

Beyond Decarbonisation:

Strategies for Inclusive and Sustainable Transport

A POLICY PAPER

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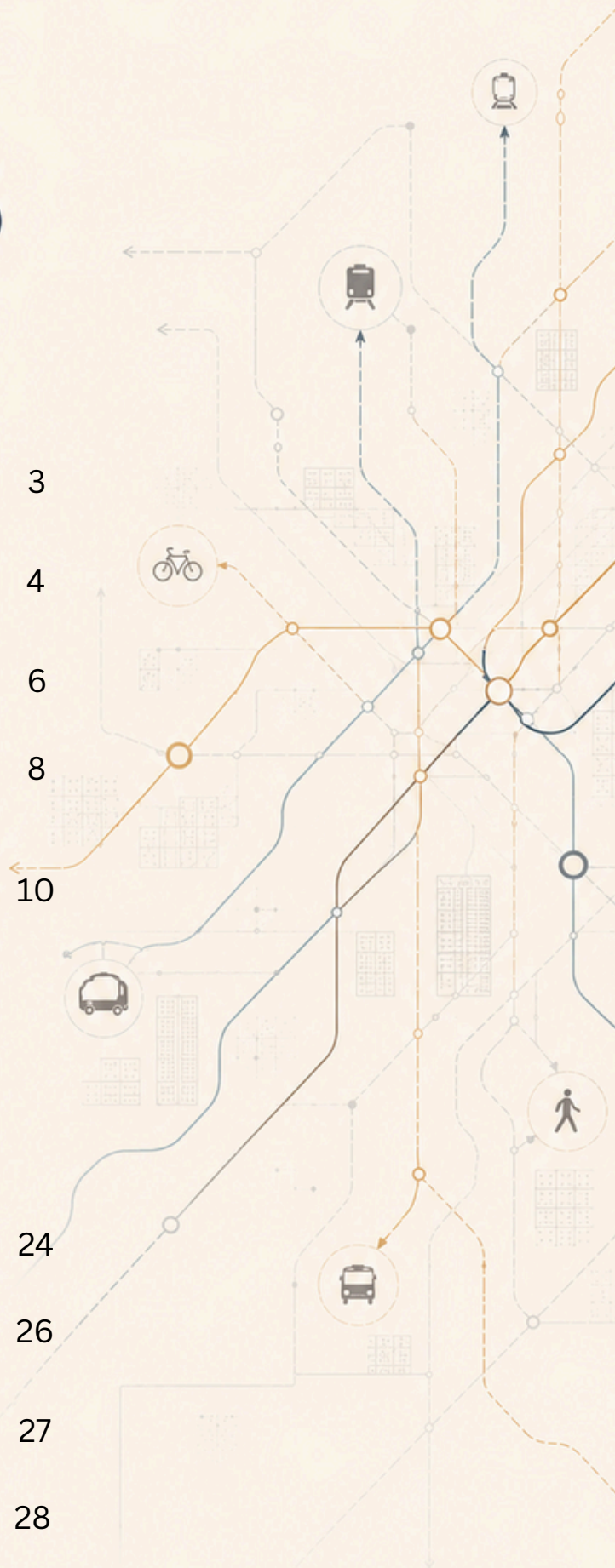
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Executive Summary

India's transport sector contributes around 5% to India's GDP and 14% of carbon dioxide emissions. It sits at the heart of India's dual development goals of Viksit Bharat 2047 and Net-Zero 2070.

The paper builds on NITI Aayog's 'Scenarios towards Viksit Bharat and Net Zero: Sectoral Insights: Transport', arguing that a structural transformation of current transport systems is required to achieve Net-Zero emissions by 2070. The projected modal shift away from road transport towards public, rail, and electrified transport cannot be achieved through technological measures alone. Complementary policy strategies across four pillars of Urban Mobility, Rural Mobility, Workforce Transition, and Freight Transport are required.

The report briefly discusses the problems and challenges and suggests recommendations to address them. Under Urban Mobility, the recommendations revolve around differentiated approaches to levels of urbanisation, non-fare revenue models for metros, stronger last-mile and multimodal integration by expanding governance capacity, and reform of transport networks before electrification. For rural mobility, the report advises precautionary measures against carbon lock-in, including electrified IPT and DRT.

The report further recommends establishing a 'Just-Transition Fund' and reskilling institutions to manage the workforce transition and, lastly, calls for tariff and infrastructure reforms to shift freight transport towards rail. Additionally, these recommendations are organised in the 'Avoid-Shift-Improve' framework, arguing that while 'Improve' measures like EVs and green fuels are important, prioritising Avoid and Shift measures is essential in achieving a sustainable and equitable transport system.



I. Introduction

Climate change is one of the defining challenges of the 21st century (United Nations, 2025). Global temperatures are now 1.42°C above pre-industrial levels, and GHG emissions reached 57.7 gigatonnes in 2024, making it the warmest year on record. India has set a target of achieving a GDP of 30 trillion dollars under the Viksit Bharat 2047 Mission (PIB, 2026). At the same time, India has pledged to achieve the net-zero emissions target by 2070, which imposes additional trade-offs and constraints. One of the most important sectors of the economy is the Transport sector, contributing about 5% to India's GDP and serving as an ancillary sector essential to the sustained growth of the economy. It facilitates the movement of both goods and people, promotes trade, connects markets, creates employment, reduces regional disparity, and enables the growth of our economy. While promoting growth, the Transport sector is also one of the emission-intensive sectors in India, with high fossil fuel dependency. It accounts for almost 14% of carbon dioxide emissions, and around 90% of those emissions come from road transport alone (Bhatt & Kodjak, 2025). Keeping in mind the goal of 2070 Net-Zero emissions, it becomes extremely important to decarbonise this integral sector.

Unlike other emission-intensive sectors like power or industry, the transport sector decarbonisation has a unique challenge, as pathways to reduce emissions often require changes in infrastructure, behaviour, land-use patterns, technology, and governance. Beyond decarbonisation, the transport system in India, especially in cities, is under tremendous stress. Indian cities often rank at the bottom of livability indices due to poor infrastructure, traffic congestion, and high pollution (Inamdar, 2025).



Major urban hubs like Delhi, Bangalore, and Mumbai face severe traffic congestion every day. In 2025, Bangalore and Kolkata are ranked 3rd and 4th, respectively, in the TomTomTom-Tom traffic index, among the slowest cities in the world by average commute time (TomTom, 2025). On a national level, an urban commuter spends almost 94 hours per year on for a 10 km one-way journey within the city centre (Narain et al., 2025). The human as well as economic cost of congestion in cities is immense. The man-hours lost in commuting could've either been invested in productive work or utilised to spend time with one's family and friends. This congestion not only causes emissions but also deteriorates the quality of life. Lost productivity, worsening air quality, and road accidents create increasingly unlivable urban environments.

Transport sector decarbonisation faces these negative externalities head-on. Through decarbonisation, vehicle emissions, which are one of the major sources of local as well as global pollutants, will be reduced, leading to less pollution in urban centres. It also addresses the problems of congestion. Decarbonised transport is one of the integral pillars to achieve India's goal of sustainable development.



2. Summary of the Niti Aayog Report

(Scenarios towards Viksit Bharat and Net Zero: Sectoral Insights: Transport)

As discussed above, the transport sector is an integral part of India's sustainable development strategy. NITI Aayog carried out a detailed assessment of transport sector decarbonisation in the report – Scenarios towards Viksit Bharat and Net Zero – Sectoral Insights: Transport (Vol. 3). The report uses a bottom-up methodology based on the Activity, Structure, Intensity, and Fuel (ASIF) framework, utilising modelling tools such as the India Energy Security Scenarios (IESS) and TIMES. The projections cover both passenger travel demand in billion passenger-kilometres (BPKM) and freight travel demand in billion tonne-kilometres (BTKM). Passenger demand is disaggregated across road, rail, air, and metro sub-sectors, while freight covers road, rail, air, pipeline, and waterways.

For projections, two future scenarios are utilised – the Current Policy Scenario (CPS), which assumes business-as-usual trends, and the Net-Zero Policy Scenario (NZS), which is aligned with the 2070 Net-Zero goals. For passenger travel, the model sets the saturation level at 12,000 kilometres per capita by 2070, down from the 14,000 km projected under the CPS. It projects that road transport's modal share will decline from 78% in 2025 to 64% by 2070, with passenger rail transport absorbing this decrease, increasing its modal share to 25% in 2070. Within road travel, public transport's share is projected to reach 60%, with private car ownership growing more slowly than CPS, up to 200 cars per 1,000 people.



For freight transport, tonne-kilometres per capita is set at 8,000 in the NZS. The model projects road freight shrinking to 60%, with rail freight increasing to 30% and waterways to 8% of goods transport, absorbing the shift away from road freight transport.

To achieve the projections under the NZS, the report suggests various strategies to adopt, such as Transit-Oriented Development (TOD), adoption of public transport and last-mile connectivity, and greater use of clean fuels and EV technology. The report discusses in detail the role of biogas, natural gas, and green hydrogen for fuel mixing and alternative clean fuels. The policy suggestions of the report revolve around the pillars of improving urban mobility and safety, the transition to sustainable freight transport in India demanding simultaneous investment in clean energy adoption, enhanced modal efficiency, and domestic technological capability, strengthening pipeline infrastructure for clean fuel transition, accelerating EV and bio-fuel adoption, enhancing energy efficiency in India's transport sector, strengthening vehicle retirement and recycling, and promoting Non-Motorised and Active Transport (NMT).



3. Background

According to urban planning principles, in an ideal city, commuters will have different modes of travel depending on the distance to their workplace or intended destination. Reducing vehicle dependency in urban areas necessitates shifting from private transport to public transport. As a general planning principle, people walk for 0–1 km, cycle for 2–5 km, and take public transportation such as buses for 5–10 km, after which mass rapid transit systems like metro or rail take over. Against this background, India's actual commuting patterns reflect something different. According to the latest 2011 census, the following was the main transport mode of commuters not engaged in cultivation, agriculture labour, or a household-based industry, representing 42% of the total workforce in India (referred to as 'other workers' in Census terminology) (Goel, 2018).

Distance travelled (in kms)					
	Mode of transport	0-1	2-5	6-10	11-20
NMT	On foot	72.62%	31.25%	26.40%	0.00%
	Bicycle	11.34%	28.48%	19.46%	14.60%
Private Transport	Moped/Scooter/Motor Cycle	9.73%	21.18%	20.81%	25.84%
	Car/Jeep/Van	1.38%	3.10%	4.29%	7.62%
IPT	Tempo/Autorickshaw/Taxi	1.36%	4.61%	5.62%	6.70%
Public Transport	Bus	2.25%	9.41%	19.73%	35.62%
	Train	0.74%	1.07%	2.53%	7.95%
	Water transport	0.13%	0.17%	0.32%	0.55%
	Any other	0.45%	0.73%	0.86%	1.12%

Counts of workers classified by mode of travel and distance

[Source: Census 2011](#)

India's commuting patterns are skewed towards 2-wheelers and 4-wheelers as distances rise above the 5 kms threshold. Non-Motorised Transport (NMT) share is notably higher within 5 km, which is a positive signal for decarbonised transport. However, the data does not distinguish between captive (those who use NMT out of necessity) and choice riders. This distinction matters because rising income correlates with a shift away from NMT towards private motorised transport (Saini et al., 2026). Without addressing the distinction, this positive feature may not last as the country develops. The pathway to decarbonised transport must therefore ensure that public transport and NMT are attractive enough for choice riders as well. The choice to drive a two-wheeler or a four-wheeler is not solely the outcome of an individual's preferences, nor are they exogenous, but are rather shaped by the infrastructure of urban systems and culture towards transport in the country (OECD, 2021).

To achieve sustainable and inclusive development and reduce dependence on road transport, structural change is required in our transport systems. The NITI Aayog report provides India with projections to achieve a decarbonised transport sector; however, achieving the Net-Zero scenario will remain difficult without complementary policy strategies across four key pillars of Urban Mobility, Rural Mobility, Workforce Transition, and Freight Transport.



4. Key Strategies towards the Transition

4.1. Urban Mobility

India is urbanising rapidly. Currently, about 37% of our population lives in urban areas, and that figure is expected to grow to 65% by 2070. Urban areas contribute around 60–70% to India's GDP, yet cities are under increasing strain (NITI Aayog & Asian Development Bank, 2021). Weak public transport infrastructure, last-mile connectivity issues, and high commute times make private vehicle ownership a practical necessity rather than a personal choice. This problem is further exacerbated by the immense number of people our mega-cities have to accommodate. The populations of cities like Delhi and Mumbai have crossed 20 million people (World Population Review, 2024b). For context, other global cities around the world like New York and London have populations of 8 million and 9 million, respectively (World Population Review, 2024a; World Population Review, 2025). The scale of urban cities in India places exceptional strain on transport infrastructure, and managing this growth sustainably is one of the central challenges for urban policy in the coming decades.

The current modal share of passenger transport in India is 78% road transport, out of which 53% are private vehicles, and metro and rail transport are less than 1% and 17%, respectively. In order to achieve the NZS projections, the report highlights the importance of TOD – Transport Oriented Development, last mile connectivity, and increased usage of non-motorised transport. However, to implement these policies, certain strategies have to be deployed. First of all, differentiated policy approaches will be required based on the level of urbanisation.



4.1.1 Differentiated Policy Approach

4.1.1.A Tier 1: Metro Cities

In mega cities, or aptly called ‘metro’ cities, the solution to sustainable urban transportation is setting up mass rapid transit systems like metros and connecting suburban or satellite towns with rapid rail. In Mumbai, the metro system helped reduce CO, HC, and NO_x emissions by 72.4%, 74.3%, and 15.5%, while simultaneously reducing commute times, congestion, and increasing the comfort of passengers (Abhijna et al., 2025). It is important to note here that these emission reductions are applicable only to scope 1 or tail-pipe emissions. Scope 2 emissions, which are generated indirectly due to India’s coal-powered grid, are not taken into account. Thus, the long-term environmental benefits of metro systems are dependent on continued grid decarbonisation as well as transport electrification. Achieving these environmental benefits also depends on the successful expansion of metro infrastructure. To achieve the Net-Zero scenario, the report projects 180 km/year of metro network growth facilitating the road-to-rail metro shift. However, the feasibility of this continued, sustained growth is uncertain.

Feasibility concerns of the modal shift:

As per the 2023 IITD report, only 25-30% of projected ridership is actualised in India’s metro systems, with Delhi covering around 50% of the projected ridership (Chitlangia, 2024). This low ridership translates to low fare revenue for the operating authority. Additionally, the government in recent years is trying to reduce its fiscal burden, so concerns might be raised as to how this momentum of additional network capacities is to be fulfilled if the metro systems keep incurring financial losses (Bhatia, 2026).



Recommendations:

To address these problems, metro systems in India need to increase non-fare revenue to hedge against low ridership. There are many avenues through which non-fare revenue can be increased:

1. Integrated Rail and Property Development Authority: One approach is to integrate TOD into the planning of new metro corridors by granting Metro Rail Corporations development rights around stations. Hong Kong's Integrated Rail and Property Development is the cornerstone of its Mass Transit Railway's (MTR) success, where MTR is both the transit authority and property owner. MTR's non-fare revenue is 58% of its total revenue, while Hong Kong's public modal transportation share is 87% (Srivastava, 2025; Itokawa, 2020). Implementing the Integrated Rail and Property Development model in Indian Metro Systems by giving development rights to the Metro Rail Corporation can increase their financial viability while aligning the incentives for better land-use planning and transport investment.
2. Distinguish Greenfield & Brownfield TOD Projects: Implementing TOD in India requires differentiated policy approaches for brownfield and greenfield TOD projects. Greenfield TOD projects will be straightforward to implement; however, most metro projects in India are brownfield in nature due to the lag in public transport infrastructure planning. In such cases, multi-level station design and targeted redevelopment within the metro catchment area can help unlock the potential land value there.
3. Non-Fare Revenue: Alongside TOD, metro stations can generate revenue through advertising, retail stores, and station naming. Delhi Metro is already implementing such endeavors.



4. Integrated TDR and FSI Framework: Transferable Development Rights (TDR) and FSI can be integrated into the metro catchment area, where premium prices can be paid to the Metro Rail Corporation for additional FSI near the catchment area. Such integration, which is already functional in Mumbai and partly functional in Pune and Nagpur, can be applied nationwide.
5. Blended Finance and PPP: Blended finance and Public-Private Partnership (PPP) models, which were successful in Hyderabad, can be implemented nationwide to reduce the burden of these expansions from the public sector (Hyderabad Metro Rail, 2026).



Station naming at DMRC's Green Park Station
Source: Own



Retail Shops between connecting lines at DMRC's Rajiv Chowk Station
Source: Own



Advertising Spaces at DMRC's Rajiv Chowk Station
Source: Own

4.I.I.B Tier 2 - Tier 3 cities

Where Tier 1 cities can rely on rail-based mass transit, Tier 2 and Tier 3 cities require a fundamentally different approach. In Tier 2 and Tier 3 cities, the economies of scale and population density are simply not enough to implement metros for transit. For decarbonised transportation in less densely populated areas, existing bus networks and fleets can be retrofitted with EV technology. TOD across Bus Rapid Transport System (BRTS) corridors can be implemented instead of metros in such areas, as BRTS replicates the high-capacity, high-performance characteristics of urban rail/ metro at a much lower price. However, while integrating green technology in legacy fleets, one has to first address the issue of Bus Networks and BRTS in India.

Feasibility concern

Bus fleets have grown minimally while population and demand for buses have grown exponentially, leading to low frequency and waiting time issues. The combined loss of 58 State Road Transport Undertakings was Rs 30,191.93 crore in 2022, and the average fleet utilisation was 72.29%, reflecting that almost 20% of buses were not in service. BRTS (Mishra, 2025), which was highlighted as one of the congestion-free mass rapid transit systems that prioritises pedestrians and high-capacity buses in the Jawaharlal Nehru National Urban Renewal Mission (JnNURM), has had mixed outcomes in India (Mishra, 2025). Pilot projects in Pune, Jaipur, and Delhi have all been rolled back, as policy support and investments shifted in favour of metro rail projects supported by both the Central and State Governments. The success story of Ahmedabad's BRTS called 'Janmarg' has also had mixed results when it comes to sustainable integrated transport (Cervero & Dai, 2014).



Janmarg was designed as a closed system, with limited feeder services and integration of BRT stations with surrounding neighbourhoods. While statutory land-use and TOD plans were developed, their implementation was limited by poor market uptake and accessibility constraints. While implementing decarbonisation policies, policymakers in India first have to fix the structural issues that plague India's bus networks; otherwise, India will end up making the same mistakes again, but just more costly. Additionally, demand-side measures to reduce the trip distance should be incorporated through urban planning concepts like the 15-minute city and planned mixed land-use development to reduce sprawl. The further people live from work, services, and transit, the more kilometres they must travel.

4.1.2 Enabling Modal Shift:

The success of both the Tier 1 and Tier 2 / 3 solutions also depends upon the following enablers: last-mile connectivity, behavioural shift, and Multi-Modal Transport.

4.1.2 A : Last Mile connectivity: the Governance Gap

The success of the metro system depends on the last-mile infrastructure in cities. According to a CEEW study, lack of last-mile connectivity was one of the major barriers identified in accessing metros and public transportation in India (CEEW, 2023). Policy documents always stress improving last-mile connectivity, but the implementation framework is rarely discussed. In India, most of the last-mile connectivity infrastructure falls under the functions of Urban Local Bodies. Amendment 74 to the Constitution gives ULBs 18 statutory functions, out of which maintenance of roads, installing bus stops, street lighting, footpaths, and drainage and sewage are all essential infrastructure improving last-mile connectivity (Election Commission of India, 2025). One of the major reasons for this poor infrastructure is a lack of accountability and the problem of devolution.



States have the power to devolve fiscal and financial roles to ULBs, giving them the autonomy to properly govern and run their cities. However, in most states, due to the lack of devolution of these functions, the ULBs themselves are not able to provide the service delivery that is required from them.

For sustainable decarbonised transport, greater emphasis should be placed first on reducing this structural gap of devolution disparity among the third tier of governance. Additionally, instead of establishing a new finance pathway to fund green infrastructure in the city, green tied grants conditional on completion of last-mile connectivity infrastructure can be disbursed through the Finance Commission for smaller interventions. For larger capital requirements, Special Purpose Vehicles (SPVs) will be the appropriate pathway; however, these two instruments need to be incorporated together within policy frameworks for decarbonised transport requirements.

4.1.2.B: The Behavioural Effect: How to shift people towards public transportation:

Improving last-mile infrastructure is just one of the enablers of the modal shift. Shifting the deep-rooted behavioural patterns, however, is another challenge. Currently in India, nudges (which aim to augment a person's behaviour by quietly 'nudging' them towards the right direction) are already implemented, like colour-coded cycle lanes in Pune or various Walk/Bike to Work challenges across India. However, the effectiveness of nudges to alter lifelong or deep-rooted cultural habits only occurs when they complement traditional policy tools rather than replace them. A nodal agency, which either implements or coordinates traditional policies that reduce vehicle dependency like congestion pricing, high rates on parking or high taxes on petrol/diesel cars, together with nudges, will have the highest effectiveness. Just implementing traditional policies or nudges is not enough; they need to be implemented in tandem with one another.



4.1.2.C: Multi-Modal transport: Insights from Singapore

Aside from nudges and traditional policy tools, the switch to public transport is also dependent on the ease of switching between transport modes. Singapore is examined here as a case study to identify what it did differently and how similar strategies could be adapted for India.

Singapore has a balanced modal share, with public transport, cars and walking accounting for 42%, 36% and 18% respectively (Wyman, 2026). It has achieved this kind of balanced modal shift through multi-modal integration, focusing on 4 key aspects (Haas, 2018):

1. Physical integration: Connecting and integrating different transport modes through shared infrastructure. For instance, Singapore mandates that all mass transit stations connect directly to commercial establishments or alternative transit options.
2. Network integration: Structuring various transit systems so they complement and feed into one another rather than duplicating services along the same routes.
3. Operational Integration: Upgrading the user experience through synchronized timetables and unified payment systems, such as a single fare card that combines mass rapid transit, buses, and light rail.
4. Institutional Integration: Integration of land-use planning with planning by coordinating, or even merging, the various government agencies and private providers responsible for transport.

In India, along with behavioral nudges and traditional policies, enhancing multi-modal integration will increase the ease of access to public transportation, making it easier for individuals who have the option of private vehicles to choose public transportation instead. Physical and network integration, like feeder buses to metro stations, is already in practice; however, in non-metro cities, electrified Intermediate Public Transport (IPT) can be utilised to bridge the first-and-last mile connectivity gap to the BRT or bus station. Establishing e-bike stations near mass rapid transit stations as well as providing bicycle lanes and parking stations at the station can help incentivise cycling in cities.



For operational integration, India has already taken great strides by launching the 'National Common Mobility Card'; however, building up its complementary infrastructure is still required (PIB, 2019). Buses need to be retrofitted with these scanners to 'tap in' to the bus networks and ensure seamless integration. Formalising and providing IPT services with such scanners can also ensure seamless integration into the transport network. Lastly, addressing institutional integration, demarcating the statutory functions and powers of UMTAs (Unified Metropolitan Transport Authority) is extremely pertinent. UMTAs will be coordinating with municipal corporations, development authorities, metro rail authorities, and other concerned institutions for integrated land use and transport development. UMTAs must therefore be entrusted with either regulatory authority or direct budgetary power over member agencies, as without one of these, coordination becomes advisory, and integrated implementation cannot be regulated or enforced. Additionally, UMTAs are proposed (currently, implementation has started in Delhi (Bureau, 2026)) only for metropolitan cities. Enhancing the capacity of local municipal corporations in tier 2 / 3 cities so they can take on the role of UMTAs in such areas is also beneficial to align land-use and transport development for non-metro cities.

4.1.3: Contradicting policy push:

As discussed above, modal shift is imperative to achieve decarbonised transportation in India. However, current infrastructure policies are pulling the shift in the opposite direction. National Highways have increased by 61% (PIB, 2026a). PM Gram Sadak Yojana is expanding rural road connectivity (PIB, 2026a). Inclusive policies such as UDAN (Ude Desh ka Aam Nagarik) are making air travel more accessible. Without simultaneous incentivisation of public transport, these policies end up incentivising car dependency and air travel, which are the cause for most of the transport sector emissions in India. Inclusive policies like these are imperative in developing the economy, but they require a greater simultaneous green push, so they do not offset the gains of transport decarbonisation.



4.2 Rural Mobility

The urbanisation rate in India is projected at 51% for 2050 and 65% for 2070. This still leaves 35% of the rural population for whom sustainable transport systems of Mass Rapid Transit System will not be applicable. There has been significant improvement in rural connectivity through schemes like PM Gram Sadak Yojana, but they solve the problems of connectivity, not mobility. As we attain Viksit Bharat and shift to manufacturing from agriculture, the rising rural purchasing power may lead to a rise in demand for private vehicles in rural areas. The growth of household ownership of two-wheelers is already higher in rural areas than urban areas, and even in absolute terms, 120 million rural households own a two-wheeler in India compared to 90 million urban households (Abhishek Waghmare, 2024). Decarbonisation efforts in urban areas will be offset by increased emissions in rural areas if specialised policies are not designed for rural areas as well. Developed countries, with highly car-dependent areas, are already experiencing increased environmental pressures, including higher local air pollution from particulate emissions and greater contributions to global CO₂ emissions (European Commission, 2025b).

While problems of urban mobility are discussed in great detail in many policy documents, to achieve decarbonisation of the transport sector, rural areas and mobility need special policy focus as well. For example: in Maharashtra, even though 50% of the people live in rural areas, only 5300 out of 14000 buses operate in rural Maharashtra (ITDP India, 2024). That is 37% of the bus fleet, where 50% of the population resides. Bus infrastructure is density-sensitive. Due to the low dispersed demand in rural areas, fewer bus networks run, even though rural roads in India span 8 times the amount of urban roads, with bus density of 26 buses per 1000 km for rural areas to 42 per 1000 km for urban areas (Latwe, 2024). Rural mobility problems cannot be solved with a toned-down version of urban mobility solutions for decarbonised transport. Separate, rural-specific policy interventions are required for such a shift.



Recommendations:

1) Prevent carbon lock-in before it happens: To prevent carbon lock-in in rural areas, decarbonisation efforts must be targeted at providing green public transportation before private vehicle dependency worsens. Expanding CNG and EV bus networks into rural areas and retrofitting existing buses with EV technology is the first step. Additionally, electrifying and formalising Intermediate Public Transport, which includes e-rickshaws, e-vans and e-bicycles, is pertinent (UK PACT, 2021). IPT is already one of the last-mile solutions in rural and semi-urban India. Integrating it within the multimodal framework and setting up charging infrastructure to support these fleets would decarbonise existing mobility trends without requiring behavioural change from users.

2) Design for dispersed demand: Fixed-route buses are not financially viable in low-density rural areas where demand is dispersed. For densifying areas and peri-urban towns, electric minibuses and vans are a cost-effective alternative to full bus fleets. For less dense rural areas, Demand Responsive Transport (DRT), which operates on demand-dependent flexible timetables, can be implemented in India. Germany's DRT project called Sprinti, in Lower Saxony, recorded 570,000 rides in its first year, showcasing that DRT can work even in low-density areas (European Commission, 2025a). For India, electrified DRT in the form of formalised and regulated shared e-vans and e-rickshaws can act as feeder vehicles into larger regional bus networks or as an alternative to the traditional fixed public transport. Rural Local Bodies should be empowered to design and implement these services with inputs from local communities, as these systems will drastically change based on the nature of demand. Additionally, to address the low digital literacy and penetration in certain rural areas or demographics, app-based bookings must be complemented with call-based bookings to ensure everyone can avail such services.



3) Finance through existing mechanisms: New financing pathways do not need to be created for such interventions. As discussed above, given the losses faced by STUs, expecting them to bear the cost of deploying electric fleets may not be financially viable. Rural Local Bodies already receive grants from the Finance Commission. A portion of these grants can be redirected toward rural electrified transport and EV charging infrastructure rather than relying solely on STUs for financing. NABARD grants can also be utilised for the same.

4.3 Workforce transition:

EV transition is one of the integral pillars towards transport decarbonisation. The Indian government has already provided policy support for this transition through FAME I and II as well as production-linked incentives for EV parts and vehicles (PIB, 2017). However, during this transition, the human cost of this should also be explicitly addressed. The automobile sector employs around 30 million people (direct jobs of around 4 million and indirect jobs of around 26 million) (PIB, 2017). According to CEEW, by achieving the 2030 target of 30% EV penetration, around 1.2 lakh new EV jobs will be created, but that gain will be offset by a loss of 1.6 lakh jobs in the ICE vehicle sector (CEEW, 2023a). To ensure the human cost of this transition is low, the following are the possible pathways to be taken by the government:

- 1) Stakeholder Consultations: Identifying and holding discussions with relevant stakeholders of this transition, such as automobile manufacturers, MSME companies, and workers' unions, to incorporate their concerns into this transition.
- 2) Reskilling institutions: Clear roles should be assigned to the relevant ministries for programme implementation, while public universities and technical institutions should be responsible for developing and delivering specialised training programmes. Additionally, digital learning platforms and workers' unions can support the transition by making learning more accessible and by dispersing information about re-skilling to affected workers.



3) Automobile Clusters: Implementing state-specific targeted policies to support local automobile clusters such as Chakan near Pune (IBEF, 2024). Due to the backward-forward linkages of the sector, many automobile firms are clustered together. Identifying the unique challenges faced by these clusters and deploying strategies faced specifically by them in a localised manner will help in the transition.

4) Transition Fund: Establishing a 'Just-Transition' Fund capable of funding such a transition. The EU has built up a corpus of around € 19.7 billion, which is funding activities around upskilling and reskilling of workers, supporting MSMEs, R&D, environmental rehabilitation, and clean energy (European Commission, 2024).

4.4 Freight Transport:

Beyond passenger mobility, freight transport in India presents its unique set of challenges as well. India's freight transport is heavily road dependent, with its modal share being 66% in 2023. Rail freight share is 22% even though rail freight is 50% cheaper per tonne than road transport (KPMG, 2025). Currently, road transport is preferred over rail due to its inability to provide door-to-door connectivity, its low operational efficiency, and lack of integration with other modes (Aritua et al., 2018). It leads to longer lead times, unreliability, and friction while switching transport modes, increasing the total supply chain costs for users. Additionally, India's operational MMLP network handles just 2% of the total freight network currently (TNIE online desk, 2026). Achieving a modal shift to rail requires, yet again, structural changes, not just infrastructure investments.

Recommendations:

1) Tariff Rationalisation: Indian Railways cross-subsidises passenger fares by increasing freight tariffs (M. Jamshed & ET Infra, 2026). These increased freight tariffs artificially incentivise utilisation of road corridors. A new tariff structure, not subsidised by passenger fares, is required to make rail freight transport competitive across a huge variety of commodities.



2) Multi-modal and last-mile integration: India has a shortage of 150–200 modern freight terminals (World Bank, 2025). Current Multi-Modal Projects are being developed as isolated infrastructure investments instead of integrating them within an overarching national freight strategy. A national freight strategy connecting these isolated projects is required. Additionally, one way to address the shortage of freight terminals is converting outdated goods sheds into freight terminals operated by private partners, serving industrial clusters and Dedicated Freight Corridors (DFCs).

3) Indian Railways predominantly carries bulk commodities. As India's economy shifts toward manufacturing, the freight basket will expand, but rail freight has to keep up with changing demands. Timely delivery, containerisation, and truck-on-trains along DFCs will revamp rail freight for manufacturing and retail goods (PIB, 2026b).

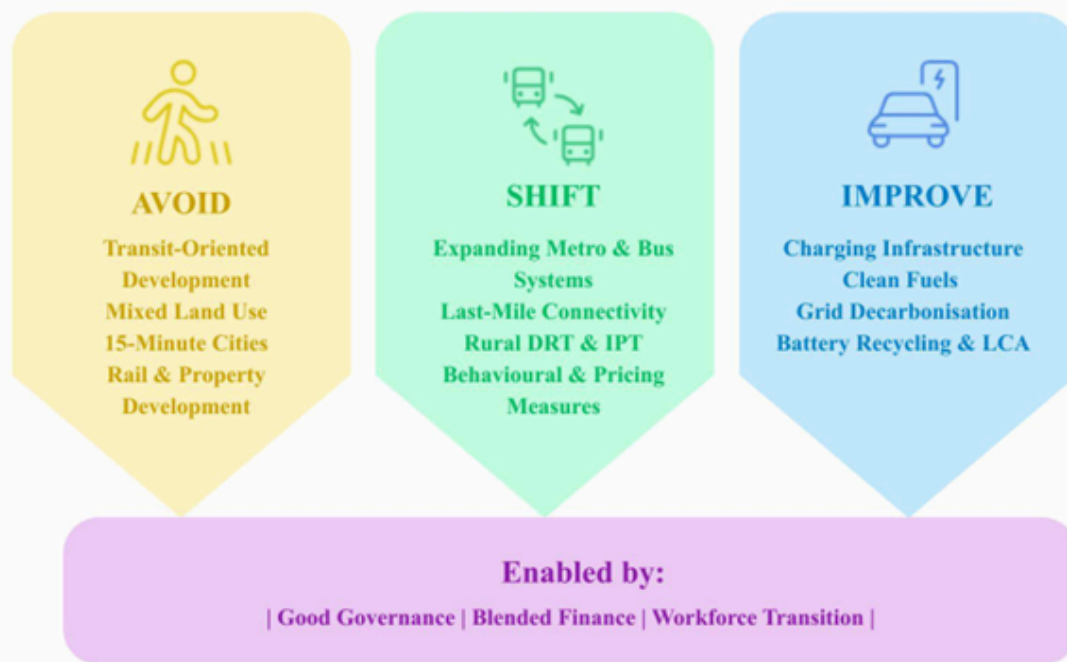


5. An Integrated Policy Response: The Avoid-Shift-Improve Framework

A policy framework India can use to streamline the process of executing the decarbonised transport policy is the Avoid- Shift- Improve framework (Bongardt et al., 2019). The framework categorises policies in 3 silos – namely the Avoid, Shift and Improve silos. Avoid means reducing the need for unnecessary car journeys through sprawl-control, compact development, mixed-land use, and 15-minute city measures. Shift refers to shifting remaining trips to lower-carbon, healthier modes like walking, cycling, and using public transport. Improve means making the transport that is unavoidable even after the Avoid and Shift measures cleaner, low-carbon, and more energy-efficient by deploying EVs, and associated grid decarbonisation and Life-Cycle Assessment measures. Reducing the need to travel comes first, followed by shifting to eco-friendly modes, and finally improving the efficiency of existing vehicles.

Research suggests that Avoid and Shift measures are more effective at lowering emissions than Improve; however, such measures are routinely given less funding (Hosseini et al., 2026). By leapfrogging directly to Improve measures, emissions can be reduced per-mile, but the overall transport system remains unchanged. In an ideal world, the Avoid policy measures are implemented first, then the Shift and finally the Improve measures. However, in India, this cannot be implemented one after the other. We are already focusing on 'Improve' measures such as EV deployment and the complementing infrastructure, fuel-mixing, and fuels like green hydrogen. Avoid and Shift measures should be brought up to the same level in terms of attention as well as funding to ensure sustainable decarbonised transport development.





*Source: Author's own creation
Platform: Canva*

The figure above showcases some of the recommendations in the report's Avoid-Shift-Improve Framework. While electrification of transport remains a top priority in India, the framework highlights that a sustained long-term goal of Net-Zero emissions also depends on reducing unnecessary travel demand and facilitating a shift towards cleaner, less private-dependent modes of transport. These three silos must be supported by good governance, innovative financing methods such as blended finance, and a workforce transition to ensure sustainable, inclusive, and successful implementation.

6 Conclusion:

India is at a crossroads in its development strategy, both as an emerging economic powerhouse through Viksit Bharat and as a nation with the potential to show the world how a developing nation can achieve sustainable and inclusive development simultaneously rather than retrofitting and updating development plans post facto. The Transport sector, which is one of the emissions-intensive sectors, will play an integral role in determining whether India will achieve its Net-Zero ambitions. The report argues that only technological interventions such as grid decarbonisation and EVs alone will not lead to a decarbonised transport sector, and must be complemented by measures such as Transit Oriented Development, 15-minute cities, sprawl management, and a modal shift towards public transport and NMT are also required. Achieving the modal shift away from road transport, both in passenger as well as freight transport, is of critical importance. Even though this shift of 66 to 60% in freight road transport and 78% to 64% for passenger transport appears to be a mere '6-14%' shift, actually reaching this stage requires structural transformation in our travel behavior, our governance, and transport systems. Accordingly, policies should prioritise strengthening public transport, integrating land-use systems and transport together by allocating budgetary and governing power, setting up differentiated strategies for urban and rural mobility, demarcating sustainable finance mechanism and ensuring that workforce transition is not overlooked in this shift. This approach is a way to transform India's mobility patterns for sustainable and inclusive development, not just to decouple transport from emissions, going 'beyond decarbonisation' to ensure accessibility, affordability, equity and resilience. The road towards decarbonisation requires intense, focused policy support as well as political and economic will, but also presents a unique opportunity to showcase development along with sustainability in one of the hardest sectors to decarbonise.



List of Abbreviations

Acronym	Full Form
ASIF	Activity, Structure, Intensity, and Fuel (framework)
BPKM	Billion Passenger-Kilometres
BRTS	Bus Rapid Transport System
BTKM	Billion Tonne-Kilometres
CEEW	Council on Energy, Environment and Water
CNG	Compressed Natural Gas
CPS	Current Policy Scenario
DFC	Dedicated Freight Corridor
DRT	Demand Responsive Transport
EV	Electric Vehicle
FAME	Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles
FSI	Floor Space Index
GDP	Gross Domestic Product
GHG	Greenhouse Gas
IESS	India Energy Security Scenarios
IITD	Indian Institute of Technology, Delhi
IPT	Intermediate Public Transport
JaNURM	Jawaharlal Nehru National Urban Renewal Mission
LCA	Life-Cycle Assessment
MMLP	Multi-Modal Logistics Park
MSME	Micro, Small and Medium Enterprises
MTR	Mass Transit Railway (Hong Kong)
NABARD	National Bank for Agriculture and Rural Development
NMT	Non-Motorised Transport
NZS	Net-Zero Policy Scenario
PPP	Public-Private Partnership
STU	State Road Transport Undertaking
TDR	Transferable Development Rights
TIMES	The Integrated MARKAL-EFOM System
TOD	Transit-Oriented Development
UDAN	Ude Desh ka Aam Nagrik (scheme)
ULB	Urban Local Body
UMTA	Unified Metropolitan Transport Authority

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