HIGH VOLUME TRANSPORT APPLIED RESEARCH

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Knowledge Exchange Report

Planning Framework for Low Emission Zone (LEZ) in Core Areas of Indian Cities

January 2025

DT Global

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This research was funded by UKAID through the UK Foreign, Commonwealth & Development Office under the High Volume Transport Applied Research Programme, managed by DT Global.

Reference No.	HVT/059
Lead Organisation/ Consultant	CEPT Research and Development Foundation
Partner Organisation(s)/ Consultant(s)	
Title	Planning Framework for Low Emission Zone (LEZ) in Core Areas of Indian Cities
Type of document	Project Report
Theme	Low carbon transport
Sub-theme	Better urban and transport planning, and peri-urban transport to reduce Greenhouse Gas (GHG) emissions and carbon reduction
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Geographical Location(s)	Ahmedabad, India

Abstract

To formulate Planning Framework for Low Emission Zone (LEZ) in Core Areas of Indian Cities, by taking the case of Ahmedabad, India, knowledge exchange programmes were conducted with different segments of stakeholders for sharing knowledge and fostering collaboration. Four programmes were organised including roundtable and meetings with city officials and mobility experts to gain inputs and recommendations, and workshops to create awareness among local stakeholders.

Keywords	Low Emission Zone, Electric Mobility, Urban Mobility, Air Quality, Vehicle Emissions, Green Mobility Solutions
Funding	HVT/ FCDO
Acknowledgements	

Issue	Status	Author(s)	Reviewed By	Approved By	Issue Date
	Draft 1	HM Shivanand Swamy, Shalini Sinha, Surya Sugathan	Holger Dalkmann		30-09-2024
	Draft 2	HM Shivanand Swamy, Shalini Sinha, Surya Sugathan, Ruchi Singhal	Holger Dalkmann		24-12-2024
	Draft 3	HM Shivanand Swamy, Shalini Sinha, Surya Sugathan, Ruchi Singhal	Holger Dalkmann		10-01-2025

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Abbreviations/Acronyms

AI	Artificial Intelligence
AJL	Ahmedabad Janmarg Limited
AMC	Ahmedabad Municipal Corporation
AMTS	Ahmedabad Municipal Transport Service
ANPR	Automatic Number Plate Recognition
AUDA	Ahmedabad Urban Development Authority
AWHCT	Ahmedabad World Heritage City Trust
BRTS	Bus Rapid Transit System
BS	Bharat Stage
CMUBS	Chief Minister Urban Bus Service
CNG	Compressed Natural Gas
CPCB	Central Pollution Control Board
CPO	Charging Point Operator
CRDF	CEPT Research and Development Foundation
DPF	Diesel Particulate Filter
EV	Electric Vehicle
FCDO	Foreign, Commonwealth and Development Office
FGD	Focus Group Discussion
GCC	Gross Cost Contract
GMRCL	Gujarat Metro Rail Corporation Limited
GST	Goods and Services Tax
HVT	High Volume Transport
IAS	Indian Administrative Service
ICCT	International Council on Clean Transport
ICE	Internal Combustion Engine
IPT	Intermediate Public Transport
LCV	Light Commercial Vehicle

LEZ	Low Emission Zone
LIC	Low Income Country
NCAP	National Clean Air Programme
OEM	Original Equipment Manufacturer
PM	Particulate Matter
PUC	Pollution Urban Control
RTO	Regional Transport Office
SUMP	Sustainable Urban Mobility Plan
TCO	Total Cost of Ownership
UD & UHD	Urban Development and Urban Housing Department
ULB	Urban Local Body
ULEZ	Ultra Low Emission Zone
UNESCO	United Nations Educational, Scientific and Cultural Organization
VGF	Viability Gap Funding
WHO	World Health Organisation

1. Background

The High Volume Transport Applied Research Programme project on 'Planning Framework for Low Emission Zone (LEZ) in Core Areas of Indian Cities' is being undertaken by the CEPT Research and Development Foundation (CRDF) with the support of Ahmedabad Municipal Corporation (AMC). By taking the case of the walled city of Ahmedabad, the project investigates an area-based approach to facilitate actions towards addressing transportation challenges and air pollution in the core area. The initiative seeks to resolve mobility issues in the core area of the city, aiming for a better quality of life and improved community welfare.

As an air quality improvement strategy, the planning and implementation of the Low Emission Zone (LEZ) are gaining attention globally. Low Emission Zone is a defined geographical area with a regulatory measure to tackle air quality challenges, commonly implementing measure like restricting the access for polluting vehicles. A well-planned LEZ has the potential to encourage the transition to low-emission vehicles and facilitate use of active and public transport to combat traffic congestion, promote accessibility, safe movement of all and improve liveability and equity. The establishment of LEZ in Indian cities with restrictions on vehicles will not work in isolation due to the absence of good alternatives for road users, such as a robust public transport system. Hence, it must be structured to ensure equitable and integrate with strategic elements to manage traffic demand and reduce air pollution.

1.1 About the Project

The objective of the study is to formulate a framework for planning and designing a Low Emission Zone for core city areas in the context of developing countries. The Walled City of Ahmedabad has a high density of population and employment and houses numerous activities such as retail shops and specific commodity markets leading to significant passenger and goods traffic movement. Air quality monitors have highlighted this place consistently exhibits the highest daily PM2.5 levels. In this regard, the project explores interventions for the core area with the support of stakeholders, organises capacity building, and formulates a monitoring and evaluation framework to ensure the successful implementation of actions.

The project involves six key tasks: reviewing international literature and India's policy landscape on LEZs; establishing partnerships with relevant stakeholders and conducting capacity-building workshops; conducting a baseline assessment to identify mobility and air quality challenges in walled city of Ahmedabad; formulating land use, mobility, and clean vehicle technology scenarios with an assessment framework that includes gender and social inclusion; outlining a phased LEZ transition strategy considering stakeholder perspectives and feasibility; and developing a LEZ planning framework based on the case city's experiences for use in other cities.

1.2 Knowledge Exchange Programmes

For seeking inputs, fostering collaboration and sharing knowledge, four workshops with different segments of stakeholders are planned to be conducted.

Table 1-1 List of Knowledge Exchange Programmes

S. No.	Events	Timeline
1	Workshop on Low Emission Zone for Ahmedabad	September 2024
2	Awareness Workshop on Electrification of Vehicles for Stakeholders	October 2024
3	Roundtable on Standardising Mobility Systems in Core Area of Indian Cities	October 2024
4	Meetings with Advisory Group Members	December 2024

1.2.1 Workshop on Low Emission Zone for Ahmedabad

A workshop was organised for Ahmedabad city officials on the Low Emission Zone on September 9, 2024 at Ahmedabad Municipal Corporation, West Zone Office, Usmanpura, Ahmedabad. The workshop brought experts involved in the planning and implementation of LEZ in international and national cities to share their

learnings and facilitate discussion among the key stakeholders to identify feasible strategies for the walled city of Ahmedabad.

1.2.2 Awareness Workshop on Electrification of Vehicles for Stakeholders

An awareness workshop on electric variants of three-wheelers was conducted on October 13, 2024 to bring stakeholders including AMC, RTO, bank representatives, vehicle manufacturers and operators/ drivers of three-wheelers to deliberate on electrification possibilities and action areas. Exhibition of electric three-wheelers along with information on its technology, financial incentives, bank loan details and opportunity to test drive shall encourage drivers to opt for electric variants.

1.2.3 Roundtable on Standardising Mobility Systems in Core Area of Indian Cities

As part of the 17th Urban Mobility India Conference cum Exhibition 2024, CRDF in collaboration with the Urban Catalysts organised a roundtable on Standardising Mobility Systems in the Core Area of Indian Cities on October 27, 2024. The roundtable discussion aimed to share evidence and knowledge based on the project and facilitate a discussion for standardisation of interventions to overcome air quality challenges in the context of core area of Indian cities. The key points include defining LEZ in the Indian context, identifying interventions to improve air quality, and exploring opportunities and barriers to the adoption of electric vehicles. The roundtable identified opportunities for policy development, stakeholder collaboration, air quality enhancement and integration of public transport, intermediate public transport and non-motorised transport, specific to core area of Indian cities.

1.2.4 Meetings with Advisory Group Members

Meetings were held with advisory group members including AMC while developing strategic plan for the walled city. These meetings aimed to share the project's approach and findings while seeking their feedback on the developed framework. This collaborative effort ensures stakeholder buy-in and support, while also facilitating the project's broader implementation.

1.3 Stakeholder Consultations

Meetings were undertaken with civic officials to brief them about the project objectives and secure buy-in.

Meeting with Municipal Commissioner of Ahmedabad Municipal Corporation

During the initial stage of the project, a meeting with Mr M. Thennarasan (IAS), Municipal Commissioner, AMC was held on June 12, 2024 to introduce the project, highlight the challenges from primary assessment in the core city area and convey the need for planning and implementation of LEZs. During the meeting, the appointment of a nodal officer for the project to support day-to-day project activities and facilitate connecting with departments under AMC and other stakeholders, formation of advisory and working groups to provide strategic guidance and support the project on a regular basis were highlighted.

Meeting with Deputy Municipal Commissioner of Ahmedabad Municipal Corporation

To secure support from AMC for the execution of knowledge exchange programmes, a meeting with Mr Amrutesh Kalidas Aurangabadkar (IAS), Deputy Municipal Commissioner, AMC took place on August 20, 2024. The project team briefed about the project including the methodology, characteristics of the study area, operations of activity generators and travel characteristics of passengers as well as goods. The board strategies for interventions identified for the project and workshops planned as part of the projects were discussed. The Deputy Municipal Commissioner had agreed to be part of the workshops and suggested to prepare a set of questions for each department to facilitate discussion and development of solutions with coherent perspective for the first workshop.

Figure 1-1 Mr Amrutesh Kalidas Aurangabadkar, IAS providing inputs for the workshop

2. Workshop on Low Emission Zone for Ahmedabad

A workshop on Low Emission Zone for Ahmedabad was organised for the Ahmedabad city officials with the experts involved in the planning and implementation of LEZ. The workshop aimed to draw lessons from the international and national experience on policy, implementation pathways, strategies adopted and monitoring and evaluation mechanisms. It facilitated discussions among stakeholders playing an important role in decision-making to provide inputs and help to identify feasible solutions for the walled city of Ahmedabad while ensuring a coherent perspective.

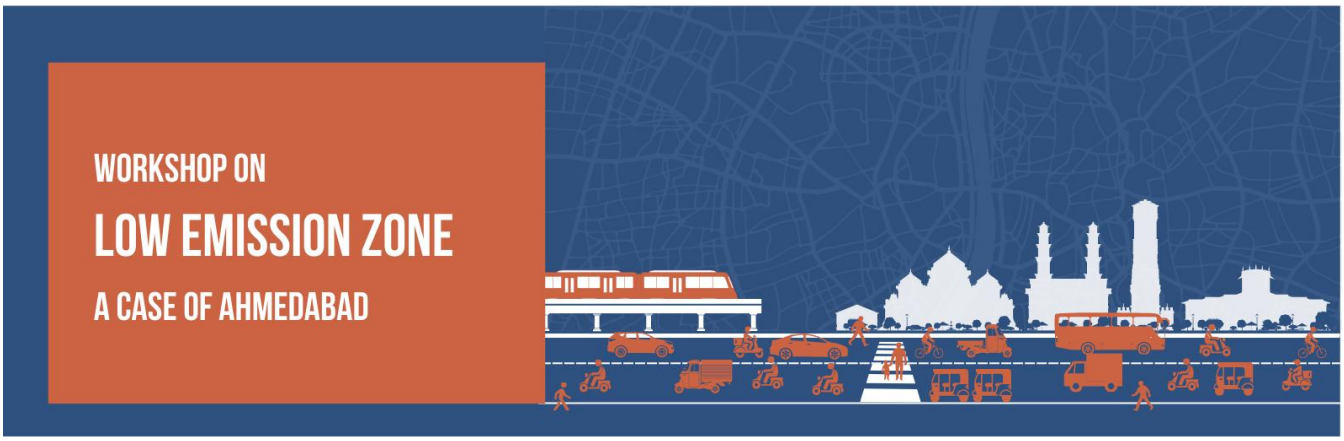

Figure 2-1 Poster of the Workshop

This workshop was conducted on September 9, 2024 at Ahmedabad Municipal Corporation, West Zone Office, Usmanpura, Ahmedabad. The two-hour event was organised in three parts which included an opening session, international and national experience on setting LEZ and closing session.

2.1 Participants

The workshop was attended by advisory group members and online participants. The speakers joined the event virtually and ten officials who are also part of the advisory group of this project attended the workshop in-person.

Table 2-1 List of Advisory Group Members

S. No.	Name	Designation	Department
1	Amrutesh Kalidas Aurangabadkar, IAS	Deputy Municipal Commissioner	Ahmedabad Municipal Corporation (AMC)
2	Vishal Khanama	General Manager	Ahmedabad Janmarg Limited (AJL)
3	R L Pandey	Deputy Transport Manager	Ahmedabad Municipal Transport Service (AMTS)
4	Dharti Acharya	DGM-Environment	Gujarat Metro Rail Corporation (GMRC) Limited
5	Deepa Dave	Deputy Manager Urban Planner	Ahmedabad Municipal Corporation (AMC)
6	Chintan Patel	Town Planner	Ahmedabad Urban Development Authority (AUDA)

7	Ankit Patel	Assistant Manager - Tech	Smart City, Ahmedabad
8	K P Sagthiya	N Traffic Police Station	Traffic Department of Ahmedabad
9	Ashish Parmar	Assistant Regional Transport Officer	Regional Transport Office
10	Shivani Shah	Assistant Architect	Ahmedabad World Heritage City Trust (AWHCT)

Source: CoE-UT, CRDF

The online platform, Zoom, was accessible to practitioners, academicians, and students across the country. Twenty-five participants had attended the workshop virtually. This included professionals from consulting and research organisations such as Deloitte India, Climate Group, Delhi Integrated Multi-Modal Transit System (DIMTS), ICLEI South Asia, LEA Associates South Asia (LASA), World Resources Institute (WRI) India. Students from the Indian Institute of Technology (IIT) Kharagpur and CEPT University had also joined the programme.

2.2 Overview of the Workshop

In the opening session, the project was introduced and had set the context for Ahmedabad. The second session involved presentations by two experts on Low Emission Zone from Seoul and India, followed by a moderated discussion with Ahmedabad city officials. The third session summarised the insights from the discussions and a vote of thanks.

2.2.1 Session 1: Opening Session

The workshop began with an overview of the project by Dr Shalini Sinha, Center, Head, Center of Excellence in Urban Transport (CoE-UT), CRDF. The relevance of the LEZ was conveyed by highlighting that a well-designed zone can promote a shift to low emission vehicles, encourage active and public transport, reduce traffic congestion, enhance accessibility and also the overall quality of life in the city. Limited focus on managing mobility through demand management and parking management had not been able to facilitate the shift to more sustainable modes like active and public transport. In this project, a more targeted approach is adopted for the core area of the city, which is also a major economic hub with a high concentration of not just people but also jobs leading to heavy traffic congestion. Hence, an area-based strategy would be essential to address the transportation, and the air pollution challenges in these core areas to support the flourishing economic activities.

The opening remarks was delivered by Mr Amrutesh Kalidas Aurangabadkar (IAS), Deputy Municipal Commissioner, AMC. India's pathway to achieving net zero carbon emissions by 2070 was highlighted, along with the steps taken by the Government of India, the Government of Gujarat as well as AMC to achieve this goal. In the transport sector, the city's key initiatives include fuel switch programme by the conversion of diesel buses to CNG, the introduction of electric buses with the support of the government of India's FAME scheme and expanding transportation fleet. Other ongoing efforts include setting up of charging stations and plantation drives along both sides of the BRTS corridors in the city. It was emphasised that LEZs have been implemented globally and must consider the benefits of adopting it to tackle cities' growing pollution challenges. Ahmedabad, India's first World Heritage City, has numerous Archaeological Surveys of India monuments within the walled city area. Heritage and tourism play a significant role in contributing to the local economy while generating revenue for AMC as well as providing livelihood to the locals. However, this area faces severe traffic congestion and requires to revamp not only to enhance user-friendliness but also to handle future footfalls by energy efficient methods. It was mentioned that this project has the potential to develop sustainable solutions for the walled city and scale beyond the core area of Ahmedabad and will serve as a template for other cities facing similar issues. The conclusion stressed AMC's eagerness to collaborate on this project to enhance its capacities and identify solutions to tackle current and future challenges.

Figure 2-2 Mr. Amrutesh Kalidas Aurangabadkar, IAS delivering the Opening Remarks

Source: CoE-UT, CRDF

2.2.2 Session 2: International and National Experience on Setting Low Emission Zone

This session began with the introduction of the speakers by Ms Surya Sugathan, Senior Transport Planner, CRDF. The first presentation was on the Introduction of Low Emission Zone in Seoul by Prof Joonho Ko, Professor at the Graduate School of Urban Studies at Hanyang University, Seoul, Korea. The presentation was focused on the LEZ programme in the Seoul Capital Region, which is a densely populated area with 50% of the country's population living in just 5.3% of its area. Air quality improvements in Seoul were highlighted, with significant reductions in PM2.5 levels over recent years. The Korean government introduced stricter environmental policies, including stronger LEZ policies, after serious air quality issues in 2019. The vehicle emission grading system introduced in 2020 to control old and polluting vehicles was discussed. Vehicles are classified into five grades; Grade 1 includes electric vehicles and other new vehicles and Grade 5 primarily targets old diesel vehicles. Only 3% of the Grade 5 is responsible for 60% of PM pollution. The city targets Garde 5 vehicles with measures like mandatory Diesel Particulate Filter (DPF) installation and scrappage programmes. Subsidies are provided for DPF installation and electric vehicle purchases. The seasonal air quality control measures were introduced in 2019, limiting the operation of Grade 5 vehicles without DPF from December to March.

In downtown Seoul, a clean transportation zone was established to have better transportation conditions, where Grade 5 vehicles are banned to promote green transportation, such as walk, public transit, bicycles and cleaner vehicles such as electric vehicles. Automated number plate recognition (ANPR) systems were installed at entry points to monitor vehicles and impose fines on non-compliant vehicles. A future expansion of the LEZ to cover Grade 4 vehicles was mentioned and by 2035, all internal combustion engine vehicles will be banned from downtown Seoul. Public opposition to stricter air quality measures was acknowledged but simulations conducted by the government demonstrated the potential benefits in reducing fine dust. Significant reductions in operation of Grade 5 vehicles and violations were reported since the implementation of the LEZ. Improvements in air quality, particularly PM2.5 levels, were observed as a result of the LEZ and seasonal control measures. The national blueprint for 2030 aims for 16.7% of all registered vehicles in Korea to be electric contributing to air quality improvement and greenhouse gas reduction.

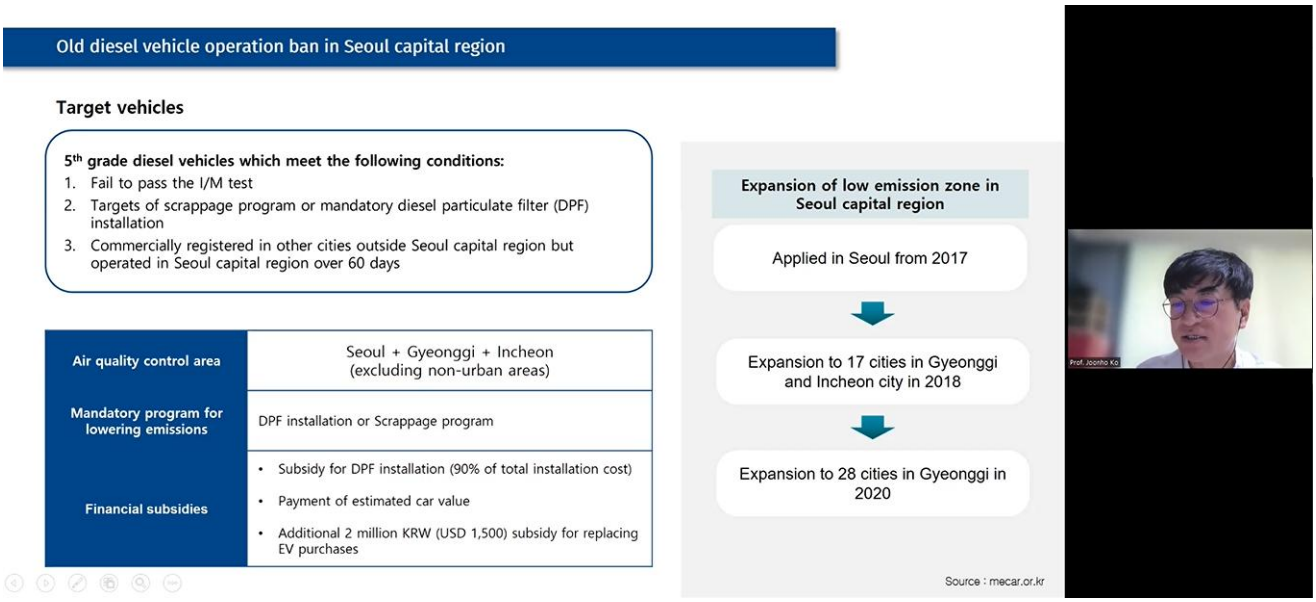

Figure 2-3 Prof. Joonho Ko on Introduction of Low Emission Zone in Seoul

Source: CoE-UT, CRDF

The second presentation was on the Implementation Pathways for enabling LEZ in India by Mr Amit Bhatt, the Managing Director of ICCT India. The presentation showcased the urgency of LEZs underscoring the need for a better understanding of real-world transport emissions. It was noted that discrepancies between lab-tested emissions and real-world emissions exist with some vehicles emitting 50-60 times more than lab limits. The current testing methods were criticised, RDE & ISC are intrusive and time-consuming and Pollution Under Control (PUC) certificates do not cover key pollutants like PM and NOx. Remote sensing technology was highlighted as a more efficient way to capture real-time emissions data. In Delhi, over 110,000 vehicles were tested and revealed that BS VI vehicles emit significantly less than BS IV vehicles, but still exceeded type approval limits. The findings showed that NOx emissions, especially from light goods vehicles of BS IV emitted 27 times the approval limit. The need to address both PM and NOx emissions was stressed, with particular attention to the impact of NOx in forming secondary PM and carcinogenic gases. It was also highlighted that CNG vehicles while performing well on particulate matter emissions, contributed significantly to NOx and carbon monoxide emissions. Three unnamed original equipment manufacturers (OEMs) were compared, revealing that vehicles from the same fuel and technology category but different OEMs have varying emission levels.

A comparison of vehicle technology and fuel type on the amount of emissions more than the approval limits was discussed. Commercial vehicles, both passenger and freight, were found to be the worst emitters even for BS IV and BS VI standards. CNG vehicles while performing well in reducing particulate matter emissions showed high NOx, carbon monoxide and hydrocarbon emissions. A reimagining of the transport emission testing system, especially for goods vehicles, was recommended. Despite the successful transition from BS IV to BS VI standards, the presentation concluded that transport emissions are underreported in their impact on public health and climate change. The Ministry of Road Transport and Highways is developing AIS 170, which offers guidance for cities on utilising remote sensing techniques to gain a clearer understanding of vehicle emissions.

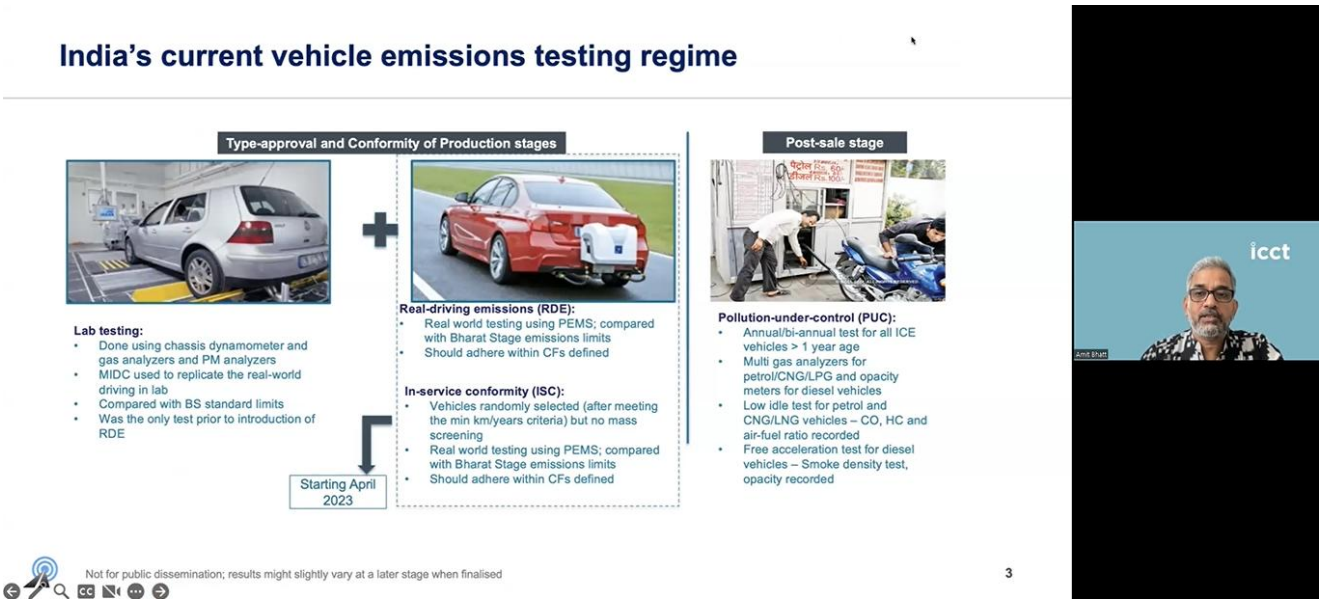

Figure 2-4 Mr. Amit Bhatt on Vehicle Emissions Testing Regime in India

Source: CoE-UT, CRDF

Followed by the learning from international cases of LEZ, Ms Surya Sugathan briefed about the approach in the Indian context. It was explained that LEZs are defined areas where access to polluting vehicles is restricted by regulatory measures, aiming to reduce air pollutants that have significant health impacts and lower carbon emissions. It was noted that 320 European cities and non-European cities like Jakarta and Seoul have adopted LEZs by restricting vehicle access to specific areas. In London, congestion charging was implemented in 2003 to address traffic congestion which reduced traffic by 30% in the first year, while bus ridership increased by 38%. Following this, a LEZ was introduced in 2008 targeting heavy vehicles, and an Ultra Low Emission Zone (ULEZ) was introduced in 2019 targeting older, more polluting vehicles. A 50% reduction in NO2 was observed in central London by 2023 after the ULEZ boundary was expanded. A similar approach took place in Seoul, where the city implemented demand management measures and enhanced public transport systems since 1990 to combat traffic congestion. LEZ implementation in Seoul began as a pilot programme in 2017 and became fully operational in 2019. Both cities had already shifted towards demand management and sustainable transport planning before the implementation of LEZs. Hence, vehicle restriction measures were feasible due to the well-developed public and active transport infrastructure offering a good alternative to road users.

The work done for Ahmedabad so far was presented by Dr Shalini Sinha. It was emphasised that Ahmedabad was identified as a non-attainment city by the Central Pollution Control Board. The walled city of Ahmedabad, a UNESCO World Heritage site, occupies around 1% of the total AMC area but houses 4% of the city's population and contributes to 10% of employment. This area has significant economic, social, and cultural activities that attract both residents and workers, leading to a conflict between passenger and freight traffic. Air pollution data from monitoring stations in the core city consistently show higher-than-acceptable levels of PM 2.5 during both summer and winter months. The residents in the walled city predominantly belong to lower-income groups, with over 60% earning less than ₹20,000 per month. Vehicle ownership is lower compared to the western parts of the city, with only 2% owning four-wheelers but 87% two-wheelers. A high concentration of commercial and industrial activities in this area leads to congestion and conflicts between pedestrians and vehicles. The travel speeds in the area are less and walkability is compromised. Public transport connectivity includes BRTS, city buses and the metro, but only 9% of trips are made using public transport, whereas two-wheeler trips account for 42% of total trips, contributing significantly to PM2.5 emissions. Freight movement contributes to around 90% of incoming trips by three-wheeler goods vehicles, further impacting pollution levels. It was highlighted that there is a potential for enhancing public transport usage, pedestrian movement and walkability to reduce the dependency on private vehicles. Electrification of public transport and three-wheeler vehicles is being considered with workshops planned to raise awareness about electric vehicle technology. Focus group discussions with residents were planned to understand their travel patterns and concerns regarding air quality and mobility within the core area. It was noted that solutions for street usage, mobility management and parking management are being explored to support sustainable mobility and minimise pollution.

Figure 2-5 Dr. Shalini Sinha briefing about Planning LEZ in Ahmedabad

Source: CoE-UT, CRDF

Moving forward, a very insightful and in-depth conversation on Strategies for Ahmedabad with city officials was initiated by Prof Shivanand Swamy, Professor Emeritus at CRDF. The following questions were tailored for each department based on their role to identify the problems and provide suggestions for the walled city of Ahmedabad.

Figure 2-6 Prof. Shivanand Swamy moderating the discussion

Source: CoE-UT, CRDF

Effectiveness of PUC certification, the role of diesel and CNG vehicles and potential strategies to address pollution challenges in the walled city.

It was stated by Mr Ashish Parmar of Ahmedabad Regional Transport Office that the ground realities of the walled city, where residents are closely tied to their work and profession, prevent fully restricting vehicle movement. The suggestion to shift markets was also deemed impractical. Regarding PUC, it was noted that there is no existing policy to effectively control pollution through fines, as fining vehicles for expired PUC certificates does not impact emission levels. It was highlighted that implementing a policy to restrict driving without PUC certification, but it could lead to political issues. The prevalence of CNG three-wheelers for goods transportation in the old city was acknowledged due to limited space for larger vehicles. It was also shared that a subsidy of Rs. 50,000 by the Gujarat government is promoting the uptake of EVs, where nearly 10,000 EVs were registered in 2023 and 6,000 until now this year. It was agreed that he would be part of the workshop planned for three-wheeler drivers to raise awareness about EVs, subsidies and their environmental benefits.

Cause and potential solutions to overcome traffic issues in the walled city and recommendations to the study to better understand the problem.

It was highlighted by Ms K P Sagthiya of the Traffic Department of Ahmedabad that traffic congestion in the old city occurs primarily during peak hours, such as 10-11 AM and 5-6 PM, which cannot be controlled through PUC measures. It was suggested that vehicles exceeding a certain mileage be identified during PUC license renewals. A high court matter regarding parking and no-parking areas in Ahmedabad was also mentioned and it is being established in the city. It was clarified that traffic police receive such traffic management plans from the AMC. Traffic management in Ahmedabad involves 14 police stations each with a different geographic area. Respective stations deploy staff in two shifts in congested areas, especially during peak hours.

On-going monitoring and management strategies by Ahmedabad Smart City

It was discussed by Mr Ankit Patel of Ahmedabad Smart City that the organisation is planning the implementation of 500 sensors and the issuance of a tender for smart parking in the city. In collaboration with RTO, the usage of ANPR cameras can be explored to enhance vehicle monitoring and address the challenge of managing vehicles without PUC by devising an efficient challan system.

Major challenges, measures undertaken and recommendations to enhance mobility in the walled city

It was mentioned by Ms Dharti Acharya of Gujarat Metro Rail Corporation (GMRC) Limited that a mindset exists linking car usage to social status with public transportation often looked down upon and it is expected to improve in the next 5-6 years. A comparison was made with London, where public transport is widely used due to affordability and government measures such as parking fares, suggesting similar measures should be enforced here to encourage a shift from private vehicles to public transportation. It was highlighted that the metro system is already electrified and contributes minimally to pollution, and the public should embrace it. It was noted that emissions in India are higher compared to cities like London and Seoul. Public awareness is an important aspect to be considered and conveyed about pollution control, vehicle usage and overloading. To reduce the dependency on private vehicles and three-wheelers, GMRCL is undertaking the multimodal integration project to maximise connectivity between metro, BRT and AMTS and conveyed that electric buses and auto-rickshaws are in consideration.

It was shared by Ms Shivani Shah of Ahmedabad World Heritage City Trust (AWHCT) that heritage zone plans have been developed with a focus on reducing congestion within the walled city. Public consultations have been planned to raise awareness and gather input on strategies such as street redesigning, segregating shop areas, designating pedestrian-only zones and allocating parking lots nearby. It was noted that proper planning of streets and parking for two-wheelers and tempos could alleviate congestion. The need for enforcing traffic rules such as one-way and two-way signboards through fines at key nodal points was emphasised. In addition, limiting goods loading and unloading to restricted hours and encouraging the use of electric vehicles for transportation were proposed to help address the issue.

It was emphasised by Ms Deepa Dave of Urban Planner of AMC that planning for the old city should focus on street redesign and management as well as addressing parking issues through both space allocation and enforcement. Collaboration with the Police Department was highlighted as necessary since AMC lacks the authority to enforce decisions. Last-mile connectivity to public transportation systems is essential, though there are challenges with balancing auto-rickshaws and freight. The pedestrian infrastructure in the

walled city was noted as inadequate despite high pedestrian traffic. The need for a unified transportation agency was emphasised to integrate BRT, Metro, AMTS and city planning. Heritage zonal plans have been prepared to address transportation corridors. However, vendor management is also a critical issue that needs to be addressed as vendor policies may contribute to congestion. In addition, involving the Railway Department, in this project was suggested as Kalupur station is undergoing redevelopment at present and it can ensure adequate pedestrian infrastructure. It was also highlighted that empty government buildings and schools in its non-operational hours can be utilised to create space for parking as well as charging electric vehicles in the walled city.

It was suggested by Mr Vishal Khanama of Ahmedabad Janmarg Limited (AJL) to adopt an approach similar to Seoul on phasing out diesel and CNG vehicles. The design of Kalupur station should prioritise improved connectivity to AMTS as well as BRTS due to its significant role in commuter transit. Efforts are underway to convert diesel buses to CNG and procure electric buses for AMTS and BRTS. In addition, electrification of private vehicles must be considered and the setting up of public charging facilities can support this measure. It was conveyed that AMC has planned for 100 stations and 15 are under operation at present. In addition, it was suggested that enhancing parking facilities in the walled city by utilising government properties is also important.

It was highlighted by Mr R L Pandey of Ahmedabad Municipal Transport Service (AMTS) that the city is currently in a transition to electric buses and planning infrastructure to accommodate it. AMTS has already discarded all diesel buses and is in the process of acquiring 250 EV buses to replace them. Seven double-decker buses have been purchased and are operational. Plans are in place to introduce charging stations across the 20 depots. The goal is to replace all AMTS buses with electric vehicles by the upcoming year. There are considerations for adapting 7 m electric bus for smaller roads and tight turns.

Figure 2-7 Glimpses of Moderated Discussion on Strategies for Ahmedabad

Source: CoE-UT, CRDF

2.2.3 Session 3: Closing Session

The session was concluded by Prof Shivanand Swamy who conveyed that the discussion was well-covered with various aspects. It was suggested that a synergistic approach could be beneficial to integrate the ongoing efforts. The need to redesign streets for pedestrians, manage parking effectively and focus more on converting freight vehicles to electric were highlighted as key points. Cooperation from all stakeholders was requested to advance these initiatives.

In continuation, it was mentioned by Dr Shalini Sinha that pedestrianisation and prioritising pedestrian movement would be one of the focus areas. The feedback from the heritage department, traffic police and AMC was stated to be considered for the preparation of the plan. In addition, the importance of electrifying freight vehicles was emphasised, and it was mentioned that a workshop on the electrification of freight vehicles would be held later this month focusing on the operational and financial feasibility of transitioning conventional three-wheelers to electric. The exploration of public transportation mode integration to benefit both the walled city and other city areas was also conveyed.

On behalf of the project team, the Deputy Municipal Commissioner and participants were thanked by Ms Surya Sugathan for their valuable contributions to the planning framework for the Low Emission Zone in the walled city of Ahmedabad, and this discussion has directed the team with specific focus areas.

2.3 Feedback from Participants

Participants' feedback was collected to understand their views about the sessions and to identify areas of improvement. Feedback forms were distributed among the participants at the end of the programme. A total of 7 responses were received from the participants. The feedback form consisted of two parts: part 1 on Technical Content Evaluation and Suggestions and part 2 on Programme Evaluation. Refer to Appendix A.

2.3.1 Technical Content Evaluation and Suggestions

Specific comments about the technical content were provided by the participants on the following.

- Key aspects of the programme found useful are the focus on green transportation zones, the trajectory of London, Seoul's mandatory diesel filters, ANPR camera integration for LEZ, and green zone and temporary vehicle bans. Specifics on Ahmedabad were useful to understand the unique transportation patterns and air pollution issues in Ahmedabad
- Required more details or clarity on implementing LEZ in Ahmedabad's walled city, strategic planning, air quality monitoring, resolution guidelines and freight management methods.
- Actions to advance LEZ in Ahmedabad should focus on improving bus quality, size and frequency, street design, last-mile connectivity, public awareness, vehicle restrictions, electrification of vehicles in the core area and implementation of a mobility plan.
- The key challenges in implementing LEZ include financial constraints, coordination among agencies, vehicle density, population, infrastructure, public behaviour, public transportation availability, cultural diversity in Ahmedabad's core, and managing traffic, parking and vehicular access in the walled city.

2.3.2 Programme Evaluation

The participants were asked to rate the details provided, programme expectations, its length, quality of presentation, discussion and its relevance for Ahmedabad, and overall quality of the workshop with a score between 1 to 5, where 1 is low and 5 is high. The average score of the programme came out to be 4.65 indicating good results. Individual score regarding each aspect is depicted in Figure 2-1.

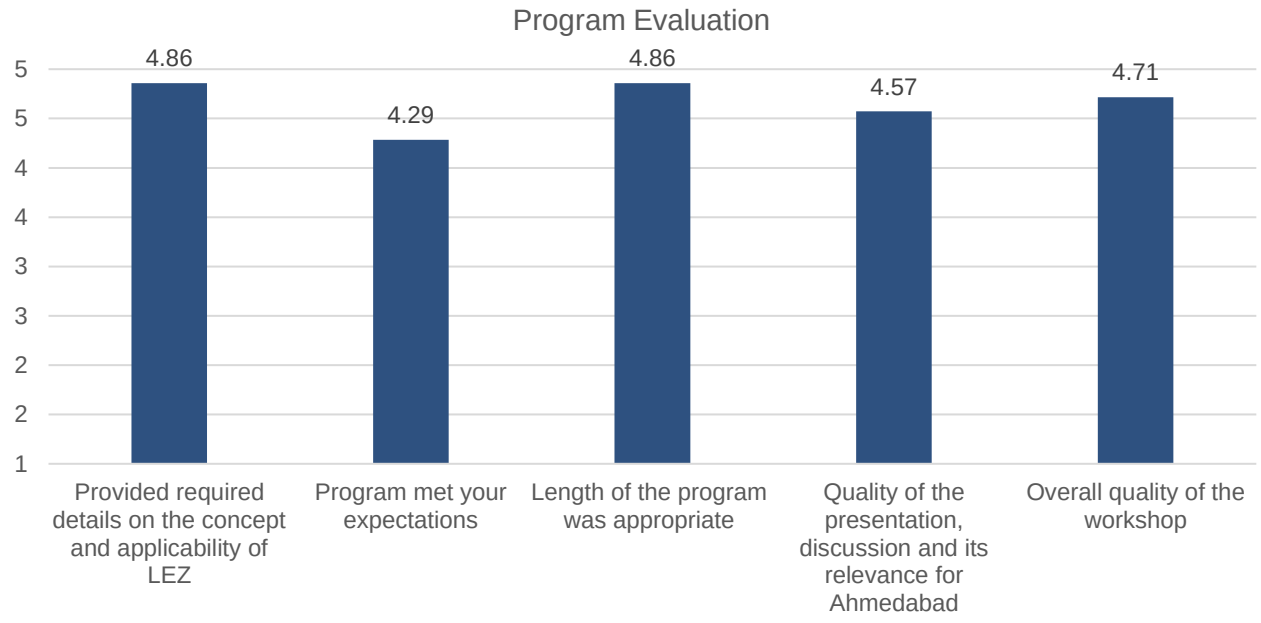

Figure 2-8 Scoring on Programme by Participants

Source: CoE-UT, CRDF

3. Awareness Workshop on Electrification of Vehicles for Stakeholders

An awareness workshop on electric three-wheelers was conducted for three-wheeler drivers with the support of Ahmedabad Municipal Corporation (AMC), Regional Transport Office (RTO), nationalised bank, Original Equipment Manufacturers (OEMs) and Three-wheeler Drivers' Associations. This collaborative event aimed to explore electrification opportunities and outline actionable steps for transitioning to electric vehicles. The event encouraged drivers to opt for electric three-wheeler with the support by the city officials, discussions with other stakeholders clarified their concerns on its technology, financial incentives and bank loan. The workshop featured an exhibition of electric vehicle models and provided drivers with the opportunity to test-drive them, offering a hands-on experience to better understand the benefits of adopting electric mobility.

Figure 3-1 Banner of the Workshop in Gujarati and English

Source: CoE-UT, CRDF

The workshop was held on October 13, 2024 at CEPT Research and Development Foundation, Vijay Cross Road, Navrangpura, Ahmedabad. The half day workshop was conducted in two sessions which began with inaugural address and session on electrification of vehicles, followed by exhibition of three-wheelers.

3.1 Participants

With the support of Autorickshaw Drivers' Association, namely Autorickshaw Drivers' Cooperative Society and Ahmedabad School Verdi Association, the event drew around 100 drivers. These participants operate autorickshaws not only within Ahmedabad's walled city but across various parts of the city, demonstrating broad interest and engagement in the potential shift to electric vehicles. Upon registration, brochures on electric passenger and goods three-wheelers were handed over to the audience (refer Appendix D and E).

3.2 Overview of the Workshop

The first session began with introduction of the project to set the context. As an initiative to overcome pollution challenges in Ahmedabad, city officials highlighted the importance of electrifying vehicles. An overview on technical aspects and economics of electric three-wheeler, followed by vehicle loan information by bank representative and model specifications by manufacturers were shared among the target group that led to impactful discussions to clarify concerns regarding vehicle purchase, its technology, operations and maintenance. Further, the exhibition and test drive provided opportunity to drivers to understand and experience the vehicles' mechanism and capacity.

Figure 3-2 Glimpses of the Workshop

Source: CoE-UT, CRDF

3.2.1 Session 1: Electrification of Three-wheelers

3.2.1.1 Welcome and Introduction

The workshop commenced with introduction of the project by Dr Shalini Sinha, Head of the Center of Excellence in Urban Transport (CoE-UT), CRDF and provided an insightful overview of the ongoing pollution challenges in Ahmedabad. The urgent need for improvement in traffic management and parking facilities in the city was emphasised as essential measures to control the pollution. The AMC's initiative on transition to electric buses in the BRT system was highlighted as a positive step forward. The critical role of passenger three-wheelers in the city was conveyed by highlighting its role in last mile connectivity and education trips, its mode share of 20% of trips and the electrification of three-wheelers is vital for improving environment. The shift to electric autorickshaws presents significant benefits, including reduced pollution and improved urban mobility.

Following this, Prof. Shivanand Swamy, Professor Emeritus at CRDF, spoke about the crucial role of autorickshaw drivers in transporting passengers for work, educational and leisure trips, particularly in areas where public transportation options are limited. The financial advantages of electric three-wheeler compared to its conventional counterparts were highlighted, noting its cost-effectiveness in both capital and operational expenses. He encouraged the audience to make the use of the workshop by engaging with stakeholders and clarify any doubts or concerns they had regarding electric vehicles, fostering an open platform for knowledge sharing and discussion.

Figure 3-3 Dr Shalini Sinha and Prof. Shivanand Swamy Introducing the Project

Source: CoE-UT, CRDF

3.2.1.2 Special Address

First, the special address was delivered by Mr Vishal Khanama, i/c Deputy Municipal Commissioner of AMC and General Manager of BRTS, where he inspired and motivated the participants to adopt electric vehicles by sharing the progress of electrification of buses in the city of Ahmedabad. He emphasised the role of three-wheelers in Ahmedabad by highlighting that approximately 0.7 million rely on buses for their daily commutes and 1.2 million choose autorickshaw for the city of 7 million population. The introduction of electric buses in the city had marked a significant milestone in 2019, contributing to a reduction in pollution levels associated with diesel-powered buses. The ideal battery size for the public transport system was determined with introduction of various battery size buses and understanding its operations. He conveyed that the city is committed to enhancing the sustainability of public transport through shifting to electric vehicles, reflecting a broader commitment. The experiences of growing interest from other cities to learn about successful implementation of electric bus in Ahmedabad were also shared, highlighting the importance of knowledge exchange in exploring sustainable transport initiatives..

The experience of electric autorickshaw over past four years was highlighted to reveal compelling economic benefits. Financial benefits were mentioned to make electric vehicle more appealing choice for operators such as maintenance cost is about 60% lower compared to CNG variant and it is approximately 40% less expensive in terms of total cost of ownership. In addition, the support by the central and state government through PM e-Drive scheme and Gujarat State Electric Vehicle policy were emphasised which makes electric vehicle more accessible to new buyers, thereby fostering a shift toward cleaner transportation options. Further, the drivers were invited to BRT control room to familiarise themselves with operations of electric vehicles and enhance their competence. In conclusion, it was highlighted that shift towards electric vehicles with the support of government incentives and knowledge sharing is paving the way for a more sustainable future.

Second, the special address was delivered by Mr Chintak Modi, RTO Inspector of Ahmedabad Regional Transport Office. The remarks began with insights on autorickshaw operations in Ahmedabad, highlighting its vital role in the city's transportation ecosystem. A noticeable trend in registration of passenger three-wheeler was elaborated, where it accounts 20 to 30 new registrations daily. However, the adoption of electric three-wheeler is relatively slow in the city as 95% of vehicles are CNG variant among these registrations. In this scenario, he highlighted the benefits of transitioning to electric three-wheelers, which are significant and deserve attention. The exemption of electric vehicles from the requirement of Pollution Under Control (PUC) certificate were highlighted and it not only streamlines the registration process but also results in cost savings for owners. The documentation needed for operating electric vehicles is minimal compared to traditional vehicles, further easing the administrative burden on drivers. The maintenance and running costs associated with electric three-wheeler are cheaper compared to conventional counterparts. For individuals with solar panels at home, running costs can be further reduced by utilising clean, renewable energy to charge their vehicles. While the transition to electric vehicles is highly encouraged, he emphasised the importance of responsible driving practices and reminded all drivers adhere to traffic rules and regulations, and to carry essential documents at all times, which are critical for both legal compliance and road safety.

Figure 3-4 Mr Vishal Khanama and Mr Chintak Modi presenting Special Address

Source: CoE-UT, CRDF

3.2.1.3 Overview of Electric Three-Wheeler

The technical aspects and economies of electric three-wheelers were presented by Mr Khelan Modi, Senior Transport Specialist, CRDF. The functions and distinct specification for electric autorickshaw and electric rickshaws were highlighted in the beginning in terms of its battery capacity, speed and passenger capacity. Autorickshaws are suitable for longer trips whereas, rickshaws are preferable for shorter trips and last-mile connectivity. Both vehicles have three-pin charger which can be carried along during trips and easily charged in 15 Amp socket. The vehicles take nearly three to four hours to charge fully to achieve a range of minimum 100 km, which is typical covers the travel distance of three-wheelers in the city per day.

Though electric three-wheeler tends to be 30-40% more expensive at the point of purchase compared to their CNG counterparts, its less mechanical parts and lower charging cost makes it 40 to 45% cheaper in monthly operating expense compared to CNG three-wheeler. In addition to various subsidies, lower Goods and Services Tax (GST) at the rate of 5% for electric three-wheeler were also highlighted, which would reduce the purchase cost of the vehicle further. The notable difference in the financials of electric versus conventional three-wheelers over a period of 10 years was highlighted, with the total cost of ownership estimated at INR 4 per km for electric vehicles compared to INR 6.5 per km for CNG models. Though various levels of the government are supporting adoption of electric vehicles, it was conveyed that these subsidies may not be available in the future and motivated potential buyers to take advantage of the current incentives while it is still available.

3.2.1.4 Vehicle Loan Information

To clarify the vehicle loan information and documentation procedure, Mr Navneet Chaudhary, Chief Manager from State Bank of India, shared detailed information with the audience. The significant role of funding support that play in facilitating the transition to electric vehicles was emphasised, particularly for drivers looking to invest in electric autorickshaws. A compelling example is Mr Yasin Bhai, who successfully secured a loan for electric autorickshaw two years ago. He had made a downpayment of INR 70,000 and to avail loan for a term of 60 weeks, required documents included as Aadhar Card, Bank Passbook and CIBIL score were required. Furthermore, he had also received a subsidy of ₹50,000, which significantly eased the financial impact of vehicle purchase. Throughout his journey, he has travelled approximately 28,000 km, showcasing the practical benefits of his investment. These include lower maintenance cost, a reduced overall financial burden, and a comfortable driving experience in busy streets as the vehicle operates without a clutch or gears.

The bank representative outlined additional prerequisites, such as the need for a permanent address and a designated parking space to ensure the vehicle's safety when not in use. To facilitate seamless bank transactions, the bank has also facilitated drivers to display a QR code in their vehicles, allowing fare payments to go directly into their accounts, with EMI deductions occurring automatically. This modern payment solution not only simplifies transactions but also makes fare payments more convenient for passengers and operators. In closing, he emphasised that with government subsidies and the necessary documentation, transitioning to electric vehicles is an accessible and advantageous choice for many drivers.

Figure 3-5 Mr Khelan Modi presenting technical and financial feasibility, and Mr Navneeth Chaudhary providing vehicle loan information

Source: CoE-UT, CRDF

3.2.1.5 Address by Autorickshaw Association Members

Mr Dharmendra Bhai Brahmbhatt, President of Ahmedabad School Verdi Association emphasised on the importance of electric autorickshaw and highlighted that currently nearly 50 electric three-wheelers are operated by drivers in their association that provides promising results. He shared that the drivers spend only INR 40 to 50 per day which its financially beneficial, despite costlier vehicles. The fellow drivers were inspired by mentioning several advantages of vehicles such as support from various levels of the government, nationalised bank as well as RTO which makes the shift to electric variant easier, as well as ensures safer and less noise travel.

Moving ahead, Mr Jafar Qureshi, President of Autorickshaw Drivers' Cooperative Society reiterated on the maintenance and subsidy availability for electric three-wheeler. The central government under PM e-Drive scheme provides financial incentive up to INR 50,000 and the Gujarat government provides INR 48,000, which makes INR 98,000 total subsidy to lower the capital cost significantly. He concluded that in a longer run, electric vehicles are profitable than CNG variant.

Further, Mr Vijay Makwana, Head of Ahmedabad Rickshaw Chalan Association addressed some pertinent points regarding electric three-wheeler. The advancement in the sector was pointed out by recalling a similar workshop held by CRDF in 2022 with the support of AMC, when electric three-wheelers faced significant challenges, including poor manufacturing quality and difficulties driving on steep slopes. However, with recent improvements in manufacturing, these issues have largely been resolved. The current lack of charging stations across the city was stressed and suggested that areas beneath flyovers could be ideal for establishing such stations. He urged drivers to utilise the INR 1 lakh subsidy provided by the government at the earliest.

3.2.1.6 Presentation of Electric Vehicles Models

Representatives from three vehicle manufacturing companies including Mahindra, Bajaj and Eblu presented technical specifications of electric three-wheelers including its speed, range, battery capacity and charging duration.

Figure 3-6 Display of electric three-wheeler models

Source: CoE-UT, CRDF

This session helped to clarify various concerns and questions drivers had about the vehicles. Key questions included:

- **Are people above 60 years of age eligible for loans?**
  Yes, individuals over 60 can obtain a loan. However, as per government regulations, those above 65 are not eligible to apply, to reduce financial risks for both lenders and borrowers.

- **What about the lack of charging infrastructure in the city (at homes and on the road)?**
  The government is actively working to expand charging infrastructure, with plans to install 100 stations soon, 15 of which are already operational. An app has been introduced to help drivers locate available charging stations across the city. The external charging cables used in these vehicles also allow for quick replacements, ensuring uninterrupted access to charging even if one station malfunctions.

- **Is it safe to drive in the rain?**
  Yes, the vehicle is equipped with waterproofing features, including a durable metal body in newer models, enabling safe driving in rainy conditions without issues.

- **Can solar panels be added to electric three-wheeler?**
  While some drivers suggested adding solar panels, this feature may impact affordability, as the vehicle must remain within an accessible price range. However, this idea could be considered for future models.

3.2.2 Session 2: Exhibition and Refreshments

Followed the session, the exhibition opened for all drivers showcasing electric three-wheeler models for both passenger and goods, displayed by Mahindra, Bajaj and Eblu. Many drivers took the opportunity to test-drive these vehicles, gaining firsthand experience of their mechanisms, handling and load capacity.

Figure 3-7 Drivers exploring Passenger Electric Three-wheeler

Source: CoE-UT, CRDF

3.3 Feedback from Participants

The drivers were positive about the event. However, it was difficult to gather feedback from all participants due to informal setting. Qualitative feedback was captured from few of them. The drivers appreciated the knowledge gained from the workshop. Below are testimonials from some of the participants:

“Today the information shared in this workshop organised by CRDF, about bank details, information from RTO and municipality officer and auto-rickshaw companies, have been very helpful. The association will provide full support to people shifting to electric three-wheeler ”"આજની CRDF દ્વારા આયોજિત વર્કશોપમાં બેંક વિગતો, RTO અને મ્યુનિસિપાલિટી ઓફિસર અને ઑટો-રીક્ષાં કંપનીઓની માહિતી શેર કરવામાં આવી હતી, તે ખૂબ જ મદદરૂપ રહી છે. સંઘ ઇલેક્ટ્રિક થ્રી-વ્હીલરમાં શિફ્ટ થતી લોકોને સંપૂર્ણ મદદ પ્રદાન કરશે."

- Dharmendra Bhai Brahmbhatt, School Vardhy Association

We're thankful for CRDF for inviting us to this workshop with experienced guidance from the speakers for auto-drivers. We really appreciate and thank them for the advice and guidance”

"અમે CRDF નો આભાર માનીએ છીએ કે તેમણે આ વર્કશોપ માટે અમને આમંત્રિત કર્યું, જેમાં ઑટો-ડ્રાઇવરો માટે સ્પીકરોની અનુંભવી માર્ગદર્શના મળી. અમે તેમને આભાર વ્યક્ત કરીએ છીએ અને તેમની સલાહ અને માર્ગદર્શન માટે તેમની પ્રશંસા કરીએ છીએ."

“After this workshop and all the guidance given today, I would urge all the rickshaw drivers to shift to electric three-wheeler”

"આ વર્કશોપ અને આજે આપવામાં આવેલ તમામ માર્ગદર્શના પછી, હું દરેક રિક્ષા ચાલકને ઇલેક્ટ્રિક થ્રી-વ્હીલરપર શિફ્ટ થવા માટે પ્રેરિત કરું છું."

“We definitely support the concept of electric three-wheeler. Currently, we have 50 electric three-wheelers in our association with an aim to make it 500”

"અમે નિશ્ચિત રૂપે ઇલેક્ટ્રિક થ્રી-વ્હીલરઝના કલ્પનાને સમર્થન આપીએ છીએ. હાલ, અમારી એસોસિએશનમાં 50 ઇલેક્ટ્રિક થ્રી-વ્હીલર છે અને અમારા લક્ષ્ય છે તેને 500 સુધી પહોંચાડવાનો."

- Dilip Joshi, School Verdi Association

“Today’s program was valuable and informative. We hoped more rickshaw drivers from our union could have been here for it and learn more about electric three-wheelers

"આજનું પ્રોગ્રામ મૂલ્યવાન અને ઉપયોગી હતું. અમે આશા રાખી હતી કે અમારા યુનિયનના વધુ રિક્ષા ચાલકો અહીં હાજર રહેતા અને ઇલેક્ટ્રિક થ્રી-વ્હીલર વિશે વધુ શીખતા."

- Organisation Head, Ahmedabad Rickshaw Ekta Union

“The workshop highlighted that issues related to charging and incomplete range of electric vehicles have been addressed by the manufacturers. Therefore, I urge every rickshaw driver to transition to electric three-wheeler, as it is highly beneficial. ”

" વર્કશોપમાં હાઇલાઇટ કરવામાં આવ્યું હતું કે ચાર્જિંગ અને ઇલેક્ટ્રિક વાહનોની અપૂર્ણ રેંજ સાથે જોડાયેલી સમસ્યાઓને ઉત્પાદકોએ સમાધાન કર્યું છે. તેથી, હું દરેક રિક્ષા ડ્રાઇવરને ઇલેક્ટ્રિક થ્રી-વ્હીલરમાં શિફ્ટ થવા માટે પ્રોત્સાહિત કરું છું, કારણ કે તે ખૂબ જ ફાયદાકારક છે."

- Vijay Makwana, School Verdi Association

3.4 Awareness Creation among Goods Drivers

This workshop on electrification of three-wheelers was conducted for passenger as well as goods three-wheeler drivers. While passenger three-wheeler drivers were engaged through their formal associations, sensitising goods drivers posed a challenge due to the lack of formal associations for them. To overcome this, targeted Focus Group Discussions (FGDs) with freight drivers working at four market areas including Gheekantha, Chokha Bazar, Relief Road and Gandhi Road were conducted

The discussion, conducted in groups of 4 to 6 people, centred on disseminating information about the benefits of electric vehicle technology, emphasising its financial viability and long-term sustainability. The engagement began with exploring the perception of drivers regarding electric vehicles. Drivers expressed similar concerns across all the groups, including the load-carrying capacity as many drivers habitually overload their conventional vehicle to maximise the profit, the inadequacy of charging infrastructure, extended charging time that may affect operations and the high cost of batteries.

However, this FGDs allowed to inform participants regarding various goods electric three-wheeler models available in the market, highlighting their technological and financial benefits compared to the conventional models in a long term and the city's effort in setting up charging infrastructure across the city.

Figure 3-8 Glimpses of focus group discussion with goods drivers

Source: CoE-UT, CRDF

4. Roundtable on Standardising Mobility Systems in Core Area of Indian Cities

The roundtable was organised by CRDF, Ahmedabad, and The Urban Catalyst, New Delhi, as part of the 17th Urban Mobility India Conference-cum-Exhibition 2024, held on October 27, 2024 at the Mahatma Mandir Convention Centre, Gandhinagar, Gujarat, India. The roundtable aimed to gather insights on the prevailing mobility and air quality challenges in core areas of Indian cities and strategies for implementing LEZs effectively. During the roundtable, the findings from the ongoing projects on implementation of low-emission zone in core area of in Indian cities, including Ahmedabad, Delhi and Chennai were presented. The session facilitated discussions with subject matter experts on standardising interventions in mobility systems to address air quality challenges in the core areas of Indian cities. The one-and-a-half-hour event began with a briefing on the project and sharing of key findings, followed by a moderated discussion with subject matter experts, and ended-up with a question-and-answer round. Key topics included low-emission zones, air pollution mitigation, inclusive mobility solutions, gender-sensitive transportation, and the adoption of electric mobility. Additionally, the discussion explored opportunities for policy development, stakeholder collaboration, the integration of public transport, intermediate public transport, non-motorised transport, and EVs.

4.1 Participants

The UMI Conference was attended by professionals, experts, government officials, academics, industry representatives, civil society members, technology and service providers, and other stakeholders in urban transport, both national and international. Participants primarily was aware of the roundtable through the conference agenda. In addition, information about the conference was shared on the social media platform LinkedIn to inform and invite connections. Nearly 85 participants had attended the roundtable and among which 24% represented female. this included people from organisations like think tank and research institute, government agency, consulting firms, academia/ universitiesand financial institutions.

Table 4-1 List of Participants of Roundtable

Organisations	Count	Affliations
Think Tank and Research Institute	10	CEEW, ITDP, TERI, WRI
Government Agency	37	Ahmedabad Janmarg Limited, Ahmedabad Municipal Transport Service, Ahmedabad World Heritage City Trust, Chennai Unified Metropolitan Authority, Metro Rail Corporation of Gujarat and Uttar Pradesh, Gujarat Urban Development Mission, Municipal Corporation of Ahmedabad, Jaipur, Pimpri-Chinchwad and Surat , Land Transport Authority Singapore
Consulting Firms	16	Arcadis, KPMG, Premya Consulting, PWC, The Urban Catalysts, The Urban Lab, Urban Mass Transit Company Limited
Academia/ Universities	17	CEPT University, IIT Roorkee, IISc Bengaluru, SPA Bhopal, SVNIT Surat
Solution Providers	4	EFKON India, Hitachi Rail
Financial Institutions and Development Banks	1	KfW Development Bank
Total	**85**	

Source: CoE-UT, CRDF

4.2 Overview of the Roundtable

The roundtable was chaired by Mr Ashwani Kumar (IAS), Principal Secretary, Urban Development and Urban Housing Department (UD & UHD), Gujarat. The discussion was moderated by Prof. H. M. Shivanand Swamy, Professor Emeritus, CoE-UT, CRDF, Ahmedabad and Dr Shalini Sinha, Center Head, CoE-UT, CRDF, Ahmedabad. The discussion began with a welcome address and introduction of the speakers, followed by the opening remarks. Then a project briefing was provided by a representative from the British Deputy High Commission, Ahmedabad, followed by the sharing of project insights by the CRDF and The Urban Catalyst teams.

The moderated discussion then commenced, covering diverse range of topics, including the implementation of the LEZ, gender equity and social inclusion, technological innovations to address air pollution issues, leveraging policies for EV adoption and more. These discussions were supported by case studies on sustainable mobility. A Q&A session followed, giving the audience an opportunity to engage with the speakers. After an engaging and informative session, the roundtable concluded with closing remarks and a vote of thanks.

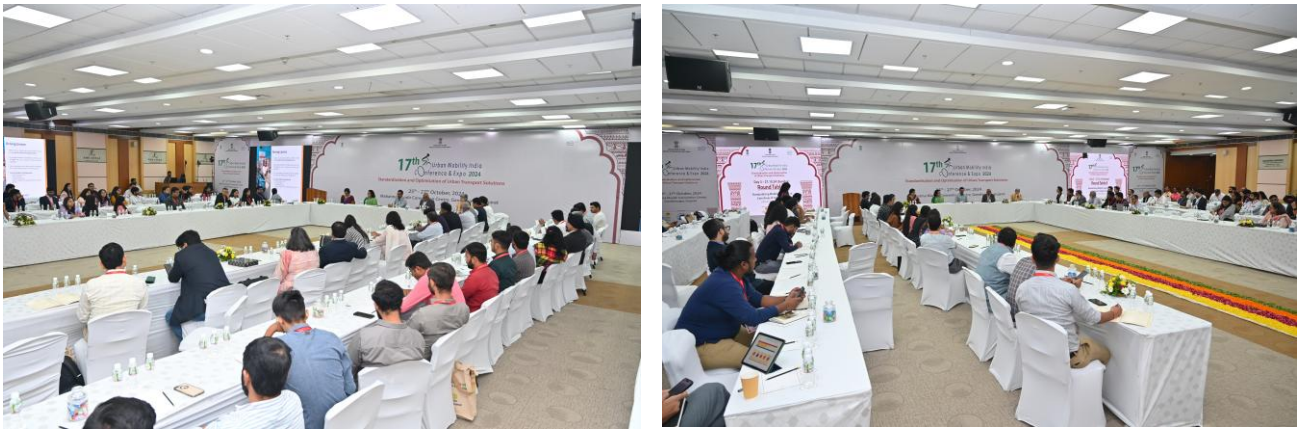

Figure 4-1 Glimpses of the Roundtable

Source: IUT 2024

4.2.1 Session 1: Welcome and Introduction

The session commenced with a brief introduction to the roundtable by Dr Shalini Sinha, Centre Head, CoE-UT, CRDF. She began by establishing the context for the discussion, focusing on an area-based approach to addressing air pollution concerns in the core areas of Indian cities. These core areas often accommodate a dense concentration of residences, jobs, markets, transport hubs, and historic buildings. Dr Sinha highlighted that urban development efforts tend to prioritise new areas, often overlooking core areas. However, these areas are crucial as they experience significantly higher levels of air pollution. The roundtable, therefore, emphasised the role of mobility in addressing air pollution challenges, with a particular focus on the planning and implementation of LEZs as a strategy to improve air quality. Following this contextual overview, she outlined the structure of the discussion and introduced the speakers.

Figure 4-2 Dr Shalini Sinha Commences the Roundtable Session

Source: IUT

4.2.2 Session 2: Opening Remarks

The opening remarks for the roundtable discussion were delivered by Mr Ashwani Kumar (IAS), Principal Secretary at Urban Development and Urban Housing Department (UD & UHD), Gujarat. He was the Chairperson of the roundtable. Drawing from his experiences as a former Municipal Commissioner of Jamnagar and Vadodara, and as a resident of Ahmedabad, Mr Kumar provided insights into the unique challenges faced by the core areas of Indian cities.

He emphasised the importance of these core areas as hubs of business activity, serving as essential focal points for the city's economy and culture. Despite being the origin of urban growth, these areas now face numerous challenges, most of which are linked to transport. Residents often move out from these areas in search of better opportunities and living conditions. While urban development and growth are essential, preserving and revitalising the core areas is equally important. Mr Kumar described the core areas as being characterised by high population densities, mixed land use, limited road infrastructure, and diverse transport demands. These features pose significant challenges for city administrators attempting to provide efficient transport systems. Narrow roads, unorganised parking, and congestion issues make it difficult to introduce public transport systems in these areas. He emphasised the importance of discussions like this roundtable to address these pressing issues.

Highlighting Gujarat's key transport initiatives, Mr Kumar spoke about the robust BRTS networks established in Ahmedabad (100 km), Surat (125 km), and Rajkot (11 km), collectively serving 300,000 passengers daily. He outlined Gujarat's proactive support for Urban Local Bodies (ULBs) in achieving green mobility goals, including the introduction of the Chief Minister Urban Bus Service (CMUBS) Scheme in 2018, well before the PM E-Bus Sewa scheme. Under the CMUBS scheme, eight municipal corporations and 22 Class-A municipalities receive Viability Gap Funding (VGF), which has facilitated the addition of 1,300 buses. The VGF ranges from INR 18 to INR 22 per kilometre for CNG buses and INR 30 to INR 40 per km for electric buses. Furthermore, under the PM E-Bus Sewa scheme, Gujarat will add 450 electric buses across six municipal corporations.

Mr Kumar highlighted Gujarat's commitment to strengthening public transport systems, improving last- and first-mile connectivity, and increasing public transport ridership, with metro systems operational in Ahmedabad and Gandhinagar, and the Surat metro in the pipeline. However, he underscored the urgent

need to focus on regenerating and revitalising the vibrant core areas of cities. He expressed keen interest in the solutions that would emerge from the discussion.

Figure 4-3 Mr Ashwani Kumar, IAS, Delivering the Opening Remarks

Source: IUT

4.2.3 Session 3: Project Introduction and FCDO Support

Ms Moumita Bhattacharya, Senior Advisor, Economics, Climate and Development – Gujarat and Rajasthan, British Deputy High Commission Ahmedabad, spoke about the UK–India collaboration on addressing climate challenges faced by Indian cities. She expressed her gratitude to the organisers of the UMI conference for selecting the roundtable to discuss the critical issues of mobility in the core areas of Indian cities, as well as to Mr Ashwani Kumar for his support of the project and to all colleagues for participating in the discussion. Ms Bhattacharya highlighted the challenges of developing urban infrastructure that meets the needs of all sections of society, stressing the importance of evidence-based research. She noted that the Foreign, Commonwealth and Development Office supports the creation of robust research to inform policy and practice-level decisions.

She explained that the HVT applied research programme, funded by UKAID, undertakes studies on sustainable transport development in countries across Africa and South Asia. She expressed her interest in hearing more about this research, which addresses gaps in evidence related to the challenges faced by Indian cities in air quality and transport, particularly regarding LEZ and e-mobility. Ms Bhattacharya encouraged participants to review this research and other HVT publications, available at https://transport-links.com/ . Additionally, she informed the audience about the release of HVT's report and toolkit on *Improving Access to Climate Finance*. She emphasised the significance of such events in showcasing the realities of how change is brought about.

Figure 4-4 Ms Moumita Bhattacharya on UK-India Collaboration in Addressing Climate Challenges Faced by Indian Cities

Source: IUT

4.2.4 Session 4:Approach on Planning Low Emission Zones in the Core Areas of Indian Cities

Ms Surya Sugathan, Senior Transport Planner, CoE-UT, CRDF, delivered a short presentation on the approach to planning LEZ in core areas of Indian cities, with a particular focus on Ahmedabad. She began by highlighting the increasing air pollution and its detrimental impact on urban life. Introducing the concept of LEZ as a regulatory measure, she explained how it aims to tackle air quality challenges by restricting the entry of polluting vehicles into designated areas.The study focuses on Ahmedabad's walled city, which experiences the highest concentration of air pollution. Recognised as a UNESCO World Heritage City, the walled city features a high concentration of historic buildings (approximately 2,700) and serves as a hub for economic activities, attracting a significant number of visitors.

The focus of the study is on the walled city of Ahmedabad, which experience highest concentration of air pollution. The city has been recognised as the world heritage city by UNESCO, with high concentration of historic buildings in the walled city area (around 2,700) and is a hub for economic activities with large number of people visiting this area. Ms Sugathan presented insights into the trip characteristics of the walled city. She revealed that shared mobility accounts for a higher share of trips in the core area (24%) compared to the city-wide average of 16%. For freight operations, three-wheeler goods vehicles dominate incoming trips (60%) during daytime hours. She highlighted the conflicts between passenger and freight movements arising from the diverse activities within the area. The identified key interventions include:

- Managing freight movement through efficient route and time planning.
- Mobility management.
- Enhancing the PT and NMT system; and
- Improving vehicle technology by adopting cleaner vehicles.

Ms Sugathan described various emission reduction scenarios. She demonstrated that vehicle electrification alone could reduce emissions by approximately 18%, while combining electrification with strategies to

improve PT and NMT could achieve a significant reduction of up to 43%. She then opened the discussion by posing the following questions in the context of planning and implementing LEZs:

- How should LEZ be defined in the context of Indian cities? Should it include vehicle technology improvements and entry regulations only?
- What will be the role of technology in LEZ implementation and regulation
- What should be the first steps towards LEZ implementation?

Figure 4-5 Ms Surya Sugathan on Approach to Planning Low Emission Zones in Core Areas of Indian Cities

Source: IUT

4.2.5 Session 5: Gender Inclusion in Electric Mobility

Ms Sonal Shah, Founder, TUC, New Delhi, began by introducing the research undertaken by her organisation, focusing on the WELECTRIC initiative, which aims to promote a gender-equitable transition to e-mobility. She highlighted the study's broader focus on low-carbon transport, rather than specifically targeting the walled city. The research explored safety and security aspects of electric bus operations in collaboration with the Delhi government. The session particularly focused on on electric two-wheelers and their gendered implications.

Ms Manisha Shah, Senior Associate- Integrated Urban Transport, TUC, New Delhi, delivered a detailed presentation on the findings. She began by highlighting the dominance of two-wheelers in India, which constitute 73% of all registered vehicles (as of September 2024). Among EV sales, electric two-wheelers accounted for 54% between June 2023 and June 2024. Regarding women's mobility, she highlighted a significant rise in two-wheeler usage: in Chennai, women's trips by two-wheelers increased from 13% in 2011 to 26% in 2018.

She also discussed the growing prominence of the last-mile delivery market and the increasing reliance on two-wheelers within it. However, women remain underrepresented in this sector, with only 7% of driving licenses issued to women (Ministry of Road Transport and Highways, 2020) and women comprising just 4-7% of delivery drivers in India (as of 2021). Their WE2 study, focusing on electric two-wheelers from gender perspective, identified following key areas of concern:

Driving license: Ms Manisha explained that women largely depend on family members to learn driving and to obtain a license, partly due to the scarcity of female driving instructors. Additionally, the cost of obtaining a license for women is typically 2.5 times higher than for men. This disparity arises because women often struggle with the processes at Regional Transport Offices (RTOs) and rely on agents. Although online learning license applications have been introduced, awareness of this option remains low. Women also face challenges in passing the driving test.

Financing: The Total Cost of Ownership (TCO) for electric two-wheelers is 1.2 to 1.7 times higher for women than for men, influenced by the varied purposes for which vehicles are used. Women also encounter difficulties in securing vehicle loans, with 46% of women respondents reporting that they had to obtain loans in the names of male relatives. Key barriers include low financial literacy, poor CIBIL scores, limited awareness of women-specific financial products, the requirement for male co-signatories, and a lack of access to financial networks and information.

Charging infrastructure: A framework was developed to audit charging points, focusing on ease of location, safety, network connectivity, and amenities. Many existing apps that help users locate charging stations were found to be outdated. In assessments conducted in Chennai and Delhi, 22% of listed stations in Delhi and 43% in Chennai did not exist physically, while 11-13% of operational stations were non-functional. Additionally, many charging points are situated in secluded areas, raising safety concerns for women. Basic amenities, such as seating areas for waiting during charging, are often lacking. It is observed that women prioritise safety, accessibility, and quality of charging points, while men tend to focus on affordability and availability.

Design: The study also revealed issues related to the design of electric two-wheelers. Both men and women reported challenges with post-sale services due to a shortage of EV technicians and spare parts. Concerns were raised about the vehicle's battery performance during monsoons, stability at high speeds due to the lightweight design, and safety risks associated with the quiet operation of EVs. Manufacturers are addressing the challenges through technological innovations, such as the reverse-assist feature for electric two-wheelers.

Figure 4-6 Ms Manisha Sharma on Gender Inclusion In Electric Mobility

Source: IUT

4.2.6 Session 6: Moderated Discussion

Prof. H. M. Shivanand Swamy, Professor Emeritus, CoE-UT, CRDF, Ahmedabad, opened the discussion by emphasising the importance of strengthening the core areas of cities to maintain their vibrancy and functionality. He highlighted Ahmedabad's significant improvement in air quality, noting that while the city was once the third most polluted in India, it no longer ranks among the top ten. However, he cautioned that this does not imply an absence of pollution issues, but rather that Ahmedabad is performing relatively better.

Figure 4-74 Prof H.M. Shivanand Swamy Moderating the Discussion

Source: IUT

4.2.6.1 Insights from Ms Anumita Roy Chowdhury

Prof. Swmy initiated the discussion by raising question to Ms Anumita Roy Chowdhury, Executive Director of Research & Advocacy at the CSE, New Delhi. Prof. Swamy referred to the concept of Low Emission Zones (LEZ), which originated around 2006-2007 in Sweden and has since been implemented in approximately 320 cities across Europe. These zones primarily focus on restricting vehicle entry to reduce pollution levels. He sought Ms. Chowdhury's insights on how Indian cities could adopt the LEZ concept, asking whether it could be implemented in the Indian context, the major challenges associated with it, other measures that could be explored for Indian cities, and the type of institutional framework that would be effective in this context.

Ms Chowdhury began by sharing that there is no absolute, single definition of LEZ, emphasising the need to adopt and adapt the concept to suit the specific requirements of individual cities. From a pollution control perspective, LEZ is not entirely new to Indian cities. She pointed out that under the National Clean Air Programme (NCAP) and clean air initiatives in the Delhi NCR region, a strategy known as Hotspot Action Plans has already been implemented. This strategy involves identifying pollution hotspots within a city and developing targeted action plans to address the local sources of pollution in these areas. While this approach has been effective for managing pollution caused by waste burning and construction activities, it has been less impactful in addressing vehicle-related pollution and transportation issues. In contrast, traffic engineering solutions such as junction modifications and flyovers are often viewed as the default remedies for transport challenges like congestion.

Ms Chowdhury also highlighted evolved practices in India, citing Delhi as an example. If measures such as imposing an environmental compensation charge on trucks entering the city, or phasing out 10-year-old diesel and 15-year-old petrol vehicles, or restricting vehicle operations to only CNG or EVs have been implemented are applied city-wide, the entire city effectively becomes an LEZ. She explained that such measures can be applied in varying geographic layers, depending on the context and objectives.

She underscored the importance of an area-wide approach that integrates existing transport and mobility policies, such as the Transit-Oriented Development Policy, parking policies, and EV policies. Currently, these policies are implemented in isolation, resulting in fragmented outcomes. A focused and integrated approach is needed to align these policies, enabling a noticeable shift in mobility behaviour. This would require scaling up local mobility infrastructure and aligning it with e-mobility incentives to encourage changes in how people walk, cycle, use PT, and adopt EVs. Citing a survey conducted in Delhi, Ms Chowdhury revealed that two-wheeler users were generally unwilling to shift to public transport due to the lower operating costs of two-wheelers. While LEZ regulations may encourage some shifts, this would require preconditions such as improving public transport services, ensuring affordability, integrating systems, addressing overcrowding, enhancing access, and ensuring safety. Therefore, a city-wide approach, even for localised actions, was deemed essential.

From a regulatory perspective, Ms Chowdhury highlighted that existing legal frameworks such as the Air Pollution Act and the Environment Protection Act allow for declaring critically polluted zones and implementing area-specific actions. Additionally, Master Plans provide scope for zone-level planning, offering legal instruments to support LEZ implementation. However, institutional and funding challenges remain. Cities must repurpose existing funds, such as those under the NCAP, for LEZ initiatives. For instance, Bhubaneswar successfully leveraged NCAP funds to implement an LEZ. Furthermore, revenue streams from developments like TOD and parking management could be channelled towards local area improvements to enhance liveability, accessibility, and placemaking is critical to the success of LEZ initiatives.Prof. Swamy agreed with Ms Chowdhury's insights and concluded the discussion by emphasising the necessity of implementing pull measures to support the success of push measures. He noted that institutional barriers are minimal, legal mechanisms are already in place, and resources are available. What is required, he highlighted, is a well-formulated plan accompanied by the willingness to take action.

4.2.6.2 Insights from Dr Kalpana Viswanath

Prof. Swamy directed the next question to Dr Kalpana Viswanath, Co-Founder & CEO, Safetipin, Gurugram, regarding the social and gender considerations in implementing LEZ and the cautions necessary for such initiatives.

Dr Viswanath began by underscoring the importance of public acceptance, which, she argued, would only occur if people see tangible benefits in the measures taken or if these measures align with their needs. She noted that individuals are unlikely to shift to PT if last-mile connectivity is inadequate or safety concerns persist, leading to increased reliance on two-wheelers. To promote gender equity and social inclusion, she stressed the need to plan with the most vulnerable communities in mind, rather than focusing predominantly on able-bodied men, as has been the traditional approach. She illustrated her point by highlighting the male-centric design of handrails in public transport, which often creates challenges for women, preventing them from feeling secure while standing. She advocated for people-centric planning, prioritising functionality, utility, accessibility, and safety over aesthetics, while considering the diverse needs of users and offering multiple mobility options tailored to various purposes.

Ms Kalpana highlighted several key mobility principles identified for making urban systems more gender equitable and socially inclusive, referencing initiatives Hamburg Charter for Just and Inclusive Mobility and Sustainable Urban Mobility Plan (SUMP) for All:

- **Equitable access** Achieving equity requires understanding economic opportunities and prioritising vulnerable communities. She cited an example from Delhi, where low-income households were relocated from the city core to the periphery during the Commonwealth Games. This relocation significantly increased commute distances—often exceeding 30 km—for these residents, disproportionately affecting women's mobility, which had previously relied on shorter, walkable distances.
- **Shared mobility**: Improving shared mobility for last-mile connectivity in larger cities and enhancing overall operations in Tier-2 and Tier-3 cities is critical.

- **Walking infrastructure**: Enhancing walking infrastructure is vital, as walking is integral to the first and last legs of any journey. Despite being originally designed for pedestrians, the streets in core areas have become increasingly unwalkable.

Dr Viswanath concluded by noting that women are among the most sustainable mode users in India, often commuting by walking or shared transport due to limited access to private vehicles. She stressed that sustainable modes of transport should be made aspirational for all. She emphasised that vulnerable groups, particularly women, are most affected by air pollution. Consequently, planning from the perspective of the most vulnerable would inherently address the needs of more privileged groups. Lastly, she highlighted the extensive burden of care work—such as childcare, eldercare, and household responsibilities—that disproportionately falls on women. If these factors are not considered in planning, the burden will only increase, further marginalising women.

Prof. Swamy added insights on Ahmedabad's BRTS, aptly named Janmarg, which translates to "The People's Way." He highlighted that the focus on inclusivity extended beyond the name. Practical measures were implemented to ensure accessibility and affordability for all, including maintaining one of the lowest fare structures, starting at just INR 5 currently.

4.2.6.3 Insights from Mr Sudhir Badami

Prof. Swamy then invited Mr Badami, Independent Consultant, Transport Professional, to share his perspective on incorporating public participation in the planning process.

Mr Badami began his discussion with an example highlighting the challenges of the underground metro system in Mumbai. He referenced a terminus along the Jogeshwari–Vikhroli Link Road (JVLR), which connects the Western Express Highway and the Eastern Express Highway. Despite the station's strategic importance, he pointed out the inadequate access design, emphasising the need for micro-level planning of station locations and access infrastructure.

He highlighted the high density of Mumbai city, which stands at 460 persons per hectare in the city and 320 persons per hectare in the metropolitan region. Greater Mumbai alone houses 1.4 million cars—relatively modest compared to other cities—but also 2.6 million two-wheelers. The metropolitan region adds another 7.6 million two-wheelers. Given these figures, Mr Badami stressed the critical need to attract car users to public transport. His strategy involves introducing both premium and regular BRTS to appeal to diverse user groups. He expressed optimism that enhancing bus capacity and quality could encourage a significant modal shift, with an expected transition of 60-65% of users, including car and two-wheeler commuters, to public transport.

He also drew attention to the approximately .2 to .3 million autorickshaws in Mumbai, many of which are outdated and in need of replacement. He suggested introducing electric micro-buses as a sustainable alternative, which could not only replace ageing autorickshaws but also generate new employment opportunities.

Mr Badami concluded by emphasising the importance of grassroots involvement. He advocated for a people-driven movement towards adopting sustainable modes of transport. If citizens actively engage with their political representatives and demand sustainable solutions, it can catalyse political will, paving the way for more inclusive and effective urban mobility planning.

4.2.6.4 Insights from Mr Vishal Khanama

Prof Swamy then invited Mr Vishal Khanama, i/c Deputy Municipal Commissioner, Ahmedabad Municipal Corporation and General Manager of BRTS, Ahmedabad, to elaborate on the city authorities' approach to bus electrification, improving feeder systems, and the challenges faced.

Mr Vishal began by highlighting Ahmedabad's pioneering efforts in public transport, particularly with the introduction of the BRTS in 2009. Currently, the city operates 1,200 buses, including 320 under the BRTS network, of which 200 are electric. Ahmedabad introduced electric buses in 2018, making it one of the early adopters of this technology. He emphasised the city's people-centric approach to route planning, ensuring that the needs of all commuters are addressed.

Discussing mobility in the city's core areas, he noted that 4–6% of the population resides in the historic walled city. Commuter patterns in this area show that approximately 40% use two-wheelers, while 18% rely on walking. Presently, mobility needs are met through Intermediate Public Transport (IPT) and public transport. However, to encourage private vehicle users to transition to public transport, last-mile connectivity

must be improved. Narrow lanes in these areas pose significant challenges, necessitating thoughtful system designs to ensure hassle-free journeys. Addressing these issues would naturally lead to increased PT usage.

Mr Vishal identified electrification of public transport, two-wheelers, and three-wheelers as a key focus, particularly in the context of establishing LEZ. Ahmedabad has taken a significant step by introducing electric three-wheelers for last-mile connectivity. He emphasised the importance of developing robust charging infrastructure, including on-route charging facilities that are already operational in Ahmedabad, alongside depot charging. Expanding these facilities for public use would further promote electric vehicle adoption.

He also discussed the critical aspect of freight movement in core areas. By transitioning freight systems to electric vehicles and providing adequate charging infrastructure, Ahmedabad could create a green mobility zone in its historic areas. He advocated for a holistic approach to LEZ planning, which includes enhancing public transport services, designing circular and anti-circular routes, electrifying all vehicle segments, developing charging infrastructure, and strategically planning freight movement timing within the city.

Mr Khanama also highlighted the introduction of an Environment Improvement Cess in the Municipal Corporation's recent budget, aimed at supporting sustainability initiatives. He stressed the importance of a bottom-up approach that involves end-users and stakeholders in the planning process. Lastly, he underscored the significance of improving walking facilities. Developing well-connected footpaths that integrate seamlessly with transport systems can greatly enhance the user experience. Throughout these efforts, ensuring customer delight along with customer satisfaction remains a core objective, reflecting Ahmedabad's commitment to sustainable and inclusive urban mobility.

4.2.6.5 Insights from Ms Sonal Shah

Prof. Swamy asked Ms Sonal Shah, Founder, The Urban Catalysts (TUC), New Delhi, to share her insights from their study on the implications of planning and implementing LEZ.

The discussion focused on New Delhi's approach to leveraging its EV policy to address critical issues such as employment generation, particularly for women. She emphasised on enhancing opportunities for their participation through learnings to earnings programmes focused on training and upskilling. One key recommendation was fostering collaboration between EV aggregators and the government to create initiatives like female driving courses and EV technician training programmes. These programs would not only equip women with technical and operational skills but also open avenues for meaningful employment in the growing EV sector.

Another critical area highlighted was the need to enhance charging infrastructure. Ms Shah proposed that a state nodal agency develop a checklist for Charging Point Operators (CPOs) to self-assess when seeking permissions for establishing charging points. Revenue-sharing agreements between CPOs and the government for charging stations on government land were also proposed to streamline implementation. Recognising the gap between policy guidelines and effective implementation, Ms Shah underscored the importance of stronger institutional support. She advocated for collaborations between Original Equipment Manufacturers (OEMs), EV aggregators, and membership-based organisations that work with women and financiers. By uniting key stakeholders, these efforts could bridge the gap and enable women to learn driving, obtain licences, access finance, and maintain their vehicles.

Prof. Swamy highlighted that driving three-wheelers is often not regarded as a respectable occupation in society, which poses a significant barrier to female participation in this sector. He emphasised the need to address this societal perception to encourage greater inclusivity.

4.2.6.6 Insights from Mr Vivek Ogra

Prof. Swamy invited Mr Vivek Ogra, Partner, Transport, EY, Ahmedabad, to share insights on technological solutions addressing the key issues discussed during the roundtable.

Mr Ogra emphasised that while Artificial Intelligence (AI) has significantly accelerated problem-solving, its impact has been both positive and negative. Focusing on pollution, he critiqued the current practice of relying on static sensors to identify pollution hotspots, describing it as very unilateral. Instead, he proposed integrating pollution sensors into public transport vehicles to serve as dynamic carriers, collecting real-time data on pollution variations throughout the day and identifying specific sources such as vehicular and construction activities. This dynamic approach could significantly enhance how cities monitor and respond to pollution.

He criticised traditional systems like Pollution Under Control (PUC) certificates for their lack of credibility and advocated for deploying remote sensing devices across urban areas. These devices, already used globally, can measure vehicle emissions daily, providing accurate data on high-polluting vehicles and specific models. Such information is critical for policymaking, including restricting certain vehicle types in cities. Mr Ogra emphasised that policies should be data-driven, and that technology should be integrated from the outset rather than as an afterthought.

Addressing mobility in core city areas, he called for scaling up people and logistics movement through shared transportation. Current systems, he noted, often operate unilaterally or bilaterally, leading to underutilised vehicles. By adopting a marketplace approach, vehicles could be used more efficiently, serving multiple users or businesses, thereby maximising load capacity and reducing emissions.

On the government's role, he stressed the importance of translating data insights, such as those from pollution sensors, into actionable measures. He also called for a shift from isolated platforms to integrated protocols, fostering linked networks that can scale effectively. While AI holds promise for the future, Mr Ogra argued that the immediate priority is to harvest data strategically to inform policies and drive impactful actions.

4.2.6.7 Insights from Mr Amegh Gopinath

Prof. Swamy then invited called Mr Amegh Gopinath, Component Team Leader at NDC-TIA India, GIZ, to elaborate on how bilateral and multilateral approaches contribute to the planning and on-ground implementation of LEZ.

Mr Gopinath began by commending Gujarat for its innovative strides in public transport and urban mobility through initiatives such as the CM Bus, BRTS, Gross Cost Contract (GCC)-based bus operations, and the One Mobility Card. He specifically highlighted Surat as the only city in India with a city-level EV policy incorporating an LEZ component. He emphasised that strong leadership during policy implementation is as crucial as people-centric design. Citing an inspiring example from Kerala, he spoke about Health Minister Dr Shailaja's leadership in addressing ambulance shortages by converting electric auto-rickshaws into ambulances with support from GIZ. This initiative demonstrated how innovative thinking can enhance emergency services and public welfare.

The speaker noted that India hosts some of the world's most polluted cities, underscoring the urgent need to transition from technical frameworks to actionable implementation, particularly in LEZs. He expressed optimism that Surat, with its LEZ plan integrated into its broader EV policy, could serve as a model for other cities. Drawing from his experiences with EV Cells in Delhi, Mumbai, and Pune, he recommended establishing a dedicated cell with clear mandates to drive EV adoption at the city level. A nodal agency with well-defined responsibilities would ensure cohesive strategy implementation.

Mr Gopinath highlighted the importance of sensitisation and people-centric campaigns, referencing successful initiatives such as Switch Delhi and NITI Aayog's Shoonya campaign. He stressed that capacity building among government officials and generating awareness among citizens are critical to ensuring the success of such initiatives. Additionally, he underlined the need for leadership development, particularly among elected representatives like mayors, to ensure effective execution and sustained progress.

Finally, the speaker underscored the importance of focusing on air quality and its health impacts. He pointed out that cardiovascular and respiratory diseases, often exacerbated by poor air quality, remain leading causes of death in India. He also emphasised the importance of addressing road safety, positioning it as a fundamental component of any urban mobility strategy.

Figure 4-8 Glimpses of the Moderated Session

Source: IUT

4.2.7 Session 7: Question and Answer

Prof. Swamy requested Mr Mohinder Singh, Ex-Dean, Land Transport Authority, Singapore, to share his insights on the ongoing discussion.

Mr Singh began by commending the speakers and appreciated the recognition of critical issues such as gender inclusion, air pollution, walkability, and aging societies. He emphasised that recognising these challenges is the first step toward addressing them effectively in the future.

Drawing on his experiences, Mr Singh shared insights into measures to attract people to PT while discouraging the use of private vehicles. He cited Singapore's cordon pricing system from the 1970s as a pioneering example. This system managed traffic in city cores by imposing fees on private vehicle entry, with rates adjusted for peak and off-peak hours. This approach not only reduced traffic congestion but also helped control pollution levels in urban areas. Mr Singh suggested implementing similar measures in Indian cities, including parking policy reforms, to further discourage private vehicle use in core urban areas.

He also highlighted the importance of thoughtful junction and road design. Citing Singapore as an example, he explained how overhead pedestrian bridges improved road efficiency. There, road infrastructure was made more efficient by introducing overhead pedestrian bridges. However, these bridges posed challenges for elderly individuals and those with physical disabilities. To address this, Singapore introduced solutions such as lifts, pedestrian signals at mid-block crossings, and senior citizen cards to enhance accessibility. Mr Singh stressed that urban planning must account for an aging population, a challenge that India needs to proactively address. By integrating inclusive design principles and people-centred measures, cities can ensure that urban mobility systems cater to all segments of society, including the elderly and differently abled.

Prof. Ashish Verma from IISc Bangalore contributed inputs to the discussion. He began by reflecting on the successful implementation of the BRTS in Ahmedabad. However, he raised a significant concern regarding the low modal share for public transport in the city. With only 12% attributed to all forms of public transit, this figure is notably low for a city with a population of nearly 7 million. Prof. Verma emphasised that this highlights a lack of critical "push measures" across Indian cities to encourage more sustainable transportation options. He suggested that LEZ could serve as an effective push measure in this regard.Mr Verma then questioned the standards being used for LEZ implementation, asking whether they are based on the Central Pollution Control Board (CPCB) standards or the World Health Organisation (WHO) standards. If the standard is CPCB, he argued that the entire city should fall under the LEZ zone, as no area should be acceptable if the pollution levels exceed CPCB limits. On the other hand, if WHO standards

are being followed, then at the very least, sensitive areas like schools, hospitals, and other sensitive areas should meet the standards, while the rest of the city could adhere to CPCB thresholds. Furthermore, Prof. Verma proposed integrating LEZ with active mobility zones, particularly in core urban areas. He stressed that without such integration, congestion issues in cities would persist.

The last question of the session was raised by Mr Shrinivas from Bengaluru working with WRI. He began by discussing the strategies implemented in Bangalore to encourage the use of public transport and reduce reliance on private vehicles. He highlighted the "Personal 2 Public" campaign, which urged people to use public transport at least twice a week. They then took a deeper look at private vehicle users and discovered that many of them were IT professionals. To target this group, they introduced incentives such as free cappuccinos and bus passes, offered by companies to encourage employees to shift to public transport.

As a result, many IT companies in Bangalore have adopted this strategy, leading to a significant increase in monthly metro ridership, especially as the metro network expands. However, despite these gains, bus ridership still remains five times higher than metro ridership, and bus usage is 100 times more prevalent nationwide. One key reason for this disparity is the lack of inclusion of public transport users in policymaking, with policies often designed for only the 8% of private vehicle users in mind.

To address this, Mr Shrinivas emphasised the need to aggregate the demand for public transport. He pointed out the creation of the "Friends of BMTC" initiative and expressed interest in establishing a similar organisation for the metro. These organisations would act as annex bodies working closely with commuters to drive policy change. By involving commuters directly, this initiative could become a powerful force for shaping transportation policies that cater to the broader public transport user base.

Figure 4-9 Glimpses from QnA Session

Source: IUT

4.2.8 Session 8: Closing Remarks

Mr Ashwani expressed his appreciation for the enlightening discussion and the presence of a diverse panel comprising both practitioners and researchers. He concluded by summarising the roundtable, emphasising the need to define Low Emission Zones (LEZ) in the context of Indian cities, rather than directly adopting approaches from European cities, while drawing inspiration from the most successful global practices.

The discussion then shifted to potential strategies for implementation, with suggestions including area-wide approaches, convergent strategies, and a people-centric focus supported by strong leadership. Gender

inclusivity and e-mobility emerged as key themes, with initiatives such as offering courses for women EV drivers highlighted as promising solutions.

Mr Ashwani also stressed the importance of strategically utilising funds to develop improved programmes and policies aimed at reducing pollution and emissions in urban core areas. He concluded by noting that the primary goal in the coming days will be to address and overcome the challenges faced in the heart of Indian cities, which remain central to the nation's economy.

4.2.9 Session 9: Vote of Thanks

Ms Sonal Shah extended her gratitude to all the participants and esteemed speakers on the panel. As a token of appreciation, a book by CRDF and a framed depiction of women walking and cycling from TUC were presented to all the panellists.

Figure 4-10 Felicitation of the Panellists

Source: IUT

5. Meetings with Advisory Group Members

The members of the advisory group comprising of 10 individuals were engaged during various stages of the project, including workshops and discussions on LEZ strategies. Their involvement has been instrumental in guiding the project, providing insights and serving as a reliable source of information and input. The strategies outlined for the walled city was discussed with advisory group members from Ahmedabad Municipal Corporation (AMC), Ahmedabad Janmarg Limited (AJL), Gujarat Metro Rail Corporation Limited (GMRCL), Regional Transport Office (RTO)and Heritage Department. Meetings were conducted with each organisation for their inputs and comments to finalise the strategic plan. These meetings were held during December 17 to 20, 2024 and January 3, 2025.

The members agreed to the three-pronged strategy of focusing on clean vehicle technology intervention, enhancement of public transport and traffic management. The members had suggested to improve the traffic and parking issues in the walled city. The key recommendation includes developing a holistic wayfinding plan and non-motorised transport plan, conducting parking demand-supply analysis and formulating parking management plan with push and pull measures to manage the demand in the limited area. They supported enhancing pedestrian experience by converting markets into pedestrian-only zones and implementing time-based restrictions for vehicles in select areas. Measures such as high parking charges could adversely impact those trying to earn a private vehicle, sticker-based vehicle access for residents and rerouting traffic near markets and heritage sites and provide circular routes and pick-up and drop-off service were suggested to manage congestion. The members also recommended planning EV charging infrastructure based on demand. In addition, alternative vendor spaces and no-honking zones in residential areas were highlighted to balance mobility and heritage preservation. AMC had expressed interest to carry forward the recommendation for the effective implementation of initiatives.

6. Conclusion

Various workshops, meetings, and discussions were held throughout the project, each serving distinct purposes, including project briefings for the advisory group, gathering suggestions from key stakeholders, and promoting knowledge sharing and awareness. The meetings involved city authorities, key stakeholders, including three-wheeler drivers, and transport and environmental practitioners and researchers.

The first workshop with advisory group members was held after the base situation analysis, which identified the key challenges and outlined the approach for implementing the LEZ. This approach covered areas such as managing freight movement, mobility management, public transport enhancement, clean vehicle technology, and other potential interventions. This session served as the kick-off meeting, laying the groundwork for identifying strategies.

The second workshop focused on raising awareness among three-wheeler drivers about the electrification of vehicles, a crucial aspect of the clean vehicle technology intervention. The objective of the event was to share the project findings on a national platform and gather insights from subject-matter experts on potential interventions for planning and implementation of LEZ.

Finally, after the draft strategy was prepared, meetings were held with various stakeholders, including representatives from AMC, AJL, GMRCL, RTO and the Heritage Department, to gather their comments and suggestions and ensure stakeholder buy-in and support.

The key takeaways from all the programmes-

- **Relevance of LEZs**: LEZs can significantly improve urban air quality by promoting low-emission vehicles, enhancing public and active transport, and reducing congestion. They are particularly relevant for densely populated and polluted urban areas.
- **Ahmedabad's Context**: The city's walled core area faces challenges of high traffic congestion, air pollution, unwalkable streets and low public transport usage. The core areas serve as hubs of business activity, serving as essential focal points for the city's economy and culture.
- **Potential Solutions:**
    - **Electrification of vehicles:** Transitioning to electric vehicles, in various segments including public transport, two-wheelers, passenger and freight three-wheelers, is crucial for reducing emissions.
    - **Enhancing sustainable transport modes**: Prioritising share mobility over use of private vehicles, and improving pedestrian facilities, can address air pollution and congestion issues.
    - **Addressing freight traffic and parking management:** Managing freight movement, particularly in the core areas, and implementing effective parking solutions are essential for reducing congestion and pollution.
    - **Integration of policies:** A coordinated approach, integrating LEZ with other urban policies such as TOD, parking management, and electric vehicle incentives, will lead to better outcomes.
    - **Technological applications in data collection and decision-making:** Using technology to gather data on traffic, air quality, and transport usage will help in informed decision-making and more effective LEZ implementation.
    - **Leveraging funds:** Repurposing existing funds like that under NCAP and creating new revenue streams from TOD, parking management, and other sources to improve local areas will enhance the overall livability, accessibility, and success of LEZ initiatives.
    - **Prioritising disadvantaged groups:** Ensuring that improvements in mobility benefit all users, especially women, the elderly, and people with disabilities, is essential for creating an inclusive urban environment.
    - **Engaging residents:** Actively involving residents through workshops and/or focus group discussions will provide valuable insights into community needs, creating awareness and buy-in for various sustainable mobility initiatives being proposed.

The meetings with advisory group have been instrumental in informing city officials and agencies about the potential actions that can be adopted to enhance the ongoing initiatives in the walled city and Ahmedabad at large. The city could share details of highly polluting vehicles retrieved as part of this study with Climate State level State Committee and State Transport Commissioner to take necessary actions. To support the electrification of vehicles, the city could recommend the state government to adopt appropriate policy measures for e-LCV. Further, the city could conduct promotional activities explore the possibility of setting

up charging stations with feasibility, operational models and pricing mechanisms. As part of ongoing development of a service and business plan for improving bus operations in Ahmedabad, the city could prioritise incorporating electric minibuses into the fleet and establish circular routes to strengthen connectivity within the walled city. Furthermore, the city could recommend the AUDA to conduct street development activities and integrate them in development plan and local area plans. Also, the city could develop traffic management plan with Traffic Police to enhance the mobility movement in the walled city.

7. Appendix

APPENDIX A: WORKSHOP ON LOW EMISSION ZONE FOR AHMEDABAD

Time (IST)	Activity	Led or moderated by	Remarks
Session 1	**Opening Session**		
11:00 – 11:05 (5 minutes)	Welcome and Project Overview	Dr Shalini Sinha, Center Head, CoE-UT, CRDF	
11:05 – 11:10 (5 minutes)	Opening Remarks	Mr Amrutesh Kalidas Aurangabadkar (IAS), Deputy Municipal Commissioner, AMC	
Session 2	**International and National Experience on Setting Low Emission Zone**		
11:10 – 11:15 (5 minutes)	Speaker Introduction	Ms Surya Sugathan, Senior Transport Planner, CoE-UT, CRDF	
11:15 – 11:35 (20 minutes)	Introduction of Low Emission Zone in Seoul	Prof Joonho Ko, Professor of the Graduate School of Urban Studies in Hanyang University, Seoul	Online
11:35– 11:55 (20 minutes)	Implementation pathways for enabling LEZ in India	Mr Amit Bhatt, Managing Director, ICCT India	Online
11:55 – 12:15 (20 minutes)	Planning Low Emission Zone in Ahmedabad	Dr Shalini Sinha	
12:15 – 12:55 (40 minutes)	Discussion on Strategies for Ahmedabad	Prof Shivanand Swamy, Professor Emeritus, CoE-UT, CRDF	
Session 3	**Closing Session**		
12:55 – 13:00 (5 minutes)	Concluding remarks	Prof Shivanand Swamy Dr Shalini Sinha	
	Vote of Thanks	Ms Surya Sugathan	

APPENDIX B: PARTICIPANT FEEDBACK FORM

Workshop on Low Emission Zone for Ahmedabad

Participant Feedback Form

Instructions

Please complete this questionnaire to help us improve our knowledge creation activities in the future. Please be honest and open. Your responses – no matter how critical – are valuable to us. To keep them anonymous, please do not write your name on the form.

1. Technical Content Evaluation and Suggestions

In terms of knowledge, acceptance and implementation of Low Emission Zone (LEZ), please provide specific comments about the technical content.

1. What key aspects of today's session on LEZ did you find useful?
2. Are there any aspects of LEZ that required more clarity or detail?
3. What actions should be taken by the city to advance LEZ in Ahmedabad?
4. What are the challenges you foresee in implementation of LEZ?

2. Programme Evaluation

Please rate each aspect of the program listed below on a progressive scale of 1 to 5, where 1 is the minimum and 5 is the maximum. If you feel that a question does not apply to you, or that you do not have enough information to express an opinion, please ignore. Please fill only one circle per question.

Aspects	Low ---------- High
1. Workshop provided required details on the concept and applicability of LEZ	① ② ③ ④ ⑤
2. Program met your expectations	① ② ③ ④ ⑤
3. Length of the program was appropriate	① ② ③ ④ ⑤
4. Quality of the presentation, discussion and its relevance for Ahmedabad	① ② ③ ④ ⑤
5. Overall quality of the workshop	① ② ③ ④ ⑤

APPENDIX C: AGENDA OF AWARENESS WORKSHOP ON ELECTRIC THREE-WHEELER

Time (IST)	Activity	Led or moderated by
09:00 – 10:00 (60 minutes)	Registration and Tea	
Session 1	**Electrification of Three-wheelers**	
10:00 – 10:10 (10 minutes)	Welcome and Introduction	Dr Shalini Sinha, Center Head, CoE-UT, CRDF
10:10 – 10:25 (15 minutes)	Special Address	Mr Vishal Khanama, i/c Deputy Municipal Commissioner, Ahmedabad Municipal Corporation and General Manager of BRTS Mr Chintak Modi, RTO Inspector, Ahmedabad Regional Transport Office
10:25 – 10:35 (10 minutes)	Overview of electric three-wheeler technology and economics	Mr Khelan Modi, Senior Transport Specialist, CoE-UT, CRDF
10:35 – 10:45 (10 minutes)	Vehicle Loan Information	Mr Navneet Choudhary, Chief Manager, State Bank of India
10:45 – 11:00 (15 minutes)	Address by Autorickshaw Driver Associations	Representatives of Autorickshaw Drivers' Cooperative Society and Ahmedabad School Verdi Association
11:00 – 11:15 (15 minutes)	Experience of Electric Autorickshaw	Owners/ Operators of Electric Autorickshaw
11:15 – 11:30 (15 minutes)	Presentation of Electric Vehicles Models	Vehicle Manufacturers
Session 2 11:30 – 13:30	**Exhibition and Refreshments**	

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APPENDIX D: PASSENGER ELECTRIC THREE-WHEELER BROCHURE

કાર્યસૂચિ

UKaid

અમદાવાદ મ્યુનિસિપલ કોર્પોરેશન, અમદાવાદ ટ્રાફિક પોલીસ, આર.ટી.ઓ., અમદાવાદ સ્કૂલ વર્ધી એસોસિએશન તથા ઓટોરિક્ષા ડ્રાઈવર્સ કો.ઓપરેટિવ સોસાયટી લિમિટેડ ના સહયોગથી, સી.આર.ડી.એફ., સેપ્ટ યુનિવર્સિટી દ્વારા આયોજિત

સી.આર.ડી.એફ. ઓફિસ, સેપ્ટ યુનિવર્સિટી, વિજય ચાર રસ્તા પાસે, નવરંગપુરા, અમદાવાદ.
૧૩ ઓક્ટોબર ૨૦૨૪ | રવિવાર
૦૯:૦૦ થી ૨:૩૦

૦૯:૩૦ - ૧૦:૦૦ · નોંધણી

૧૦:૦૦ - ૧૦: ૨૦
સ્વાગત અને સંબોધન
ડૉ. શાલિની સિન્હા, સેન્ટર હેડ અને પ્રિન્સિપલ રિસર્ચર, સેન્ટર ઓફ એક્સેલન્સ ઈન અર્બન ટ્રાન્સપોર્ટ, સેપ્ટ યુનિવર્સિટી.

૧૦: ૨૦ - ૧૨:૩૦
વિશેષ સંબોધન
શ્રી સફીન હસન (IPS), DCP ટ્રાફિક અમદાવાદ (પૂર્વ ઝોન), અમદાવાદ.
શ્રી વિશાલ ખનામાં, ઇન-ચાર્જ ડેપ્યુટી મ્યુનિસિપલ કમિશનર, એ.એમ.સી. & જનરલ મેનેજર, એ.જે.એલ., અમદાવાદ.
શ્રી જે.જે. પટેલ, પ્રાદેશિક વાહન વ્યવહાર અધિકારી, આરટીઓ, અમદાવાદ.

ઇલેક્ટ્રિક ઓટો ટેક્નોલોજી પર ચર્ચા
શ્રી ખેલન મોદી, જ્યોધ પરિવહન નિષ્ણાત, CoE-UT, સેપ્ટ યુનિવર્સિટી, અમદાવાદ

વ્હીકલ લોન માટેની માહિતી
શ્રી નવનીત ચૌધરી, મુખ્ય મેનેજર, રેટ્ટ બેંક ઓફ ઇન્ડિયા

અમદાવાદ સ્કૂલ વર્ધી અસોસિએશન અને ઓટોરિક્ષા ડ્રાઈવર્સ કો.ઓપરેટિવ સોસાયટી લિમિટેડ દ્વારા સંબોધન

ઓટોરિક્ષા ડ્રાઈવર્સ કો.ઓપરેટિવ સોસાયટી લિમિટેડ
- શ્રી જાફર ગુલામહુસેન કુરેશી, પ્રમુખ
- શ્રી ઉસ્માનગની રસુલભાઈ શેખ
- શ્રી સાજીદહુસેન સાબિરહુસેન શેખ
- શ્રી ઈન્તિયાઝભાઈ શેખ

અમદાવાદ સ્કૂલ વર્ધી એસોસિએશન
- શ્રી ધર્મેન્દ્રભાઈ વ્રજભૂષ, પ્રમુખ
- શ્રી ઋષભભાઈ કલાલ
- શ્રી દિલીપભાઈ જોશી
- શ્રી ભગવાનદાસ ભાવનાની
- શ્રી પ્રતાપ ભાઈ ચૌહાણ
- શ્રી કલ્પેશભાઈ પ્રજાપતિ
- શ્રી નરેશભાઈ મોદી

ઇલેક્ટ્રિક ઓટો ડ્રાઈવર દ્વારા તેમના અનુભવ ની ચર્ચા
શ્રી યાસીન ખાન
શ્રી ઈન્તિયાઝભાઈ શેખ
શ્રી મનોજ તિવારી

ઇલેક્ટ્રિક ઓટો બનાવનાર કંપનીઓ દ્વારા ઇલેક્ટ્રિક ઓટો મોડેલોની રજૂઆત

૧૨: ૨૦ - ૦૧:૩૦
પ્રદશન અને અલ્પાહાર

નોંધ સવારે ચા અને બપોરે જમવાનું રાખેલ છે.

ઇલેક્ટ્રિક ઓટો જાગૃકતા કાર્યક્રમ અને પ્રદર્શન
પેસેન્જર 3W

"ચાલો ભવિષ્યને ઇલેક્ટ્રિક ઓટો દ્વારા ચલાવીએ"

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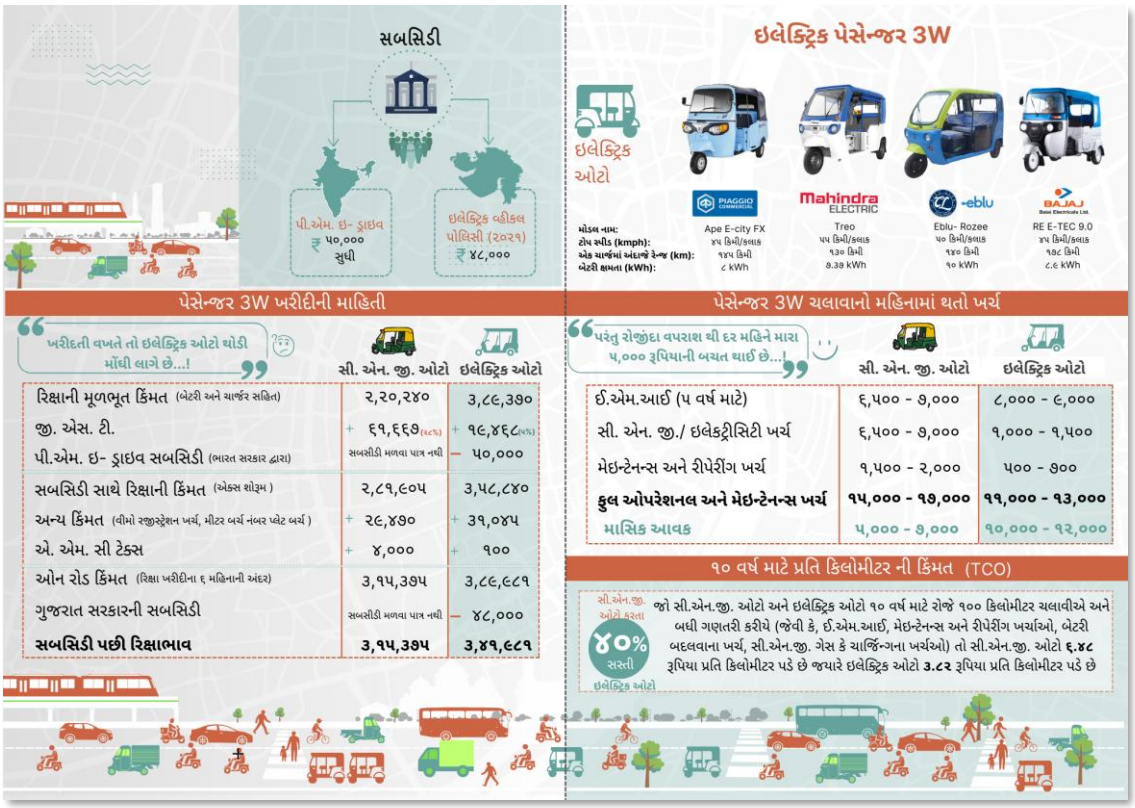

સબસિડી

પી.એમ. ઇ- ડ્રાઇવ
₹ ૫૦,૦૦૦
સુધી

ઇલેક્ટ્રિક વ્હીકલ પોલિસી (૨૦૨૧)
₹ ૪૮,૦૦૦

ઇલેક્ટ્રિક પેસેન્જર 3W

ઇલેક્ટ્રિક ઓટો

મોડલ નામ:	Ape E-city FX	Treo	Eblu- Rozee	RE E-TEC 9.0
ટોપ સ્પીડ (kmph):	૪૫ કિમી/કલાક	૫૫ કિમી/કલાક	૫૨૦ કિમી	૪૫ કિમી/કલાક
એક ચાર્જમાં અંદાજે રેન્જ (km):	૧૨૫ કિમી	૧૩૦ કિમી	૧૨૦ કિમી	૧૪૮ કિમી
બેટરી ક્ષમતા (kWh):	८ kWh	8.38 kWh	૧૦ kWh	८.६ kWh

પેસેન્જર 3W ખરીદીની માહિતી

"ખરીદતી વખતે તો ઇલેક્ટ્રિક ઓટો થોડી મોંઘી લાગે છે...!"

	સી. એન. જી. ઓટો	ઇલેક્ટ્રિક ઓટો
રિક્ષાની મૂળભૂત કિંમત (બેટરી અને ચાર્જર સહિત)	૨,૨૦,૨૪૦	૩,૮૯,૩૭૦
જી. એસ. ટી.	+ ૬૧,૬૬૭ (૨૮%)	+ ૧૯,૪૬૮ (૫%)
પી.એમ. ઇ- ડ્રાઇવ સબસિડી (ભારત સરકાર દ્વારા)	સબસીડી મળવા પાત્ર નથી	— ૫૦,૦૦૦
સબસિડી સાથે રિક્ષાની કિંમત (એક્સ શોરૂમ)	૨,૮૧,૯૦૫	૩,૫૮,૮૪૦
અન્ય કિંમત (વીમો રજીસ્ટ્રેશન ખર્ચ, મીટર બર્ચ નંબર પ્લેટ બર્ચ)	+ ૨૮,૪૭૦	+ ૩૧,૦૪૫
એ. એમ. સી ટેક્સ	+ ૪,૦૦૦	+ ૧૦૦
ઓન રોડ કિંમત (રિક્ષા ખરીદીના ૬ મહિનાની અંદર)	૩,૧૫,૩૭૫	૩,૮૯,૯૮૧
ગુજરાત સરકારની સબસિડી	સબસીડી મળવા પાત્ર નથી	— ૪૮,૦૦૦
સબસિડી પછી રિક્ષાભાવ	**૩,૧૫,૩૭૫**	**૩,૪૧,૯૮૧**

પેસેન્જર 3W ચલાવાનો મહિનામાં થતો ખર્ચ

"પરંતુ રોજીંદા વપરાશ થી દર મહિને મારા ૫,૦૦૦ રૂપિયાની બચત થાઈ છે...!"

	સી. એન. જી. ઓટો	ઇલેક્ટ્રિક ઓટો
ઈ.એમ.આઈ (૫ વર્ષ માટે)	૬,૫૦૦ - ૭,૦૦૦	૮,૦૦૦ - ૯,૦૦૦
સી. એન. જી./ ઇલેકટ્રીસિટી ખર્ચ	૬,૫૦૦ - ૭,૦૦૦	૧,૦૦૦ - ૧,૫૦૦
મેઇન્ટેનન્સ અને રીપેરીંગ ખર્ચ	૧,૫૦૦ - ૨,૦૦૦	૫૦૦ - ૭૦૦
કુલ ઓપરેશનલ અને મેઇન્ટેનન્સ ખર્ચ	**૧૫,૦૦૦ - ૧૭,૦૦૦**	**૧૧,૦૦૦ - ૧૩,૦૦૦**
માસિક આવક	૫,૦૦૦ - ૭,૦૦૦	૧૦,૦૦૦ - ૧૨,૦૦૦

૧૦ વર્ષ માટે પ્રતિ કિલોમીટર ની કિંમત (TCO)

૪૦% સસ્તી ઇલેક્ટ્રિક ઓટો વપરતા સી.એન.જી.

જો સી.એન.જી. ઓટો અને ઇલેક્ટ્રિક ઓટો ૧૦ વર્ષ માટે રોજે ૧૦૦ કિલોમીટર ચલાવીએ અને બધી ગણતરી કરીયે (જેવી કે, ઈ.એમ.આઈ, મેઇન્ટેનન્સ અને રીપેરીંગ ખર્ચાઓ, બેટરી બદલવાના ખર્ચ, સી.એન.જી. ગેસ કે ચાર્જિંગના ખર્ચઓ) તો સી.એન.જી. ઓટો **૬.૪૮** રૂપિયા પ્રતિ કિલોમીટર પડે છે જ્યારે ઇલેક્ટ્રિક ઓટો **૩.૮૨** રૂપિયા પ્રતિ કિલોમીટર પડે છે

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APPENDIX E: GOODS ELECTRIC THREE-WHEELER BROCHURE

કાર્યસૂચિ

સી.આર.ડી.એફ. ઓફિસ, સેપ્ટ યુનિવર્સિટી, વિજય ચાર રસ્તા પાસે, નવરંગપુરા, અમદાવાદ.
૧૩ ઓક્ટોબર ૨૦૨૪ | રવિવાર
૦૯:૦૦ થી ૨:૩૦

૦૯:૩૦ - ૧૦:૦૦ - નોંધણી

૧૦:૦૦ - ૧૦: ૨૦
સ્વાગત અને સંબોધન
ડૉ. શાલિની સિન્હા, સેન્ટર હેડ અને પ્રિન્સિપલ રિસર્ચર, સેન્ટર ઓફ એક્સેલન્સ ઈન અર્બન ટ્રાન્સપોર્ટ, સેપ્ટ યુનિવર્સિટી.

૧૦: ૨૦ - ૧૨:૩૦
વિશેષ સંબોધન
શ્રી સફીન હસન (IPS), DCP ટ્રાફિક અમદાવાદ (પૂર્વ ઝોન), અમદાવાદ.
શ્રી વિશાલ ખનામાં, ઇન-ચાર્જ ડેપ્યુટી મ્યુનિસિપલ કમિશનર, એ.એમ.સી. & જનરલ મેનેજર, એ.જે.એલ., અમદાવાદ.
શ્રી જે.જે. પટેલ, પ્રાદેશિક વાહન વ્યવહાર અધિકારી, આરટીઓ, અમદાવાદ.

ઇલેક્ટ્રિક ઓટો ટેકનોલોજી પર ચર્ચા
શ્રી ખેલન મોદી, જ્યોપ્ડ પરિવહન નિષ્ણાત, CoE-UT, સેપ્ટ યુનિવર્સિટી, અમદાવાદ

વ્હીકલ લોન માટેની માહિતી
શ્રી નવનીત ચૌધરી, મુખ્ય મેનેજર, સ્ટેટ બેંક ઓફ ઇન્ડિયા

અમદાવાદ સ્કૂલ વર્ધી અસોસિએશન અને ઓટોરિક્ષા ડ્રાઈવર્સ કો.ઓપરેટિવ સોસાયટી લિમિટેડ દ્વારા સંબોધન

ઓટોરિક્ષા ડ્રાઈવર્સ કો ઓપરેટિવ સોસાયટી લિમિટેડ
- શ્રી જાકર નુરાનહુસેન કુરેશી, પ્રમુખ
- શ્રી ઉકાભાનભાઈ રબારીભાઈ શેખ
- શ્રી સાજીદહુસેન સાબિરહુસેન શેખ
- શ્રી ઈન્તિયાઝભાઈ શેખ
- શ્રી ધર્મેન્દ્રભાઈ બહાદભાઇ પ્રમુખ
- શ્રી જયભાભાઈ કનાદ
- શ્રી દિલીપભાઈ જોશી

અમદાવાદ સ્કૂલ વર્ધી એસોસિએશન
- શ્રી ભગવાનદાસ ભાવનાની
- શ્રી પ્રતાપ ભાઈ મોહાણ
- શ્રી કલ્પેશભાઈ પ્રજાપતિ
- શ્રી નરેશભાઈ મોદી

ઇલેક્ટ્રિક ઓટો ડ્રાઈવર દ્વારા તેમના અનુભવ ની ચર્ચા
શ્રી યાસીન ખાન
શ્રી ઈન્તિયાઝભાઈ શેખ
શ્રી મનોજ તિવારી

ઇલેક્ટ્રિક ઓટો બનાવનાર કંપનીઓ દ્વારા ઇલેક્ટ્રિક ઓટો મોડેલોની રજૂઆત

૧૨: ૨૦ - ૦૧:૩૦
ભોજન અને અલ્પાહાર

નોંધ: સવારે ચા અને બપોરે જમવાનું રાખેલ છે.

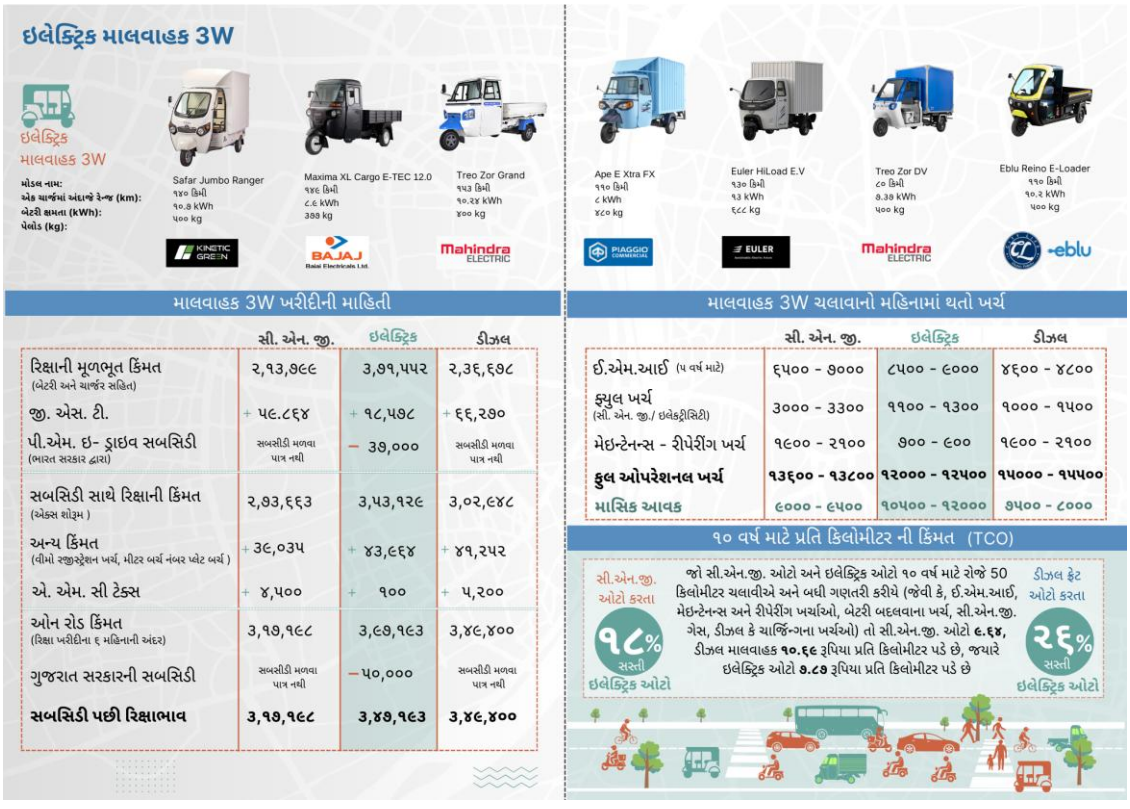
UKaid from the British people

અમદાવાદ મ્યુનિસિપલ કોર્પોરેશન, અમદાવાદ ટ્રાફિક પોલીસ, આર.ટી.ઓ., અમદાવાદ સ્કૂલ વર્ધી એસોસિએશન તથા ઓટોરિક્ષા ડ્રાઈવર્સ કો.ઓપરેટિવ સોસાયટી લિમિટેડ ના સહયોગથી, સી.આર.ડી.એફ., સેપ્ટ યુનિવર્સિટી દ્વારા આયોજિત

ઇલેક્ટ્રિક ઓટો જાગૃકતા કાર્યક્રમ અને પ્રદર્શન
માલવાહક 3W

"ચાલો ભવિષ્યને ઇલેક્ટ્રિક ઓટો દ્વારા ચલાવીએ"

HIGH VOLUME TRANSPORT APPLIED RESEARCH · DT Global · CRDF · CEPT UNIVERSITY



ઇલેક્ટ્રિક માલવાહક 3W

ઇલેક્ટ્રિક માલવાહક 3W

	Safar Jumbo Ranger	Maxima XL Cargo E-TEC 12.0	Treo Zor Grand
મોડલ નામ:			
એક ચાર્જમાં અંદાજે રેન્જ (km):	૧૪૦ કિમી	૧૪૬ કિમી	૧૫૩ કિમી
બેટરી ક્ષમતા (kWh):	૧૦.૪ kWh	૮.૬ kWh	૧૦.૨૪ kWh
પેલોડ (kg):	५०० kg	३७७ kg	४०० kg

KINETIC GREEN · BAJAJ Bajaj Electricals Ltd. · Mahindra ELECTRIC

	Ape E Xtra FX	Euler HiLoad E.V	Treo Zor DV	Eblu Reino E-Loader
	૧૧૦ કિમી	૧૩૦ કિમી	८० કિમી	૧૧૦ કિમી
	८ kWh	૧૩ kWh	૭.૩૮ kWh	૧૦.૨ kWh
	४८० kg	६८८ kg	५०० kg	५०० kg

PIAGGIO COMMERCIAL · EULER · Mahindra ELECTRIC · eblu

માલવાહક 3W ખરીદીની માહિતી

	સી. એન. જી.	ઇલેક્ટ્રિક	ડીઝલ
રિક્ષાની મૂળભૂત કિંમત (બેટરી અને ચાર્જર સહિત)	૨,૧૩,૭૯૯	૩,૭૧,૫૫૨	૨,૩૬,૬૭૮
જી. એસ. ટી.	+ ૫૯.૮૬૪	+ ૧૮,૫૭૮	+ ૬૬,૨૭૦
પી.એમ. ઇ- ડ્રાઇવ સબસિડી (ભારત સરકાર દ્વારા)	સબસીડી મળવા પાત્ર નથી	– ૩૭,૦૦૦	સબસીડી મળવા પાત્ર નથી
સબસિડી સાથે રિક્ષાની કિંમત (એક્સ શોરૂમ)	૨,૭૩,૬૬૩	૩,૫૩,૧૨૯	૩,૦૨,૯૪૮
અન્ય કિંમત (વીમો રજીસ્ટ્રેશન ખર્ચ, મીટર બર્ચ નંબર પ્લેટ બર્ચ)	+ ૩૯,૦૩૫	+ ૪૩,૬૬૪	+ ૪૧,૨૫૨
એ. એમ. સી ટેક્સ	+ ૪,૫૦૦	+ ૧૦૦	+ ૫,૨૦૦
ઓન રોડ કિંમત (રિક્ષા ખરીદીના ૬ મહિનાની અંદર)	૩,૧૩,૧૯૮	૩,૯૭,૧૯૩	૩,૪૯,૪૦૦
ગુજરાત સરકારની સબસિડી	સબસીડી મળવા પાત્ર નથી	– ૫૦,૦૦૦	સબસીડી મળવા પાત્ર નથી
સબસિડી પછી રિક્ષાભાવ	**૩,૧૩,૧૯૮**	**૩,૪૭,૧૯૩**	**૩,૪૯,૪૦૦**

માલવાહક 3W ચલાવાનો મહિનામાં થતો ખર્ચ

	સી. એન. જી.	ઇલેક્ટ્રિક	ડીઝલ
ઈ.એમ.આઈ (૫ વર્ષ માટે)	६५०० - ७०००	८५०० - ९००००	४६०० - ४८००
ફ્યુલ ખર્ચ (સી. એન. જી./ ઇલેક્ટ્રીસિટી)	३००० - ३३००	११०० - १३००	१००० - १५००
મેઇન્ટેનન્સ - રીપેરીંગ ખર્ચ	१९०० - २१००	७०० - ९००	१९०० - २१००
ફુલ ઓપરેશનલ ખર્ચ	**१३६०० - १३८००**	**१२००० - १२५००**	**१५००० - १५५००**
માસિક આવક	९००० - ९५००	१०५०० - १२०००	७५०० - ८०००

૧૦ વર્ષ માટે પ્રતિ કિલોમીટર ની કિંમત (TCO)

સી.એન.જી. ઓટો કરતા ૧૮% સસ્તી ઇલેક્ટ્રિક ઓટો

જો સી.એન.જી. ઓટો અને ઇલેક્ટ્રિક ઓટો ૧૦ વર્ષ માટે રોજે 50 કિલોમીટર ચલાવીએ અને બધી ગણતરી કરીયે (જેવી કે, ઈ.એમ.આઈ, મેઇન્ટેનન્સ અને રીપેરીંગ ખર્ચાઓ, બેટરી બદલવાના ખર્ચ, સી.એન.જી. ગેસ, ડીઝલ કે ચાર્જિંગના ખર્ચાઓ) તો સી.એન.જી. ઓટો **૯.૬૪**, ડીઝલ માલવાહક **૧૦.૬૯** રૂપિયા પ્રતિ કિલોમીટર પડે છે, જ્યારે ઇલેક્ટ્રિક ઓટો **૭.૮૭** રૂપિયા પ્રતિ કિલોમીટર પડે છે

ડીઝલ ફ્રેટ ઓટો કરતા ૨૬% સસ્તી ઇલેક્ટ્રિક ઓટો

APPENDIX F: AGENDA OF ROUNDTABLE ON STANDARDISING MOBILITY SYSTEMS IN CORE AREA OF INDIAN CITIES

Time (IST)	Activity	Led or moderated by
11:30 – 11:33	Welcome and Speaker Introduction	Dr Shalini Sinha, Center Head, Center of Excellence in Urban Transport (CoE-UT), CRDF, Ahmedabad
11:33 - 11:38	Opening Remarks	Mr Ashwani Kumar (IAS), Principal Secretary, Urban Development and Urban Housing Department (UD & UHD), Gujarat
11:38 - 11:43	Project Introduction and FCDO Support	Ms Moumita Bhattacharya, Senior Advisor, Economics, Climate and Development – Gujarat and Rajasthan, British Deputy High Commission Ahmedabad
11:43 - 11:48	Approach on Planning Low Emission Zone in the Core Area of Indian Cities	Ms Surya Sugathan, Senior Transport Planner, CoE-UT, CRDF, Ahmedabad
11:48 - 11:53	Equity and Social Inclusion in Low Emission Zones, with a Focus on Electromobility	Ms Manisha Sharma, Senior Associate-Integrated Urban Transport, The Urban Catalysts (TUC), New Delhi
11:53 - 12:33	Moderated Discussion	Ms Anumita Roy Chowdhury, Executive Director, Research & Advocacy, Centre for Science and Environment (CSE), New Delhi Mr Vivek Ogra, Partner, Transport, Ernst and Young LLP (EY), Ahmedabad Dr Kalpana Viswanath, Co-Founder & CEO, Safetipin, Gurugram Mr Sudhir Badami, Independent Consultant, Transport Professional Mr Vishal Khanama, i/c Deputy Municipal Commissioner, Ahmedabad Municipal Corporation and General Manager of Bus Rapid Transit System (BRTS), Ahmedabad Mr Safin Hasan, IPS, Deputy Commissioner of Police, Traffic (East Zone), Ahmedabad Mr Amegh Gopinath, Component Team Leader at NDC-TIA India, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH Ms Sonal Shah, Founder, The Urban Catalysts (TUC), New Delhi
12:33 - 12:53	Q&A	Prof. H. M. Shivanand Swamy, Professor Emeritus, CoE-UT, CRDF, Ahmedabad
12:53 - 12:58	Closing Remarks	Mr Ashwani Kumar (IAS)
12:58 - 13:00	Vote of Thanks	Ms Sonal Shah