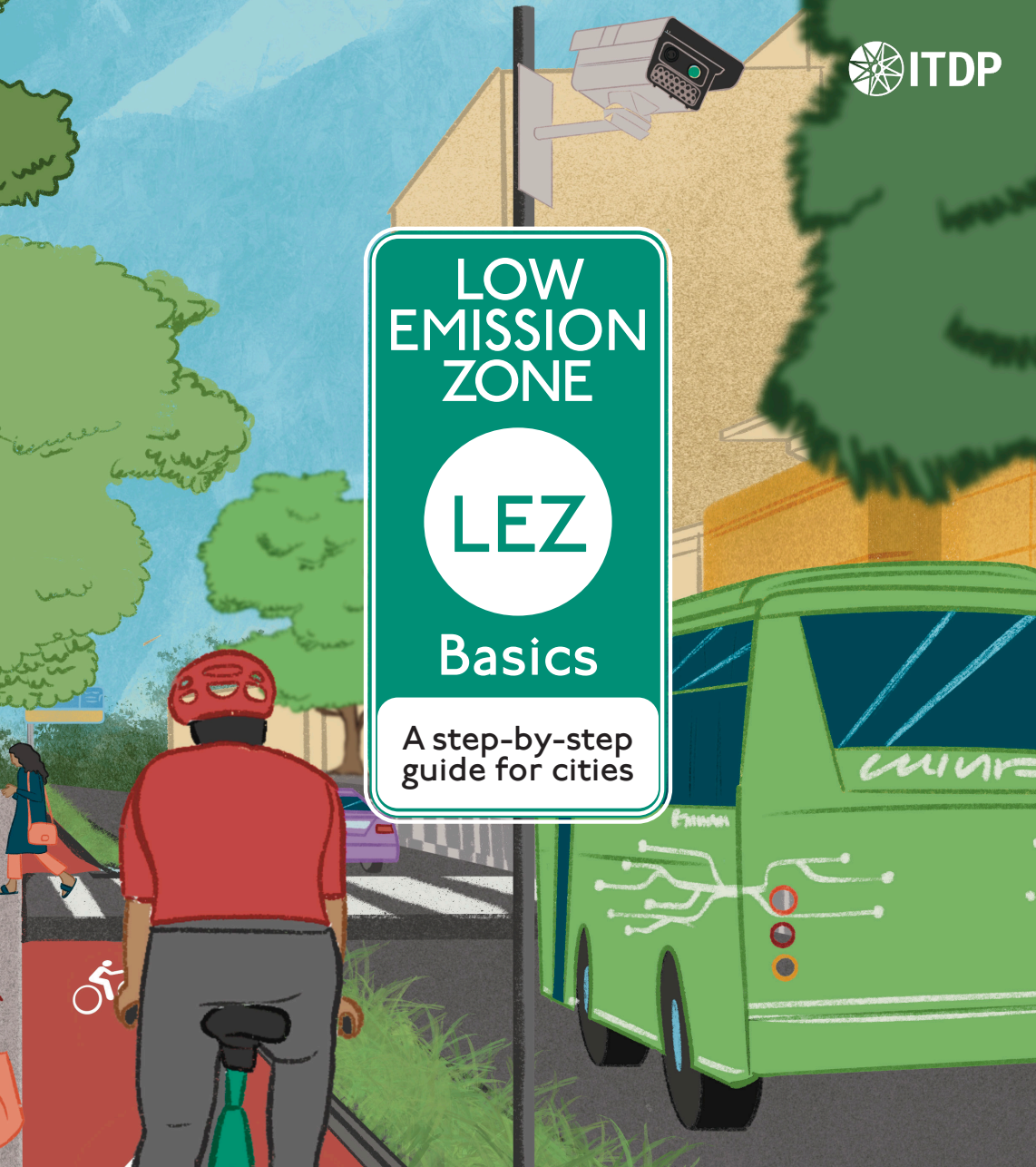
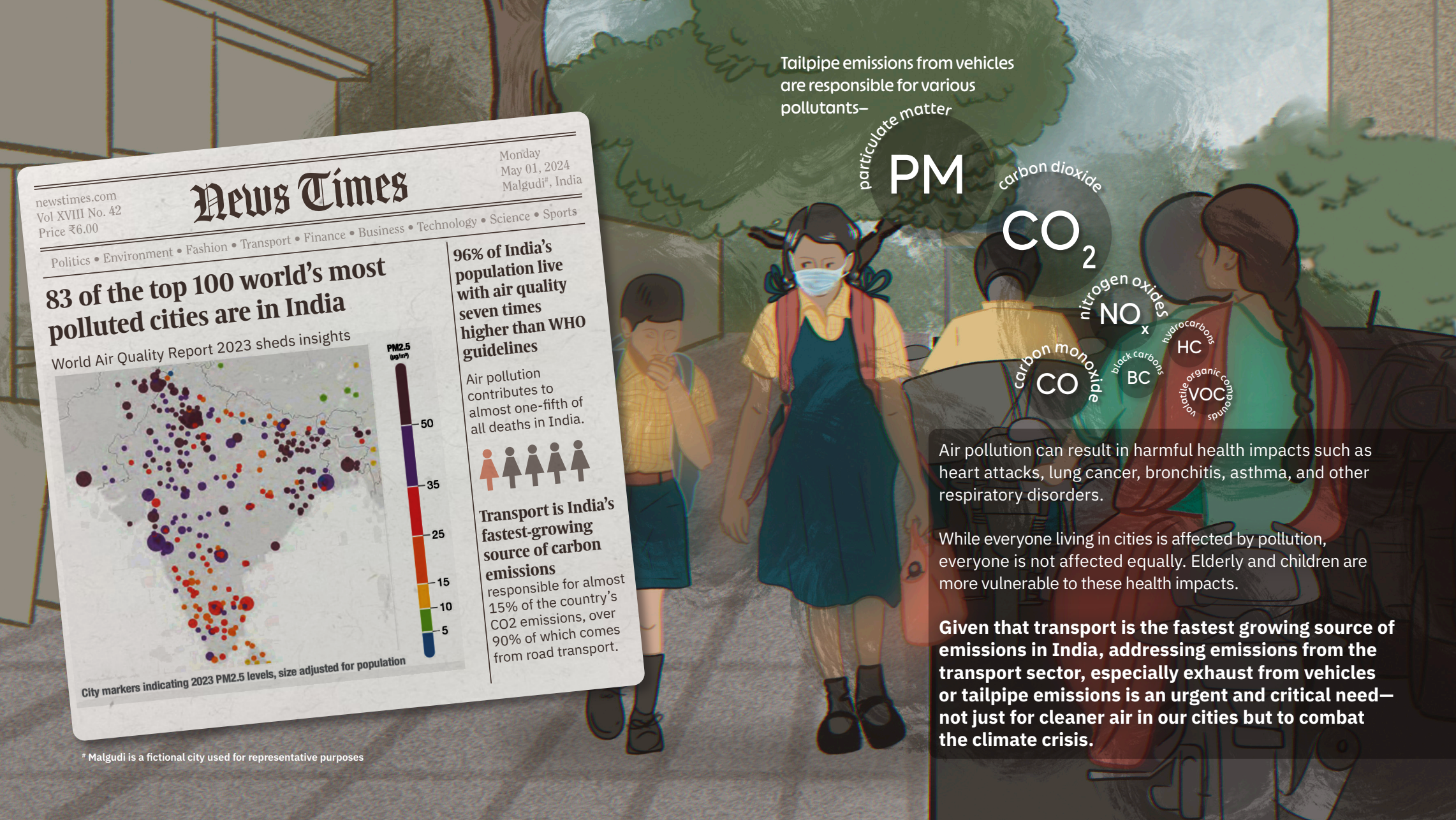

ITDP
LOW EMISSION ZONE
LEZ
Basics
A step-by-step guide for cities




# Malgudi is a fictional city used for representative purposes

# What can cities do to cut down tailpipe emissions?

**Accelerate a shift to**

**Alternative less polluting modes** & **Zero tailpipe emission vehicles**

- Create safe infrastructure for walking and cycling
- Create well-connected, frequent, and reliable public transport networks
- Encourage the use of shared transport modes

- Increase availability of charging infrastructure
- Provide incentives for using zero tailpipe emission vehicles
- Encourage scrapping of older polluting vehicles

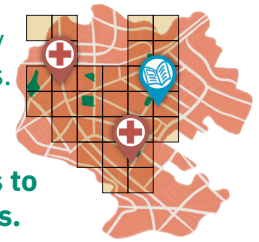
## ✓ Create Low Emission Zones

**Low Emission Zones or LEZs can be a powerful strategy for cities to restrict the use of polluting vehicles, reduce tailpipe emissions, and accelerate a shift to cleaner vehicles.**

# So, what are LEZs?

LEZs are **designated areas** of the city **that restrict or completely ban** the movement of **polluting vehicles** to improve air quality.

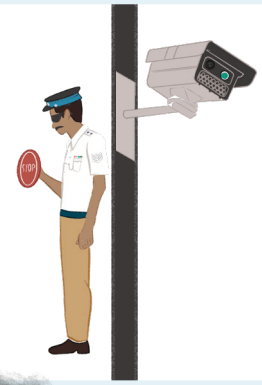
The concentration of pollution is not equally severe across all areas. **Prioritise areas with higher density of hospitals and schools to maximise the benefits.**



**Would this not increase pollution in other areas as vehicles move there?**

Eventually, the entire city should become an LEZ to be impactful. **Start with parts of the city and scale up in a phased manner to give people time to adapt to the restrictions.**

Restrictions on the most polluting vehicles can accelerate a shift to cleaner vehicles and other alternative modes. **Enforce the restrictions strictly to ensure impact.**



**But if vehicles are restricted, how will people move?**

Cities should ensure people's access to mobility is not impacted. **To mitigate the impact, include citizens in decision-making, provide exemptions for specific groups, and ensure high-quality alternatives are available for people to move.**

All modes do not pollute equally. **Restrict the most polluting vehicles first to maximise impact.**

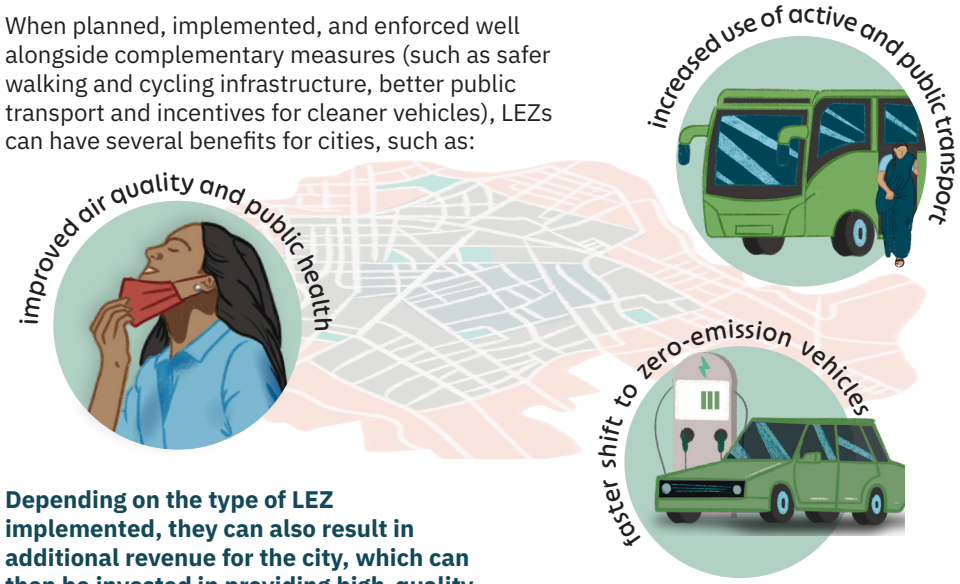
**What about people who own polluting vehicles?**

Not everyone can afford to immediately shift to newer, cleaner vehicles. **Provide a transition period and targetted incentives and subsidies to support this transition.**

**Well-planned implementation of LEZs can improve people's mobility and result in several benefits for cities.**

# What are the benefits of LEZs for cities?

When planned, implemented, and enforced well alongside complementary measures (such as safer walking and cycling infrastructure, better public transport and incentives for cleaner vehicles), LEZs can have several benefits for cities, such as:




**Depending on the type of LEZ implemented, they can also result in additional revenue for the city, which can then be invested in providing high-quality sustainable transport initiatives.**

# What are the types of LEZs?

LEZs can have different types, sizes, and strategies for restrictions, and may have different names—
*Clean Air Zones, Clean Mobility Zones, Green Zones, Limited Traffic Zones, Low Emission Mobility Zones, Healthy Air Zones.*

Some cities have implemented temporary restrictions—such as odd-even schemes, time-based restrictions on freight vehicles, or restrictions only during periods of high pollution. However, to be impactful, LEZs have to be created as permanent city-wide measures, not stopgap arrangements.

**Cities can choose between two types:**

| **Factors to consider** while choosing between the approaches | **Priced LEZs** charge polluting vehicles a fee to enter based on the 'Polluter pays' principle. *E.g. London, Delhi* | **Non-priced LEZs** ban the most polluting vehicles. If polluters enter, they pay a heavy fine. *E.g. Seoul, Paris* |
|---|---|---|
| **Pollution Reduction**  | ★☆☆ Polluting vehicles can still pay the fee and enter the zone. The fee should be high enough to discourage polluting vehicles. | ★★★ Since entry is banned, it can accelerate the shift to cleaner vehicles or alternatives like walking, cycling, and public transport. |
| | **Non-priced LEZs are more impactful because they completely restrict the most polluting vehicles. However, hybrid models like in Antwerp can be considered where some vehicle categories can enter by paying a fee, while others are restricted.** | |
| **Revenue**  | ★★★ Priced LEZs can generate more revenue since non-compliant vehicles will be charged a fee each time they enter the zone. | ★☆☆ Revenue generated is lesser since non-compliant vehicles are not allowed and the fee should be set high enough to discourage entry. |
| | **Revenue generated from the fee/fine can be invested to improve walking, cycling, and public transport infrastructure and provide incentives for cleaner vehicles.** | |

# How can cities create LEZs?

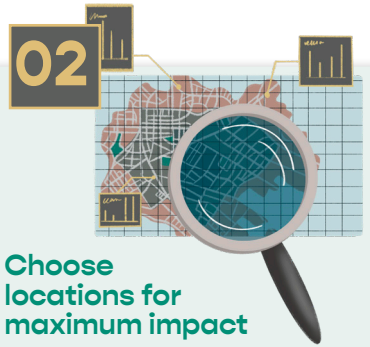
Cities can create LEZs by following these steps:

01

## Set ambitious targets for vehicle emission reduction

- Who is polluting and how much?
- Which types of vehicles should be restricted?

02



## Choose locations for maximum impact

- Which areas should be prioritised?
- Where should restrictions be applied?

03


## Develop effective strategy for implementation

- Should the LEZ be priced or non-priced?
- When should the LEZ be in operation?
- How much should the fee/fine be?

04

## Choose a robust enforcement method

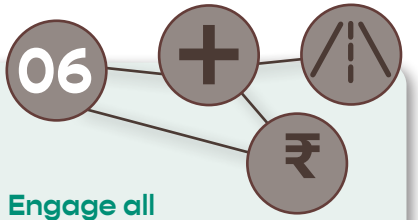
- How are vehicles charged a fee?
- How are violations detected?
- What technology is required to ensure seamless operations?

05

## Build strong support

- Whose support is required?
- What are the means to garner support?
- What should the message be?
- How can legal hurdles be overcome?

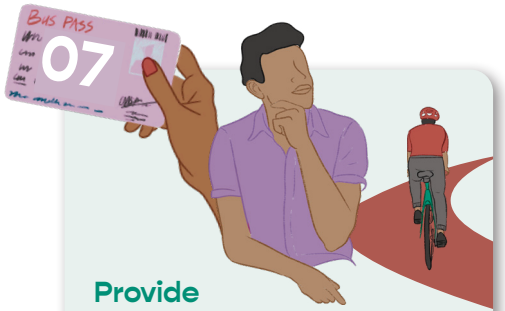
06




## Engage all relevant institutions

- Who will implement low emission zones and how?
- Which public institutions must be engaged?
- Does the private sector have a role? What should the terms be?

07




## Provide complementary measures

- How can cities reduce pushback?
- What measures can help citizens adapt to the restrictions?

08


## Measure the right indicators

- Which indicators can show the impact of the intervention?

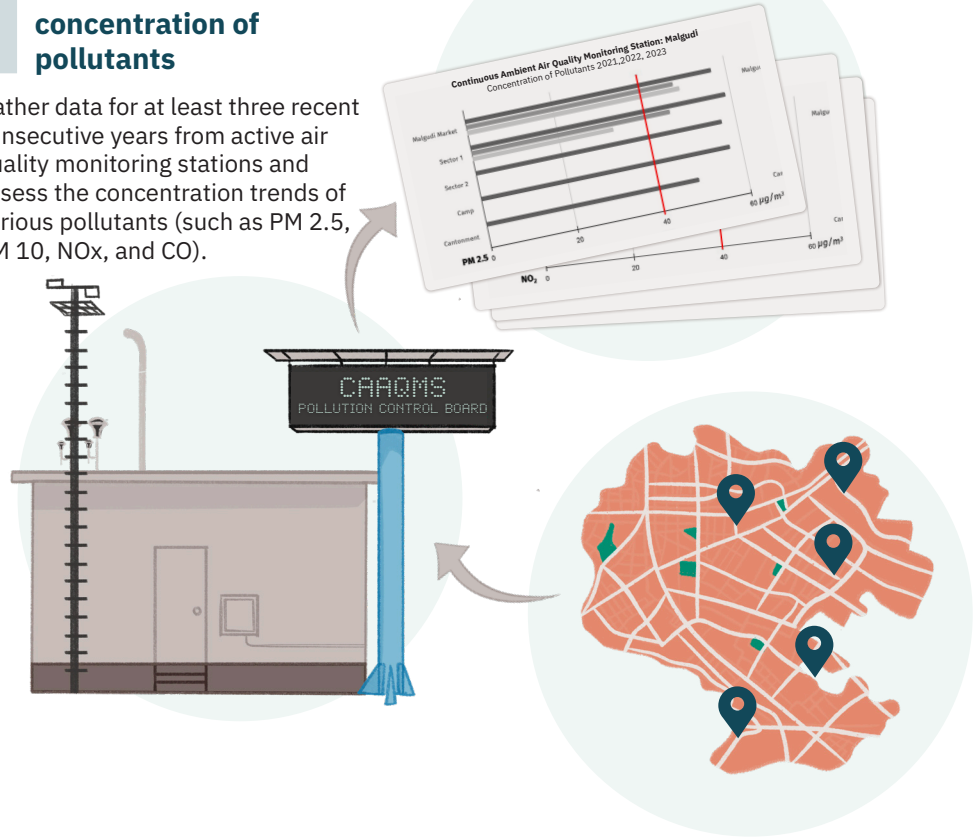
STEP 01 LEZ

# Set ambitious targets for vehicle emission reduction

Understanding the scale of the problem and the specific contribution of vehicle emissions can inform the development of targetted restrictions for the most polluting vehicles. It will also help form a baseline to assess their impact.

## 1 Assess concentration of pollutants

Gather data for at least three recent consecutive years from active air quality monitoring stations and assess the concentration trends of various pollutants (such as PM 2.5, PM 10, NOx, and CO).



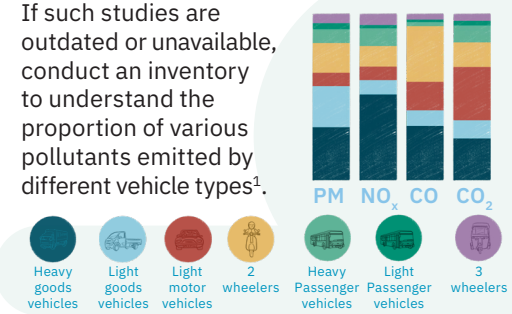

## 2 Estimate tailpipe emissions of different vehicle types

### a Refer to existing emission inventories

Refer to recently conducted studies identifying various sources of air pollution and the extent of their contribution.


### b Conduct city-wide vehicle emission inventory

If such studies are outdated or unavailable, conduct an inventory to understand the proportion of various pollutants emitted by different vehicle types[1].

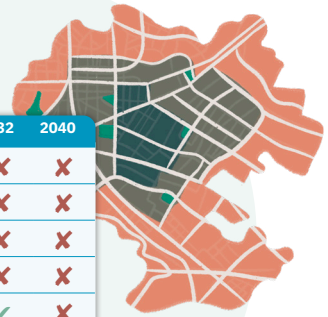



Cities can also use advanced remote sensing methods for real-time measurement of tailpipe emissions. However, such methods can be cost-intensive.

## 3 Set targets for vehicle emission reductions

Based on the sources identified, set targets with timelines for phasing out polluting vehicles of different types.

| Type | 2024 | 2025 | 2026 | 2030 | 2032 | 2040 |
|---|---|---|---|---|---|---|
| BS I | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| BS II | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ |
| BS III | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ |
| BS IV | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ |
| BS VI | ✓ | ✓ | ✓ | ✓ | ✓ | ✗ |
| Electric | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |



[1]*As per Central Pollution Control Board (CPCB) methodology*

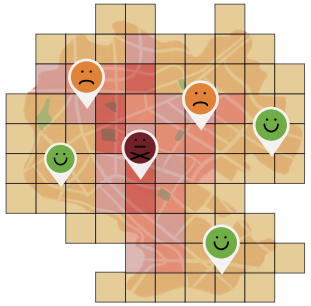
STEP 02 LEZ

# Choose locations for maximum impact

City-wide LEZs are the most effective in discouraging polluting vehicles and accelerating the shift to cleaner vehicles. But cities can identify priority areas to start implementation, and create a roadmap to gradually scale up across the city.

## 1 Identify highly polluted areas

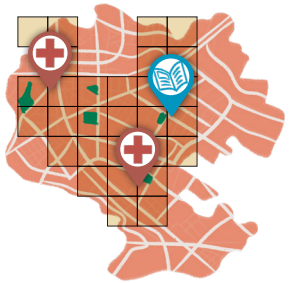
Based on the assessment of pollutants, map the concentration of various pollutants (such as PM 2.5, PM 10, NOX, and CO)* across the city using a square grid, preferably 2X2 km. Identify the locations with pollution levels above permissible limits. Some cities may exceed these limits in all areas.



* Vehicle emissions are more responsible for pollutants like NOx and CO at the local level.

## 2 Identify areas with maximum potential impact

Maximise the benefits of the LEZ by identifying areas with high population density, schools, and hospitals to benefit more people, especially children and patients. High travel demand (such as the central business district (CBD), markets, and tourist destinations) could also be considered.



## 3 Assess the availability of complementary measures

Identify areas with a higher availability of supporting infrastructure that can provide alternatives—such as walking and cycling infrastructure, electric vehicle charging stations, bus stops, and mass rapid transit stations.

## 4 Define the LEZ boundary

Based on the assessments, select the priority locations for LEZ implementation. Define the boundaries using the existing road network, administrative ward or zone boundaries, or any other physical features such as water bodies. Start with a priority area large enough* to see a change in travel behaviour.

* At least 5 sq. km. where distances are beyond comfortable walking range.

STEP 03 LEZ

# Develop effective strategy for implementation

## 1 Select the LEZ type

Decide whether to implement a priced or a non-priced LEZ depending on acceptability.


## 2 Define the criteria for restrictions

To be most effective, the LEZ should
(i) only allow the least polluting internal combustion engine (ICE) vehicles that meet the most stringent Bharat Stage emission standards (currently BS-VI) and zero emission vehicles;
(ii) be in operation 24X7.

This can gradually be expanded to ban all ICE vehicles (including BS VI) and allow only zero-emission vehicles.

✘ *BS I*
*BS II*

✘ *BS III*
*BS IV*

✔ *BS VI*

✔ *Electric vehicles*

## 3 Decide exemptions

Public buses, emergency vehicles such as ambulances and fire trucks, and utility vehicles like garbage and towing vans can be exempted for a specified period.

Fleet renewal plans should also be developed for transitioning them to clean zero tailpipe emission vehicles.



## 4 Set the fee or fine

If implementing a priced LEZ, set the entry fee for different vehicle types based on various factors—such as:

**size and weight**

**fuel type**

**registration year**

**emission standards**

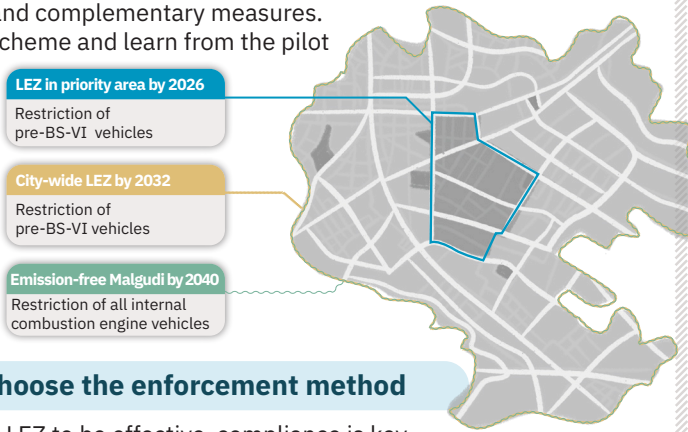



For non-priced LEZs, set the fine for banned vehicles.

Set a fee/fine high enough to discourage entry of non-compliant vehicles. Any revenue generated can be invested in sustainable transport initiatives.

## 5 Set timeline for preparation, rollout, and scale-up

Create a clear phase-wise timeline for the rollout of restrictions and for their subsequent scale-up across the city. Consider preparation time for stakeholder engagement and detailed planning of restrictions and complementary measures. Test the restrictions with a pilot scheme and learn from the pilot before rolling out the final scheme.


## 6 Choose the enforcement method

For the LEZ to be effective, compliance is key. Choose the right method and enforce strictly. Various methods are explained in the next section.

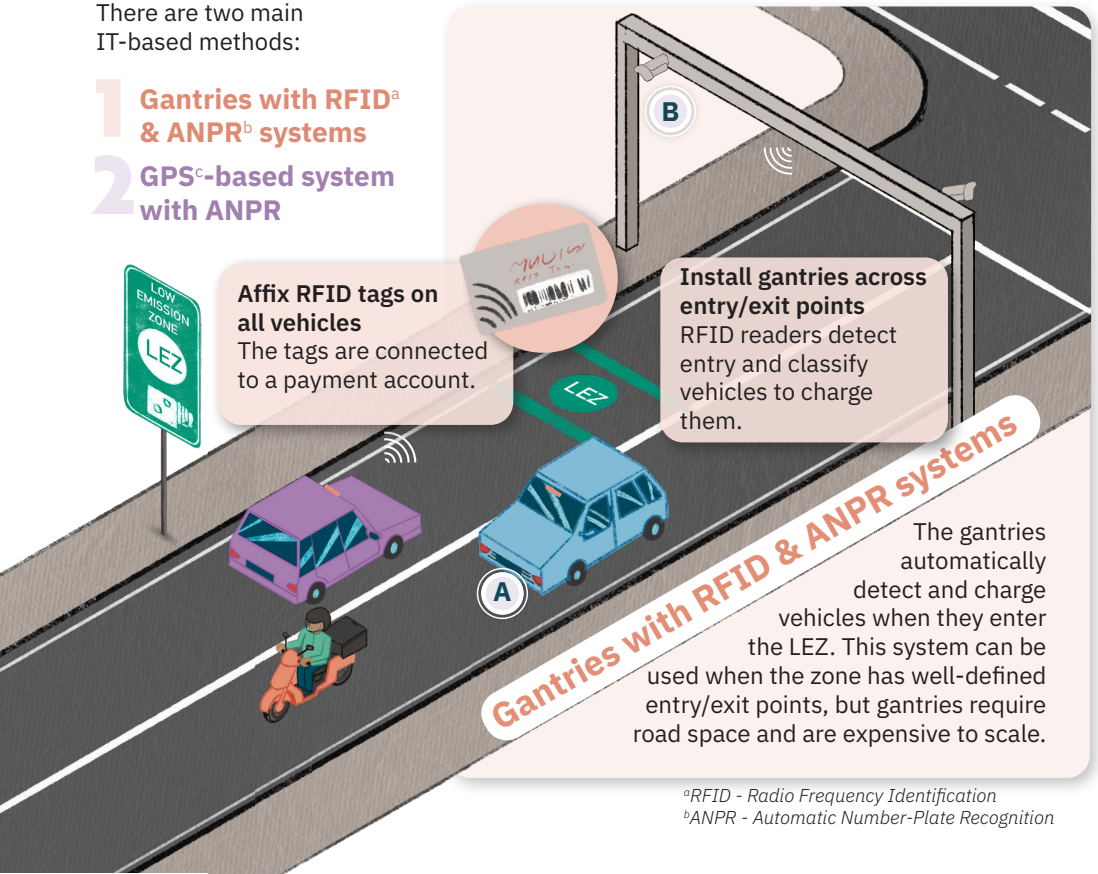
STEP 04 LEZ

# Choose a robust enforcement method

LEZ restrictions can be enforced using manual or information technology-based (IT) solutions. IT-based enforcement is preferred since it is efficient, scalable, and seamless. The data collected can also be used to inform future planning and measure the impact of the LEZ. However, users' personal information should be protected to ensure this data is not misused.

There are two main IT-based methods:

1. **Gantries with RFID[a] & ANPR[b] systems**
2. **GPS[c]-based system with ANPR**




**Affix RFID tags on all vehicles**
The tags are connected to a payment account.

**Install gantries across entry/exit points**
RFID readers detect entry and classify vehicles to charge them.

## Gantries with RFID & ANPR systems

The gantries automatically detect and charge vehicles when they enter the LEZ. This system can be used when the zone has well-defined entry/exit points, but gantries require road space and are expensive to scale.

[a]*RFID - Radio Frequency Identification*
[b]*ANPR - Automatic Number-Plate Recognition*

These actions are common across both the methods:

### Detect and enforce violations

- **A** **Affix standardised number plates on all vehicles:** This enables detection by ANPR system.
- **B** **Install ANPR cameras to identify violations:** ANPR cameras identify the defaulters.

### Establish a control center

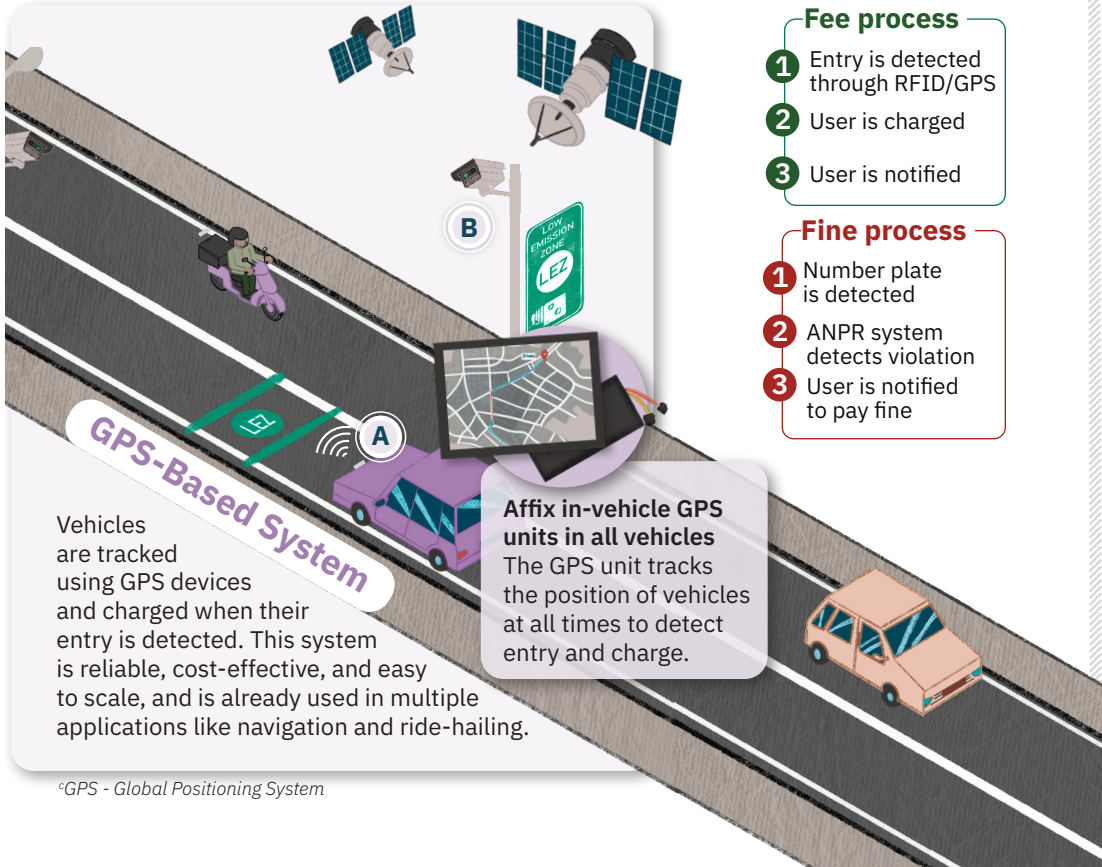
The backend action happens here: charging users, identifying defaulters, providing customer support, and monitoring system performance.

**Fee process**

1. Entry is detected through RFID/GPS
2. User is charged
3. User is notified

**Fine process**

1. Number plate is detected
2. ANPR system detects violation
3. User is notified to pay fine




## GPS-Based System

Vehicles are tracked using GPS devices and charged when their entry is detected. This system is reliable, cost-effective, and easy to scale, and is already used in multiple applications like navigation and ride-hailing.

**Affix in-vehicle GPS units in all vehicles**
The GPS unit tracks the position of vehicles at all times to detect entry and charge.

[c]*GPS - Global Positioning System*

STEP 05 LEZ

# Build strong support

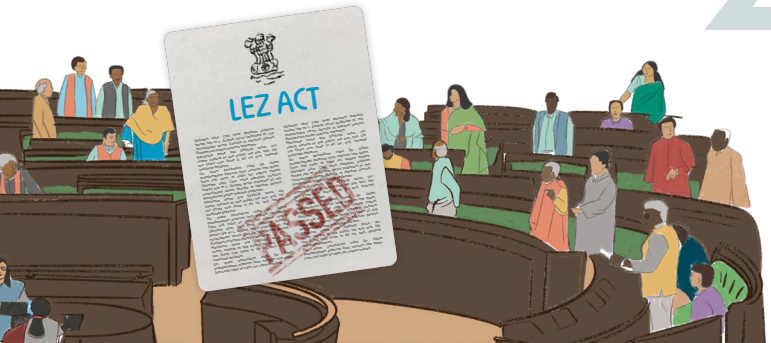
Ensure proactive and effective communication at all stages—from inception to implementation. Garner the support of all key stakeholders—such as political and administrative leaders, media, businesses, and residents—for successful rollout of LEZs.


## 1 Identify champions

Ensure there is strong political and administrative support backing the idea.

## 2 Ensure legislative backing

Statutory backing ensures the legality of LEZ. Existing laws and regulations can be leveraged, aligned, and amended to enable implementation.




## 3 Engage with key government stakeholders

Hold consultations with all relevant authorities—at the city, state, and national levels—to get their buy-in and support for smooth implementation.


## 4 Roll out communications strategy to build public support

Hold consultations with key stakeholders, such as local businesses, residents, and the media, to address any concerns. Roll out awareness campaigns to effectively communicate the benefits of LEZs.

Before implementing the LEZ, inform people well in advance about the details of upcoming restrictions or charges, timelines, and any actions required from them.

STEP 06 LEZ

# Engage all relevant institutions

## 1 Identify key public agencies*

**State Agencies**
Urban Development, Transport, Environment, and Health departments, Pollution Control Board

**Urban Local Body**
Roads, Environment, Health departments

**Regional Transport Office (RTO)**

**Traffic Police**

**Regional/City Development Authority**

**Other Road-owning Agencies**
Highway Authority, Public Works Department etc.

**Public Transport Agencies**

**Electronic Payment and Settlement Agencies**

* List of agencies is not exhaustive, other departments may be relevant for each state and city.

## 2 Create LEZ Apex Committee

Ensure representation from various key agencies for coordinated decision-making.

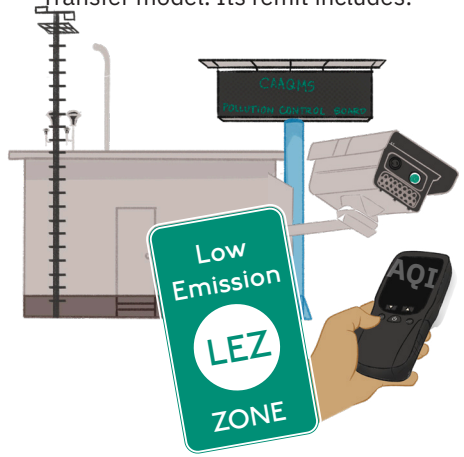
## 3 Form LEZ Working Group

Create a team of competent professionals and experts to implement the LEZ and subsequently oversee its day-to-day operation.

Include representatives from technical institutes to support aspects like air quality forecasting, monitoring, and impact studies.

## 4 Hire a competent operator

Installing infrastructure and managing day-to-day operations is best done by a competent private sector agency hired through a competitive bid under a Build-Operate-Transfer model. Its remit includes:




a. Installing hardware: gantries, RFID readers, cameras, signages, emissions monitors, air-quality measurement sensors, etc.

b. Developing software for system operations and reporting.

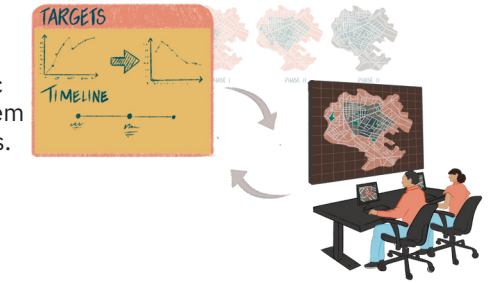
c. Operating a control centre to monitor the system in real-time.

d. Developing and managing web and mobile apps for system information, user accounts, and payment.

e. Maintaining the system.

## 5 Keep track of performance

Organise quarterly meetings with all public agencies and the operator to monitor system performance and take corrective measures.





## 6 Share revenues

Revenue should be deposited in an escrow account and distributed amongst the agencies as defined by inter-agency agreements and service contracts.

STEP 07 LEZ

# Provide complementary measures

Motorists may resist any curbs on their use of polluting vehicles especially in the absence of convenient alternatives and incentives to shift to cleaner vehicles. Complementary measures can help people adapt and reduce pushback.

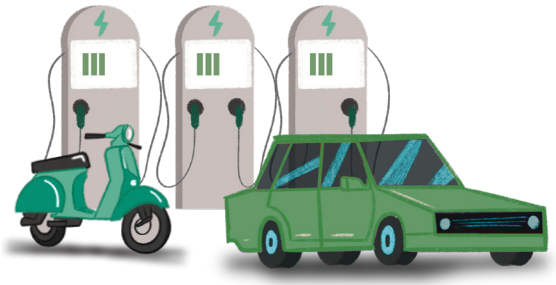
## 1 Improve infrastructure for walking, cycling, and public transport

Comfortable and safe footpaths, crossings, and cycle tracks can shift more people to walking and cycling for shorter trips.

Public transport must be frequent, reliable, and convenient for people to shift from personal vehicles for longer trips and other modes.

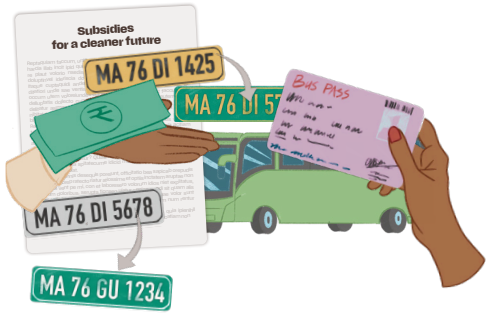
## 2 Increase availability of charging infrastructure

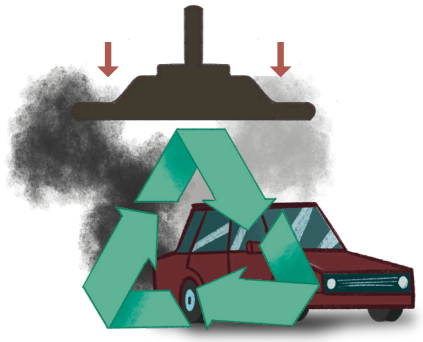
Robust infrastructure can make it more convenient and reliable for people to shift to electric vehicles.



## 3 Incentivise a shift to zero-emission vehicles or alternatives

Incentives like subsidies on the cost of purchasing electric vehicles or free public transport passes for a specified period can support people to shift away from using polluting vehicles.



## 4 Encourage scrapping of polluting vehicles

Scrapping incentives can prevent shifting the pollution elsewhere and ensure that polluting vehicles are not available for use in other parts of the city or outside the city.

## 5 Disincentivise personal vehicle use

Methods like parking pricing and congestion pricing can manage the demand for personal vehicles to reduce traffic congestion. These measures can encourage a shift to public transport and other modes.

*(For more information, see ITDP India's Parking Basics and Congestion Pricing Basics)*

STEP 08 LEZ

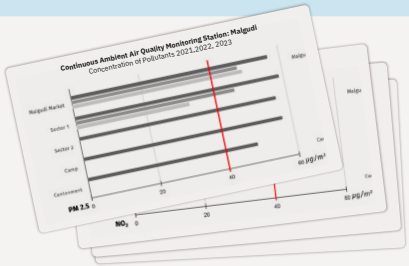
# Measure the right indicators

Once the priority locations are selected, set up air quality monitoring units in these areas to collect robust data.

Use the data collected to assess the impact of the LEZ and communicate results to various stakeholders to ensure their continued support for the initiative and its gradual scale-up.

Institutionalise this periodic impact assessment as a mandatory requirement and allocate the resources needed to make it feasible.

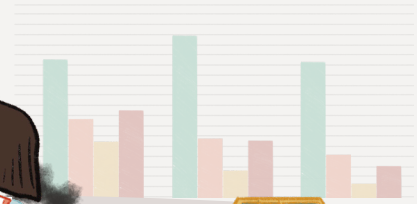
## Level of tailpipe emissions




Through vehicle emission inventory surveys and real-time measurement of air quality and tailpipe emissions.

## Proportion of highly polluting vehicles on streets

Through vehicle emission inventory and traffic volume count surveys



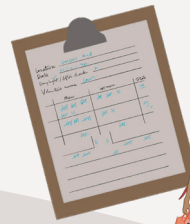
## Proportion of new electric vehicles registered


Through vehicle registration data

## Public transport ridership

Through data from public transport agencies

## Number of walking and cycling trips



Through volume counts and citizen surveys

Other indicators like **traffic speeds** (through GPS data from public transport agencies and satellite navigation companies) and **health benefits** (through data on respiratory illnesses from the Health department) can also be measured.

## Clean Air, Healthy Streets, Happy Cities.

Imagine a future for our cities where the air is clean and healthy for everyone—from an 8-year old to an 80-year old. Where streets are not choked with vehicles and walking, cycling, and public transport are attractive, safe, and convenient.

LEZs are just the beginning. We can create a future where all trips are on clean non-polluting modes and cities create Zero Emission Zones.

Whether this future becomes a reality or remains a dream depends on the steps we take and the choices we make today.

So, choose wisely.

# Acknowledgements

We would like to thank the team at the International Council on Clean Transportation (ICCT) India for their contribution and support to our ongoing work on Low Emission Zones.

Publishing date
**July 2024**

**'LEZ Basics: A step-by-step guide for cities' prepared by**

ITDP | Institute for Transportation & Development Policy

**W** itdp.in
**E** india@itdp.org

**Author:**
Keshav Suryanarayanan, ITDP India

**Publication Designers:**
Varsha Jeyapandi, ITDP India
Aishwarya Soni, ITDP India

**Technical Contributor:**
Parin Visariya, ITDP India

**Reviewers:**
Kashmira Dubash, ITDP India
Anumita Roychoudhury, Centre for Science and Environment (CSE)
Rutul Joshi, CEPT University

**Based on research conducted by:**

*ITDP India*
Aswathy Dilip
Parin Visariya
Aangi Shah
Siddhartha Godbole
Rutuja Nivate

*ICCT India*
Amit Bhat
Vaibhav Kush
Moorthy Nair

# Notes




# Notes

**Clean Air,**
**Healthy Streets,**
**Happy Cities.**

ITDP | Institute for Transportation & Development Policy