UITP INDIA

› REPORT

NATIONAL WORKSHOP ON SHAPING TOMORROW'S CITIES TODAY: THE LOW EMISSION ZONE JOURNEY

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INTRODUCTION

Air pollution is broadly recognised as one of the gravest environmental threats to human health. The European Environment Agency (EEA) identifies it as the single largest environmental risk to public health. The World Health Organization (WHO) similarly reports that outdoor (ambient) air pollution caused approximately 4.2 million premature deaths globally in 2019, with nearly 89% occurring in low- and middle-income regions, particularly South-East Asia and the Western Pacific. India carries a significant share of this burden. According to WHO estimates, around 1.8 million deaths in India in 2016 were attributable to ambient air pollution, largely due to stroke, ischaemic heart disease, chronic respiratory diseases, and lung cancer. (WHO, 2022).[i] Urban areas face an even greater burden, as emissions from vehicles, particularly particulate matter (PM2.5 and PM10) and nitrogen oxides (NOx), remain a major contributor to deteriorating air quality. Updated assessments from the Central Pollution Control Board (CPCB) show that in cities like Delhi and Mumbai, vehicular sources may contribute up to 40% of overall urban air pollution (CPCB, 2023).[ii]

The EEA notes that road transport is frequently the dominant contributor to urban air pollution, with dense traffic linked to roughly 64% of nitrogen dioxide (NO_2) exceedances in European cities. The WHO likewise identifies transportation—along with industry, power generation, and household fuel use as a major source of ambient pollution in India. Vehicles emit fine particulate matter ($PM_{2.5}$ and PM_{10}) and nitrogen oxides (NOx), pollutants directly associated by the WHO with elevated risks of cardiovascular and respiratory diseases and several cancers. (EEA, 2020).[iii] In response, many cities worldwide have turned to Low Emission Zones (LEZs) as a targeted mitigation tool. LEZs typically restrict access to the most polluting vehicles, often using European emission standards as the benchmark, thereby reducing local concentrations of PM and NOx. An EEA review finds that traffic-related interventions including LEZs, parking controls and speed management account for nearly 39% of all actions in urban air-quality plans. Cities such as London, Berlin and Barcelona have documented significant declines in NO_2 and $PM_{2.5}$ levels following LEZ implementation, with corresponding improvements in public health indicators. (EEA, 2022).[iv]

*In this context, on **November 27, 2025, UITP India organised the National Workshop on "Shaping Tomorrow's Cities Today: The Low Emission Zone Journey"** that brought together policymakers, researchers, city authorities, mobility experts, public transport undertakings, and development partners to collectively deliberate on the pathways for LEZ in India. Designed as a full-day forum for knowledge exchange, the workshop aimed to build a shared understanding of the regulatory foundations, governance mechanisms, health imperatives, and operational strategies required to plan and implement LEZs across Indian cities in alignment with national clean air and net-zero ambitions of the country.*

WORKSHOP OVERVIEW

The one-day workshop brought together leading national experts to share global best practices and India-specific insights on advancing LEZ. Senior representatives from Commission for Air Quality Management (CAQM) in the National Capital Region and Adjoining Areas, Lung Care Foundation, Centre for Science and Environment (CSE), The Energy and Resources Institute (TERI), NITI Aayog, Kochi Metro Rail (KMRL), Delhi Integrated Multi-Modal Transit System Limited (DIMTS), Delhi Transport Corporation (DTC), and Kochi Municipal Corporation, enriched the dialogue with diverse technical, policy, and operational perspectives. The event also witnessed active participation from a plethora of organisations such as The National Institute of Urban Affairs (NIUA), Delhi Metro Rail Corporation (DMRC) Limited, National Capital Region Transport Corporation (NCRTC), Noida Metro Rail Corporation (NMRC) Limited, Olectra Greentech Limited, Ola Mobility Institute (OMI) Foundation, Pricewaterhouse Coopers (PwC), International Council on Clean Transportation (ICCT), Raahgiri Foundation, World Resources Institute (WRI), Institute for Transportation and Development Policy (ITDP), etc. The involvement of these stakeholders further highlighted the growing national need for commitment towards development of LEZ.

INAUGRAL SESSION

The workshop commenced with an inaugural session led by three distinguished speakers. **Ms. Rupa Nandy, Head of UITP India**, welcomed participants and highlighted UITP's commitment to advancing sustainable mobility through evidence-driven initiatives like research and advocacy on LEZs. **Dr. Virinder Sharma, Member (Technical), CAQM** delivered the keynote address, underlining the urgency of city-level emission reduction measures and the regulatory direction set by CAQM for cleaner and healthier urban environments. This was followed by opening remarks from **Mr. Abhishek Kumar, CEO and Founder Trustee, Lung Care Foundation**, who emphasised the public health dimensions of air pollution and reinforced why LEZs must be viewed as health-protection zones, not just mobility interventions.

SESSION 1: PANEL DISCUSSION ON ENABLING LOW EMISSION ZONES: REGULATORY FRAMEWORKS AND GOVERNANCE ENABLERS AND FIGHTING AIR POLLUTION IN DELHI: TOWARDS SUSTAINABLE AND HEALTHY SOLUTIONS

The panel discussion on "Enabling Low Emission Zones: Regulatory Frameworks and Governance Enablers" followed by the discussion on "Fighting Air Pollution in Delhi: Towards Sustainable and Healthy Solutions", moderated by **Ms Anindita Ghosh, Senior Researcher, UITP**, brought together senior national experts to outline the governance, regulatory, and public health frameworks necessary for effective LEZ adoption in Indian cities. **Mr. Sudhendu J. Sinha, Former Advisor, NITI Aayog**, underscored the need for harmonised national–state policy alignment, clear legislative authority for cities, and data-driven decision-making for LEZ enforcement. **Mr. Virinder Sharma** highlighted the crucial role of integrated, technology-enabled enforcement systems, particularly Automatic Number Plate Recognition (ANPR) and VAHAN connectivity, and on the importance of a nodal agency to address fragmented jurisdiction and ensure sustained compliance. **Mr. Abhishek Kumar** brought a strong public health perspective, presenting medical evidence of lung impairment among non-smokers and emphasising that LEZs must be framed as health-protection zones to build public support. **Ms. Anumita Roychowdhury, Executive Director (Research and Advocacy), CSE**, stressed that LEZs should be part of a broader sustainable mobility transition, backed by robust public transport systems, parking reform, and equitable measures for vulnerable commuters. **Dr. Anju Goel, Senior Fellow and Associate Director, TERI**, reinforced the scientific basis for LEZs, advocating for hotspot analysis, source apportionment studies, and targeted restrictions on high-emission vehicle categories to maximise air-quality benefits. **Ms. Anupama Saha, Assistant General Manager, Delhi Integrated Multi-Modal Transit System (DIMTS)**, highlighted the importance of integrated data systems and multimodal coordination for ensuring seamless public transport connectivity as a foundational pillar for LEZ effectiveness.

Collectively, the speakers highlighted that LEZs are not just vehicle-control measures but multi-dimensional governance instruments requiring coordinated institutions, advanced monitoring technology, public transport readiness, regulatory clarity, and a strong health-centered communication strategy.

SESSION 2: ROUND TABLE ON TRANSLATING POLICY INTO PRACTICE: PERSPECTIVES ON LEZ IMPLEMENTATION

The second session brought together city officials, public transport representatives, enforcement agencies, experts from civil society and research organisations to share practical lessons on implementing LEZs across Indian cities. UITP India team opened the session with a presentation on its LEZ research work in the three partner cities of Mysuru, Kochi, and Bengaluru, outlining key analyses such as delineated site area, data insights and proposals, mobility initiatives and enforcement readiness. The presentation was followed by a round table discussion on the theme of the session. The round table graced speakers including **Mr. Biju Isac, Regional Transport Officer (RTO), Motor Vehicles Department, Kerala; Mr. Gokul T.G., Additional General Manager (Urban Transport), Kochi Metro Rail Limited (KMRL);**

Ms. Devi Shree, Assistant Engineer, Kochi Municipal Corporation; Mr. Navneet Chaudhary, Deputy Chief General Manager (Traffic), Delhi Transport Corporation (DTC); Ms. Anumita Roychowdhury; Dr. Anju Goel; Mr. Parin Visariya, Programme Manager – Inclusive Compact Cities, ITDP; Ms. Kanika Gounder, Senior Program Associate – Electric Mobility, WRI; Mr. Arpan Patra, Programme Associate, Council on Energy, Environment and Water (CEEW); and Mr. Vaibhav Kush, Researcher, ICCT who collectively discussed on operational challenges, technology readiness, parking reforms, freight management, EV integration, and evidence-based approaches required to translate LEZ concepts into practical city-level actions.

SESSION 1A: PANEL DISCUSSION ON ENABLING LOW EMISSION ZONES: REGULATORY FRAMEWORKS AND GOVERNANCE ENABLERS AND SESSION 1B: FIGHTING AIR POLLUTION IN DELHI: TOWARDS SUSTAINABLE AND HEALTHY SOLUTIONS

Dr. Virinder Sharma - Member (Technical), CAQM, Government of India delivered a detailed, ground-level perspective of the complexities of implementing LEZs in Delhi National Capital Region (NCR) and similar Indian megacities. He framed LEZs as governance instruments that must balance scientific evidence, technological capability, public mobility needs, and socio-economic realities. He stressed that Delhi's unique winter inversion, dense urban form, and multi-jurisdictional administrative layers make enforcement far more challenging than in European cities. Drawing from CAQM's coordination experience, he highlighted how non-destined vehicles particularly heavy goods vehicles continue entering restricted areas due to weak monitoring at peripheral entry points. This, he argued, underscores the need for integrated ANPR, RFID-based checkpoints, and seamless linkage with VAHAN for real-time compliance verification.

Dr. Sharma placed particular emphasis on foundational enforcement and mobility systems. Without strong parking management, improved last-mile connectivity, reliable public transport, and digital enforcement, LEZs risk becoming symbolic rather than impactful. He cautioned against over-reliance on technology without institutional readiness, noting that "gaps between technological capability and administrative alignment" undermine the very purpose of LEZs. One of his strongest point of views centred on equity. India's legacy fleet comprising nearly 92 million older vehicles, especially two-wheelers, supports the livelihood of delivery workers, commuters, and small businesses. Imposing immediate bans on vehicles, he explained, could disproportionately harm economically vulnerable groups. Therefore, LEZs must integrate scrappage schemes, Electric Vehicle (EV) financing support, and phased restrictions.

He concluded by advocating outcome-based governance, where success is measured in pollution reduction rather than number of challans, cameras, or enforcement drives. His message reinforced that LEZs must be designed as multi-layered transformations involving legal authority, infrastructure readiness, data systems, and behavioural shifts, not just regulatory announcements.

> *"Our LEZ needs to be both ambitious, but practical and realistic to Indian conditions" - Dr. Virinder Sharma*

Mr. Sudhendu J. Sinha, – Former Advisor, NITI Aayog positioned LEZs within India's broader national development agenda, describing them as instruments that advance clean mobility, reduce congestion, protect public health, and support climate goals. He stated that LEZs cannot be implemented as isolated restrictions; they must be integrated into a city's long-term urban planning and mobility restructuring. He highlighted the dangers of relying on stringent mandates, noting that abrupt restrictions can provoke public resistance, administrative pushback, and political complications. Instead, he advocated for gradualism through strategic "nudges," pilot demonstrations, and consensus-building.

Mr. Sinha emphasised the need for developing few "lighthouse LEZ cities" that could be well-designed, visible models to demonstrate tangible benefits. The showcase areas can catalyse public support, help refine enforcement models, and build administrative confidence. He suggested that clear goals and milestones such as

phased emission targets or zone expansions, provide direction and stability to the LEZ journey. Recognising India's diverse urban landscape, he mentioned that Tier-2 and Tier-3 Indian cities, with their relatively manageable scales and emerging mobility pressures, are excellent sites for early LEZ adoption. Such cities can pioneer locally suitable regulatory frameworks, test enforcement systems, and build acceptance before megacities like Delhi implement large-scale LEZs.

He also highlighted the importance of aligning national, state, and local governance mechanisms. LEZs must be backed by legal clarity, enabling notifications, sustainable funding models, and cross-sector institutional coordination. Ultimately, Mr. Sinha framed LEZs not just as environmental policies but as essential tools for shaping healthier, people-centric urban environments.

> *"Cities need lighthouse zones that clearly demonstrate the real benefits of cleaner air." - Sudhendu J. Sinha*

Ms. Anumita Roychowdhury - Executive Director (Research and Advocacy), CSE Ms. Roy Chowdhury contextualised LEZs within India's broader mobility crisis, arguing that restrictive measures alone cannot generate sustained improvements unless mobility choices fundamentally shift. She presented an evidence-based analysis demonstrating that a significant proportion of trips in Indian cities can be met through public transport, walking, and cycling. Her key message was that LEZs must be expansionary expanding mobility options not merely restrictive. She highlighted that India's over-dependence on private vehicles stems from inadequate street design, lack of pedestrian facilities, unsafe cycling conditions, unreliable bus services, and unregulated parking. In her opinion, LEZs must address these structural barriers. She advocated for integrating LEZs with pedestrianisation, complete-street design, transit priority corridors, rationalised parking fees, and electric bus adoption. Without this integrated approach, LEZs risk being labelled anti-poor or anti-mobility.

She recommended micro-LEZ pilots in Indian Tier-2 and Tier-3 cities where congestion is rising but not yet entrenched so that cities can prevent a Delhi-like crisis rather than cure one. These smaller cities offer an opportunity to test governance, enforcement, communication, and design frameworks. Her key highlight was that LEZs must prioritise accessibility, equity, and mobility efficiency. Enforcement without mobility alternatives will generate backlash, but LEZs anchored in better public transport, safer streets, and cleaner vehicles can transform public behaviour and city form.

> *"LEZs must be embedded in broader mobility reforms, not imposed in isolation." - Anumita Roychowdhury*

Dr. Anju Goel - Associate Director, TERI focused on the governance and financing ecosystem required for LEZ to be successfully implemented. She explained that although Indian cities receive significant funding through National Clean Air Programme (NCAP), Finance Commission grants of Government of India, and urban development schemes, fund utilisation remains low and skewed towards monitoring infrastructure rather than mitigation. She mentioned that LEZ implementation requires cities to shift from "measurement-heavy governance" to "action-oriented governance." She stressed that air quality is multi-sectoral, spanning transport, waste, industry, construction dust, and urban design, so cities must create converged planning frameworks that unify departmental budgets and programmes. Dr. Goel also highlighted the importance of capacity-building within municipal corporations, particularly in project design, emissions assessment, data interpretation, and financial management.

She shared her insights on options of exploring innovative financing models such as green municipal bonds, climate funds, and blended finance for EV transitions. However, she cautioned that cities should not pursue such instruments prematurely, unless they can identify emissions sources, design targeted interventions, and ensure transparent monitoring, these financing tools will not deliver results.

A key part of her contribution was the emphasis on data governance. She urged for a central, government-led unified air-quality data platform that integrates transport, emissions, enforcement, and land-use information. Such systems help cities prioritise zones, track compliance, and communicate transparently with citizens.

> *"Across cities, fund utilisation has been suboptimal, with money largely channelled into monitoring rather than concrete implementation." - Dr. Anju Goel*

Mr. Abhishek Kumar - CEO and Co-Founder, Lung Care Foundation brought a powerful health narrative to the session, anchoring the LEZ discussion in the lived human consequences of unsafe air. He explained that while LEZs are often discussed in technical or regulatory terms, their true value lies in preventing severe long-term health damage, reduced lung capacity, childhood asthma, cardiac issues, and early mortality. He shared clinical evidence from the Foundation's work, including lung images showing black carbon deposits in non-smokers and children. These visuals, he argued, help people emotionally grasp the severity of pollution. He highlighted that India's population breathes 20,000–30,000 times daily, meaning pollution exposure is constant and unavoidable. His widely publicised analogy of equating Delhi's PM2.5 exposure to "smoking 20 cigarettes a day" was presented as an example of how simple communication can bridge the gap between science and public understanding.

He particularly emphasised the plight of frontline workers like rag pickers, sanitation workers, delivery agents, and traffic police who are exposed the most but lack protective gear or medical support. He urged integrating LEZs with worker protections such as Personal Protective Equipment (PPE), awareness campaigns, medical screenings, and welfare schemes. His message was unequivocal: LEZs should be designed and communicated as urgent public-health interventions. Health-based narratives, he argued, generate far higher social acceptance than technocratic or punitive messaging.

> *"We breathe more than 20,000 times a day. Why don't we question what we breathe?" - Abhishek Kumar*

SESSION 2: ROUND TABLE : "TRANSLATING POLICY TO PRACTICE: PERSPECTIVES ON LEZ IMPLEMENTATION"

SETTING THE CONTEXT: UITP INDIA'S LEZ PROJECT JOURNEY

The session began with UITP India presenting a comprehensive overview of its ongoing Low Emission Zone (LEZ) project, providing a detailed account of the project's objectives, phases, methodologies, and city-level engagements. The presentation highlighted the journey so far, including stakeholder consultations, regulatory assessments, hotspot analysis, and evaluations of freight and passenger mobility patterns. In addition, the readiness of enforcement systems was assessed to understand the practical feasibility of LEZ implementation. UITP emphasised a multi-disciplinary approach that integrates air quality improvement, traffic management, public transport strengthening, and long-term environmental sustainability, underlining the need for collaborative action across multiple urban governance and transport stakeholders.

The proposals for each partner city of Mysuru, Kochi, and Bengaluru were tailored to their unique urban contexts, reflecting different strategic approaches.

- In Mysuru, the focus was around the Mysuru Palace area, a compact and dense heritage-cum-commercial zone that makes the city well-suited for early adoption of LEZ measures. The proposed interventions include restrictions on older two-wheelers and goods vehicles, regulating tourist bus entry into the core, and redefining parking fees to prioritise public transport and pedestrianisation. The relatively smaller scale and manageable traffic volumes allow for a more focused and rapid implementation, enabling Mysuru to act as a pilot for scalable LEZ measures.
- Kochi's proposal concentrated on its Central Business District (CBD), particularly around the High Court and Mahatma Gandhi Road corridors, which experience high air quality stress. The approach here is distinctly different, emphasising multimodal integration, pedestrianisation pilots, and temporal restrictions for older diesel light commercial vehicles and goods transport. Strengthening connections between metro and bus services is a core component, reflecting the city's reliance on diverse transport modes and the need to enhance sustainable mobility options while reducing congestion and emissions.

- In Bengaluru, given its scale and complex urban dynamics, the UITP team focused on a phased approach within the CBD as the initial focus. The stratergies targeted freight movement, older commercial vehicles, and parking management around key commercial areas. LEZ enforcement is planned to be embedded within the Bengaluru Traffic Police command systems, leveraging technology such as ANPR and digital challans to ensure compliance. Unlike Mysuru or Kochi, the city-wide scale of Bengaluru necessitates incremental implementation, with lessons learned from the CBD phase informing expansion to other urban zones.

Finally, UITP outlined a structured framework defining stakeholder roles and responsibilities. Regulators such as State Pollution Control Boards and Transport Departments would define emission standards, legal powers, and compliance frameworks. Municipal Corporations are expected to manage parking, public space improvements, signage, and local enforcement. Police and RTOs would handle vehicle interception, digital challans, and ANPR monitoring. Public transport agencies are tasked with providing credible alternatives, strengthening last-mile connectivity, and supporting EV transition.

Civil Society Organisations (CSO) and research institutions added critical value to the LEZ discussions by providing data-driven analysis, supporting pilot development, offering behavioural insights, and strengthening communication approaches. Their contributions helped build a solid evidence base and collaborative framework for shaping city-level LEZ proposals into feasible, implementation-ready plans. The session convened mobility experts, CSOs, and city authorities, who together explored the practical, technical, institutional, and equity-focused elements necessary to move LEZ policies from concept to execution. The detailed insights shared by each stakeholder group are outlined below.

1. MOBILITY EXPERTS:

The mobility experts opened the session by sharing the practical realities of LEZ implementation in core transport principles, particularly they focused-on parking management, public transport readiness, and freight movement regulation. Their collective emphasis was that no LEZ irrespective of its regulatory strength, can succeed without restructuring how road space is allocated and how vehicle demand is managed. They highlighted that Indian cities currently suffer from unregulated on-street parking, especially short-duration parking that clogs arterial corridors, increases idling, and creates micro-hotspots of vehicular pollution. They mentioned that dynamic pricing, where charges vary by time, demand and location, must become standard practice. On-street parking, they insisted, cannot remain cheaper than multi-level parking structures; doing so guarantees that structured parking will remain underutilised. Experts further stressed that enforcement contracts must move from simple revenue collection to facility management models, integrating digital platforms, real-time parking availability systems, and transparent user information to transform parking into a core LEZ instrument.

In addition to parking, mobility experts underscored the importance of public transport strength, especially in the context of Delhi's long-term bus electrification targets. They reiterated that last-mile connectivity remains the biggest bottleneck preventing modal shift. Without dense feeder networks, high-frequency bus corridors, and integrated pedestrian–cycling access, citizens will not voluntarily shift away from personal vehicles, even with LEZ restrictions. They also touched upon integrating intermediate public transport (three-wheelers / autos, shared mobility) into LEZ frameworks through cleaner fleet mandates, electrification incentives, and better charging/waiting infrastructure.

Freight management was another critical dimension highlighted in the session. Experts argued that older diesel goods carriers, particularly high-mileage inter-state fleets, contribute disproportionately to PM and NOx emissions. They advocated for restricted entry windows, consolidation hubs at city peripheries, and progressive electrification of last-mile delivery fleets. Technology, they agreed, is the fulcrum that links all these domains, integrated ANPR–VAHAN systems, digital challan workflows, automated vehicle classification, and centralised command centres are essential for building compliance at scale.

2. CIVIL SOCIETY AND RESEARCH ORGANISATIONS

CSOs and research institutions like CSE, TERI, ICCT, ITDP, WRI, and CEEW brought an evidence-driven and public-health-focused lens to the discussion, emphasising that LEZs must be designed not as generic traffic restrictions but as scientifically justified, health-centred interventions. They highlighted that Indian cities cannot replicate European LEZ models due to fundamental differences in density, enforcement capacity, and socio-economic realities. Their analysis from Delhi's New Delhi Municipal Corporation (NDMC) area showed that although commercial vehicles account for only one-third of inflowing traffic, they contribute more than 50% of particulate matter (PM) pollution and over 70% of NOx emissions. This data underscored the need to begin LEZ restrictions by targeting high-emission vehicle categories older commercial fleets, goods carriers, and high-mileage vehicles rather than placing blanket restrictions on general commuters.

The representatives from the CSOs strongly advocated defining LEZ boundaries using air quality hotspot analysis, already mandated under NCAP. Hotspot-based boundaries ensure scientific legitimacy, clearly targeted high-impact corridors, reduced political contestation, and alignment with statutory powers under the Air (Prevention and Control of Pollution) Act. Research organisations also emphasised the importance of transparent public dashboards, where citizens can view real-time pollution levels, compliance rates, and progress reports. Such communication builds trust, counters misinformation, and shifts public perception of LEZs from punitive measures to health-protection strategies.

One of the most powerful interventions was from organisations studying driver behaviour and gig-economy mobility. They warned that LEZs risk disproportionately impacting delivery workers, auto drivers, and small traders who depend on older two-wheelers or goods vehicles for livelihoods. Therefore, any LEZ framework must embed equity safeguards scrappage incentives, EV financing support, subsidised public transport options, and phased compliance timelines. One of the CSO introduced its Pimpri-Chinchwad pricing-based LEZ model, where non-compliant vehicles pay daily charges (Rs. 100–Rs. 750 depending on category), with revenues ring-fenced for public transport and EV transition. This alternative, they argued, offers a more socially acceptable pathway that avoids the disruption of outright bans. Collectively, CSOs asserted that evidence, transparency, and equity are the pillars of lasting LEZ acceptance.

3. CITY STAKEHOLDER REPRESENTATIVES

Officials from partner cities of Kochi and Mysuru, representing transport departments, and enforcement agencies provided on-ground realities operational perspectives shaped by day-to-day realities of governance, infrastructure, and political cycles. Their insights revealed both the readiness and the vulnerabilities of Indian cities in adopting LEZ frameworks. Officials from Mysuru highlighted the city's unique suitability for early LEZ implementation, especially in its compact and heritage-sensitive Mysuru Palace Area. They described opportunities to regulate tourist bus entry, restrict older two-wheelers and goods vehicles, and redesign parking to prioritise pedestrians and public transport. With manageable traffic volumes and stable administrative support, Mysuru positions itself as a potential Indian Tier-2 city that could pioneer LEZ implementation.

Kochi's representatives shared a contrasting picture one of strong technical initiatives but vulnerable to political turnover. The city has undertaken drone-based corridor surveys, initiated pedestrianisation pilots, and conducted detailed assessments around the CBD and High Court area. But these advances have slowed due to leadership changes. Their experience illustrated how institutional continuity, rather than technical capacity, often determines the pace of LEZ progress. KMRL added that multimodal integration metro, bus, ferry, and feeder services is essential to support any LEZ restrictions in Kochi's dense urban core area.

RTO and enforcement representatives, especially from Kerala's Motor Vehicles Department, brought forward stringent lessons on compliance. They detailed crackdowns on end-of-life vehicles, fraudulent Pollution Under Control (PUC) certificates, illegal re-registrations, and reiterated that LEZ success is impossible without a digital-first enforcement backbone. Cities must adopt ANPR–VAHAN integration for vehicle age and emission verification, automated

violation management, and shared access to databases among police, municipal bodies, and pollution control boards. Officials also highlighted neglected issues such as inadequate toilets, rest areas, and welfare facilities for truck drivers as factors that shape compliance behaviours and must be addressed for fairness and operational feasibility. Their collective message was clear that LEZs must be embedded in institutional reform, inter-agency coordination, political stability, and human-centred implementation.

KEY TAKEAWAYS FROM THE SESSIONS

1. **Health-based Framing and Public Acceptance:** A central takeaway was that LEZs must be positioned foremost as health-protection zones, not as traffic restriction schemes. Experts stressed the power of clinical evidence especially lung imagery and relatable analogies such as "cigarette-equivalent exposure" to communicate the urgency of air pollution. Health-based framing significantly improves public acceptance and creates moral legitimacy for vehicle restrictions, making LEZs a socially resonant and politically defensible intervention.
2. **Robust Enforcement and Foundational Systems:** Participants agreed that LEZs cannot succeed without strong foundational enforcement systems. Key requirements include integrated ANPR–VAHAN networks, remote sensing for on-road emissions, structured parking management, and reliable last-mile public transport. Inadequate foundations lead to enforcement leakage, poor compliance, and weak environmental outcomes. Kerala's digital-first enforcement model was frequently cited as a practical benchmark for Indian cities.
3. **Parking Management as a Core Enabler:** Unregulated, cheap on-street parking continues to fuel congestion, idling, and hotspot pollution directly undermining LEZ objectives. Cities must adopt dynamic, differential pricing, making on-street parking costlier than off-street, and redesign enforcement contracts to focus on digital facility management. Reclaiming street space for walking, cycling, and public transport is essential to enable modal shift and reduce non-essential traffic entering LEZs.
4. **Scientific, Hotspot-Based LEZ Boundary Planning:** Defining LEZ boundaries using NCAP air-quality hotspot diagnostics ensures scientific credibility and maximises pollution reduction. Hotspot-based zones minimise political resistance, clearly target critical corridors, and align with statutory powers under the Air (Prevention and Control of Pollution) Act. This approach turns LEZs into outcome-driven interventions rather than administratively convenient boundaries.
5. **Public Transport Strengthening and Last-Mile Connectivity:** LEZ effectiveness depends on offering practical mobility alternatives to private vehicle users. Cities must prioritise public transport frequency, depot readiness (especially for e-buses), and seamless last-mile connectivity through autos, e-rickshaws, and shared mobility. Without dependable multimodal options, behavioural shift becomes infeasible, and LEZ compliance cannot be sustained.
6. **Digital Enforcement and Institutional Coordination:** A digital-first enforcement framework is essential for scalable, consistent LEZ operations. ANPR-linked vehicle identification, automated challan processing, and centralised command centres enable transparent and real-time monitoring. However, cities must also resolve legacy data gaps and clearly define enforcement responsibilities across police, RTOs, municipal bodies, and Pollution Control Boards. Multi-agency coordination remains a structural requirement for LEZ success.
7. **Technology as the Operational Backbone:** Cities were encouraged to adopt unified technological ecosystems integrating ANPR feeds, Geographical Information System (GIS) based LEZ boundary monitoring, real-time vehicle databases, and public pollution dashboards. Automated workflows reduce human error and build transparent enforcement. Public dashboards showing air quality trends, compliance rates, and vehicle patterns are vital for building trust and demonstrating measurable progress.
8. **Equity, Social Inclusion and Transition Support:** LEZs can disproportionately affect low-income riders, gig workers, and delivery operators who rely on older two-wheelers or commercial vehicles. The session emphasised equitable transition mechanisms, scrappage incentives, affordable EV financing, subsidised public transport, and phased compliance timelines. Driver welfare infrastructure (clean toilets, rest areas, safe waiting zones) must be integrated into LEZ plans to ensure fair and practical implementation.
9. **Evidence-Based, Targeted Restrictions:** Experts advocated for targeted LEZ measures based on emission-weighted data rather than blanket bans. Older commercial vehicles, high-mileage fleets, and

diesel goods carriers contribute disproportionately to PM and NOx emissions and should be prioritised in early phases. Transparent reporting mechanisms enhance policy legitimacy and help balance political and public expectations.

10. **Pricing-Based LEZ Models:** Pricing mechanisms were highlighted as a flexible, scalable, and socially acceptable alternative to restrictive bans. Daily environmental charges for non-compliant vehicles can regulate entry while generating revenue to reinvest in public transport, EV infrastructure, and pedestrianisation. Such models require legal backing through Pollution Control Boards under the Air (Prevention and Control of Pollution) Act.
11. **Governance Leadership, Institutional Alignment and Capacity Gaps:** LEZs are inherently multi-agency interventions requiring strong governance architecture. Cities need nodal authorities, converged planning across transport and environment departments, and outcome-based monitoring frameworks. Capacity building is crucial not just for monitoring but for problem-solving, fund utilisation, and cross-sector coordination. Financial tools like green municipal bonds are promising but require technical readiness and robust data systems.
12. **Phased Implementation and Pilot Micro-LEZs:** Participants strongly recommended starting LEZ implementation with micro-pilots around schools, markets, heritage precincts, or CBD blocks particularly in Tier 2 and Tier 3 cities in India. Phased deployment helps refine enforcement systems, communications strategy, and transition mechanisms before scaling to larger zones. Early pilots also help cities demonstrate quick wins and build public confidence.

CONCLUSION

LEZs represent a transformative approach to urban mobility and air quality management, offering Indian cities a strategic pathway to address the dual challenges of rising vehicular pollution and public health risks. The workshop underscored that successful LEZ implementation requires more than regulatory enforcement, it demands integrated governance, robust public transport systems, equitable transition support, and strong health-centred communication. By prioritizing scientific hotspot-based planning, digital enforcement, and inclusive mobility alternatives, LEZs can catalyse sustainable urban transformation, balancing environmental protection with social equity and economic vitality. Ultimately, LEZs in India should not be merely treated as traffic restrictions but multi-dimensional instruments for building healthier, more resilient cities where cleaner air and accessible mobility go hand in hand.

[i] https://www.who.int/teams/environment-climate-change-and-health/air-quality-energy-and-health/health-impacts/exposure-air-pollution?utm_source=chatgpt.com

[ii] https://cpcbccr.com/#:~:text=Did%20You%20Know?,4%C2%B0C%2C%20worsening%20heatwaves.

[iii] https://www.eea.europa.eu/en/analysis/publications/managing-air-quality-in-europe?utm_source=chatgpt.com

[iv] https://www.eea.europa.eu/en/analysis/publications/managing-air-quality-in-europe#:~:text=The%20most%20common%20measures%20adopted,and%20modal%20shifts%20in%20transport

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