A Compendium

of Low Carbon Mobility Solutions for Nagpur City

MOBILISING COMMUNITY SUPPORT FOR LOW CARBON MOBILITY IN MAHARASHTRA'S CITIES

परिसर

Prepared under the project:
MOBILISING COMMUNITY SUPPORT FOR LOW CARBON MOBILITY IN MAHARASHTRA'S CITIES

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Acknowledgement

We would like to extend our heartfelt gratitude and appreciation to all the participants for their active involvement in the workshop, which has now been compiled into a compendium. The contributions from each participant have played an instrumental role in shaping the outcome of the workshop, and this compendium stands as a testament to everyone's collective efforts and commitment to the project.

We are proud to say that this compendium is a result of our collective ownership of the goal of making Low Carbon Mobility a reality. And we would like to express our gratitude to each and every participant for their collaborative effort in the development of this resource. The dedication, insights, and feedback provided by the participants have been invaluable in creating a comprehensive and informative compendium that we can all take pride in.

The level of understanding and insight gained through this process would not have been possible without a sincere dedication to the cause. This compendium is a reflection of our shared commitment to the project and the collective effort we have put forth to achieve our goal of working towards solutions for Low Carbon Mobility in Nagpur. And we believe that this compendium will serve as a valuable resource for all stakeholders and will contribute significantly to the advancement of our project.

Team Parisar

MOBILISING COMMUNITY SUPPORT FOR LOW CARBON MOBILITY IN MAHARASHTRA'S CITIES

Moving towards better transport solutions in Nagpur

Quotes from the participants

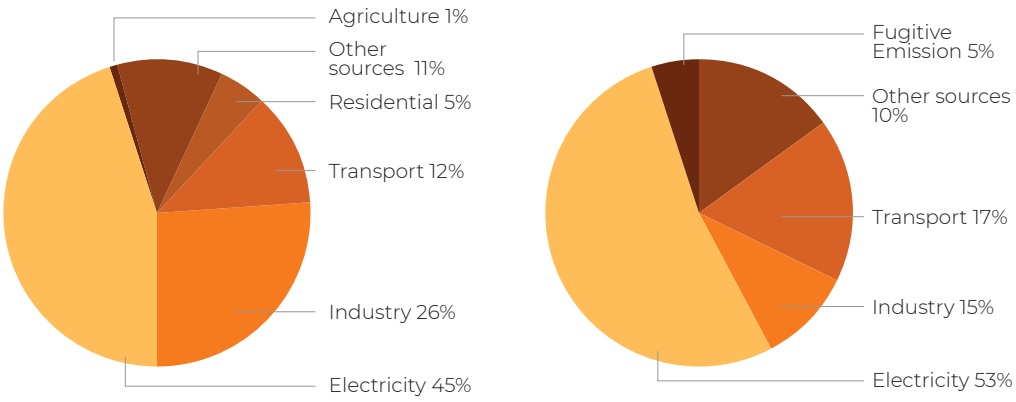
Solutions suggested by the participants

1. INTRODUCTION

India has witnessed a **300% increase in passenger vehicle ownership** since 2000. Per capita transport emissions, while still low, have increased by 184%.

Road transport contributes to approximately 90% of the total CO_2 emissions[1] in the transport sector in India.The decarbonisation of the transport sector plays a crucial role in advancing India's climate action goals, taking significant strides toward reducing air pollution and its associated health impacts while also mitigating well-being losses[2]. India has witnessed a 300% increase in passenger vehicle ownership since 2000. Per capita transport emissions, while still low, have increased by 184%. If economic growth continues in the absence of sustainable transport, car ownership and emissions will approach high-income country levels. The Prime Minister of India during the 2018 Global Mobility Summit[3] outlined the 7Cs of India's mobility pathways: Common, Connected, Convenient, Congestion-free, Charged, Clean, and Cutting-edge mobility espousing ease of living, developing an affordable, accessible and inclusive network of transportation systems.

Burning fossil fuels such as coal, gas and oil and deforestation have resulted in a drastic shift in global temperatures and weather patterns and are therefore considered instigators of climate change. In 2018, India's total CO_2 emissions[4] were estimated to be at 2455.25 $mtCO_2e$, with electricity holding 45% of the total share, industries 26% and the transport sector constituting 13% of the total CO_2 emissions **(figure 1).** In the same year, Maharashtra contributed 238.44 $mtCO_2e$ emissions , with the highest electricity generation followed by transportation.



Carbon Emission - India 2455 Mt CO_2e (2018)

Carbon Emission - Mah 238Mt CO_2e (2018)

Figure 1: Carbon emissions in India (Left) and Maharashtra (Right), *(Source: GHG Platform India, 2018)*

1 Decarbonizing India's Road Transport: A Meta-Analysis of Road Transport Emissions Models, 2022
2 Decarbonising the Indian transport sector pathways and policies, 2020
3 MOVE: Global Mobility Summit, 2018
4 Energy Sector, GHG Platform India, 2018

In 2014, TERI published a report[5] on Assessing Climate Change Vulnerability and Adaptation Strategies for Maharashtra which "show that temperature and rainfall are projected to increase all over the state" and that the heat index "may increase human discomfort due to heat stress and also increase the number of days that are conducive to malaria parasite development and transmission. It may also increase the energy demand for cooling in urban areas that are already experiencing the urban heat island effect." Maharashtra[6] is a highly urbanised State, with almost 50% of the State's 120 million population living in urban areas. It has 27 cities (population >300,000) and ten cities with more than one million residents. Fast forward a decade later, the concerns highlighted in the report stand to be true. Today, the State is witnessing extreme growth in energy demand and consumption[7] and an increase in temperature and annual heat waves[8]. Not only this, but the projections for the change in climatic events cause greater damage to natural and human habitats.

This project by Parisar is conceived with the belief that a shift to low-carbon mobility in cities requires greater engagement and demand from a wide section of civil society. India has seen national-level policies and initiatives such as promoting low-carbon mobility[9] and the climate-smart cities assessment framework[10]. At the city level, climate concerns are not the drivers of solutions; since urban transport is a state subject, projects and budget allocations are driven locally. Unless there is vocal and demonstrable support from the grassroots for low-carbon mobility initiatives, the political economy is likely to pursue vehicle-centric solutions resulting in rapidly increasing urban transport emissions. This project seeks to mobilise support for low-carbon mobility by conducting city-specific discussions, widening engagement with civil society, and supporting local advocacy efforts.

Unless there is vocal and demonstrable **support from the grassroots for low-carbon mobility** initiatives, the political economy is likely to pursue vehicle-centric solutions.

1.1. Carbon emissions in Nagpur City

Nagpur is the largest City in Central India, the third largest City and the winter capital of Maharashtra, and the most developed City in the Vidarbha region of the country. It is spread over an area of 227.28 sq. km with a population of ~2.4 million (Census of India, 2011) with a growth rate of 1.5%. Nagpur's urban expansion happened from its core, the urban sprawl happening horizontally[11] along the major transport corridors; from the period between 1998-2010, the built-up area of the City has increased[12] by ~15.47% (37.18 km2) of the total sprawl

5 Assessing Climate Change Vulnerability and Adaptation Strategies for Maharashtra: Maharashtra State Adaptation Action Plan on Climate Change (MSAAPC), 2014

6 Urban India 2011: Evidence (IIHS, 2011)

7 Maharashtra lagging behind in renewable energy transition (The Times of India, 2023)

8 Explained: Why Maharashtra is experiencing a heatwave again (Indian Express, 2023)

9 India Roadmap on Low Carbon and Sustainable Mobility (Decarbonisation of Indian Transport Sector, 2020)

10 Climate Smart Cities Assessment Framework 2.0: Cities Readiness Report, 2021

11 Carbon Inventory of Nagpur City (2017-18)

12 Spatial Monitoring of Urban Growth of Nagpur City (India) Using Geospatial Techniques

area as a result of increased population growth, the continuous establishment of industries, educational hubs, development of roads, etc.

From Greenhouse Gas Inventory Report (2017-18), Nagpur's total GHG emissions stand at 3.03 million tonnes of carbon dioxide equivalent ($mtCO_2e$), which translates to average per capita GHG emissions of 1.13 $mtCO_2e$. The report also presents a detailed comparison of GHG emissions in the five-year period between 2013[13] - 2018, noting a 23% increase in emissions. The transport sector had the highest average growth rate of ~9% from the same trend, followed by the commercial and institutional sectors at ~5.5%.

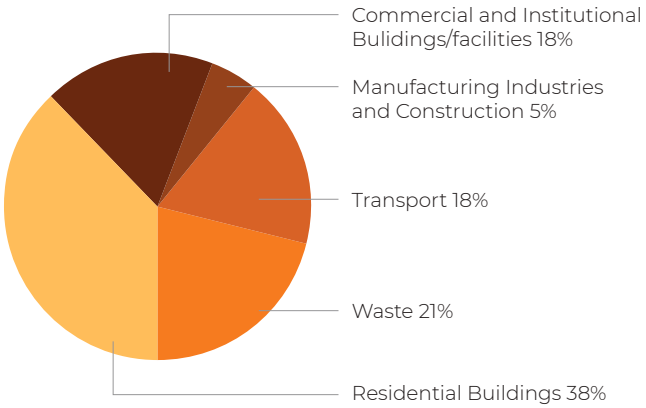


Figure 2: Sector-wise GHG emissions for Nagpur city in 2017-18
[Source: Greenhouse Gas Inventory Report (2017-18)]

Recently, an article by Times of India (2023) noted there is a 20% increase in registration of new vehicles in Nagpur:

> *"Despite having Metro service, Nagpur Municipal Corporation city bus service with a fleet of over 400 buses, and around 30,000 auto-rickshaws, the addition of 197 vehicles every day raises a doubt over the efficiency of public transport service."*

With an increase in vehicle registration in the City, MobiliseYourCity, 2021 modal share also highlights the total share of PT in the City at 9.8%. Nagpur city[14] has a mere 11 buses per lakh population, a far cry from the suggested 50 buses per lakh population as advised by the Ministry of Housing and Urban Affairs MoHUA[15]. Informal public transport, such as auto-rickshaws, has more commuters share (26%), and the share of private vehicles is higher than public transport and accounts for 50%.

13 Total GHG emissions for 2013 = 2.45 $mtCO_2e$

14 Engage for Environment: Bus based public transport and environment in Maharashtra, 2022

15 https://mohua.gov.in/upload/uploadfiles/files/Service_level.pdf The service level benchmarks define the indicator "Extent of Supply Availability of Public Transport" at Level of Service of 2 for .4-.6 buses per 100 residents

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2. CONSULTATIVE WORKSHOP

Decarbonising the transport sector and moving towards low carbon-sustainable mobility are the major ways to mitigate climate change. This City-specific compendium of low-carbon mobility initiatives has been prepared through a participatory and consultative workshop involving civil society organisations, independent people and consultants, union representatives, and other sectors.

2.1. Methodology: ideate-connect-discuss

At its core, this compendium is a list of low-carbon mobility initiatives relevant to Nagpur city. Through this project, we engaged with CSOs on climate change and the need for cities to adopt low-carbon mobility solutions that would contribute to GHG emissions reduction and help improve access and affordability of mobility for the people in the City. Engaging with city-specific CSOs helped create new civil society networks. In Nagpur, we created a coalition of the Low Carbon Mobility Nagpur City network with the participating organisations.

The city-specific compendia of low-carbon mobility initiatives have been prepared through a participatory and consultative process involving the CSOs. It is written to identify initiatives in terms of their scope, feasibility, institutional set-up and integration with other modes of transport (for e.g., a public bike share system initiative would contain how many bicycles, integration with the city bus system, fares, and how it could be run).

Engaging with city-specific CSOs helped create a coalition of the Low Carbon Mobility Nagpur City network.

We followed the concept of *Ideate - Connect – Discuss* for this engagement:

- **Ideate:**
  to come up with a set of ideas for low-carbon mobility initiatives to be adopted by the City
- **Connect:**
  i) to deepen our understanding of the existing incentives to promote low-carbon and sustainable mobility solutions,
  ii) to address the gaps between what has already been done, and
  iii) to think about where we stand in adopting low-carbon mobility
- **Discuss:**
  i) to come up with a list of possible CSO-centric solutions/initiatives for a more action-oriented stand,
  ii) to recognise our role as a civil society in promoting low-carbon, sustainable mobility in Nagpur.

2.2. Various transport issues

Relevant literature on low carbon and sustainable mobility emphasised a paradigm shift from fossil fuels and coal-based energy to cleaner energy and electric vehicles. Though electric mobility is a low-carbon solution and

contributes immensely to reducing GHG emissions in the transport sector as a civil society organisation, the question remains as to whether electric mobility is sustainable for a long-term and liveable solution when there are huge emissions from the production of energy (figure 1). The City administration's approach to vehicle-centric policies promotes individual vehicular ownership, which only increases the problems of traffic, congestion and other problems related to road infrastructure. The process of vehicular ownership has been made increasingly easy, and as a result, the roads are witnessing a heavy influx of private vehicles. Thus, the road infrastructure would always be inadequate to carry the ever-increasing influx of private vehicles.

The only way to escape the vicious cycle of induced demand is to reduce the number of vehicles in the City. Parisar intends to produce an archive focused on low-carbon mobility alternatives that could be achieved from the already existing transport infrastructure. Thus this project intends to move further by focusing on prioritising public transport and shared modes of travel.

Following the Avoid-Shift-Improve (A-S-I) approach[16], we based our discussion on mobility concerns to find underlying causes root causes and understand issues related to these modes of mobility that result in the promotion of private vehicles on the road:

A) Walking
B) Cycling
C) Public transport
D) Shared mobility
E) Reduced usage of private vehicles in the City

Later, solutions were derived from the causes and root causes of the problem statement and understood within the context of pre-existing policies, documents, conversations, initiatives, etc.

The **process of vehicular ownership has been made increasingly easy,** and as a result, the roads are witnessing a **heavy influx of private vehicles.**

16 Sustainable Urban Transport: Avoid-Shift-Improve (A-S-I), 2019

2.3. Fishbone Activity 1: an approach to finding causes and root causes

Fishbone activity was one of the workshop's participatory tool methods **(Appendix 1)**. One approach to narrowing down the causes and root causes was dividing the participants into five groups to discuss the problem statements. Enriching insights were documented on a chart paper and later opened for discussion.

Pedestrians are unaware of the **right to walk** in the City.

2.3.1. Causes for (not)-walking in the City

- The City of Nagpur lacks awareness of the use of footpaths, and pedestrians are unaware of the right to walk in the City.
- Participants also discussed the safety issues for girls and women, wherein one participant said we also need a lifestyle change among the people and their attitude towards walking in the City, *"it is not like people are not aware, there are people who know these things, but it is always the attitude who would walk in the high temperature, there is also a question of time, security, fear of accidents, comfort and overall willingness to walk for those who own vehicles"*, so community's attitudes and behaviour also needs to be mobilised. Also, one of the participants mentioned, *"people don't use public transport, thus do not prefer to walk too"*.
- There have been gaps found in urban planning norms on footpaths:
- First, the footpaths have been encroached upon by vehicles, vendors, etc.
- Second, they lack shade, plants, etc., to make walking comfortable.
- Third, there are places where footpaths are absent - giving rise to increasing ownership of vehicles in the City.
- The political environment in the City promotes a vehicle-centric approach, which is why there is a lack of commitment to improving public transport infrastructure. And even though public transportation is affordable, the City residents lack awareness about its importance.

Political environment in the City **promotes a vehicle-centric approach.**

Underlying root causes:

- lack of proper urban planning, high political influence creating a chaotic mobility environment, awareness or lack thereof at the public's end and encroachments.

2.3.2. Causes for (not)-cycling in the City

- Causes for (Not)cycling in the City were similar to causes for (not)walking. *"With longer distances, people need to reach points A to B faster than cycling speed"*. To save time, people don't use cycling as a mode of transport.
- A lack of dedicated cycle lanes has induced a rational fear of accidents, safety issues, etc., because of too many vehicles on the road. Plus, participants mentioned proper cycle stands should be allotted in different locations. Cycle stands are available at metro stations but are not integrated properly with other modes of travel.
- A participant mentioned that good cycles are expensive to buy (they may not be affordable to all classes of people).

- There is also a lack of maintenance shops along the road for cycle repairs for a long distance. In interaction with the other group participants, it was found that many shops are available, but many may not be on the routes frequented by the cyclists. Also, with the ease of availability of OLA/Uber services, cycle repair shops are scant.
- Another line of thought focused on gender and disability: women as cyclists on the road maybe even lesser in number due to family constraints, a woman cannot cycle while wearing a burkha, *"clothing and accessories required for women to wear (traditionally) are not cycle friendly"*. The design of cycles is not disabled-friendly and thus restricts the overall cycle mobility.
- Other reasons found were: people's lifestyle wherein the need for comfort travelling is prioritised, most roads are inaccessible to cycling, encroachment of vehicular traffic in cycle lanes where there are cycle lanes, cycling requires stamina and strength to cycle, a person needs to be healthy at some level.

A **lack of dedicated cycle lanes has induced a rational fear of accidents, safety issues,** etc., because of too many vehicles on the road.

Root causes:

- time management, budget and governance, lack of skills, lack of public awareness, prices and economy, infrastructure and design were highlighted as the possible root causes that restrict cycling mobility in the City.

2.3.3. Using public transport in the City

Causes and root causes in public transport infrastructure mainly focused on inadequate bus fleet and non-integration of the metro with other modes of transport in the City as:

- Lack or less investment in public transport.
- Bus stops and bus availability is not adequate.
- First and last-mile connectivity is not at par with the system.
- There is a gap in the information on bus routes, timings and frequency of buses.
- There should be dedicated/reserved seats for transgender women for safety reasons.
- The quality of rides and public facilities for Pubic Transport is not up to City's standard, the travel is time-consuming, and there is a space constraint.
- Although buses are affordable, there is less fleet available in the City, i.e., less public transport (buses) per lakh population. And even if there is enough bus fleet, there is not enough space because the metro pillars have occupied it; there is a lack of space for parking (bus terminals).
- The car-oriented transport development dictates the Master Plan of the City, *"the pillars for the metro have space in the planning, but city administration is looking at the other side for more bus fleet"*, as mentioned by the participant.
- Metro in Nagpur is a recent development, yet compared to buses, it has been provided with all the space and infrastructure it needs to run smoothly. On the other hand, buses have been running for decades and

There should be **dedicated/ reserved seats for transgender women for safety reasons.**

are still struggling to have a running depot; therefore, policies and who has power in the City need to be scrutinised.

- Though the metro is running in the City, it is lacking in a multi-modal integration (of the buses and other modes of transport) and is not affordable to everyone (the fare for the metro was increased recently). People, in general, are not aware of the routes - it has been like a recreational ride for now in the City where people every Sunday go out and take a metro ride just for fun. Connectivity for the metro also came across as one of the causes for not using the metro.

Root causes:

- Lack of public participation, urban planning governed by automobile, (in) competence of decision makers and implementers were the underlying root causes for public transport in Nagpur city, in addition to the lack of political will to promote PT.

2.3.4. Shared Mobility in the City

Participants identified the following causes and root causes concerning shared mobility, why people are using it and not using it and various stumbling blocks to this mode of mobility:

- Participants opened the discussion on shared mobility, asking whether shared mobility is even considered public transportation. And after deliberation, there was a consensus about shared mobility being in direct competition with public transport in the City. Participants raised concerns about driving behaviour and the ride being unsafe (conditions of the vehicles, not hygienic, there are still effects of COVID-19, rash driving, suffocation due to overcrowding of the passengers, etc.).
- In addition to this, participants also felt the shared mobility option has a long waiting time while the driver waits for other passengers for a shared ride. Six-seaters/auto-rickshaws were the shared modes of transport that were discussed.
- Commuting using shared transport also brings the concerns of travelling with strangers regarding the safety of valuables and it not being a comfortable ride. Shared mobility is also not affordable at times, since drivers have their rates per kilometre and don't charge by the metre, which violates RTO regulations. The rates also vary during peak hours (morning-evening times); these options are also not the most reliable; there is also the question of shared mobility not being disabled-friendly and the seats are not safe.
- Sharing a space with strangers is sometimes faced with public fighting; the drivers do not follow the rules, mostly breaking the signals, etc.
- People also don't use shared mobility as a symbol of status. There is also gender-based discrimination faced by women and transgender to have safe travel using public transport or shared mobility in the City.

Shared mobility is also not affordable at times, since drivers have their rates per kilometre and **don't charge by the metre.**

Root causes:

- With the discussion of shared mobility in the City, the major root causes were as follows:
  First and last-mile connectivity issues, expensive shared mobility due to

high diesel/petrol prices, there being no fixed routes for shared rides, traffic congestion, the attitude of people, respect/ social status symbol, and the status oneself in the society like factor either enabling or disabling the shared mobility in the City.

2.3.5. Reducing vehicles in the City

How to reduce the usage of private motorised vehicles in the City directed us toward this problem statement. The causes and root causes for the increasing number of private vehicles on the road summed up the absence or lack thereof of improvements in the options for the sustainable shift to low-carbon mobility. These are as follows:

- The discussion began with why people prefer private vehicles more than public transport in the City - what are the causes for the increasing number of vehicles - the discussion centred on five major issues: a) demographics, b) lack of alternatives, c) mindsets, d) convenience, comfort safety, e) external supportive policies and instruments.
- In demographics, participants mentioned increasing population is the cause for the increasing number of vehicles in the City.
- If the public (government) bus services were good in the City, people wouldn't prefer private vehicles; no NMT policies and no public opinions or CSO consultations for the same. There is a scarcity of people who could talk about transportation and mobility issues in the City.
- When we talk about mindset, people do not want to walk in their City, but when they go abroad, they talk about public transport and NMT there, so is the hypocrisy. People feel that it's their right to have a vehicle and having a car is a part of status and is an aspirational want, status and competition - impacts of globalisation, the influence of media, and hundreds of advertisements on automobiles in newspapers, it creates an impression.
- For convenience, comfort and safety - a person owning a car won't feel the increasing temperatures as compared to people who are walking, cycling or using PT. There is a safety parameter in cars that even two-wheelers don't provide. Also mentioned by the participant, *"The five family members can reach at one time to the same place"*.
- External supportive policies and instruments: there is easy financing where policies are promoting private vehicles; these are the demands induced by market-driven policy - automakers/ vested interests and how automobiles are being promoted, finances are easily available for their purchase, to carry a loan - interest rates are also low - all these things come together with automobiles. Nobody prioritises public transport, and when they do - it is only the metro.

Having a car is a part of status and is an aspirational want, status and competition.

There is **easy financing** where policies are **promoting private vehicles.**

Root causes:

- Lack of political will, power not with the people, the kind of environment induced by the Media, TV, advertisements on cars and two-wheelers, lack of coordination between agencies, there are gaps in implementing the NUTP within the local city planning and lack of think-tanks at the ground level policy emerged as the root causes for the increasing private vehicles in the City.

2.4. Existing policies in Nagpur's mobility and transport

At National Level:

- National Urban Transport Policy[17] (2006, revised 2014)
- National Transit Oriented Development Policy, TOD[18] (2017)
- Metro Rail Policy[19] (2017)
- Jawaharlal Nehru National Urban Renewal Mission[20] (2005-2014)
- Atal Mission for Rejuvenation and Urban Transformation, AMRUT[21] (launched in 2015)
- National Electric Mobility Mission Plan, NEMMP[22] (2020)
- Heritage City Development and Augmentation Yojana, HRIDAY[23] (2015)
- The Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act[24] (2014)
- The Rights of Persons with Disabilities Act[25] (2016)

At State Level:

- Maharashtra State Electric Vehicle Policy[26] (2018)
- RTO regulations
  - » Maharashtra City Taxi Rules[27] (2017)
  - » Hakim Committee Recommendations for Auto-Taxi Fares[28] (2012)
- Joined the 'Race to Zero' initiative[29] (adhering to Paris Agreement for Climate Action)

At City Level:

- Comprehensive Mobility Plan[30] (NIT and UMTC)
- City Development Plan for Nagpur, 2041[31] (Government of India, 2015)
  - » "82% of the roads have footpaths. But, the footpaths along some of the stretches are encroached by hawkers, or too many obstructions, such

17 National Urban Transport Policy (2006, revised 2014)
18 National Transit Oriented Development Policy, TOD (2017)
19 Metro Rail Policy (2017)
20 Jawaharlal Nehru National Urban Renewal Mission (2005-2014)
21 Atal Mission for Rejuvenation and Urban Transformation, AMRUT (launched in 2015)
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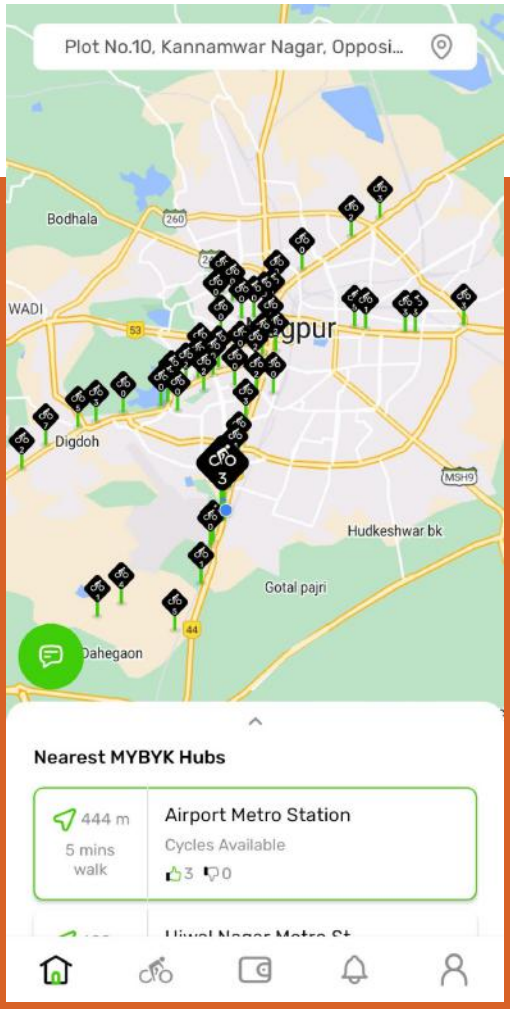
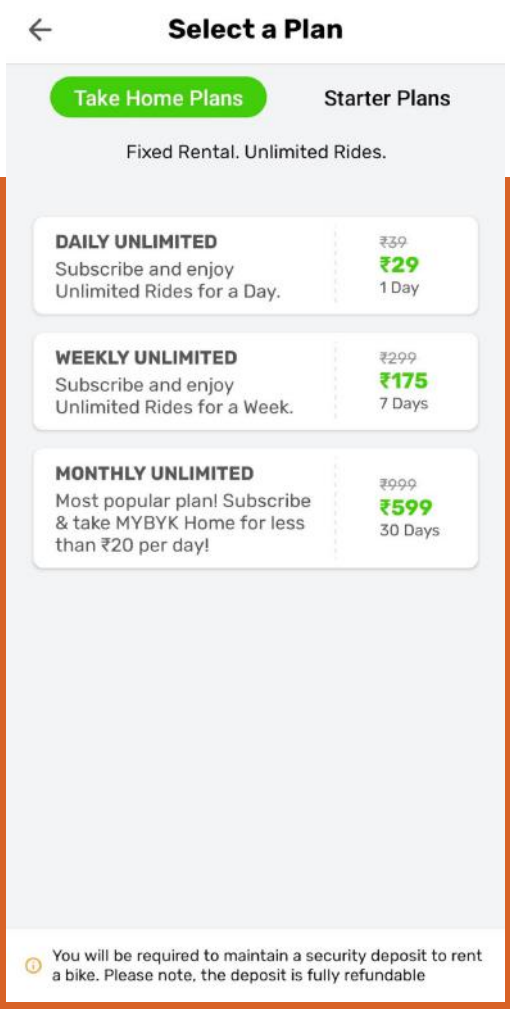
28 Hakim Committee Recommendations for Auto-Taxi Fares (2012)
29 Joined 'Race to Zero' initiative (adhering to Paris Agreement for Climate Action)
30 Comprehensive Mobility Plan (NIT and UMTC)
31 City Development Plan for Nagpur, 2041 (GoI, 2015)

as trees, poles, etc., have been observed. Hence, the use of footpaths is very limited. In the name of NMT facilities as present in Nagpur, the footpath is the only infrastructure developed. Even in the master plan, development of the Infrastructure for NMT/pedestrians is not given a priority" (pg. 116).

- Bike Sharing[32] (MYBYK - station-based bicycle-sharing and renting service in association with Nagpur Metro to cover last-mile connectivity)
  - » Deployed 400 bikes at 40 locations in Nagpur City (The Live Nagpur, 2022). Renting bikes is available at ₹29 per day (daily unlimited plan).





MYBYK Stations (at present) in Nagpur City and their usage plan - Mobile Interface (Screenshots from the app)

32 Bike Sharing

- Mobilise Your City training program[33] (with support of the Ministry of Housing and Urban Affairs, 2018)
  - » Technical assistance for e-buses and mobility observatory.
- Nagpur City Draft GHG Emission Inventory Report[34] (2017-18)
  - » By 2017-18, the petrol consumption in the City for transportation alone increased to 141,523-kilo litres.
  - » Provided a detailed overview of GHG emissions and energy consumption in Nagpur City.
- Climate Resilient City Action Plan for Nagpur[35] (a joint initiative by Nagpur Municipal Corporation and Urban Leds)
  - » For transport (overall transport resilience impact): reduction of GHG emissions, improved air quality, reduced traffic congestion, improved public health
- Environmental Status Report: Nagpur[36] (2019-20)

Modal share for the transport vehicles (passenger carriers) running on the city roads is as follows: Private (two-wheelers; moped/scooters/ motorcycles and four-wheelers; cars/jeeps/vans), Public (autos/cabs/taxis, buses, trains). From the Census Data 2011[37], the modal share for Nagpur (urban) is summarised in **Figure 3**. The current modal share estimated by MobiliseYourCity Global Monitor, 2021,[38] is given in **Figure 4**. The number shows differences in the bicycle and on-foot share between a decade. From the 2021 modal share, 51% of trips are shared by formal public transport, informal public transport (auto rickshaw, minibus, school bus, chartered bus, etc.), walking and cycling. These figures should be taken into consideration when developing a transport network for the City that meets the infrastructural needs of its people, at the same time, a more sustainable, safer, accessible and affordable transport system. An enormous shift in modal percentage from 35% in 2011 to 43% in 2021 for two-wheelers is a concern for the city administration to consider for total vehicular emissions.

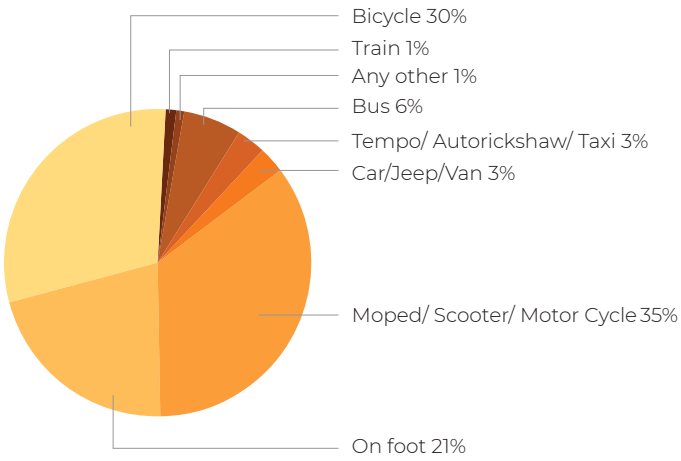


Figure 3: Total Modal Share of Nagpur (urban), Census of India (2011)

33 Mobilise Your City training program

34 Nagpur City Draft GHG Emission Inventory Report (2017-18)

35 Climate Resilient City Action Plan for Nagpur

36 Environmental Status Report: Nagpur (2019-20)

37 The modal share includes work trips from residence to place of work and mode of travel to place of work. Total percentage does not include no travel data from the Census, 2011

38 MobiliseYourCity Global Monitor, Nagpur Fact Sheet, 2021

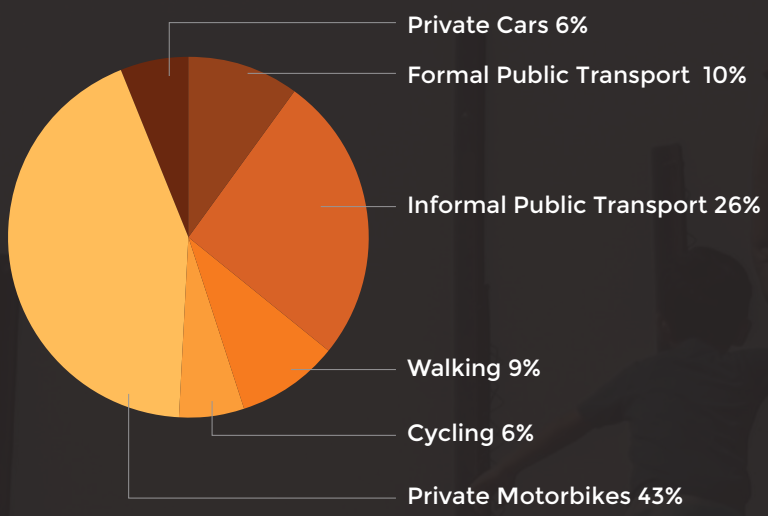


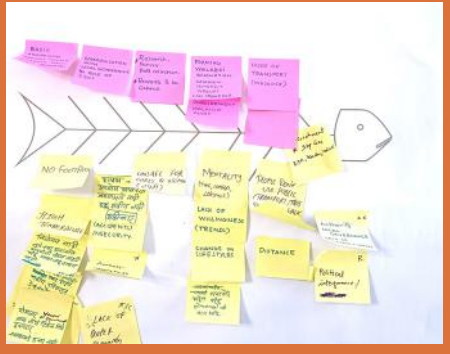
Figure 4: Modal Share of Nagpur (urban), MobiliseYourCity Global Monitors (2021)

2.5. Fishbone Activity 2: finding potential actionable solutions

Reducing vehicles in the city

Using public transport in the city

Cycling in the city



Walking in the city

Shared mobility in the city

Fishbone Activity (causes and root causes in the yellow sticky notes and solutions in the pink sticky notes)

The list of initiatives for low carbon mobility in Nagpur city is categorised into the following based on the nature of action that could be taken:

2.5.1. Awareness Campaigns and Advocacy Programmes

Demanding for a set/fixed fare structure for morning/ evening (peak hour) timings for affordability in shared mobility.

Awareness and advocacy on the importance of using public transport in the City, sustainable mobility and ill-effects of road transport on the environment and its climatic implications emerged as an area with a lot of potential and scope for a shift towards the use of private vehicles to public transport. These action solutions can be taken as demand, protest or campaign in the City, creating awareness and education of low carbon mobility.

Scope: pushing for low carbon mobility in the City at a larger scale

Feasibility: demand, protest and campaign around the ideas of LCM.

Initiatives that could be taken/improved:

- Creating awareness programmes recognising walking as a mode of transport, doing walking audits and pedestrian safety.
- Creating awareness through social media, cinema halls, and signboards (important landmarks and distance) to adopt walking cycling; hence vehicles can be a status quo and avoid crowding on the road.
- Demanding for a set/fixed fare structure for morning/evening (peak hour) timings for affordability in shared mobility.
- Digital outreach: cycle rallies, banners/campaigns/events such as cycle races.
- Form citizens forums/pressure groups to raise collective voices. Public-led initiatives - collective demands in pressure groups, advocacy and campaign.
- Liaising and networking with NGOs to push for separate cycle tracks and other campaigns.
- Promote carpooling could be incentivised through children's campaign awareness, especially post-pandemic awareness, for long-term change gains. NGOs, administration and public awareness, need to be rich.
- Pushing for a no-vehicle day, mandatory with a popular plan for awareness implementation with mapping/ zones led by political leaders.
- Spreading awareness about cycling benefits helps to improve health.
- Street play, films, summer camp/ workshop, teachers and students/ women groups on cycling (women/ youth).
- Working toward writing a new narrative on aspirations and mindset on public transport is our personal transport and public responsibility to promote more public transport usage.

2.5.2. Research and Data Dissemination

Research and analysis are the skeleton of any structure. For accurate and reliable data, gathering facts, information and other related developments is important.

Scope: presenting reliable, accurate and live information on the transport network in the City.

Feasibility: coordinating between civil society organisations and collecting data from various secondary sources, primary surveys, etc.

Initiatives that could be taken/improved:

- Collaborating with apps like 'My Bike', study integration of public transport and systems and interconnection for smooth transportation and cycling in the City.
- Research various aspects of walking in the City, do surveys and data collection.
- Study on mapping of location, routes, stops and frequency and raise demand for incentives in shared mobility.

2.5.3. CSO engagement: citizens and political leaders

Finding gaps in implementing the policy-informed solutions on where policy and decision makers should be cognizant for maximum climate action and green mobility effect in the City. Engaging with the public and city citizens to lead more sustainable mobility campaigns.

Scope: listing out various gaps in the policy planning and implementation, raising awareness and demanding changes/improvements in the transportation services.

Feasibility: revising the plans, policies and schemes and having an interdisciplinary understanding of the problem statements.

Initiatives that could be taken/improved:

- Collaborating with local governing bodies, police, and other CSOs for a comprehensive road safety campaign.
- Partnering with auto-drivers to raise awareness about safety regulations while using auto rickshaws/e-rickshaws, benefitting both drivers and passengers.
- Organising monthly meetings to address cycling for girls and women.
- Maintaining consistent communication with local government officials and advocating for the inclusion of a political manifesto aimed at reducing private vehicle usage in the city.
- Establishing a walker's association as a unified interest group dedicated to promoting the advantages of walking.
- Taking the lead in advising the government on the implementation of an awareness campaign for cycling and walking.
- Advocating for necessary population control measures through government channels.
- Pressuring the government to enforce a rule that permits car usage only when four people are travelling, imposing a fine of Rs. 1000 otherwise. A policy framework for driving/vehicle use should include issuing three or more challans leading to a restriction or ban of vehicle use for three months, along with the introduction of an accompanying app managed by the traffic department.
- Addressing concerns with decision-makers through meetings, letters, and deputations to enhance awareness of public transportation.

Partnering with auto-drivers to raise awareness about safety regulations while using auto rickshaws/ e-rickshaws, benefitting both drivers and passengers.

2.5.4. Capacity Building, Education and Training

Scope: to spread awareness, education and training for low carbon mobility and bridging communication between the city-state and City's people.

Feasibility: adopting and practising low carbon sustainable mobility by the individuals and network of CSOs to promote, encourage, and educate on the dangers of climate change.

Initiatives that could be taken/improved:

- Capacity building for media and city officials to promote public transport usage in the city.
- Enhancing individual capacity for self-demonstrations and efforts towards low carbon mobility.
- Developing shared mobility networks and implementing them, with reference to successful international examples, to present to the government.
- Emphasising vehicle occupancy ratios as per RTO guidelines and highlighting their significance.
- Promoting inclusive collective communication within shared mobility, spanning from the public to drivers.

2.5.5. Demanding Pilot Interventions

Demanding pilot interventions could significantly raise awareness on a broader scale.

Calling for more **inclusive and participatory planning processes** for the implementation and modification **of public transport infrastructure.**

Scope: pilot interventions could help undertake impact assessment before or after the intervention.

Initiatives that could be taken/improved:

- Linking Aadhar cards to establish car caps per family and adjusting parking fee structures based on car capacity.
- Requesting better coordination with implementers of public transport solutions and presenting actionable suggestions for consideration.
- Advocating for financial discipline and the adoption of an income-based policy to discourage the excessive use of personal vehicles in the city.
- Calling for more inclusive and participatory planning processes for the implementation and modification of public transport infrastructure.
- Urging government recognition of shared mobility with well-defined regulations, structured operations, and dedicated rickshaw stands.
- Transitioning to a smart city app for streamlined paper verification and handling of challans through document uploads.
- Promoting increased design allocation for walking and cycling on roads and streets.
- Pursuing the integration of the metro system with e-rickshaws and public buses for improved connectivity.

Pilot interventions could help undertake impact assessment before or after the intervention. Promoting increased design allocation for walking and cycling on roads and streets.

ABBREVIATIONS

CO_2:	Carbon dioxide
CSO:	Civil Society Organisations
GHG:	Greenhouse Gases
LCM:	Low Carbon Mobility
$mtCO_2e$:	Metric tons of carbon dioxide equivalent
MoHUA:	Ministry of Housing and Urban Affairs
NGO:	Non-governmental Organisation
NIT:	Nagpur Improvement Trust

NMC:	Nagpur Municipal Corporation
NMT:	Non-motorised Transport
NUTP:	National Urban Transport Policy
PT:	Public Transport
RTO:	Regional Transport Office
TERI:	The Energy and Resources Institute
TOD:	Transit Oriented Development
UMTC:	Urban Mass Transit Company Ltd.

APPENDIX 1:

FISHBONE ACTIVITY: PARTICIPATORY TOOL

The workshop took place at Chitnavis Center on 24 February 2023, facilitated by Dr Avinash Madhale of the Centre for Environment Education.

Indian cities are grappling with severe traffic problems, leading to expensive, time-consuming, and stressful daily commutes. The current approach adopted by the City is flawed, exacerbating existing issues and neglecting the concerns of the majority. Moreover, this approach contributes to increased air pollution and greenhouse gas emissions, aggravating the impact of climate change on the population. It is crucial to explore better solutions that are both environmentally friendly and people-centric. However, achieving this goal requires collective agreement, prioritisation, and concerted efforts to push this agenda forward.

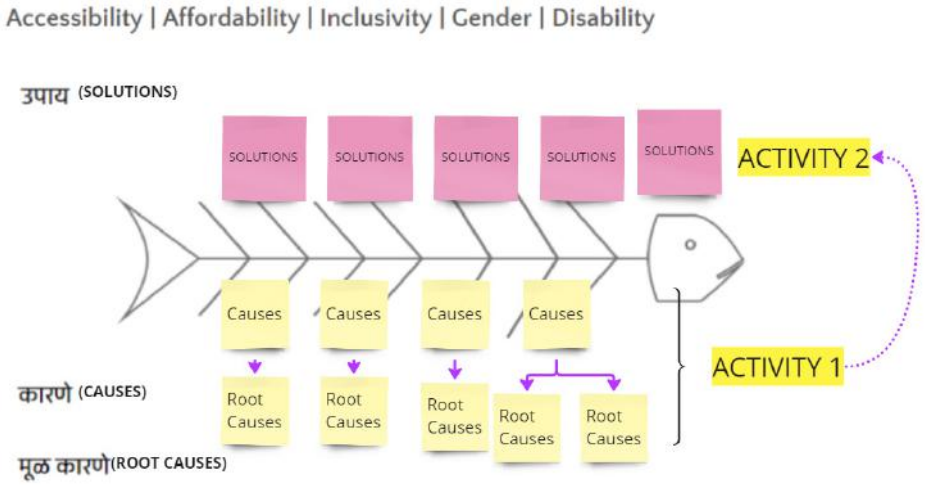
While some organisations are already working on transport issues, it is essential to recognize that this is a problem affecting us all. Therefore, every individual must actively participate in finding a solution.

The focus of our workshop was to establish a network of civil society organisations and mobilise support for low-carbon mobility in the City. The selected cities for this project are struggling to adopt low-carbon mobility options due to a lack of awareness among citizens. Understanding that participation is crucial in addressing these challenges, we opted for a participatory tool that is engaging and enjoyable for the workshop. We used the fishbone activity in two phases (refer to the figure below). The fishbone diagram is a visual representation of cause and effect, and it is used for enumerating causes to achieve desired results. To suit our workshop's needs, we modified the methodology. Instead of focusing solely on causes and effects, we used the bottom side of the fishbone to identify the root causes of the problem states and the top side to explore solutions for promoting low-carbon mobility in the City. Each branch of the diagram allowed us to brainstorm different causes and root causes, enabling us to generate diverse solutions. This activity fostered active participation, with all attendees contributing their views and thoughts on the chart paper.

Activity 1:
(writing down the issues based on the problem statements)

Objective: To write the issues (causes) of the problem statements as given in the chart paper.

Procedure: The facilitator explained the objectives of the activity to the participants. The participants were sorted into four groups; each group got one problem statement. All the groups were provided with table facilitators (a member of the Parisar team sat with the participant at each table). The participants got time to write their thoughts on the sticky notes, which were later led by a discussion on what they wrote as a cause, and sticky notes were pasted on the bottom of the fishbone on the chart paper. After everything got on the fishbone, discussions on root causes took place. After internal discussions on the table, each group presented their causes and root causes for the problem statement and got inputs from participants on the other tables.



Fishbone Activity Sample

The groups were divided considering no two participants from the same organisation sat at the same table, making note of the diversity of impact areas of the organisations and maintaining the gender balance on the tables. Tables were facilitated as follows:

1. Walking: Paornima Gabhale
2. Cycling: Priyanka Joshi
3. Using Public transport: Sandeep Gaikwad
4. Shared mobility: Shivani
5. Reducing vehicles in the city: Ranjit Gadgil

Activity 2: (writing down the solutions of the problem statement)

Objective: To identify the solutions to the problem statement based on the issues and root causes discussed in Activity 1.

Procedure: Similarly followed as Activity 1. Now, the sticky notes were pasted on the top part of the fishbone.

Organisation of tables at the time of Fishbone Activity

APPENDIX 2:

PARTICIPATING ORGANISATIONS

S.No.	Name of the organisation	Impact areas of the organisation	Name of the participant	Gender
01	Anviti	Waste Management and Environment protection	Shafali Dudhbade	Female
02	Centre for Sustainable Development	Advocacy and Environment	Leena Buddhe	Female
03	ICLEI: Local Governments for Sustainability (South Asia)	Sustainability	Akshay Kashikar	Male
04	Learn	Labour, Mahila Kamgar and education	Nikhat Sayyad	Female
			Shamina Shaikh	
05	Nagpur Jilha Pathvekreta Sangh	Hawkers and vendors	Kavita Dhir	Female
06	Nagpur Smart city	Mobility and environment	Pranita Umredkar	Female
			Priyanka Bhivade	
07	National Hawker Federation	Unorganised sector workers, Hawker	Jammu Anand	Male
08	Paryavaran Niti Mulya	Plantation, Waste Management	Shreyesh Marathi	Male
09	Paryavaran Pratham	Environment, Climate Change, Disaster Risk Management	Aprup Adawadkar	Male
10	Retired from TATA steel	-	Praveen Tapase	Male
11	Roadmarc foundation	Road Safety	Rajesh Wagh	Male
12	Sarathi Trust	HIV/AIDS	Sanket Patil	Male
13	Swacch Association	Waste, Environment, Livelihood, Health, Education	Anasuya	Female
14	Viddarth Molkarin Sanghatna	Domestic Workers	Sujata Bhogade	Female
15	Youth development alliance	Road Safety	Sanjay Kumar Gupta	Male
16	Youth for Unity and Voluntary Action (YUVA)	Urban poverty, Governance, Housing, Informal Sector, Children, Youth and Climate change	Nitin Meshram	Male
17	Yuva Rural Association	Environment, Livelihood, Natural Resource Management	Devraj Patil	Male

APPENDIX 3:

OBSERVATIONS FROM NAGPUR: WALKING IN THE CITY

The team has taken these photos when walking in the City - the right of way for walking and cycling is either dug up or encroached by the construction work, etc.

These photos are an example of the non-existent/absent footpaths in Nagpur City (photos taken on Chandrapur-Nagpur Road between Jay Prakash Nagar and Airport Metro Stations).

(left) shows an EV charging spot but the possible charging of vehicles results in vehicle parking on the footpath.

(right) shows bicycle/2-wheeler parking under the metro station, leaving no space for walking.

Pedestrian Crossing Signage board hidden behind the tree, broken pedestrian carriageway and unwalkable (non-existent) footpath.

MYBYK bicycle sharing system + Electric Vehicle charging facilities at the metro station.

परिसर

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