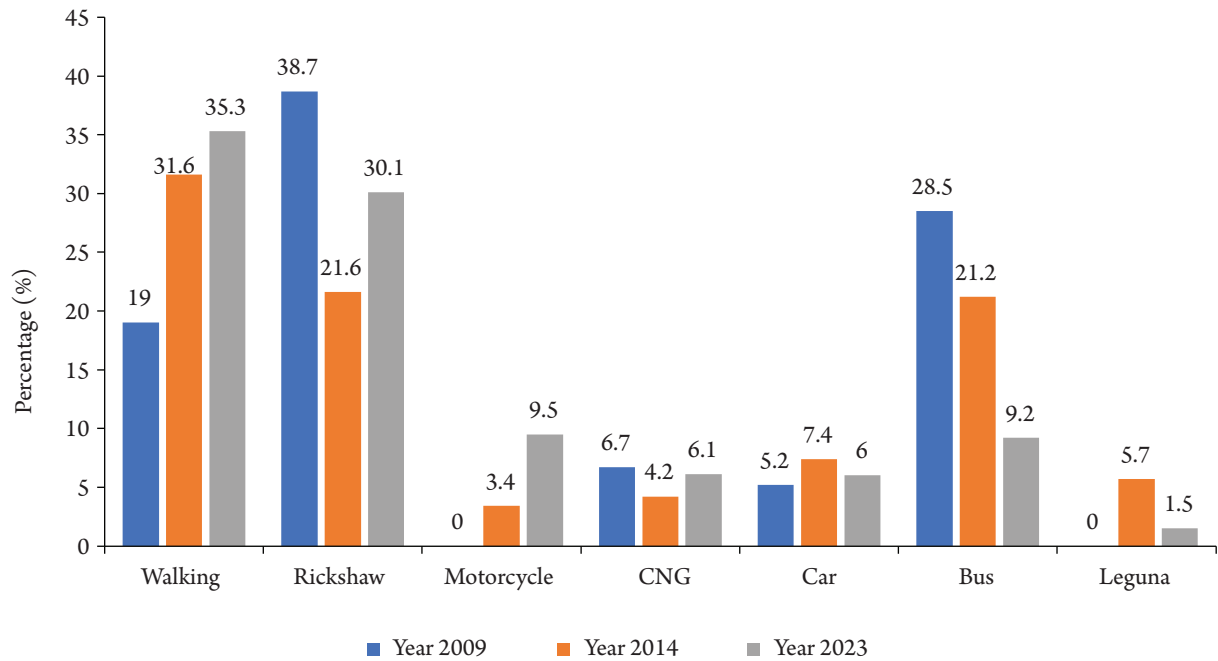
The vehicle registration data in Dhaka between 2010 and June 2025 reveals that continuous motorisation trend, culminating in a grand total of 2,270,631 registered vehicles (Table 1). This rapid expansion is overwhelmingly dominated by the Motorcycle segment, which, with a cumulative total exceeding 1.23 million, accounts for over half of the total registered fleet, indicating a significant reliance on high-volume, low-capacity personal transport. While the Private Passenger Car category also represents a substantial portion, with over 353,000 units, the data highlights a clear imbalance between personal and public transport modes, with the Bus category registering a comparatively low total of 43,398 units (Table 1). This compositional bias towards personal vehicles suggests a worsening scenario for urban congestion and environmental externalities, placing considerable pressure on Dhaka's severely limited road infrastructure. The infrastructural gap is causally linked to severe environmental externalities,

**Table 1: Total Number of Registrations of Different Types of Vehicles in Dhaka**

Type of Vehicles	Grand Total (From Year: Jan 2010 to June 2025)
Ambulance	6,141
Auto Rickshaw	20,980
Bus	43,398
Cargo Van	9,063
Covered Van	42,968
Delivery Van	27,365
Human Hauler	4,752
Jeep (Hard/Soft)	86,163
Microbus	103,591
Minibus	10,291
Motorcycle	1,239,548
Pick Up (Double/Single Cabin)	124,086
Private Passenger Car	353,539
Special Purpose Vehicle	2,620
Tanker	3,290
Taxicab	30,136
Tractor	39,213
Truck	87,096
Others	34,985

Source: (Bangladesh Road Transport Authority, 2025b).

**Figure 4: Change of Modal Share from 2009 to 2023**



Source: (Asian Development Bank, 2023a) & (JICA, 2010).

including heavy congestion, air quality degradation with PM 2.5 and NO<sub>2</sub> concentrations significantly exceeding healthy limits. In 2023, the sector’s emissions reached 11.6 million tonnes, constituting 9 per cent of the country’s total emissions (Asian Transport Outlook (ATO), 2024).

The comparison between the 2009 JICA Dhaka Urban Transport Network Development Study (DHUTS) and the 2023 URSTP Household Interview Survey reveals notable shifts in urban travel behaviour in Dhaka. In 2009, Rickshaws dominated modal share at 38.7 per cent, followed by public buses (28.5 per cent) and walking (19 per cent), with motorised private modes such as CNGs (6.7 per cent) and cars (5.2 per cent) playing a relatively minor role (Figure 4). By 2023, daily trip generation had increased substantially to 38.7 million trips, accompanied by a reconfiguration of modal distribution. Walking emerged as the largest share at 35.3 per cent, indicating a significant rise in non-motorised travel, while Rickshaw usage declined to 30.1 per cent. The share of public buses dropped sharply to 9.2 per cent, suggesting a weakening in formal public transport reliance, whereas motorcycles (9.5 per cent) and private cars (6 per cent) gained prominence, reflecting growing motorisation (Figure 4). Vehicle speeds in Dhaka have plummeted over time: average speed dropped from 21 km/h a decade ago to as low as 4.5 km/h (or 4.8 km/h in some reports) in recent years, contributing to severe congestion and economic losses estimated at USD 6.5 billion annually (Saif, 2020).

## 4.2 Evaluation of Dhaka’s Transport System

Dhaka’s urban transport system exhibits significant structural and operational challenges despite ongoing initiatives aimed at improving mobility and sustainability. Institutional frameworks, guided by the Strategic Transport Plan (STP) and its revisions, outline objectives for mass transit expansion, non-motorised transport promotion, and environmental sustainability, yet implementation remains slow and fragmented due to limited inter-agency coordination and resource constraints. The city’s transport functions reveal a heavy reliance on buses and informal modes, with emerging metro and BRT projects only partially alleviating congestion (Table 2). Road networks are narrow and discontinuous, traffic management is inadequate, and parking shortages exacerbate mobility issues.

**Table 2: Key Observations on Dhaka’s Urban Transport System**

Dimension	Aspects	Key Observations
Institutional	Sustainable Planning & Development	Guided by STP & URSTP; focus on mass transit, non-motorised transport, and sustainability; implementation slow, fragmented; weak integration with land use planning.
	Institutional & Organisational Arrangements	Multiple agencies (DTCA, BRTA, DMP, city corporations) with overlapping roles; poor coordination, delayed decisions, weak enforcement; limited capacity for data-driven policy.
	Fiscal & Financial Competencies	Public transport funding constrained; reliance on government budgets & international aid; capital-intensive projects with long payback; underutilised revenue mechanisms (tolls, congestion pricing).
Urban Transport Functions	Mass Transit Development	Metro rail partially operational; BRT and elevated expressways underway; buses remain main mode (30–35%); private vehicles growing (24% cars, 15% motorcycles); network limited and unreliable.
	Public Passenger Transport	Buses, minibuses, auto-rickshaws dominate; fleet aging, irregular schedules, weak safety; app-based services limited; passenger dissatisfaction high, especially among vulnerable groups.
	Road Network	Coverage 7–8% (3,000 km); narrow, discontinuous, poorly maintained; weak hierarchical planning; encroachment reduces capacity.
	Traffic Management	Limited infrastructure and enforcement; peak-hour speeds 4–7 km/h; heterogeneous traffic worsens congestion and accidents.
	Parking	Severe shortage; dominated by on-street parking; off-street limited/expensive; illegal parking contributes to congestion.
	Road Traffic Safety	High accident rates; pedestrians and non-motorised users most vulnerable; insufficient footpaths, signage, crossings; inconsistent enforcement and incomplete accident data.
	Air Quality Management	Severe vehicular pollution; PM2.5 exceeds WHO guidelines 3–5×; partial mitigation via electrification & CNG vehicles; weak monitoring, regulation, and incentives for cleaner tech.

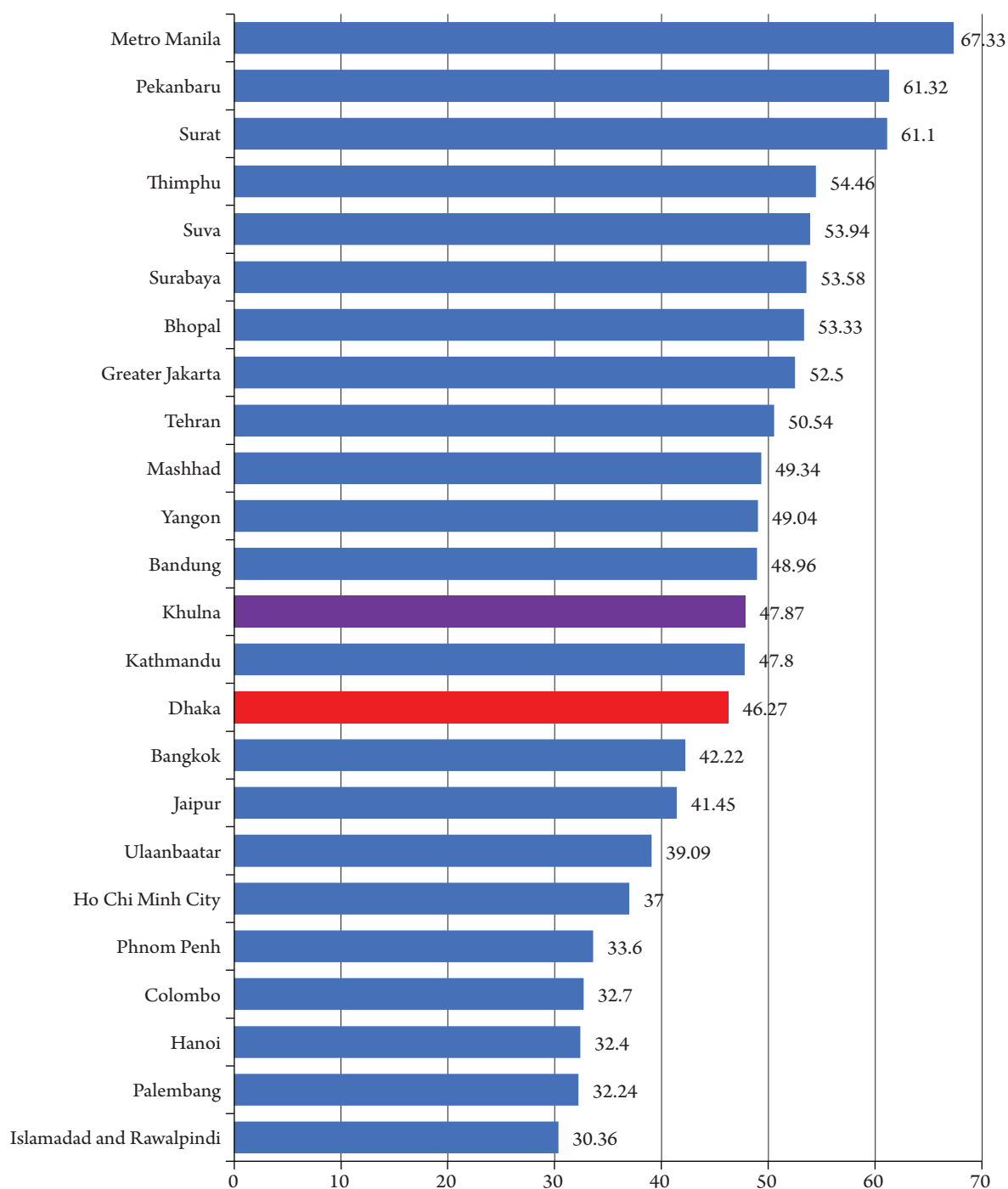
Source: Authors’ observation.

High accident rates, poor safety infrastructure, and severe air pollution further highlight systemic deficiencies. Collectively, these institutional and functional limitations underscore the need for integrated planning, strengthened governance, and sustainable investment strategies to enhance the efficiency, safety, and environmental performance of Dhaka’s urban transport system.

### 4.3 Sustainable Urban Transport Index (SUTI) Score Comparison

The aggregate Sustainable Urban Transport Index (SUTI) score was computed using a set of key indicators outlined by UNESCAP encompassing city mobility and public transport planning, modal share of active and public transport, accessibility, service quality and reliability, traffic fatalities, affordability, operational costs, investment in public transport, air quality (PM10), and greenhouse gas emissions from transport. As illustrated in Figure 5, the comparative assessment indicates that Dhaka and Khulna rank 10th and 12th among the analysed cities, achieving SUTI scores of 46.27 and 47.87, respectively (Figure 5). These mid-range positions reflect persistent challenges in public transport quality, environmental performance, and safety, despite ongoing investments. In contrast, Metro Manila, Philippines, attains the highest overall SUTI score among the selected cities, demonstrating comparatively stronger performance across multiple transport sustainability dimensions. This disparity underscores the need for Bangladeshi cities to adopt more integrated and performance-driven urban transport policies to enhance sustainability outcomes.

**Figure 5: SUTI Score of Major Asian Cities**



Source: (UNESCAP, 2022a).

The details of the indicators are as follows:

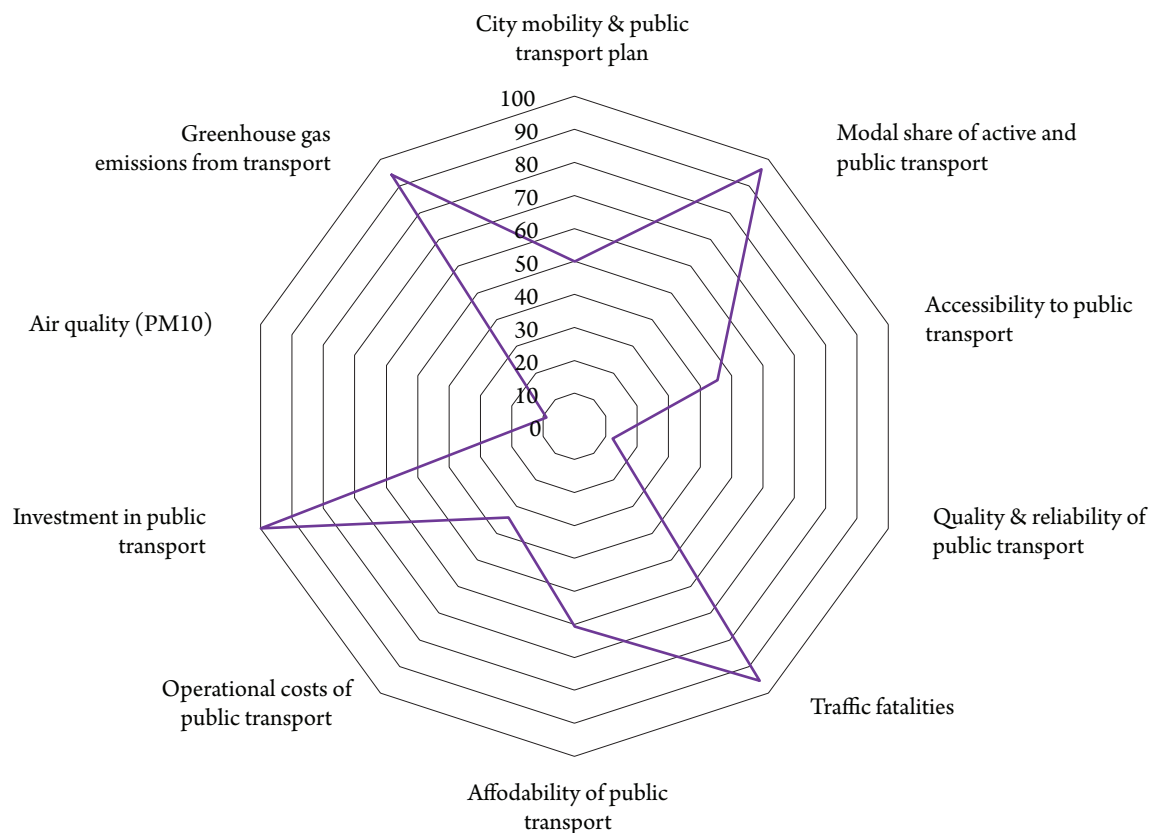
- **City Mobility and Public Transport Plan:** Assesses the presence and effectiveness of integrated urban mobility and public transport planning frameworks that support sustainable transport development.
- **Modal Share of Active and Public Transport:** Measures the proportion of trips made by walking, cycling, and public transport, reflecting the level of sustainable and inclusive mobility.

- **Accessibility to Public Transport:** Indicates the percentage of the urban population with convenient access to public transport services within acceptable walking distances.
- **Quality and Reliability of Public Transport:** Evaluates service performance in terms of comfort, safety, frequency, punctuality, and operational reliability.
- **Traffic Fatalities:** Represents the rate of road traffic deaths, serving as a key indicator of transport system safety.
- **Affordability of Public Transport:** Measures the extent to which public transport fares are financially accessible, particularly for low-income users.
- **Operational Costs of Public Transport:** Assesses the cost efficiency of public transport operations relative to the level of service provided.
- **Investment in Public Transport:** Reflects the level of financial commitment towards public transport infrastructure, services, and system enhancement.
- **Air Quality (PM10):** Measures ambient particulate matter (PM10) concentration linked to transport activities, indicating health and environmental impacts.
- **Greenhouse Gas Emissions from Transport:** Assesses the magnitude of transport-related greenhouse gas emissions, reflecting climate impact and mitigation performance.

#### 4.4 SUTI Score of Dhaka’s Transport System

The overall Sustainable Urban Transport Index (SUTI) score of Dhaka city is 46.27, reflecting a generally underperforming urban public transport system (Figure 6). The radar chart reveals pronounced weaknesses, particularly the extremely low score for public transport service quality, indicating deficiencies in reliability, comfort, and user satisfaction. Environmental performance also remains poor, driven by high vehicular emissions,

Figure 6: SUTI Score Breakdown of Dhaka City



Source: (UNESCAP, 2022a).

weak enforcement of emission standards, and continued dependence on aging and highly polluting vehicle fleets. Moreover, operational inefficiencies and the absence of effective, integrated planning constrain the overall functionality and responsiveness of the transport system. Notably, although investment in public transport records a maximum score of 100, suggesting strong financial commitment, the limited translation of these investments into tangible service improvements highlights significant gaps in implementation efficiency and governance effectiveness.

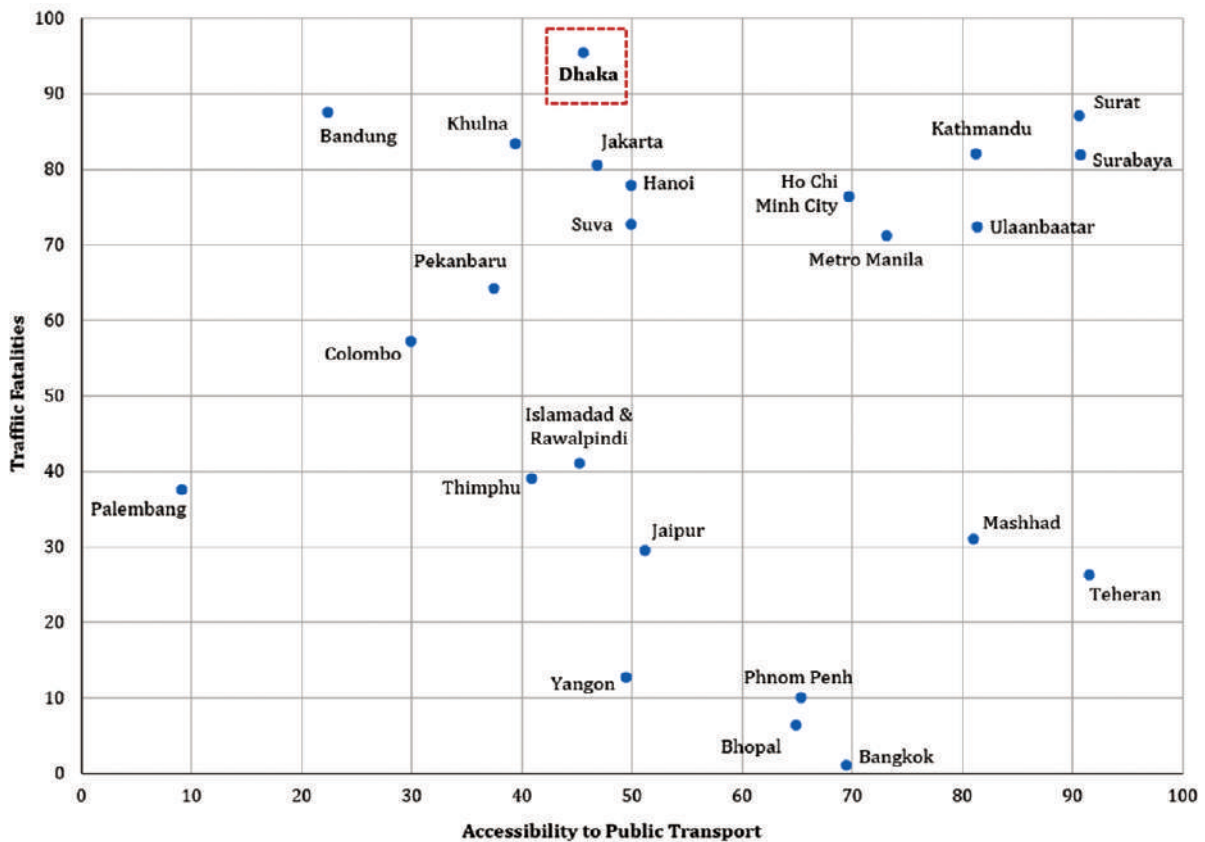
#### **4.5 Access of Public Transport and Traffic Fatalities Across the Asian Cities**

In the Asia-Pacific region, urban sprawl and the characteristics of transport infrastructure often result in distances from residential or commercial locations to public transport nodes exceeding the convenient walking threshold of 500 metres. This gap has led to the emergence of informal transport modes, which play a crucial role in providing low-cost mobility services for populations traveling between areas that are underserved or inefficiently served by formal public transport. Examples include communal for-hire vehicles and motorbikes operating along feeder routes from main transport hubs. While these modes offer affordable and relatively fast short-distance travel, they also raise concerns regarding safety and air pollutant emissions.

Sustainable Development Goal (SDG) 11, target 2, urges United Nations member states ‘to provide access to safe, affordable, accessible, and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, including women, children, persons with disabilities, and older persons’. Progress towards this target is assessed by the proportion of the population with convenient access to public transport (Indicator 11.2.1) (UNESCAP, 2024). For this measure, public transport is considered convenient if the nearest stop is within 500 metres for low-capacity systems and 1,000 metres of high-capacity systems. Under this measurement, Dhaka’s public transport scores 45.6 which ranks 17th among the cities mentioned. Whereas Khulna ranks 20 and the score was 39.48 (Figure 7).

The FLM problem reflects broader, unresolved challenges in urban transport across the region. Potential solutions include expanding public transport networks to increase coverage within cities, optimizing route planning to align with changing demand patterns, enhancing existing informal transport services, and integrating different transport providers through mechanisms such as unified fare systems to enable seamless and well-coordinated journeys. Additionally, promoting a shift away from private car usage and incorporating pedestrian-friendly urban designs can contribute to a more accessible, inclusive, and safe transport environment. Ultimately, ensuring safe, convenient, and efficient first- and last-mile travel options can significantly encourage greater public transport utilisation.

Figure 7: Access of Public Transport and Traffic Fatalities Across the Asian Cities



Source: (UNESCAP, 2024).

Note: 0 on the vertical scale indicates a high amount of traffic fatalities while 100 indicates a low amount of traffic fatalities.

## 4.6 Importance of FLM Transport Management

In Dhaka’s congested urban transport environment, FLM connectivity remains a critical challenge due to limited road capacity, high traffic congestion, and insufficient pedestrian infrastructure. Low-speed electric three-wheelers (E3Ws) serve an essential role in addressing this gap by providing flexible, affordable, and environmentally friendly mobility for short trips between commuters’ origins or destinations and major public transport nodes. The importance of E3Ws in FLM connectivity, and the need for regulated management, can be highlighted as follows:

- **Enhanced FLM Accessibility:** E3Ws link residential areas, commercial centres, and transit hubs that are otherwise poorly served by buses or metro lines.
- **Congestion Mitigation:** By facilitating short-distance trips, E3Ws reduce the dependence on private cars and larger informal vehicles, easing urban traffic pressure.
- **Affordability & Inclusivity:** Low fares make E3Ws accessible to low-income commuters, women, and elderly passengers, ensuring equitable mobility.
- **Environmental Benefits:** Electric propulsion reduces local air pollution and noise, contributing to cleaner FLM transport.
- **Integration with Public Transport:** Properly managed E3W services enhance the efficiency and attractiveness of buses, BRT, and metro lines by providing seamless FLM connectivity.

However, the rapid and unregulated expansion of E3Ws has become a growing concern, contributing to increased traffic congestion on local roads and a higher risk of accidents. In the absence of formal oversight, the growth of these vehicles remains uncontrolled. Implementing proper management and regulations could mitigate these risks while ensuring that E3Ws effectively deliver the benefits of FLM connectivity.

## 4.7 E3Ws in Major Cities in Bangladesh

Present profile of E3Ws in major cities (Dhaka, Rangpur, Khulna, Sylhet, Rajshahi, Mymensingh, Chattogram) in Bangladesh has been illustrated in this section (Table 3).

**Table 3: Scenario of E3Ws in Different Cities in Bangladesh**

Location	Total E3Ws	Registration	Charging Stations
Dhaka	• Around 2 Million inside Dhaka.	Registered: 5% Unregistered: 95%	Mostly informal home-based charging and small garage networks
Rangpur	• City: 40k • 8 Upz: 100k • Panchagarh: 6.5k Kurigram: 40k Thakurgaon: 10k	Registered: 6% Unregistered: 94%	Majority Unregistered
Khulna	• City: 30k • Bagerhat: 7k • Magura: 10k • Meherpur: 12k • Chuadanga: 100k Jhineidah: 3.5k Jashore: 38k Kushtia: 17k	Registered: 7.9% Unregistered: 92.1%	469 (Listed) Majority Unregistered
Sylhet	• City: 40k • Sunamganj: 15k	Registered: 18.2% Unregistered: 81.8%	Mostly household/garage charging
Rajshahi	• City: 30k • 9 Upz: 65k • Joypurhat: 6.5k • Sirajganj: 7k • Naogaon: 106k Pabna: 64.5k Chapainawabgonj: 6k Natore: 5k	Registered: 8.8% Unregistered: 91.2%	403 (Listed)
Mymensingh	• City: 40k • 13 Upz: 30k • Jamalpur: 15k Netrokona: 15k Sherpur: 56k	Registered: 23% Unregistered: 77%	Mostly household/garage charging
Chattogram	• Above 300k inside City.	Registered: 24.5% Unregistered: 75.5%	Mostly household/garage charging

Source: Authors' compilation based on available data.

### 4.7.1 Dhaka

In Dhaka Division, E3Ws operate extensively but largely informally due to regulatory restrictions. The DSCC and DNCC reports that about 80,000 rickshaws are registered within both city corporation; however, the city corporation officials estimate that 500,000 to 1,000,000 rickshaws are actually in operation, with roughly 80–90 per cent unregistered (Is a rickshaw-free Dhaka really possible?, 2025). Battery-run rickshaws were officially banned under a High Court ruling from 2014, and their import was prohibited in 2021 (Is a rickshaw-free Dhaka really possible?, 2025). Another study states that, currently 2 million E3Ws are operating in Dhaka (Hossain A., 2025). This highly unregulated expansion of E3Ws reflects both public dependence on affordable electric transport and creates challenges in enforcing regulatory compliance. In consequent, BRTA continues to face difficulties in controlling the rapidly expanding informal sector of E3Ws.

### 4.7.2 Rangpur

In the Rangpur Division, the adoption of E3Ws has grown significantly across both urban and rural areas. Approximately 1,00,000 electric rickshaws operate in the eight upazilas of Rangpur, with 40,000 more within Rangpur City, 40,000 in Kurigram, 6,500 in Panchagarh, and 10,000 in Thakurgaon (Farooq, 2025a). However, only 11,141 vehicles are officially registered in Rangpur, comprising 5,341 auto-rickshaws and 5,800 normal rickshaws. The registration fees vary by vehicle types, with auto-rickshaws requiring BDT 17,700 and normal rickshaws BDT 3,300, which needs to pay to the city corporation (Farooq, 2025a). The purchase price also differs across categories auto-rickshaws range from BDT 2.5 to 2.65 lakh, normal rickshaws from BDT 70,000 to 90,000, and Mishuks from BDT 1.18 to 1.6 lakh (Farooq, 2025b). The E3Ws in Rangpur collectively consume around 3

MW of electricity daily, equivalent to 90–100 MW per month, with each rickshaw typically using 10–12 kWh per full charge cycle that takes about 12–13 hours (Farooq, 2025a). Charging tariffs under NESCO-2 are set at BDT 7 per unit, while in Thakurgaon, local charging fees range between BDT 80–100 (Farooq, 2025a). Garage deposits also differ regionally, auto-rickshaw drivers pay about BDT 550 per day, normal rickshaws BDT 400, and Mishuks BDT 500, while in Thakurgaon, the daily deposit is comparatively lower at BDT 300. Despite the growing number of E3Ws, the electricity grid faces notable supply challenges, particularly in Kurigram city, where the demand is 14 MW against a supply of 10–11 MW, leaving a 3–4 MW deficit (Farooq, 2025a). Across the seven upazilas of Kurigram, the demand reaches 108 MW, whereas the grid supplies only 80–85 MW, indicating a persistent energy shortfall that directly impacts E3W charging operations (Farooq, 2025a).

#### **4.7.3 Khulna**

In the Khulna Division, the use of E3Ws has expanded rapidly, reflecting diverse licensing, registration, and energy use patterns across districts. In Khulna City, around 25,000–30,000 auto-rickshaws are currently in operation, though only 7,000 - 8,000 are registered (Milon, 2025). There are 72 officially registered charging points with a combined allocation of 891 kW, while local sources report more than 200 active charging sites operating informally (Milon, 2025). Garage owners in the city pay a relatively high energy cost of BDT 16 per unit (mean), and most charging activities occur after 9 PM to avoid peak demand hours. The city's licensing data shows fluctuating growth, 17,000 licenses were issued during the year 2005–06, 2,096 in 2021, and a surge to 7,898 in 2019, indicating a gradual recovery of regulatory activity. In Satkhira, 695 licenses were issued during 2017–18, whereas Bagerhat has fewer than 1,000 licensed vehicles against an estimated 6,000 unregistered units (Milon, 2025).

Over 3,500 E3Ws operate in the city, including 1,300 unlicensed, with 2,500 new licenses issued this year and 1,570 more in the upazilas of Jhenaidah (Milon, 2025). The district maintains 80 pre-paid charging stations handling a daily load of 1,640 kW, and each rickshaw consumes around 350–400 kWh per month (Milon, 2025). Magura hosts approximately 6,000–7,000 auto-rickshaws and 2,000–3,000 battery vans, supported by 28 charging stations with an allocated capacity of 45,000 kWh, while 1,156 vehicles are officially licensed (Milon, 2025). The total number of registered E3Ws stands at 7,768, comprising 4,478 auto-rickshaws, 2,973 rickshaws, 24 smart models, and 293 electric vans in Jashore (Milon, 2025). However, there are an additional 20,000–30,000 unregistered vehicles, collectively consuming 40–45 MW of electricity daily. Meherpur records 2,000 registered easy bikes but faces a much higher count of more than 10,000 unregistered units, including 2,000 within the city (Milon, 2025). Most vehicle components such as tires, motors, batteries, and bodies are imported from China, contributing to a daily energy consumption of 15 MW (Milon, 2025).

Similarly, in Kushtia, there are approximately 10,000 easy bikes where only 3,000 are registered and 7,000 battery rickshaws, of which 1,400 are registered (Milon, 2025). Licensing trends show 2,278 licenses issued in 2020 and about 500 so far in 2025, while unregistered units remain around 5,000. Chuadanga exhibits the highest E3W penetration in the division, with over 100,000 easy bikes and battery rickshaws operating and 259 listed charging garages, underscoring both the intensity of electric mobility adoption and the growing challenge of unregulated power usage across the Khulna (Milon, 2025).

#### **4.7.4 Sylhet**

In the Sylhet Division, the use of E3Ws presents a contrasting regulatory landscape between urban and semi-urban areas. Within Sylhet City, an estimated 15,000 - 20,000 unregistered battery-powered rickshaws operate informally despite regulatory restrictions (Rony, 2025). The Sylhet City Corporation has enforced a policy effective from 22 September 2025, allowing only pedal-driven rickshaws within city limits while banning battery-driven rickshaws to address traffic congestion and power management issues (Rony, 2025). Sunamganj demonstrates moderate but growing E3W activity, with 2,300 registered vehicles in the municipal area comprising 1,300 easy bikes and 1,000 electric rickshaws alongside 8,000–9,500 unregistered units across the district (Rony, 2025). Operators typically pay a daily garage deposit of BDT 600, highlighting both the economic significance and informal operational structure of E3Ws in the region.

### **4.7.5 Rajshahi**

E3Ws have become a dominant mode of urban and peri-urban transport, supported by rapid growth across all districts of Rajshahi. The city itself has 16,000 registered electric rickshaws, comprising 10,000 easy bikes and 6,000 rickshaws, with around 300 garages operating within the city corporation area (Ashiq, 2025). Across the 9 upazilas of Rajshahi District, the total number of E3Ws is estimated between 60,000 and 65,000, including roughly 30,000 easy bikes and 35,000 rickshaws, highlighting the city's strong dependency on battery-powered mobility (Ashiq, 2025). In Joypurhat, there are about 6,500 electric rickshaws and vans across five upazilas, among which 1,461 are registered including 271 easy bikes, 860 rickshaws, and 330 Mishuks (Ashiq, 2025).

E3Ws have also expanded extensively, with 3,500 registered easy bikes and 3,000 registered rickshaws operating within the city of Pabna, alongside 8,000 unregistered vehicles (Ashiq, 2025). Across the 9 upazilas of Pabna, approximately 50,000 battery-driven rickshaws are in operation, indicating a high rate of unregulated growth. Similarly, Chapainawabganj records steady annual licensing activity, with 91 easy bike and 73 rickshaw licenses issued in 2025, compared to 214 and 96 in 2024, and 785 combined in 2022 (Ashiq, 2025). The Chapainawabganj Sadar area alone hosts 5,000–6,000 electric rickshaws, with typical operator earnings ranging from BDT 800–900 per day, of which BDT 200 goes towards charging costs and BDT 500 towards rental fees (Ashiq, 2025). In Sirajganj, 4,703 electric rickshaws are officially registered, while Natore reports 365 new registrations over June - August 2025 against an ambitious target of 300,000 licenses, suggesting a large pool of unregistered vehicles among an estimated 5,000 total (Ashiq, 2025). Meanwhile, Naogaon has registered 685 easy bikes and 1,500 rickshaws in 2025, but the total number of E3Ws exceeds 6,000 in the city and over 100,000 across its 11 upazilas. The district also maintains 103 officially registered charging stations, reflecting growing energy demand linked to electric mobility (Ashiq, 2025).

### **4.7.6 Mymensingh**

The Mymensingh Division exhibits rapid growth in E3Ws usage across both urban and rural areas, with a large portion of vehicles operating without registration. In Mymensingh City, there are approximately 5,400 electric rickshaws, 5,571 Mishuks, and 5,968 easy bikes, while the number of unregistered vehicles is estimated to be nearly double these figures (Akand, 2025). Beyond the city, across the 13 upazilas of Mymensingh District, an additional 30,000 E3Ws are in operation, highlighting the extensive penetration of battery-powered transport (Akand, 2025). In Netrokona, the Sadar area alone accounts for 5,614 registered electric rickshaws, consisting of 2,450 easy bikes, 1,311 Mishuks, and 1,903 electric rickshaws, showing a balanced mix of vehicle types under formal registration (Akand, 2025).

In Jamalpur, the municipality has registered 4,300 easy bikes and 3,100 Mishuks, with annual licensing fees of BDT 3,500 for easy bikes and BDT 2,500 for Mishuks (Akand, 2025), contributing to local government revenue. Meanwhile, Sherpur has shown consistent licensing activity, issuing 2,900 licenses in 2024 (including 1,400 easy bikes, 1,350 Mishuks, and 150 rickshaws) and 2,400 more in 2025 (Akand, 2025). The city now accommodates 5,000–6,000 electric rickshaws, while the total number across the Sherpur District exceeds 50,000, indicating strong reliance on E3Ws for local mobility (Akand, 2025). Collectively, the Mymensingh Division's data reflects the increasing dominance of electric mobility paired with challenges in registration and regulation, which remain crucial for balancing energy demand, traffic control, and municipal management.

### **4.7.7 Chattogram**

In Chattogram Division, electric rickshaws also form an important part of urban mobility, though regulatory and enforcement challenges persist. The Chattogram City Corporation (CCC) reports around 70,000 registered rickshaws and 3,500 vans, while the actual number of unregistered or informal vehicles is likely much higher (Chowdhury, 2023). To improve governance, the city recently introduced a digital registration system with QR codes for rickshaws (Chowdhury, 2023). Nevertheless, enforcement remains a challenge, as evidenced by the seizure of over 3,000 battery-run rickshaws in April 2025 (Chowdhury, 2023). These developments underscore

the difficulty of regulating electric mobility in rapidly growing cities and the need for better data on E3Ws, charging infrastructure, and energy consumption for sustainable urban transport planning.

Based on the scenarios across different cities in Bangladesh, there is clear evidence of nationwide unregulated expansion of E3Ws, which needs to be formally addressed through standardised regulatory compliance.

## E3Ws Legal, Institutional and Operational Issues

### 5.1 Policy and Law Evaluation Related to E3Ws

This section examines the existing policies, laws, ordinances, and guidelines relevant to E3Ws, including the Bangladesh Road Transport Act (2018), Electric Vehicle Charging Guidelines (2022), EV Registration and Operation Policy (2023), and the Ordinance on Battery Rickshaw Operation (2025) (Table 4). Among these instruments, only the 2025 Ordinance directly addresses E3Ws. The remaining documents primarily focus on electric motorcycles or high-speed electric vehicles (HSV), with limited or no provisions tailored to low-speed vehicles (LSV) such as E3Ws. Despite the critical role of E3Ws in first- and last-mile (FLM) transport, the lack of LSV-specific regulations has contributed to their rapid and largely unregulated expansion across the country. Table 4 presents the evaluation metrics for these policies, laws, ordinances, and guidelines in relation to E3Ws.

**Table 4: Evaluation of Policy, Law, Ordinance and Guideline with Respect to E3Ws**

Metrics in Aspect of EW3s	Bangladesh Road Transport Act 2018	Electric Vehicle Charging Guidelines	Ordinance on Battery Rickshaw Operation 2025	EV Registration and Operation Policy 2023	EV Industry Development Policy 2025
Legal Recognition and Classification	Absent	Partially Present	Present	Absent	Not Recognised
Operational Rules & Urban Transport Integration (FLM)	Absent	N/A	Weak	Absent	Absent
Safety & Technical Standards	Absent	Present	N/A	Absent	Partially Present
Registration & Licensing	Absent	Present	Present	Absent	Present (EV)
Charging, Batteries & Infrastructure	Absent	Present	Absent	Absent	Present (EV)
Environmental & Sustainability Alignment (Disposal)	Absent	Partially Present	Absent	Absent	Present
Economic & Financial Provisions	Absent	N/A	Absent	Absent	Present

Source: Authors' analysis.

Across both the Road Transport Act (2018) and the EV Charging Guideline (2022), major gaps remain for regulating electric rickshaws (E3Ws). Neither policy explicitly defines or classifies E3Ws, nor provides technical, safety, or operational standards tailored to them. Informal home-based charging and battery-swapping central to rickshaw operations are not addressed and charging guidelines do not consider last-mile mobility needs or strategic charger locations for E3Ws (Table 5). Financial incentives, affordability measures, and social protections for low-

income operators are missing, while environmental and monitoring provisions lack E3W-specific requirements. Overall, the policies remain fragmented and insufficient for supporting safe and sustainable E3W integration.

**Table 5: Gaps of Policy, Law, Ordinance and Guidelines for Integrating E3Ws into the Urban Transport System**

Names	Key Gaps Identified for Integrating E3Ws in Urban Transport System
Bangladesh Road Transport Act 2018	<ul style="list-style-type: none"> <li>• No formal definition or classification of electric rickshaws.</li> <li>• No EV or battery-related provisions (charging, safety, disposal, swapping).</li> <li>• No FLM integration measures within urban transport planning.</li> <li>• No incentives or financial support mechanisms for E3W operators.</li> </ul>
Electric Vehicle Charging Guidelines	<ul style="list-style-type: none"> <li>• No regulatory guidance for home-based or informal e-rickshaw charging setups.</li> <li>• No framework for battery-swapping stations widely used by E3Ws.</li> <li>• No provisions linking charging infrastructure with E3W-dominant FLM routes or hubs.</li> </ul>
Ordinance on Battery Rickshaw Operation 2025	<ul style="list-style-type: none"> <li>• No concrete route/ road network plan for operation of E3Ws.</li> <li>• Absence of proper distribution of E3Ws in different routes.</li> <li>• Lack of analysis on integrating E3Ws in transport system.</li> </ul>
EV Registration and Operation Policy 2023	<ul style="list-style-type: none"> <li>• No recognition of E3Ws under EV.</li> <li>• Absence of classification of LSEV and HSEV.</li> </ul>
EV Industry Development Policy 2025	<ul style="list-style-type: none"> <li>• No recognition of E3Ws as Low Speed Electric Vehicle.</li> <li>• Absence of FLM transport and its importance.</li> <li>• Mainly discusses about E4Ws.</li> </ul>

Source: Authors' observation.

## 5.2 New Vehicle Implementation, Distribution Plan and Activities

The existing E3Ws are mostly manufactured in Bangladesh where the key components have been imported from China. The key components are motor, controller, differential, and batteries. Nowadays, the lead acid batteries also been manufactured in Bangladesh. The rest of the body parts have been developed in local workshops in Bangladesh. As a result, the quality of the vehicles was not ensured properly. The rise of E3Ws increased in a significant way after the massive rise of July 2024. Due to the fall of previous governments, the regulatory body was unfunctional which gives the open license to the people to manufacture more E3Ws. Due to this concerning issue, the Dhaka North City Corporation took the grip of those vehicles and plans to introduce a new vehicle which was designed to a standard to ensure the safety of passengers. A specialised team of BUET developed a better version of the existing easy bikes under the funding of BEPRC since 2023. This vehicle has been selected by the DNCC as the standard model of easy bikes.

The DNCC and DSCC jointly launched the driver training programme in 10 different zones (each city corporation: five pilot training programmes). The locations of pilot training programmes of DNCC are Mohakhali: Zone 3 (Two Training Point), Mohammadpur: Zone 5 (One), Mirpur: Zone 4 (Two). In these training points, around 300-400 drivers are able to get trained every day and as of 4 November 2025, 8,000 drivers have received the successful training certificate from DNCC and DSCC (KIIs). By the end of this year, Dhaka City Corporation (North and South) will possibly start to launch new vehicles on the roads. They tagged these vehicles as Low-Speed Vehicles (LSV), and according to their plan, these vehicles will not get the permit to run on highways. To distribute these vehicles in the city streets, city corporations will distribute these vehicles with specific numbers in designated zones. And each zone of vehicles will not get the permit to run on other zones. The respective city corporations will regulate them in this way. Regarding the existing vehicle, it will not be banned with sudden notice, the city corporation will set a timeline for phasing out the existing vehicles. Moreover, new licenses will be provided to the drivers, and the drivers need to undergo some tests which will be taken by respective city corporations. The license fees will be set at a tolerable rate so that drivers can easily afford the new fees.

### 5.3 Regulatory Institution

E3Ws are classified as Low-Speed Vehicles (LSVs) and are therefore not suitable for operation alongside high-speed traffic on highways. Consequently, the BRTA will not exercise full regulatory authority over these vehicles. However, selected BRTA representatives will participate in committees responsible for their oversight. Regulatory responsibility for E3Ws primarily falls under the jurisdiction of the DNCC, which will serve as the leading governing body for the management and regulation of these newly introduced vehicles. (Figure 8).

The Dhaka City Corporation (North and South) will be responsible for the registration of E3Ws, issuance of driver licenses, implementation of driver training programmes, enforcement of manufacturer standards, and overall law and policy enforcement related to these vehicles. The Heat Engine Laboratory of BUET has been designated as the authorised body for type testing newly developed E3Ws. This laboratory will conduct comprehensive assessments of the vehicles across multiple performance and safety parameters. Manufacturers are required to adhere to the standard design and development guidelines established by the BUET team. At the local level, district city corporations will oversee and regulate the operation of these vehicles within their respective jurisdictions.

**Figure 8: Regulatory and Testing Authority of E3Ws**

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<b>DNCC and DSCC</b>	Dhaka North & South City Corporation
<ul style="list-style-type: none"><li>• The main body to control this vehicles inside Dhaka.</li><li>• Local Municipalities will take the control outside Dhaka similarly.</li><li>• Provide new license to the driver.</li></ul>	
<b>BRTA</b>	Bangladesh Road Transport Authority
<ul style="list-style-type: none"><li>• No direct involvement.</li><li>• Few officials from BRTA are in the team along with City Corporation to support and assist in implementation.</li></ul>	
<b>BSTI</b>	Bangladesh Standards and Testing Institution
<ul style="list-style-type: none"><li>• Approval for motors, controller, batteries and chargers.</li></ul>	
<b>BIDA</b>	Bangladesh Investment Development Authority
<ul style="list-style-type: none"><li>• Provide approval to manufacturer and assembler.</li></ul>	
<b>BITAC</b>	Bangladesh Industrial Technical Assistance Centre
<ul style="list-style-type: none"><li>• Evaluates prototypes and approves companies for manufacturing standardised electric rickshaws that meet government specifications.</li></ul>	
<b>BUET</b>	Bangladesh University of Engineering and Technology
<ul style="list-style-type: none"><li>• New vehicles need to undergo with the testing phases of BUET Heat Engine Lab.</li><li>• Approves the type of the vehicle.</li></ul>	

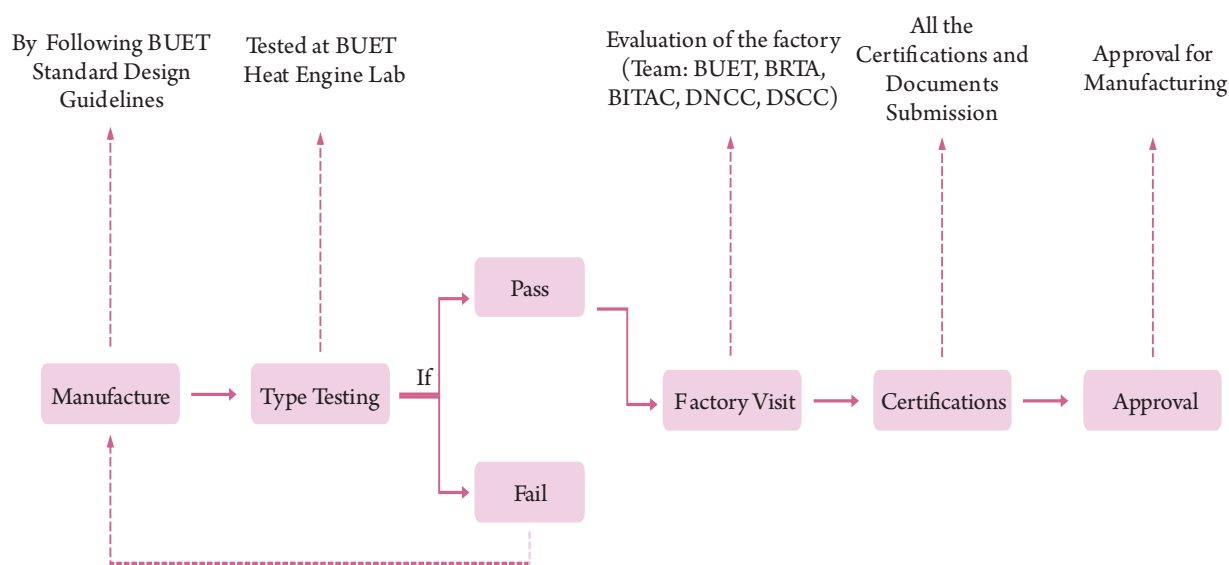
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**Source:** Authors' illustration based on KIIs.

### 5.4 Operation Principle for Type Approval

In accordance with the design and development guidelines provided by the BUET team, all manufacturers are required to adhere strictly to these standards during vehicle production (Figure 9). Following compliance, manufacturers must register with DCC to request type testing. Eligibility for type testing at BUET is granted only after registration. Upon successful completion of the type testing, a joint inspection team comprising DCC officials and a BUET representative will conduct a factory visit. If the factory meets the required standards, the

**Figure 9: Types of Approval Process of New E3W**



Source: Authors' illustration based on KIIs.

manufacturer will receive type approval and manufacturing authorization. During this inspection, the authorities will also determine the maximum number of vehicles the manufacturer is permitted to produce in a calendar year, which must be strictly observed.

### 5.5 Flaws in New Vehicle Implementation Approach

Several shortcomings have been identified in the current approach to introducing new vehicles into the transport system (Table 6). Key informant interviews (KIIs) with stakeholders involved in E3W regulation in major Bangladeshi cities revealed the absence of a comprehensive plan for integrating E3Ws into the existing transport network, particularly in alignment with the phase-out strategy for earlier E3W models. The KIIs highlighted that establishing a structured network of low-speed vehicles (LSVs) for first-and last-mile (FLM) connectivity is essential for effective urban transport management. Without such planning, regulating the rapid increase of these vehicles will remain challenging. A significant flaw noticed in the approach toward phasing out existing vehicles. With nearly two million E3Ws actively operating in Dhaka, a sudden ban would create substantial socio-economic disruptions for those dependent on these vehicles for their livelihood. Therefore, a well-designed, inclusive transition plan one that balances stakeholder interests while addressing health and environmental concerns is crucial for achieving a sustainable and socially acceptable solution.

**Table 6. Evaluation of Present Approach of Implementing E3Ws**

Metrics	Observations
Zone or Network Creation for E3Ws	Weak
Zone-wise Distribution Plan	Absent
Phase-out Plan for Existing E3Ws	Weak
Incentive Approach to Adopting New Vehicles	Absent
Phase out of Lead Batteries	Absent
Concern of Lead Battery Health and Environmental Effect	Absent
Battery Recycling and Disposal Guideline	Absent

Source: Authors' observation.

## Technical Evaluation of E3Ws

### 6.1 Types of E3Ws in Bangladesh

In Bangladesh, there are so many types of E3Ws are running on the highways and the local roads as well. There are no specific types of design or standards that are not set and as a result the local manufacturers made these rickshaws according to their own standards. Previously, these rickshaws were imported from China when these types of vehicles were newly introduced in Bangladesh. Currently, only motor, controller, battery and differential have been imported from China and rest of the things are made in local workshops in Bangladesh. According to the design view and capacity of passengers, five major types of E3Ws have been identified. In this section the different types of vehicles have been added with their specifications (Table 7). However, a wide variety of vehicle types operate on urban and peri-urban streets across Bangladesh.

**Table 7: Detailed Specifications of Different Types of E3Ws**

Metrics	Type 1 Electric Rickshaw	Type 2 E-Pedal Rickshaw	Type 3 Electric Van	Type 4 Electric Mishuk	Type 5 Electric Easy Bike
Power Consumption	800-1200W	800W	800-1000W	800-1200W	1000-1500W
Battery Capacity	48/60V 58-120Ah	48V 50-100Ah	48V	48V, 120Ah	60V, 120Ah
Body Size (Approx.)	2370*990*1680 mm	2200*850*1550 mm	2600*1100*1850 mm	2370*990*1680 mm	2980*1180*1190 mm
Tire Size (W-D)	2-26	1.95-26	1.95-26	2.75-14	3.25-16
Payload Capacity	200-300 kg	120-150 kg	~450 kg	<300kg	420 kg
Brake System	Caliper Brake	Rim Brake	Rim Brake	Disc or Drum Brake	Drum or Disc Brake
Gradient	Less than 15 degree	Less than 12 degree	Less than 15 degree	17 -19 degree	17 -19 degree
Passenger Capacity	2	2	6-8	3	Large: 6-8 Small: 3-4

**Source:** Authors' compilation.

### ***Type 1: Electric Rickshaws***

The most common type of E3W in Bangladesh is the Electric Rickshaw (Figure 10). Within this category, there are several variations, such as models with or without shade and differences in tire size. These rickshaws mostly use 800–1000 W BLDC motors imported from China (KIIs).

Earlier, wet lead acid batteries were more popular and frequently used in these rickshaws. However, recently these rickshaws started using dry lead acid batteries. Previously, these batteries were imported from China. Currently, local battery manufacturers meet the entire demand for lead-acid batteries. Each battery has a rated voltage of 12 V, and four batteries are connected to provide a total system voltage of 48 V (KIIs). Such rickshaws are able to carry only two passengers at a time. The designs vary from one workshop to another and across regions, but they all use the same electrical components. This indicates that the designs have not followed standard manufacturing guidelines, and over time this practice reduces the overall manufacturing quality of the vehicles.

**Figure 10: Variation of Electric Rickshaws**



Source: Authors' capture.

### ***Type 2: Electric Converted Pedal Rickshaw***

The second type of the E3Ws is the Electric Converted Pedal Rickshaw (Figure 11). This is the most dangerous practice in Bangladesh. The present situation bounded the pedal rickshaw drivers to convert their rickshaws. One of the main reason is that the electric rickshaw drivers are able to earn more in a short time and such motorised rickshaws require less physical strength to operate. This motivates pedal rickshaw drivers to convert their rickshaws into electric version. The concerting part of such conversion is the loss of balance during driving, as the vehicle body weight is not compatible with with the higher operating speed. As a result, accidents occur frequently because the rickshaw's balance is not aligned with its body structure and payload capacity. Most of these rickshaws use an 800W BLDC motor (KIIs).

**Figure 11: Pedal to Electric Rickshaw Conversion**



Source: Authors' capture.

### **Type 3: Electric Van**

The third type of E3W is the Electric Van, which is mostly seen in district-level areas in Bangladesh. These vehicles are used for both passenger and goods transportation (Figure 12). Previously, they were pedal-driven vehicles that were later converted to electric mode, using BLDC motors with power ratings of 800-1200W and 48V lead-acid batteries (KIIs).

**Figure 12: Electric Van**



Source: Authors' capture.

#### ***Type 4: Electric Mishuk***

The fourth type of E3Ws in this category is Electric Mishuk (Figure 13). These vehicles has two types one is with shade and another is without shade. It can accommodate three passengers. It uses 800-1200W of BLDC motor and 48V lead acid batteries. Including batteries the price of this vehicles is approximately BDT 110,000 (Haque, 2021). The braking system of this vehicle differs from the above-mentioned types, as it uses disc or drum brakes. In addition, the position of the foot brake is not appropriate and causes discomfort for the drivers.

**Figure 13: Electric Mishuk**



Source: Authors' capture.

#### ***Type 5: Electric Easy Bikes***

The fifth type of E3W is the Electric Easy Bike, which is also one of the most popular E3Ws in Bangladesh (Figure 14). One variant can accommodate 6-8 passengers, while another can accommodate 3-4 passengers. These vehicles

**Figure 14: Electric Easy Bikes**



(a) Easy bike: Variant 1 (6-8 passengers)

(b) Easy bike: Variant 2 (3-4 passengers)

Source: Authors' capture.

are mainly used for short to medium-distance commuting and are commonly seen in district-level areas. Easy bikes typically use 1500W BLDC motors and 60V lead-acid batteries, depending on the voltage ratings of the motor and controller (Hossain, 2022). With a shade, these vehicles can operate even in the rain. This version of E3W also features a better braking system compared to types 1 to 3, using disc or drum brakes.

## 6.2 Present Charging Practices

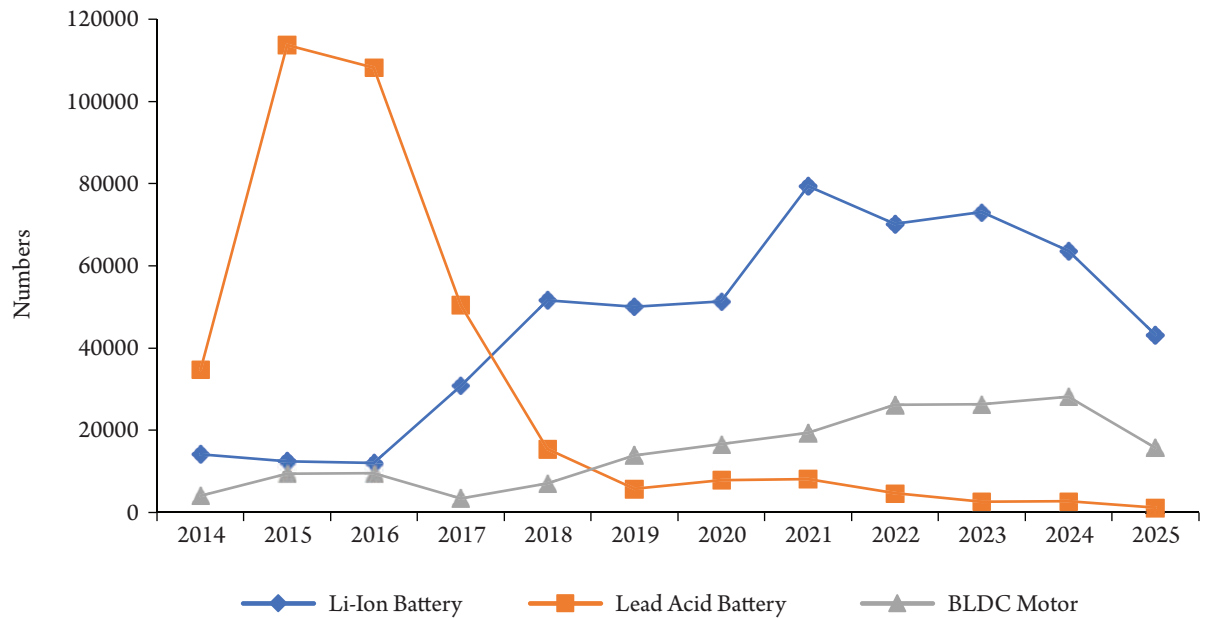
In Bangladesh, the charging practices and energy use of electric three-wheelers (E3Ws) reveal both growing dependence on electricity and significant infrastructural weaknesses. In Rangpur, each vehicle consumes 10–12 kWh per day, requiring 10–12 hours to fully charge, with daily electricity demand of approximately 3 MW; supply-demand gaps are evident in areas like Kurigram, where a 3–4 MW deficit exists. Garage owners charge BDT 80–550 daily, depending on vehicle type (Farooq, 2025b). In Khulna, charging mostly occurs after 9 PM to avoid peak costs, with per-unit energy priced at BDT 16, and while only 72 registered charging points exist, local operators use over 200 informal sites, highlighting unregulated networks (Milon, 2025). Sylhet's Sunamganj shows daily garage deposits of BDT 600, though city regulations now ban battery rickshaws within city corporation limits, forcing reliance on informal networks (Rony, 2025). In Rajshahi, about 300 garages serve the city, and operators' energy costs BDT 200 per charge and rent BDT 500 including charge form a significant operational burden (Ashiq, 2025). Interestingly, 48,136 illegal charging points are in Dhaka according to Dhaka Metropolitan Police (DMP) whereas the government approved charging stations are 3,300. Due to this illegal charging stations, government is losing revenue worth around BDT 4,000 crore which should come from this sector (Islam M. J., 2025). The investigation also shows that behind most of the legal charging station, there is an illegal connection which connected to the households connection. Thus, the operators are providing charging services illegally.

The E3W charging infrastructure is fragmented, largely informal, and energy-inefficient. Long charging times reduce fleet productivity, while unregulated garages and uneven electricity supply create safety risks and grid instability. High costs for operators discourage formal registration, and the absence of smart charging management leads to nighttime congestion at garages and underutilized daytime grid capacity. To ensure sustainable growth of E3Ws, there is a pressing need for grid-integrated, well-planned charging networks, standardised tariffs, smart charging systems, and stricter regulatory enforcement to balance accessibility, affordability, and energy efficiency.

## 6.3 Key Components Import Trend

The main components that has been imported over the years from overseas to develop E3Ws in Bangladesh are lead acid batteries, BLDC motor and controller pack, and Li-Ion batteries. Figure 9 represents the import history of these components from Jun 2014 to Aug 2025 (Figure 15). During this period, the fall of importing lead acid batteries from China is clearly indicates that these batteries are now made by local manufacturers. On the other hand, the figure shows that Li-ion batteries are rapidly increasing. Though these batteries are not commonly seen in the use at E3WS. Moreover, the figure also depicts that import history of BLDC motor and controller pack, which increasing in a significant way. The main use of these 800-1500 W of BLDC motor are in these E3Ws. The curve shows that the highest import of BLDC motor comes in the year of 2024. This rapid import of this motor shows the demand for these vehicles and the unregulated way of manufacturing these vehicles locally in Bangladesh.

**Figure 15: Components of E3Ws Import Trend from China**



Source: (International Trade Center, 2025).

## 6.4 Evaluation of Existing Vehicles (Manufacturing and Testing)

Majority of the existing E3Ws in Bangladesh are manufactured locally, predominantly in small workshop facilities that do not adhere to established quality control practices. Because the chassis and body structures are entirely produced within the country, concerns have emerged regarding compliance with standard design specifications

**Table 8: Evaluation of Existing E3Ws in Aspect of Manufacturing and Testing**

Indicators	Observed Performance	Remarks
Manufacturing Quality	Mostly produced by local workshops, no standard process of production followed.	Poor
Chassis/Body Structure	Entire body made locally, designs vary a lot from one to another workshop.	Poor
Design Standards Compliance	No adherence to standard design specifications.	Absent
Vehicle Weight-Speed Balance	Weight distribution poorly matched with operational speed.	Average
Converted Rickshaws	Pedal rickshaws are frequently converted to electric by installing motors, controllers, and battery.	Very Poor
Braking System	Mostly, caliper brakes were originally designed for low-speed pedal rickshaws. Easy bikes use disc or drum break without hydraulic feature.	Average
Headlights	Headlight positioned behind front mirror; no high/low beam control.	Average
Indicators	Most vehicles lack turning signals.	Absent
Weather Protection	Insufficient rain protection.	Average
Overall Safety	Instability and inadequate safety features.	Average
Standard Testing	Do not undergo any standard testing phases.	Poor

Source: Authors' observation based on KIIs

\*Evaluation Sequence (Low to High): Very Poor – Poor – Average – Acceptable – Good.

(Table 8). Key informant interviews (KIIs) revealed that these vehicles generally fail to meet the necessary design requirements. In the absence of enforced design standards in the past, most E3Ws currently in operation are not properly suited for use on public streets. A critical design deficiency relates to the imbalance between vehicle body weight and operational speed. When the vehicle's weight, whether with or without payload, does not correspond appropriately with its speed capacity, maintaining control becomes challenging. Furthermore, the rapid expansion of E3Ws has contributed to a decline in demand for pedal-driven rickshaws. As a result, many operators convert traditional rickshaws into electric versions by adding motors, controllers, and batteries. This practice poses significant hazards, as pedal rickshaws are originally engineered for low-speed operation; once motorised, they frequently become unstable at higher speeds, thereby increasing accident risk. The braking system represents another major area of concern. Most E-rickshaws employ caliper brakes, which are insufficient for speeds of 30–40 km/h and provide inadequate stopping power. These brakes were originally designed for low-speed pedal rickshaws and are not suitable for motorised applications.

On the other hand, easy bikes use disc or drum break without the feature of hydraulic which raises the concern of proper braking at higher speed. Additional safety issues arise from improper headlight placement, often behind the front mirror, causing reflection and diminishing visibility during nighttime operation. Moreover, the headlights typically lack adjustable high- and low-beam settings, further reducing illumination and increasing the likelihood of collisions. Indicator lights are also absent in many E3Ws, resulting in unclear signaling during turns and heightening the risk of accidents for trailing vehicles. Passenger protection during adverse weather is another limitation, as battery-powered rickshaws and mishuks often fail to shield occupants from rain. Collectively, these findings highlight significant safety and design shortcomings within the current generation of E3Ws in Bangladesh, underscoring the urgent need for standardised regulations and improved manufacturing practices.

Standardised testing of a complete vehicle to evaluate its roadworthiness constitutes a critical step in the introduction of a new vehicle. However, existing E3Ws are not required to undergo any formal testing procedures. This regulatory gap enables the unregulated production and rapid proliferation of E3Ws on the roads, contributing to severe congestion, particularly on first- and last-mile routes. Furthermore, drivers of these vehicles are not subjected to formal training or licensing requirements, which often results in reckless driving and increases the risk of accidents.

## **6.5 Manufacturing and Testing Guidelines of New E3W**

Since 2023, the Bangladesh University of Engineering and Technology (BUET) has been conducting a project focused on standardising existing easy bikes, funded by the Bangladesh Energy and Power Research Council (BEPRC). Insights from key informant interviews (KIIs) indicate that the easy bike model developed under this initiative is a significantly improved version of the existing vehicles (Figure 16). BUET's primary contribution lies in introducing a standardised mechanical design. In the absence of such standards, local manufacturers have traditionally produced E3Ws according to their own preferences, contributing to rapid and unregulated expansion.

To address this issue, the BUET team has proposed a comprehensive standard design intended to guide future manufacturing (Table 9). Production of vehicles under these guidelines requires that major components meet international standards, most of which such as the BLDC motor, controller, and differential are imported. The recommended motor capacity ranges from 1,000 to 1,200 W. The subsequent table outlines the detailed design specifications. As part of the introduction of this new standardised vehicle, all manufacturers will be required to follow BUET's design guidelines to ensure consistent quality and improved safety.

The design incorporates several key mechanical features aimed at enhancing both vehicle functionality and user safety. These include a hydraulic brake system and a parking brake for improved control, a half-door system and front cover for structural protection, and modifications to the driver seat size to optimise ergonomics. Passenger safety is addressed through the inclusion of a safety net, while vehicle identification is ensured via a designated vehicle identification number. Additional features such as a rearview mirror, windshield wiper, and all-weather protection cover contribute to operational safety and comfort. The design also considers structural and regulatory aspects, including attention to sharp corners and the prohibition of rear mirrors in specific contexts.

**Figure 16: BUET Developed New E3Ws**



Source: Authors' capture.

The design integrates several electric features to enhance visibility, safety, and operational control. These include the strategic positioning of headlights and tail lamps to ensure effective illumination and signaling, a power cut-off switch that activates during braking to improve safety, and a roof light to provide additional visibility under various conditions.

**Table 9: Manufacturing Guidelines by BUET for New Easy Bikes**

Parameters	Specifications
Width	Maximum 1.1m
Length	Maximum 2.5m
Height	Maximum 1.9m
Length/Width Ratio	Maximum 2.27
Ground Clearance	Minimum 140mm
Flore Height	Minimum 240mm
Carb Weight	325 – 425 kg (Including Battery)
Pay Load Capacity	Maximum 250kg
Rear Axle Length	37-39 inch (Hub Faceplate Out-Out), Differential and Parallel Motor Drive
Tire: Solid Rim Size	12-16 inches
Tire: Outer Diameter	20-23 inches
Tire: Width	Minimum 3 inch
Brake	Hydraulic Disk/Drum (All Three Wheel), Parking Brake
Spare Wheel	Rear Side or Under the Seat

Source: Authors' compilation based on KII.

The BUET-developed electric three-wheeler (E3W) differs from existing E3Ws in several key aspects. It features an improved braking system and a chassis specifically designed to accommodate the motor and controller specifications. Passenger safety is enhanced during rainy conditions, while the headlight is positioned externally for better visibility. Additionally, the vehicle incorporates a regenerative braking system and is programmed with a speed limit of 30 km/h, reflecting a focus on safety and energy efficiency.

The key testing parameters and compliance ranges for type approval of a new vehicle. It specifies that the maximum speed should be between 27–30 km/h, with acceleration time at high speed not exceeding 20 seconds. The vehicle must be able to stop within 10 metres during braking and achieve a turning radius of no more than 3 metres. Gradient capability with payload is set at a minimum of 7 degrees (12 per cent), and water resistance is ensured with an IP67-rated motor. These parameters collectively define the performance and safety standards for vehicle approval (Table 10).

**Table 10: Testing Parameters for Type Approval of a New Vehicle**

<b>Parameters</b>	<b>Compliance Range</b>
Maximum Speed Limit	27-30 km/hour
Acceleration Time (During High Speed)	Maximum 20 second
Maximum Distance during Braking	10m
Turning Radius	Maximum 3m
Gradient (With Payload)	Minimum 7 degrees (12%)
Water Resistance Capability	IP 67 Motor

**Source:** Authors' compilation based on KII.

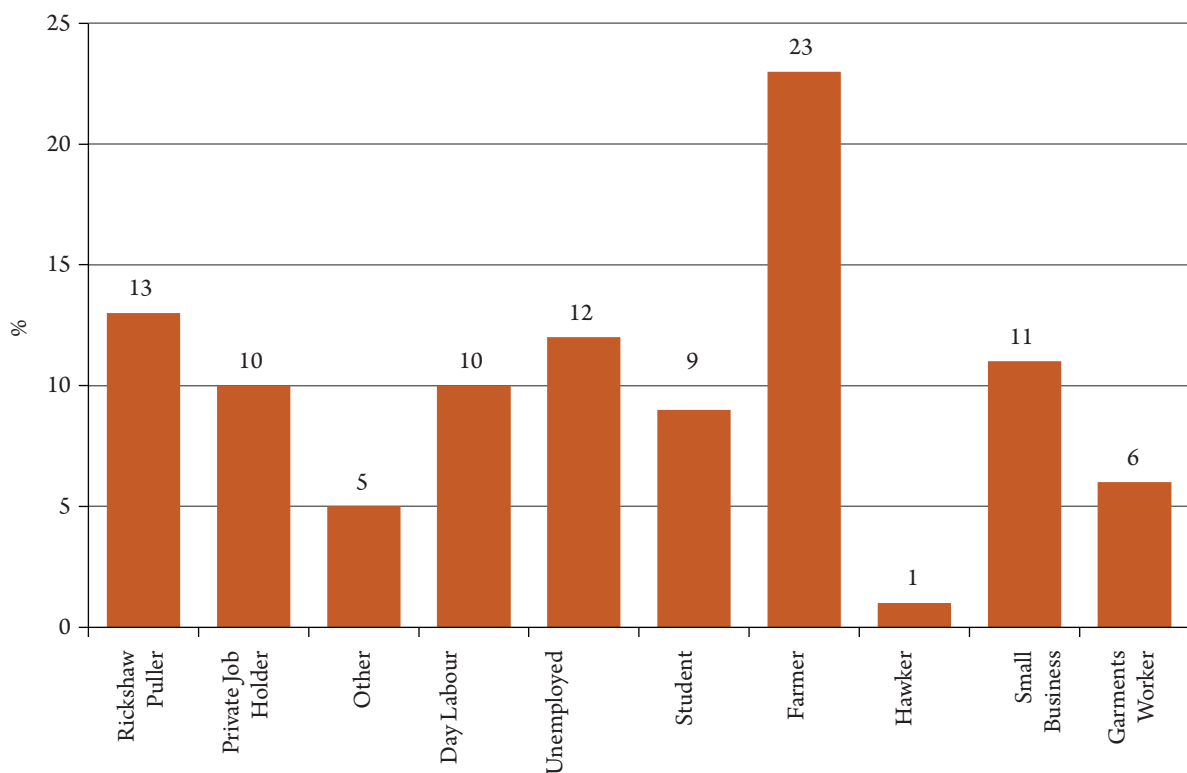
## Socio-economic Aspects Related with E3Ws

### 7.1 Employment and Income

#### 7.1.1 Drivers' Income

The widespread use of electric three-wheelers (E3Ws) in Bangladesh has generated substantial social and economic impacts, particularly by creating employment opportunities for a large segment of the population. An estimated four million people are directly involved in driving these vehicles, making the sector a major source of livelihood for low- and middle-income groups (Hasan M., 2024). Drivers typically earn a daily income ranging from BDT 1,000 to 2,500, depending on the battery condition, newer batteries enable longer operation and higher fares, while older batteries yield lower returns. After paying daily deposits to vehicle owners typically BDT 550 for easy bikes, BDT 400 for battery rickshaws, and BDT 500 for Mishuks drivers can secure a net daily profit between BDT 500 and 1,500, which often supports entire households (Pramanik, 2024). This income flexibility and relatively

**Figure 17: Previous Occupation of E3W Drivers in Rangpur City**



Source: (Pramanik, 2024).

low entry cost have made E3Ws a crucial livelihood option, especially in rural and peri-urban areas where formal employment opportunities remain limited. A survey conducted in Rangpur city among 400 Electric Three-Wheeler (E3W) drivers (Pramanik, 2024) (Figure 17) examined their previous occupations and income patterns. The results indicate that 23 per cent of the drivers were formerly farmers who shifted to operating E3Ws, 13 per cent were previously rickshaw pullers, 11 per cent came from small businesses, and the remainder represented other occupational backgrounds. The instability of their prior incomes appears to have motivated these individuals to adopt E3W operation as their primary source of livelihood.

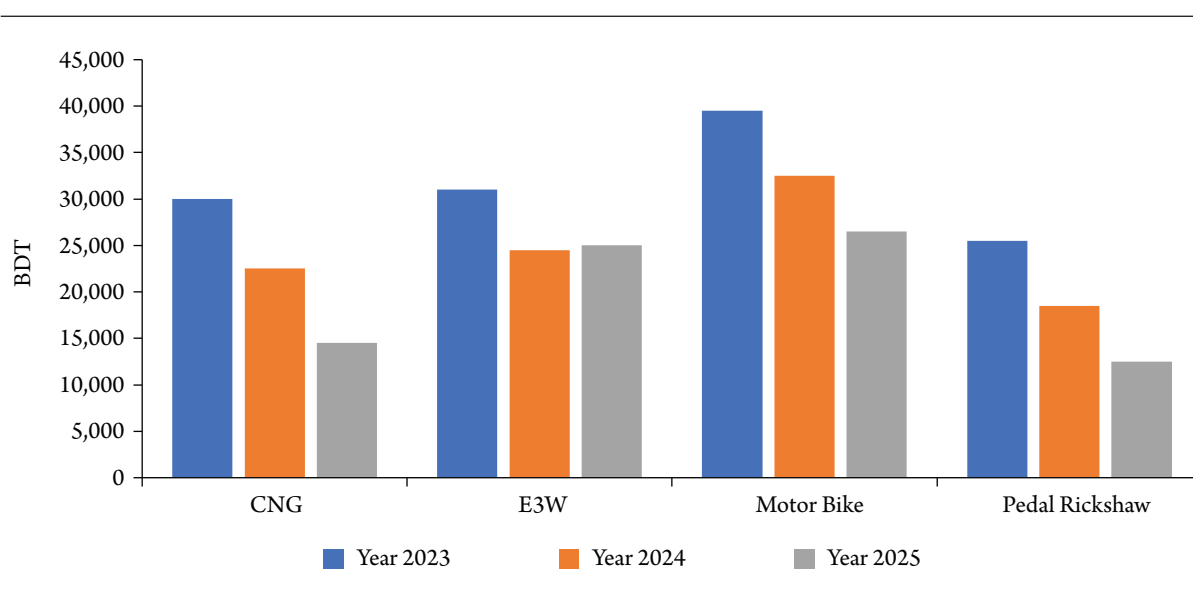
**Table 11: Average Monthly Income of Different Types of Vehicle Drivers in Dhaka City**

Vehicles	Avg. Monthly Income Year: 2023 (BDT)	Avg. Monthly Income Year: 2024 (BDT)	Avg. Monthly Income Year: 2025 (BDT)
CNG 3-Wheeler	28 – 32,000	20 – 25,000	13 – 15,000
E3W	30 – 32,000	23 – 25,000	24 – 27,000
Motor Bike	37 – 42,000	32 – 33,000	25 – 28,000
Pedal Rickshaw	24 – 27,000	17 – 20,000	11 – 14,000

Source: Authors' compilation.

Key informant interviews conducted in the Dhanmondi-27 area of Dhaka indicate a substantial decline in the earnings of conventional transport operators between 2023 and 2025, coinciding with the rapid expansion of electric three-wheelers (E3Ws). The average monthly income of CNG auto-rickshaw drivers decreased by approximately 25 per cent from BDT 30,000 in 2023 to BDT 22,500 in 2024, followed by a further reduction of about 36 per cent to BDT 14,500 in 2025, resulting in an overall decline of more than 50 per cent over the study period. Pedal Rickshaw drivers experienced a comparable contraction in earnings, with average monthly income falling from BDT 26,500 in 2023 to BDT 18,500 in 2024 (a 30 per cent decrease), and further to BDT 12,500 in 2025 (a 32 per cent decrease), amounting to a cumulative reduction of approximately 53 per cent (Table 11) & (Figure 18). In parallel, drivers face fixed daily vehicle rental deposits of BDT 550 for easy bikes, BDT 400 for battery-powered rickshaws, and BDT 500 for Mishuks, which further erode net income margins. Collectively, these quantitative trends demonstrate that the increasing market penetration of E3Ws is associated with a marked redistribution of income within the urban transport sector, disproportionately disadvantaging CNG and pedal rickshaw drivers in the study area.

**Figure 18: Income Decrease Trends of Different Vehicles**



Source: Authors' compilation.

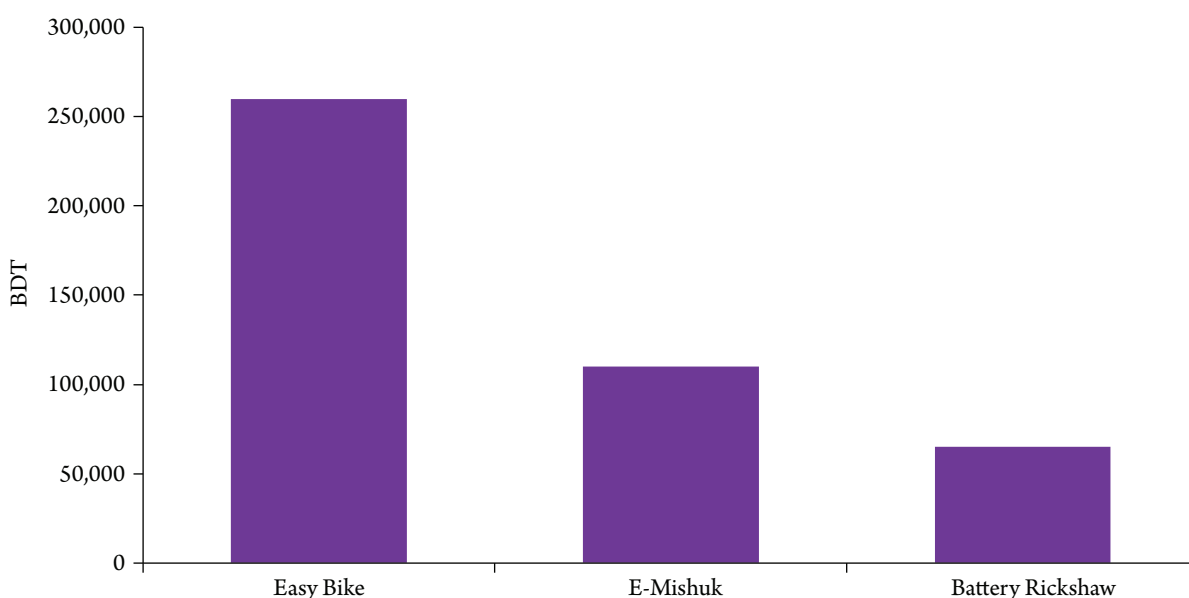
### 7.1.2 Garage Owners Income

Garage and workshop owners servicing battery-run three-wheelers in Bangladesh derive income from multiple streams daily charging, recharging and parking fees, rental or garage space for vehicles, routine servicing and spare-parts notably batteries, and occasional vehicle sales producing highly variable earnings that reflect scale and location. Empirical studies and local reporting show modest owner profits in small urban samples such as many owners report monthly profits in the range of BDT 6,000–15,999, while larger operators who control dozens of vehicles can earn substantially more through per-vehicle rents and charging margins (Mazumder, 2018). For example, a Kamrangirchar garage proprietor reported gross daily takings of about BDT 4,000 while facing roughly BDT 2,000 daily electricity costs, and some garage operators charge fixed monthly garage or rentals of around BDT 3,000 per parked vehicle, creating steady cash flow for owners who host many vehicles. Garage owners often host 40–60 battery-run rickshaws easy bikes in their garages, enabling scale-based income (Ali, 2024). Policy analyses and investigative reporting emphasise that these incomes are supported by an enormous informal battery and servicing market but are exposed to regulatory uncertainty, safety risks and high operating costs like electricity, battery replacement, which compress net returns for small operators.

### 7.2 Cost Efficiency of E3Ws

The cost efficiency of Electric Three-Wheelers (E3Ws) in Bangladesh stands out as one of the key factors behind their widespread adoption across both urban and rural regions. The market offers several variants catering to different passenger capacities and income levels. The Easy Bike, capable of carrying up to eight passengers, costs between BDT 2.5–2.65 lakh and offers a mileage of 70–90 km per charge, making it the most efficient option for commercial use. The Normal Rickshaw, available in two variants, is priced between BDT 70,000–110,000, with mileage ranging from 40–70 km per charge, while the smaller Mishuk model priced at BDT 1.18–1.6 lakh provides up to 80 km of travel per full charge (Figure 19). Powering these vehicles are lead-acid batteries costing around BDT 26,000–30,000, with an average lifespan of one year, implying recurring annual replacement costs but relatively low maintenance expenditures compared to conventional fuel vehicles.

Figure 19: Price of Different Types of E3Ws

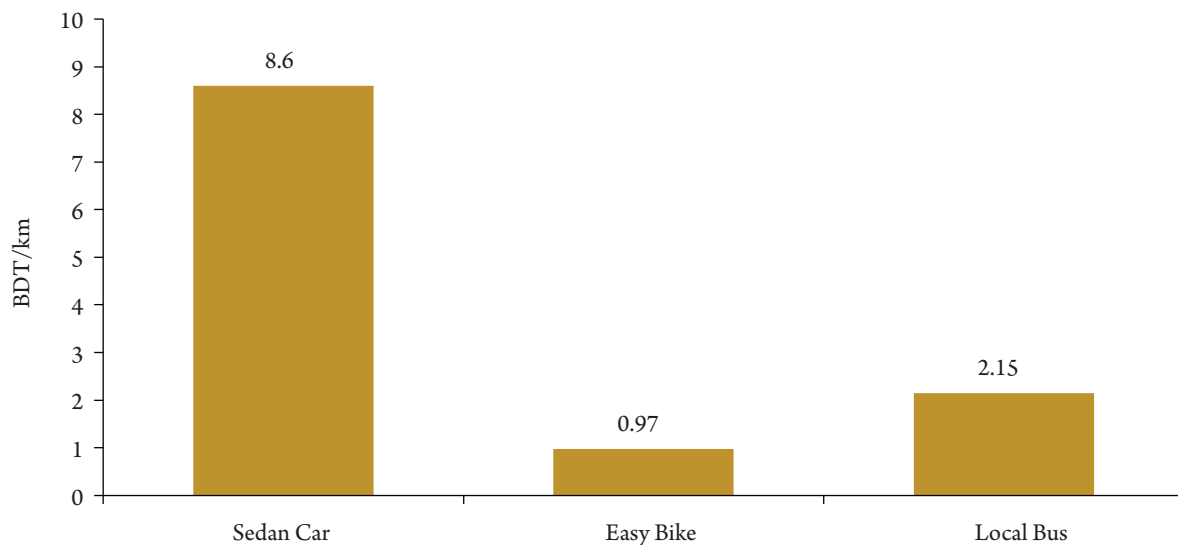


Source: (Farooq, 2025a).

From an operational perspective, E3Ws exhibits remarkable per-kilometre cost efficiency. Studies indicate that Easy Bikes operate at only BDT 0.97 per kilometre, compared to BDT 8.60/km for a sedan car and BDT 2.15/km per person for bus services. This makes Easy Bikes 9 times cheaper than private cars and roughly half the cost of public buses, underscoring their affordability as a mass transport option for low-income commuters. In terms of energy use, the charging fare averages around BDT 100 in cities, while domestic or rural garages charge BDT 150–170 per session, with electricity tariffs ranging from BDT 9.62 per unit (flat) to BDT 12.14 per unit (peak) (Figure 20). Despite slightly higher nighttime tariffs, overall energy expenditure remains minimal compared to fossil fuel costs.

The combination of low purchase price, minimal operational expense, and high energy efficiency positions E3Ws as an economically sustainable mode of transport. Their affordability not only benefits drivers and passengers but also contributes to reduced dependency on imported fuels. However, challenges such as short battery lifespan and the reliance on lead-acid technology slightly diminish their long-term cost advantage, suggesting that the transition towards lithium-ion batteries and smart charging systems could further enhance economic viability and operational durability in the coming years.

**Figure 20: Costs Per Kilometre Comparison Among Other Vehicles**

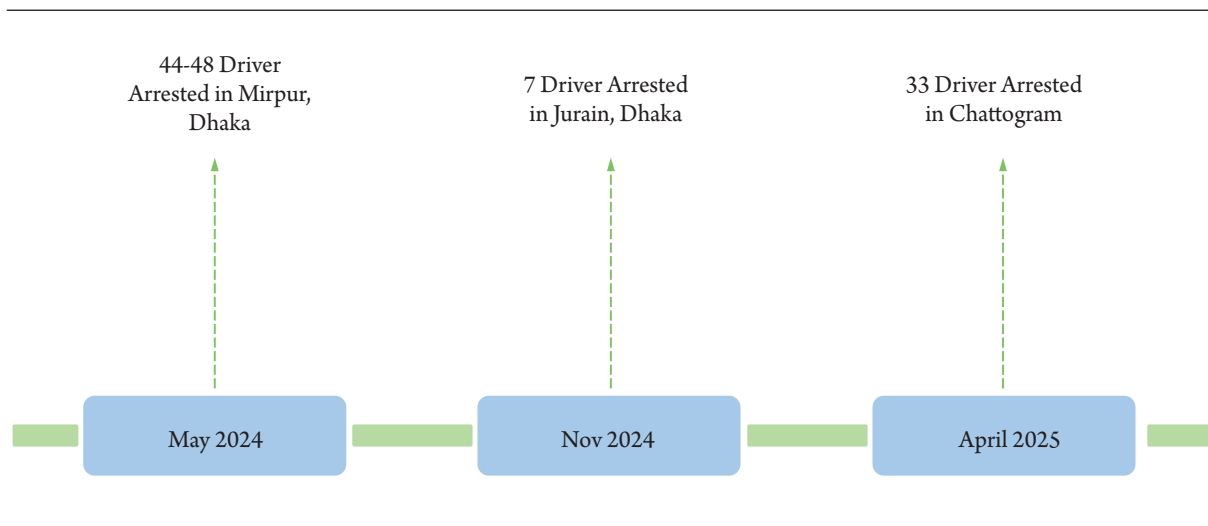


Source: (Hasan M., 2024)

### 7.3 Protest Trends of E3Ws Driver Across the Country

Recent protests against restrictions on battery-run rickshaws in Bangladesh have resulted in a series of arrest incidents across major cities, particularly Dhaka and Chattogram. In May 2024, clashes in Mirpur led to the arrest of approximately 44–48 drivers (Figure 21), with multiple cases filed against hundreds of protesters ('Battery-run rickshaw ban: 44 arrested in 4 cases over Mirpur clashes', 2024). Subsequent demonstrations in Dhaka, including those in Jurain in November 2024, resulted in additional small-scale arrests) and detentions ('Battery-run rickshaw drivers block rail crossing, clash with police', 2024). In Chattogram, large confrontations between drivers and police in April 2025 produced at least 33 arrests on the first day, increasing to 51 over the following days as police conducted extended drives and follow-up raids (33 arrested over clash between police, battery-run rickshaw drivers in Ctg, 2025). Smaller protest actions, including sit-ins and road blockades, also saw sporadic arrests, although many reports documented vehicle seizures without giving clear arrest numbers. Overall, media reports indicate that more than one hundred drivers were arrested during major protest waves, though exact nationwide totals remain uncertain due to overlapping reports and incomplete official data.

**Figure 21: Recent Arrest Case History of E3W Drivers**



Source: Authors' illustration.

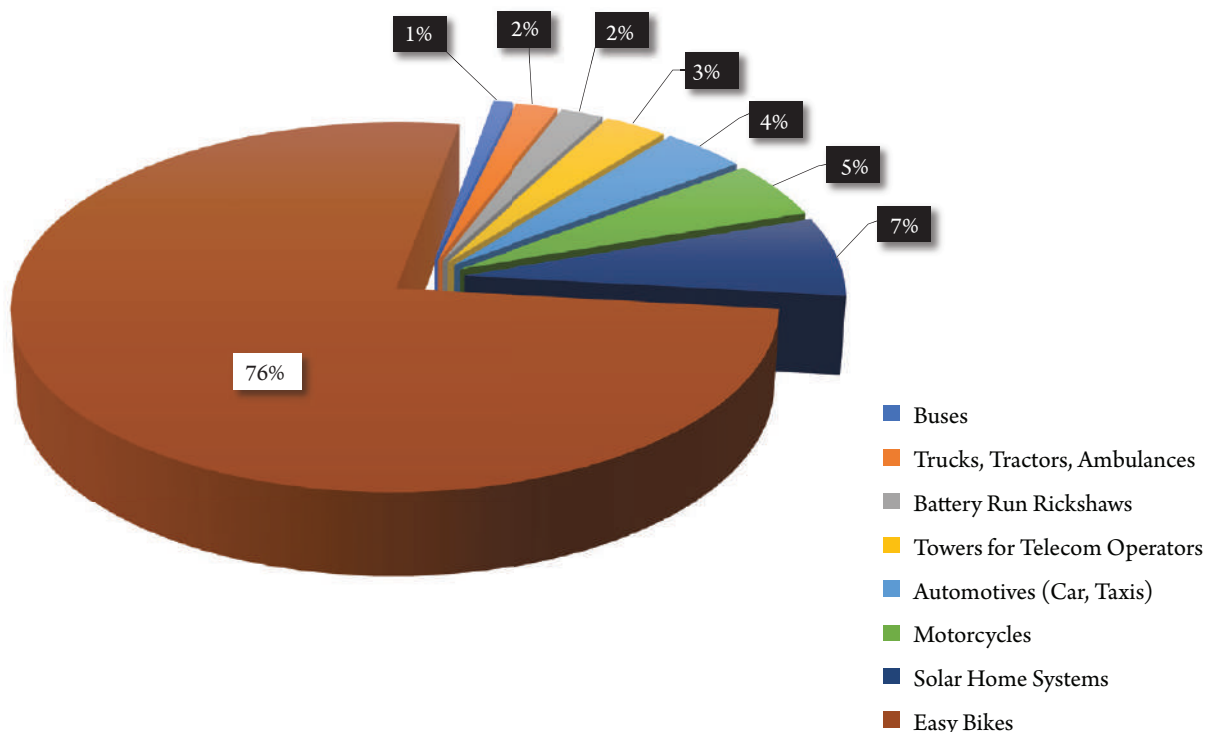
## Health and Environmental Aspects of E3Ws

### 8.1 Health Consequences

#### 8.1.1 Lead Poisoning Effects

The rapid growth of Bangladesh's electric three-wheeler (E3W) sector has intensified the use of lead-acid batteries, which contain metallic lead (Pb) plates, lead oxide, and sulfuric acid electrolyte with lead being the most toxic component. Globally, lead-acid battery production accounts for nearly 90 per cent of total lead consumption, making it a major source of environmental contamination (Gottesfeld, 2017). In Bangladesh, the E-rickshaw and easy-bike segment consumes more than 76 per cent of the total lead-acid battery market, driving a parallel surge in informal and unsafe recycling of used lead-acid batteries (ULABs) (Figure 22). Studies and UNEP and Pure Earth

**Figure 22: Lead Acid Battery Shares in Transport Sector**



Source: (Pure Earth Bangladesh, 2020).

assessments have identified hundreds to over 1,100 informal ULAB recycling sites across the country, though many more operate unrecorded (Pure Earth Bangladesh, 2020). These sites typically lack protective measures and release toxic lead dust and wastewater into nearby soil and water, exposing both workers and communities to dangerous levels of contamination.

Health evidence is alarming. Lead has no safe level of exposure, and even small amounts can harm children's developing brains. Globally, lead exposure was responsible for over 1.5 million deaths in 2021, primarily due to cardiovascular impacts, and contributed to 33 million years lost to disability (World Health Organization, 2024). In Bangladesh, the crisis is severe, UNICEF, IEDCR, and icddr,b studies detected lead in the blood of all 980 children tested in Khulna, Tangail, Patuakhali, and Sylhet, and among 500 children in Dhaka. Shockingly, 40 per cent of children in those four districts and 80 per cent in Dhaka had blood lead levels (BLLs) exceeding the WHO's intervention threshold of 5 µg/dL. Over 35 million children in the country have dangerously high lead levels in their blood (UNICEF Bangladesh, 2024). The national average BLL is 6.8 µg/dL, and approximately 60 per cent of Bangladeshi children suffer from lead poisoning (Das, 2023). Health consequences are profound: children experience brain damage, loss of learning ability, and behavioural disorders, while adults face heightened cardiovascular risks and women report increased rates of pregnancy complications. Cognitive assessments estimate that lead exposure causes an average loss of 6.9 IQ points per child, totaling a staggering 20.6 million IQ points lost among children under five, placing Bangladesh 8th globally in IQ loss due to lead exposure (Das, 2023).

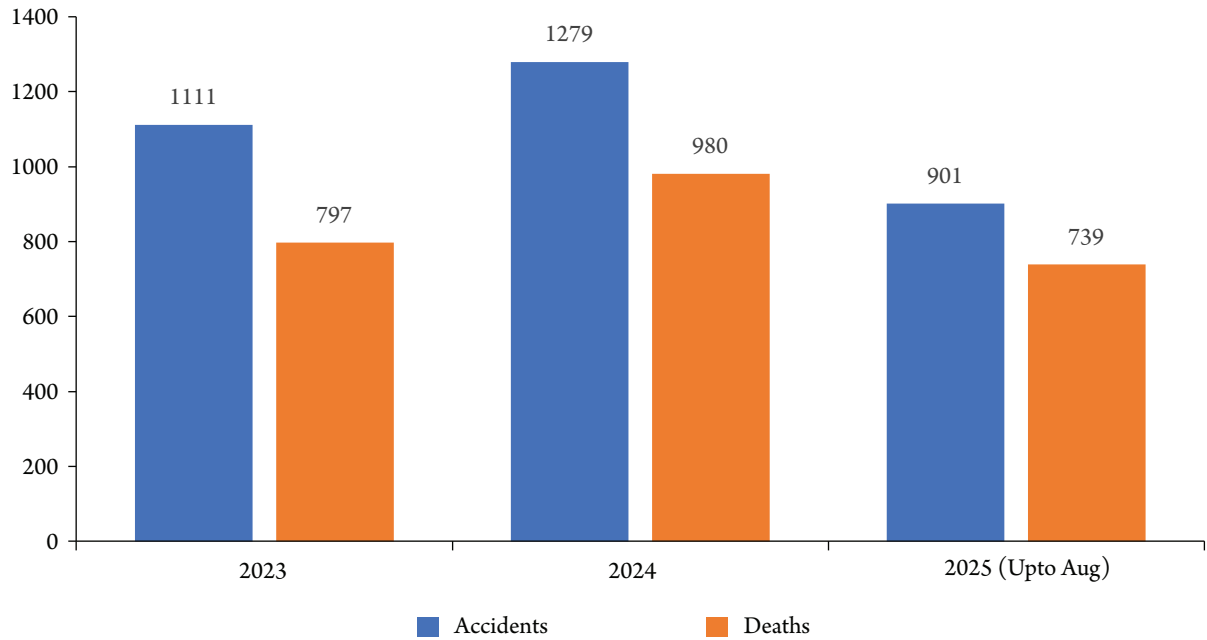
The economic and societal costs are equally devastating. In 2019, the combined cost of these health effects in Bangladesh was USD 28,633 million, which is a loss of 6 to 9 per cent of the country's GDP (Das, 2023). The country also ranks as the 4th most lead-polluted nation in the world, with an estimated 30,000 annual deaths from lead-related diseases (Das, 2023). There are 138,000 cardiovascular deaths among adults over the age of 25 due to the lead exposure in Bangladesh (Larsen, 2023). Despite this, only 20 per cent of ULAB recycling occurs through formal, regulated channels, with the remainder handled informally resulting in an estimated USD 91 million in annual tax losses (Sustainable Manufacturing and Environmental Pollution Programme, 2024). Informal recycling not only harms human health but also undermines government revenue and industrial accountability. Bangladesh faces a public health and environmental emergency driven by uncontrolled lead pollution from the E3W battery sector. The combination of unregulated recycling, weak enforcement, and lack of public awareness has created widespread chronic exposure, especially among vulnerable children. Without urgent interventions such as transitioning to safer battery technologies, enforcing strict recycling regulations, and expanding community-level monitoring and remediation the long-term cognitive, health, and economic toll of lead exposure will continue to undermine the nation's human capital and sustainable development. Moreover, this lead contamination is not only limited to affecting human health alone, but also posing serious threats to animals, as well. In November 2025, around 30 cows died due to severe lead contamination in Jamalpur ('Itaail devastated by lead factory poisoning; Cattle death procession', 2025). On the other hand, the KIIs found that an outbreak of lead contamination occurs at a village of Magura resulting in death of 50 animals through lead contamination. The main reasons for these incidents are the infor-mally used lead acid battery recycling factory.

### **8.1.2 Accident History of E3Ws**

The rapid and unregulated expansion of E3Ws has intensified traffic congestion and contributed to a high frequency of road accidents. Data from BRTA shows a consistent rise in E3W-related accidents, increasing from 1,111 cases in 2023 to 1,279 in 2024, before reaching 901 cases by August 2025 (Figure 23). This upward trend underscores the consequences of inadequate oversight and the absence of a structured regulatory framework. Although the year-wise accident shares slightly declined, from 17.4 per cent in 2023 to 16.5 per cent in 2024 and 14.8 per cent in 2025 (Figure 24), E3Ws still account for a substantial proportion of road accidents nationwide. These figures reflect persistent safety vulnerabilities within the sector and highlight the urgent need for formal regulation to ensure safer and more orderly E3W operations in Bangladesh.

The Figure 23 also indicates that E3Ws remain a notable source of road fatalities in Bangladesh between 2023 and August 2025. The number of deaths rose from around 800 in 2023 to nearly 1,000 in 2024, marking the peak of

**Figure 23: Year-wise Number of Accidents and Deaths by E3Ws in Bangladesh**

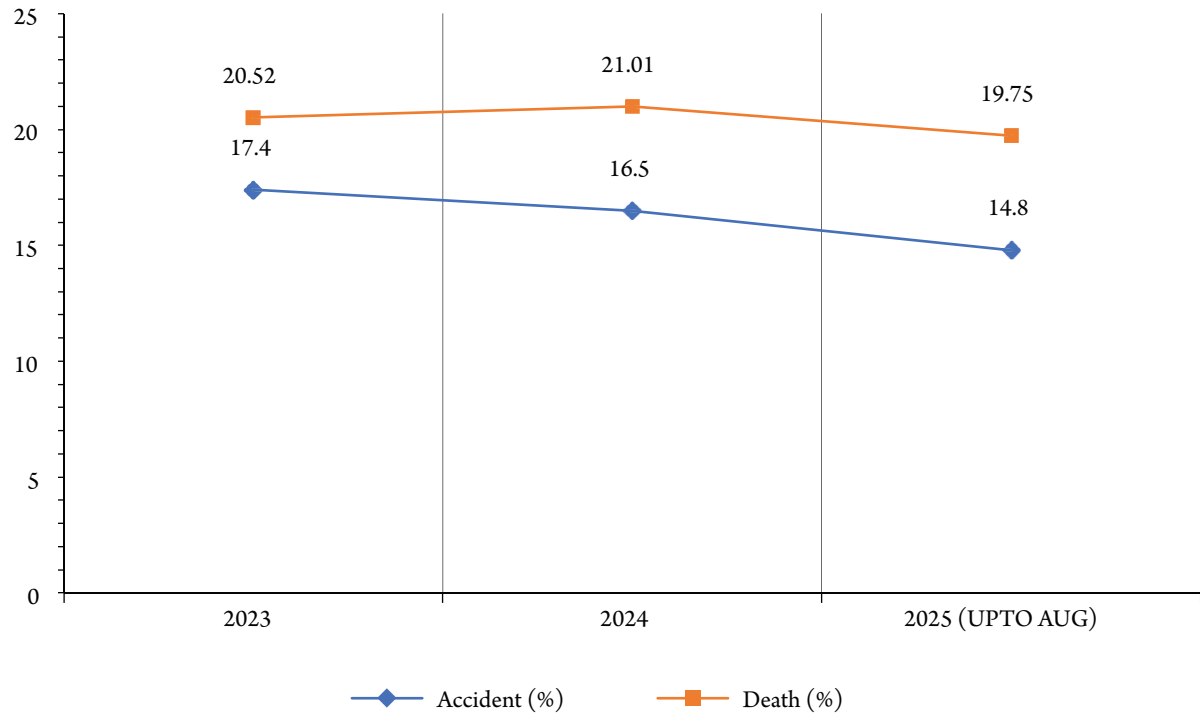


**Source:** (Bangladesh Road Transport Authority, 2025a).

the period. However, by 2025, deaths declined to about 740, suggesting a slight improvement or reduced exposure due to partial regulatory actions or operational adjustments. A similar pattern is reflected in the death-share trends: E3Ws accounted for 20.52 per cent of total road deaths in 2023, which increased to 21.01 per cent in 2024, before dropping to 19.75 per cent in 2025 (Figure 24). Although the recent decline is encouraging, the persistently high share, hovering around one-fifth of all road fatalities, highlights the significant safety challenges associated with the rapid and largely unregulated expansion of E3Ws in the country.

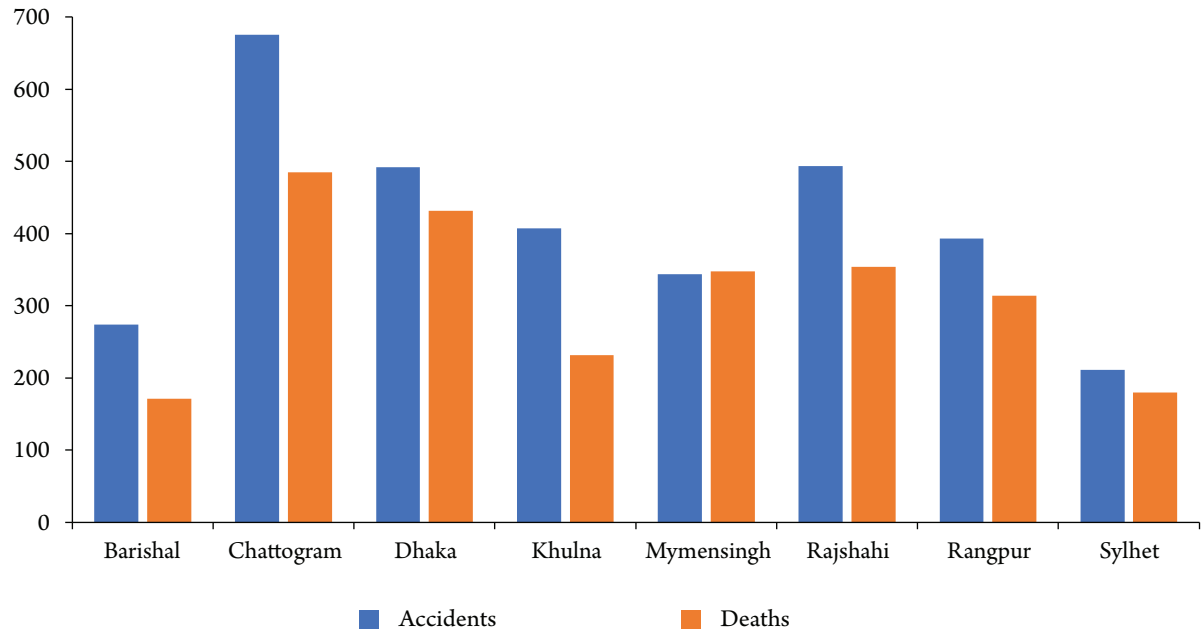
The location-wise data from 2023 to August 2025 reveal significant geographic disparities in E3W-related accidents and deaths across Bangladesh (Figure 25). Chattogram reports the highest number of accidents (676) and deaths (485), indicating severe safety challenges in the region. Dhaka and Rajshahi follow, with Dhaka recording 492 accidents and 432 deaths, while Rajshahi shows 494 accidents and 354 deaths both reflecting substantial risk exposure in densely populated and rapidly urbanising areas. In contrast, Sylhet and Barishal consistently exhibit the lowest figures, with Sylhet reporting 211 accidents and 180 deaths, and Barishal recording 274 accidents and 171 deaths. Mid-range regions such as Khulna, Mymensingh, and Rangpur also account for notable accidents and fatality numbers, underscoring that E3W safety concerns are widespread rather than isolated. The spatial distribution highlights the need for region-specific regulatory measures, targeted enforcement, and localised safety interventions to effectively address E3W-related risks across the country.

**Figure 24: Year-wise Accident and Death Share by E3Ws**



Source: (Bangladesh Road Transport Authority, 2025a).

**Figure 25: Location-wise Number of Accidents and Deaths from January 2023 to August 2025**



Source: (Bangladesh Road Transport Authority, 2025a).

## 8.2 Soil and Water Contamination Due to Lead Poisoning

Improper handling, disposal, and manufacturing of lead-acid batteries create significant environmental hazards, particularly through the contamination of soil, water, and air (Figure 26). Toxic lead and corrosive sulfuric acid can leach from discarded batteries into surrounding soil and groundwater, while acidic effluent and dissolved lead from recycling or manufacturing sites can enter surface water systems, bind to sediments, and accumulate throughout aquatic food chains. These processes not only degrade soil fertility but also threaten aquatic ecosystems, as lead exposure harms aquatic organisms and can bioaccumulate, posing longer-term risks to human and ecological health.

Additionally, emissions from battery manufacturing, including pollutants such as sulfur dioxide (SO<sub>2</sub>), contribute to air pollution and acid rain, further increasing the environmental burden associated with the lead-acid battery lifecycle. From KII at IEDCR, we came to know that, due to used battery informal factory, soil and crops has been contaminated in several areas like Magura, Patuakhali, etc. The presence of lead has been found in soil and crops in those areas, which eventually contaminate with human blood. These are the major issues with informal ways of recycling used lead acid batteries.

**Figure 26: Soil Contamination Due to Lead Poisoning at Mirzapur, Bangladesh**



**Source:** ('Battery boom drives Bangladesh lead poisoning epidemic', 2024).

## 8.3 Disposal and Recycling Practices in Bangladesh

Bangladesh's transition from an agriculture-based economy to a more diversified manufacturing and services sector has generated substantial growth but has also intensified pollution and environmental health risks that exceed existing regulatory capacity. One of the most critical concerns is the widespread informal recycling of used lead-acid batteries (ULABs). Although more than 1,100 informal or illegal ULAB recycling sites (Figure 27) are believed to exist, assessments conducted by Pure Earth and the University of Dhaka at 270 identified locations show dangerously high lead contamination and severe health threats for nearby communities. Only 30 per cent of Used Lead Acid Battery (ULAB) recycling is formal (Pure Earth Bangladesh, 2020). As a result, informal ULAB

**Figure 27: Used Lead Acid Battery Informal Recycling Factory**



Source: (Pure Earth Bangladesh, 2020).

recycling is considered a major source of lead exposure nationwide and the leading cause of pollution hotspots. Bangladesh now reports one of the world's highest average blood lead levels among children approximately 8  $\mu\text{g}/\text{dL}$ , far above the 5  $\mu\text{g}/\text{dL}$  intervention threshold used in countries such as the United States. Estimates indicate that 28.5 million Bangladeshi children exceed this reference level, with over 21 million having levels above 10  $\mu\text{g}/\text{dL}$ , suggesting widespread risks of cognitive impairment. In 2017, lead exposure accounted for 4.3 per cent of all deaths in the country (Das, 2023).

To address these challenges, the Ministry of Environment (MoE) issued a law in 2021 governing the manufacturing, importing, and recycling of batteries. The regulation mandates that no entity can engage in the recycling of used lead-acid batteries (ULABs) without obtaining prior clearance from the MoE. It further requires that manufacturers secure approval for an authorised collection and recycling mechanism for ULABs as a prerequisite for obtaining manufacturing permits. Similarly, importers of lead-acid batteries must establish an effective collection system for ULABs; failure to do so disqualifies them from receiving import authorisation. Despite the existence of this regulatory framework, the number of ULAB recycling facilities continues to increase, indicating significant gaps in enforcement and regulatory oversight in this sector.

## E3Ws in Public Transport System: Lessons from ASEAN Countries

### 9.1 Thailand's Urban Transport and Electric Tuktuk

Thailand's urban public transport system is shaped by a diverse mix of rail, bus, and water-based services, with Bangkok hosting the country's most extensive and complex network. The capital features an expanding metro system exceeding 500 km in planned length, alongside a wide bus network of over 260 routes and major river and canal transport services (UNESCAP, 2022b). The sector involves multiple government bodies responsible for regulation, operation, and infrastructure development, requiring stronger coordination to achieve seamless multimodal integration. While significant investment is directed towards Bangkok's mass transit expansion, progress in provincial cities remains limited, despite ongoing feasibility studies for LRT and monorail systems in locations such as Chiang Mai, Khon Kaen, Phuket, and Nakhon Ratchasima. Outside the capital, long-term viability is challenged by competition from low-cost motorcycle travel, although tourist cities show greater potential for successful implementation.

Having an efficient public transport system alone is insufficient if the first and last mile (FLM) distances remain unaddressed. Bridging the FLM gap is considered an integral part of a comprehensive urban transport system. The concept of the FLM is crucial in urban transportation. It refers to the distance between a person's origin (e.g., home-the first mile) or destination (e.g., workplace-the last mile) and the nearest public transport stop. FLM often presents a significant barrier to effective public transport usage, as passengers must bridge this gap to access transit services. The time, cost, and inconvenience associated with first-and last-mile travel are frequently cited as major deterrents to broader public transport adoption. Studies have also shown that the quality of the travel experience during these segments strongly impacts overall satisfaction with public transport. Addressing the FLM gap can therefore enhance public transport uptake. Potential solutions include various forms of shared and on-demand mobility, such as ridesharing, bike-sharing, shuttle services, and micro-transit options like motorbike taxis and tuktuks, which provide flexible, short-distance connections for travelers.

Electric tuktuks (e-tuktuks) are becoming more popular in Southeast Asia to support the FLM connectivity. As of January 2023, Thailand had approximately 30,000 registered E-tuktuks, with 9,000 operating in Bangkok. These three wheelers are iconic within the city's transport sector, with an estimated annual travel of 388.5 million person-kilometres in the capital. The potential for electrifying Bangkok's tuktuk fleet has been recognised by the Thai government, which introduced limited subsidies for e-tuktuk adoption in 2017. Demand for electric tuktuks in Thailand has been steadily increasing, with 586 e-tuktuks registered as of 31 March 2023 (Asian Development Bank, 2023b). While major companies globally are investing in electric vehicle fleets and charging infrastructure including for e-tuktuks, MuvMi remains the sole provider of e-tuktuk services in Bangkok.

## 9.2 Integration Strategy of Electric Tuktuk in Thailand's Urban Transport

Electric tuk-tuks are being piloted and scaled across Thai cities as a nimble, low-emission first and last mile solution and tourist service. Integration strategies vary by city: private micro transit apps (e.g., MuvMi), platform partners (Grab's Chiang Mai pilot), NGO/industry conversion projects, plus government, ADB, and industry plans for charging and incentives. Thailand's approach to environmental progress is reflected in the evolving fuel profile of its iconic tuk-tuks. The early two-stroke engines, while defining their signature sound, were major contributors to Bangkok's air pollution. The shift to liquefied petroleum gas in the 1990s marked a practical step forward, reducing emissions while preserving the affordability and economic sustainability essential for drivers working with narrow profit margins. The strategies of integrating E-tuktuks in Thailand's urban transport system are as follows:

- **App-based micro transit and pooling (Digital Integration):** Platforms (MuvMi, Grab) use apps for trip matching, dynamic routes and payments, enabling e-tuks to act as formalized FLM feeders to rail or bus nodes. This provides data for planners and can reduce empty trips (Tribdino, 2025).
- **Conversion Programmes & Policy Support:** Thailand Government launched fully subsidised programmes to convert existing internal combustion tuk-tuks to electric powertrains, acknowledging operators' limited capacity to buy new vehicles. These initiatives cut emissions, strengthen local conversion industries, and allow traditional drivers to adopt electric mobility without displacement. By accounting for the daily income-based economics of tuk-tuk operators, the subsidies remove financial barriers and support a faster, more inclusive fleet transition (Tribdino, 2025).
- **Targeted charging infrastructure and fleet logistics:** Rather than widespread fast-charging for cars, many e-tuk pilots rely on depot charging and swappable batteries or opportunistic slow charging at terminals and markets. National charging plans and private operators are slowly adding infrastructure but tend to prioritise buses and cars (Thananusak, 2021).
- **Regulatory & registration workarounds:** Formal integration requires legal vehicle classification, safety and insurance frameworks and driver licensing. Thailand has complex rules (tuk-tuks face registration limits in Bangkok), prompting advocacy by EV groups for law changes to allow safe, legal registration of modern three-wheel EVs (Maikaew, 2019).
- **Public-private partnerships and funding:** Development finance (ADB, UN, domestic industry) and private OEM support pilots, batteries, or charging pilots. These actors are crucial to scaling beyond small pilots (Asian Development Bank, 2023b).

Notably, MuvMi is leading Thailand's shift to electric tuk-tuks with a centrally managed, app-based fleet of more than 600 vehicles operating across 12 Bangkok neighborhoods. Its six-seat electric tuk-tuks eliminate noise and exhaust emissions, significantly cutting PM2.5 pollution while offering efficient first- and last-mile links to main transit lines (Tribdino, 2025). By owning and maintaining the vehicles, MuvMi reduces financial and maintenance burdens for drivers, while the app-based system ensures more stable and predictable earnings than traditional street hailing.

The growing investment in electric tuk-tuk infrastructure reflects strong institutional commitment to the sector's transition. In January 2024, the Asian Development Bank and BANPU approved a 2.4-billion-baht loan to deploy 1,500 six-seater electric tuk-tuks and build the charging networks required for micro-transit services across Bangkok (Asian Development Bank, 2023b). This scale of funding signals confidence in electric tuk-tuks as practical urban mobility solutions, particularly in dense areas where larger vehicles struggle. By prioritising dedicated charging infrastructure, the initiative ensures reliable fleet operation and supports sustained commercial use.

## 9.3 ASEAN Guidelines for LEV

**Table 12: ASEAN Standard Guidelines for LEV**

Standard Categories	International Standard	Standard Details
Battery Performances	IEC 62660	Performance, reliability, and safety testing requirements for lithium-ion rechargeable cells used in electric vehicles.
Battery Swapping Requirements	IEC 62840	Electric vehicle battery swap system
Battery Testing	a. IEC 62660 b. ISO 18243	a. Performance, reliability, and safety testing requirements for lithium-ion rechargeable cells used in electric vehicles. b. Test methods and safety requirements for lithium-ion traction battery packs are used in electric road vehicles.
Charging Requirements	IEC 61851	Specifies requirements and safety guidelines for electric vehicle conductive charging systems
LEV Classifications	ISO 13062	Electric mopeds and motorcycles – Terminology and classification
Vehicle Approval	a. UNR 100 b. UNR 136 c. EU 168	a. Uniform provisions concerning the approval of vehicles concerning specific requirements for the electric power train b. Uniform provisions concerning the approval of vehicles of category L with regard to specific requirements for the electric power train c. Approval and market surveillance of two- or three-wheel vehicles and quadricycles
Vehicle Safety	a. ISO 13063 b. ISO 18243 c. ISO 18246 d. ISO 26262	a. Electrically propelled mopeds and motorcycles: Safety Specifications b. Electrically propelled mopeds and motorcycles: Test specifications and safety requirements for lithium-ion battery systems c. Electrically propelled mopeds and motorcycles — Safety requirements for conductive connection to an external electric power supply d. Road vehicles - Functional safety - Part 12: Adaptation of ISO 26262 for motorcycles
Vehicle Testing	a. ISO 13063 b. ISO 13064	a. Electrically propelled mopeds and motorcycles: Safety Specifications b. Battery-electric mopeds and motorcycles: Performance

Source: (ASEAN, 2024).

The ASEAN Guidelines for LEV highlights that establishing a unified classification system for light electric vehicles (LEVs) is essential for market development, as it supports economies of scale, harmonises registration and regulatory processes across government agencies and addresses the current uncertainty surrounding the legal status of low-speed E2Ws, E3Ws, and light E4Ws. Regulatory ambiguity regarding permitted road usage, safety equipment, insurance requirements, and age limits creates significant barriers for users and fleet operators. Further compounded by the rapid emergence of new LEV technologies that outpaced existing legal frameworks (Table 12). The study emphasises the importance of interoperability standards for charging systems, batteries, and other components, along with rigorous safety and security standards covering high-voltage markings, braking and lighting requirements, and standardised testing protocols. The key standard areas highlighted by this study are as follows:

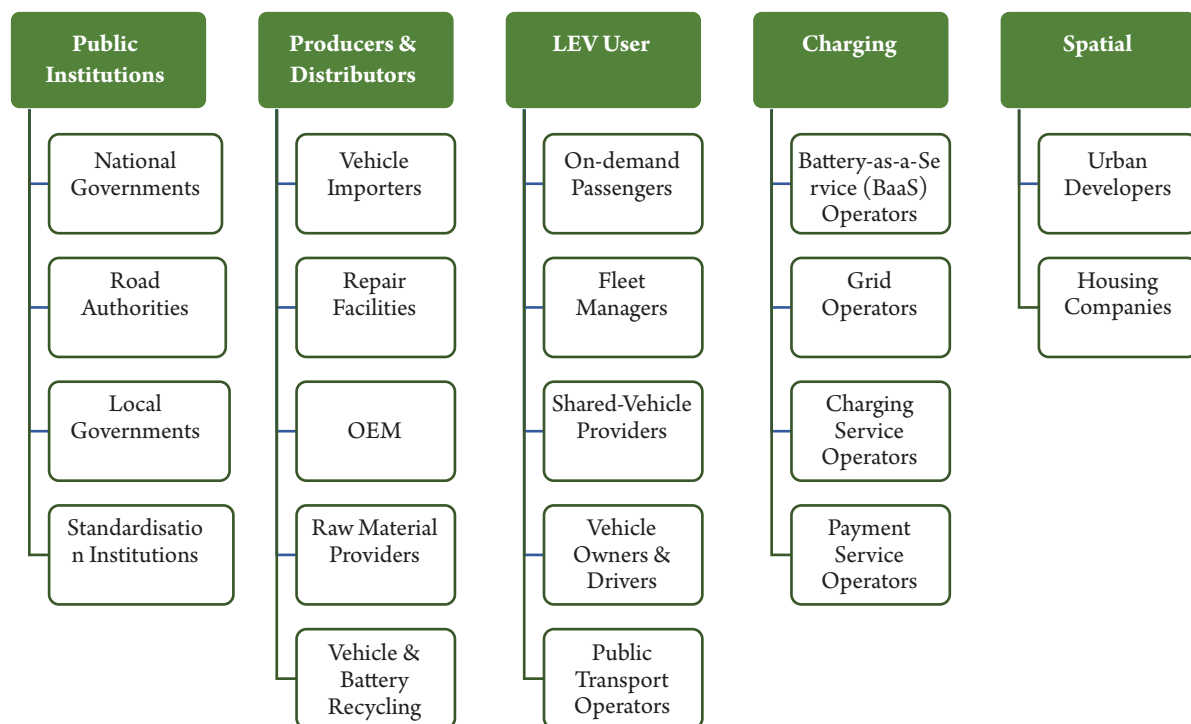
- Vehicle Category and Approval Standards
- Interoperability Standards
- Safety and Security Standards
- Product Quality and Repairability Standards

## 9.4 Governance Framework for Adoption of LEV in ASEAN Countries

The LEV ecosystem and governance framework provides a holistic structure for regulating low electric vehicles in ASEAN countries by organising key stakeholders across five interlinked domains: public institutions, producers and distributors, LEV users, charging services, and spatial actors (Figure 28). Public institutions establish policies, standards, and enforcement mechanisms, while producers and distributors support the full LEV lifecycle, from manufacturing and import to maintenance and recycling. LEV users ranging from private owners to fleet and public transport operators form the operational core of the system. Charging and energy actors ensure reliable power supply, service interoperability, and payment integration, whereas spatial stakeholders align LEV deployment with urban development and land-use planning. Collectively, the framework emphasises coordinated, multi-level governance as essential for sustainable and scalable LEV integration in ASEAN contexts.

Effective coordination among these actors requires robust governance structures that clearly delineate responsibilities and ensure stakeholder engagement in formulating a comprehensive strategy. Such a strategy must adopt a multi-dimensional approach combining economic incentives, energy infrastructure development, updated regulatory frameworks, and technological advancement which in turn demands substantial interagency collaboration. Experiences across ASEAN Member States (AMS) illustrate the diversity of institutional arrangements: Indonesia and the Philippines rely on numerous ministries and regulatory bodies to integrate EV policies, while Thailand operates through several key ministries and its Board of Investment. In contrast, Singapore has centralised its efforts through the National Electric Vehicle Centre (NEVC), led by the Land Transport Authority, to drive EV adoption, coordinate standards, and support the transition towards phasing out internal combustion engine vehicles by 2040.

**Figure 28: LEV Ecosystem for Adoption in ASEAN Countries**



Source: (ASEAN, 2024).

## 9.5 Lessons from ASEAN Countries

### **Thailand's Iconic Tuk-Tuks Evolve: From Smoker to Zero Emission:**

- Previously, Thailand had two stroke engines base Tuktuk which pollutes the air, creates noise and has some other negative impacts.
- The revolution towards green solution came through Electric Tuktuk.
- The pioneer of E-TukTuk is MuvMi, an app-based transport service.
- MuvMi operates a centrally managed fleet that passengers can summon through a smartphone application.

### **Prioritise First and Last Mile Connectivity:**

- ASEAN countries show that LSVs work best when they fill short-distance mobility gaps.
- Integrating them with mass-transit stations, BRT corridors, ferry terminals, or regional bus hubs creates a seamless door-to-door system.
- Thailand's e-tuktuk services and the Philippines' e-trikes demonstrate that LSVs thrive when strategically placed to support existing public transport networks rather than compete with them.

### **Formalisation and Regulation Improve Safety and Reliability:**

- Countries like Thailand and the Philippines have shown that clear regulations on speed limits, passenger capacity, designated routes, and vehicle standards significantly improve public acceptance.

### **Infrastructure Must Expand in Parallel:**

- LSVs depend on strategic charging infrastructure along high-demand corridors. Countries that paired vehicle rollout with infrastructure development experienced smoother adoption compared to places where charging lags behind vehicle deployment.
- Having a good infrastructure for High-Speed vehicles allows us to adopt E-tuktuks so smoothly.

### **Local Manufacturing and Conversion Programmes Reduce Costs**

- ASEAN countries learned that local assembly or retrofitting drastically reduces costs:
  - Thailand converts old ICE tuk-tuks to electric.
  - Vietnam encourages local micro-EV production.
  - The Philippines supports localised e-trike assembly.

## Conclusion and Recommendations

Despite having the potential of E3Ws, it increased challenges to the health and environment, creates concerns on road safety, and for maintaining urban transport system effectively. Poor Urban Public Transport System is not responsible for unregulated expansion of E3Ws – there are multiple reasons behind this. To mitigate these issues related to health and environment, technical, social and economical and urban public transport systems, the recommendations are as follows:

### 10.1 Recommendations: Urban Public Transport System Management of E3Ws

#### Strengthening institutional capacity for regulating and managing low-speed vehicles (LSVs) in Bangladesh

- Institutional weaknesses have been a primary driver of the rapid and unregulated expansion of E3Ws in Bangladesh.
- Dedicated and well-resourced units should be established within city corporations, with clear mandates to implement, monitor, and enforce E3W-related policies and regulations.
- Respective Authorities to implement: DTCA, City Corporations (DNCC & DSCC).

#### Preparing a Dedicated Road Network for E3Ws

- The absence of a designated road network for E3Ws allows unrestricted movement across the city, contributing to severe congestion on both main and local roads.
- Dedicated routes should be developed to ensure E3Ws can operate efficiently without accessing highways or main roads.
- Respective authorities to implement: Roads and Highway Department (DTCA).

#### Restrict E3Ws from Operating on Highways and Major Arterial Roads in Bangladesh

- Revise BRTA and city corporation regulations to formally classify E3Ws as low-speed urban vehicles, making them ineligible for highway and arterial road permits.
- Implement enforcement through traffic police and city authorities using designated routes, clear road signage, and routine monitoring in high-traffic corridors.
- Respective authorities to implement: Dhaka Metropolitan Police (Traffic Division).

#### Determining an Optimal Balance Between High-Speed Vehicles (HSVs) and Low-Speed Vehicles (LSVs) in Dhaka

- A comprehensive urban transport study specific to Dhaka should be conducted to determine the optimal ratio of high-speed vehicles and E3Ws, based on road capacity, travel demand, and network performance.
- Based on rigorous surveys and technical assessments by urban transport experts, a capped number of operating licenses for both vehicle categories should be introduced within the city.

- Anyone from anywhere is launching vehicles on the roads. This must be stopped, otherwise traffic congestion will increase day by day more.
- Respective authorities to determine: DTCA, BRTA, City Corporations.

### **Proper Distribution of E3W Licenses in Major Bangladeshi Cities**

- Restrict the number of E3W licenses in major cities based on study findings.
- Allocate licenses according to road capacity and accident data to reduce congestion and improve pedestrian safety.
- Implement zone-based operations with colour-coded vehicles to ensure compliance with designated routes.
- Respective authorities for distribution: City Corporations.

### **Strengthening Enforcement of Urban Transport Laws and Policies**

- Inadequate enforcement of existing laws is a major contributor to inefficiencies in urban transport systems. Strengthening compliance mechanisms is essential to improve system performance.
- Revised laws and policies should be properly enforced through designated institutional channels to ensure an inclusive and effective urban transport system.
- Respective authorities for implementation: MORTB, DTCA, BRTA, and City Corporations.

## **10.2 Recommendations: Policy Improvements**

### **Develop Comprehensive Guidelines for LSVs (FLM Transport Support)**

- Prepare a unified guideline to establish a sustainable ecosystem for LSVs. Key areas to include:
  - Manufacturing standards aligned with international norms.
  - Rigorous vehicle compatibility and testing procedures.
  - Licensing procedures for vehicles and drivers.
  - Operating rules, regulations, and institutional responsibilities.
  - Guidelines for used battery recycling facilities.
  - Charging station standards and tariff frameworks.
- Respective authorities to implement: Ministry of Road Transport and Bridges (MoRTB), BRTA and City Corporation.

### **Increase taxes on imported components.**

- Major components like BLDC motors, controllers, and differentials are heavily imported from China.
- Higher import taxes can help regulate growth and discourage excessive entry into the sector.
- Respective authorities to implement tax on components: National Board of Revenue (NBR).

### **Ban Lead-Acid Batteries in E3Ws**

- Many countries are phasing out lead-acid batteries due to environmental and health risks.
- Ministry of Environment (MoE) should develop a comprehensive policy to prohibit their use and promote safer alternatives.
- Ban implementation: District level wing of MoE, District level police.

## **10.3 Recommendations: Technical**

### **Transition to LiFePO<sub>4</sub> Batteries in E3Ws**

- LiFePO<sub>4</sub> batteries are less prone to overheating, leakage, or explosion compared to lead-acid batteries, enhancing overall vehicle safety.

- LiFePO<sub>4</sub> batteries offer significantly higher cycle life and energy efficiency, reducing replacement frequency and long-term operational costs.
- Without LiFePO<sub>4</sub> battery, the license should not be given.
- Respective authorities for this transition: City corporations.

### **Standardise E3W Charging Stations and Adjust Tariff Rates**

- Regulation and Authorisation: Most E3W charging stations are unregistered or unauthorised, causing losses for public sector utilities (PSUs). Identifying and regulating these stations ensures proper billing and fair revenue collection.
- Tariff Adjustment: Increasing tariff rates can help discourage excessive use and uncontrolled entry into the E3W sector.
- Power Quality Considerations: Low-quality or unregulated charging systems can introduce harmonics and Total Harmonic Distortion (THD) into the grid, affecting power quality and potentially damaging both the electrical network and connected devices.
- Respective authorities for standardisation: BPDB, BREB.

### **Infrastructure Development and Route Segmentation for FLM Transport in Dhaka**

- To achieve an efficient and sustainable first-and last-mile (FLM) transport system, segregate routes for low-speed vehicles (E3Ws) and high-speed vehicles (HSVs), while upgrading high-speed vehicle infrastructure to support safe and integrated operations.
- Without improving the infrastructure for high-speed vehicles, the problem of FLM cannot be resolved.
- Respected authorities to develop infrastructure: Roads and Highway Department (MoRTB), DTCA (MoRTB) along with BRTA.

### **Increase Passenger Capacity and Limit the Speed of Newly Designed Vehicles**

- Introduce a mixed fleet combining low-capacity 2-seater E3Ws and medium-capacity 8–10-seater vehicles to efficiently meet the FLM demand.
- Replace some low-capacity vehicles with medium-capacity alternatives to reduce the total number of vehicles and alleviate congestion on urban roads.
- Limit vehicle speed through advanced technologies to ensure a safer ride.
- Respective authorities to implement: DNCC & DSCC along with BUET team.

## **10.4 Recommendations: Socio-economic, Health and Environmental**

### **Establish a Regulatory and Monitoring Framework for Battery Recycling and ULAB Management**

- Develop a national system to register and monitor all battery recycling facilities, ensuring they operate legally and safely.
- Identify and shut down informal or illegal used lead-acid battery (ULAB) recycling operations to prevent environmental contamination and health hazards.
- Introducing guidelines and standards for safe ULAB handling, storage, and disposal to formalise the recycling sector.
- Respective authorities to establish: Ministry of Environment.

### **Implement Licensing and Regulatory Management for E3W Garage Owners**

- Establish a formal licensing system for all E3W garage owners to regulate operations and prevent illegal charging or unauthorised practices.
- Identify informal garage operators and integrate them into the formal framework, ensuring compliance with safety, service, and environmental standards.

- Create a unified structure that includes both garage owners and E3W drivers, safeguarding driver rights and preventing excessive vehicle rent or exploitative practices.
- Respective authorities to implement: City corporations (DNCC & DSCC).

### **Conduct a Nationwide Survey on Lead Exposure in Vulnerable Populations**

- Initiate a comprehensive nationwide survey to assess lead levels in the blood of children and women, who are most vulnerable to lead exposure.
- Based on survey findings, implement targeted medical interventions, awareness programmes, and preventive measures to reduce lead exposure.
- Use the survey results to inform national policies on battery recycling, E3W operations, and environmental health management.
- Respective institutions to conduct the survey: IEDCR, icddr,B, MoE.

### **Identify and Remediate Lead-Contaminated Lands**

- Conduct systematic identification of lands affected by lead contamination, particularly in areas surrounding informal or formal ULAB recycling sites.
- Assess the severity of soil contamination and its impact on agricultural productivity and local livelihoods.
- Implement remediation measures, such as soil decontamination and restoration techniques, to remove lead and restore soil fertility.
- Respective authorities to identify: Ministry of Environment.

### **Enforce Minimum Age Requirement for E3W Drivers and Continuous Training Programmes**

- Establish and strictly enforce a minimum age requirement for obtaining an E3W driving license to prevent underage operation.
- Implement mandatory verification procedures during license issuance to ensure compliance with the age requirement.
- Respective authorities for enforcement: DNCC, DSCC, DTCA.

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Electric three-wheelers (E3Ws) have emerged as a dominant mode of urban transport in Bangladesh, driven by the rising demand for affordable and accessible mobility in densely populated cities. Despite their potential, the rapid and largely unregulated proliferation of E3Ws has posed significant challenges to urban transport systems, including increased traffic congestion, elevated road safety risks, weak institutional governance, and serious health and environmental concerns, particularly those associated with the improper management of used lead-acid batteries (ULABs). The lack of standardised manufacturing, licensing, and operational frameworks has further exacerbated these challenges, allowing E3Ws to operate beyond designated routes and outside formal regulatory oversight. Addressing these multidimensional issues, this study evaluates the current E3W ecosystem and proposes evidence-based policy recommendations aligned with global best practices to guide the transition towards a more sustainable and well-regulated urban transport system.



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