Urban Transformation for Healthier, Inclusive Lifestyles and Efficient, Resilient, Prosperous Cities

For

Low Carbon & Sustainable Mobility in India
(Decarbonisation of Indian Transport Sector)

Lead

FICCI

Knowledge Partners

IPPMG

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SHAKTI SUSTAINABLE ENERGY FOUNDATION



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PREFACE

To move down the path of reduced emissions from the Indian transport sector and provide direction to low carbon and sustainable mobility for India, FICCI embarked on the initiative for Developing an **India Roadmap** for Low Carbon and Sustainable Mobility with thrust on decarbonisation of the Indian transport sector. FICCI is supported in this initiative by knowledge partners, WWF-India, Paris Process on Mobility and Climate (PPMC) and Shakti Sustainable Energy Foundation (SSEF). The India Roadmap has eight distinct components outlined below.

1. Urban transformation for healthier, inclusive lifestyles and efficient, resilient, prosperous cities
2. Low-carbon energy supply strategy
3. Improve intermodal and mode-wise system efficiencies
4. Optimise supply chains to manage freight transport emissions
5. Avoid vehicle kilometres for commuting, shopping and accessing services
6. Provide low-carbon solutions for the rural (non-urban) populations
7. Accelerate action on adaptation in the transport sector
8. Large scale deployment of economic instruments and leveraging finance

Each of these components is covered in detail under individual reports, available separately as Theme Reports. The India Roadmap provides summaries of each component and actionable recommendations for short-term (2020-22), medium-term (2022-30) and long-term (2030-50). For detailed narrative of each component, the reader may refer to the individual theme reports of the respective component. For getting an overview of all components, the India Roadmap provides the complete context for low carbon and sustainable mobility for India.

This report covers the first component on "Urban transformation for healthier, inclusive lifestyles and efficient, resilient, prosperous cities".

The work on the India Roadmap has been guided by the FICCI Core Group on Sustainable Mobility consisting of eight working groups, each of which has worked on the eight components. The components are based on the Global Macro-Roadmap developed by PPMC. This methodological approach developed by PPMC is at the heart of the India Roadmap, with components of the India Roadmap being customised to Indian context and circumstances.

INTRODUCTION

Urban transformation for healthier, inclusive lifestyles and efficient, resilient, prosperous cities

This report of the roadmap addresses key aspects related to urban transportation such as common governance structures for managing urban transport, changes needed in regulation to encourage public transport, policies to incentivise public, shared and sustainable transport, improving infrastructure for public, shared, and non-motorised transport, creation of low and zero emission zones in peak hours, enhancing last mile connectivity, and ensuring smooth Interoperability for payments/ technology solutions.

The report covers detailed insights along with actionable recommendations, and draws on the deliberations with different stakeholders from the public and private sectors, including from industry, think tanks, governments and research institutions and non-government organisations.

CHAPTER 1

HEART OF THE PROBLEM

The solutions often lie within the problem itself

"A developed country is not a place where the poor have cars. It's where the rich use public transportation."

- Gustavo Petro,
Mayor of Bogotá

1.1 Current Case

With 377 million people forming a third of India's population living in urban centres, India is at the cusp of urban transformation. In fact, the 2011 Census identified 50 metropolitan cities (with population over one million) across the country which are likely to witness significant growth in their size and population in the coming decades. According to NITI (National Institution for Transforming India) Aayog in 2011-12, these urban centres contributed 53% of the national income.

As India gets more urbanised, cities and towns are likely to contribute even more to India's economic growth.

As per several studies, India is transforming with existing cities expanding and extending their periphery to accommodate the steady exodus from rural to urban India. As per some estimates, it is expected that the percentage of people living in urban India is likely to increase to 40% by 2030. This directly translates to an increase of around 200 million people in urban India.[1] Since cities are the major contributors to the GDP (gross domestic product), the manner in which India's urban centres grow and evolve will define India's growth trajectory towards the aspirational milestone of USD 5 Trillion by 2025.

Accelerating urbanisation invariably leads to an exponential increase in demand for travel. As urban activity increases, mobility tends to become a bottleneck, unless adequate and well planned public transportation systems are put in place. In India, most of the urban cities and towns have evolved over several decades and centuries. Their growth has been organic, even unplanned. As a result, deploying robust and adequate mobility systems has often been delayed. It has also proven inadequate in terms of addressing the mobility needs of urban India. With limited access to efficient public transport, this has led to unsustainable growth in private vehicle ownership. And this in turn has resulted in several unintended and unanticipated side effects such as congestion, declining air quality, noise pollution as well as increasing road fatalities.

A study in trends

Rising vehicle ownership coupled with unplanned human habitation and arbitrary city growth has led to increased congestion in the cities, gradual usurping of community spaces for parking spaces and rising vehicular pollution levels. With urban India aspiring for more and a rising middle class, public transportation, even when available, has started to be perceived as an inferior mode of travel. The figures that follow present a clear picture of these trends, and their adverse impact.

[1] McKinsey Global Institute(2010). India's Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth. McKinsey & Company

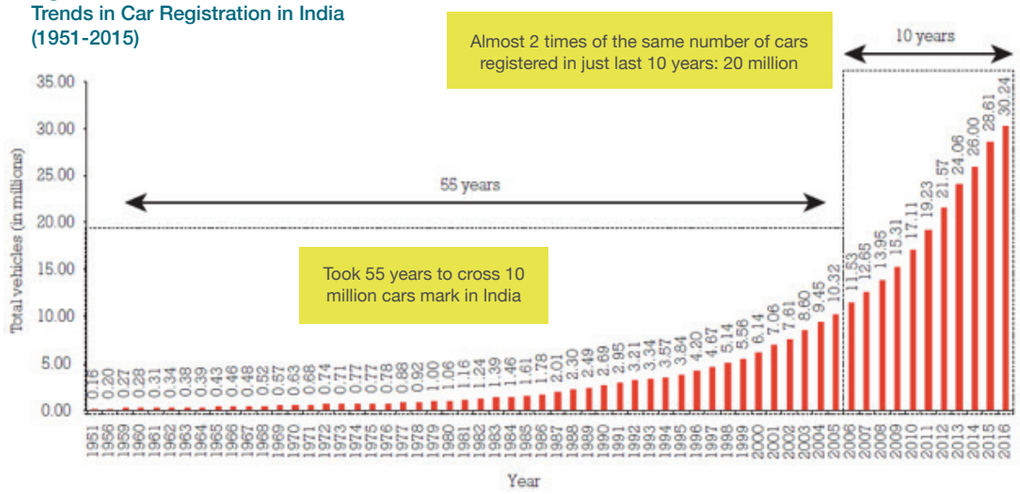
With the rising urban population in India, demand for personal mobility is expected to triple by 2030. A deeper look at the transport infrastructure shows that development to manage this rise has been fairly reactive rather than proactive.

Finally, the linkage between transportation and land development in the city has been quite tenuous, with the Land Development Authority and various transport infrastructure creation institutions working on individual goals and at times on cross-purposes.

The case for decarbonisation

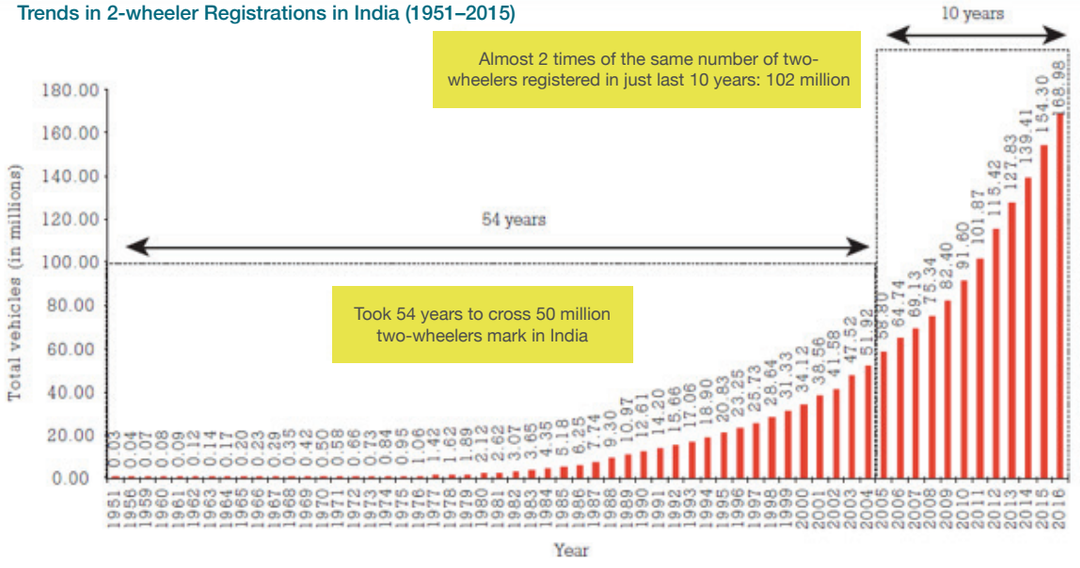
Decarbonisation in the Indian transport sector is essential to meet the growing needs of the Indian population, especially in cities, while limiting negative externalities that result from increased transportation, such as GHG (greenhouse gas) emissions, congestion, and pollution. To bring about decarbonisation, sustainable mobility is a must.

Figure 1
Trends in Car Registration in India (1951-2015)



Source: Centre for Science and Environment (CSE) (2018). The Urban Commute. https://www.cseindia.org/the-urban-commute-8950

Figure 2
Trends in 2-wheeler Registrations in India (1951–2015)



Source: Centre for Science and Environment (CSE) (2018). The Urban Commutehttps://www.cseindia.org/the-urban-commute-8950

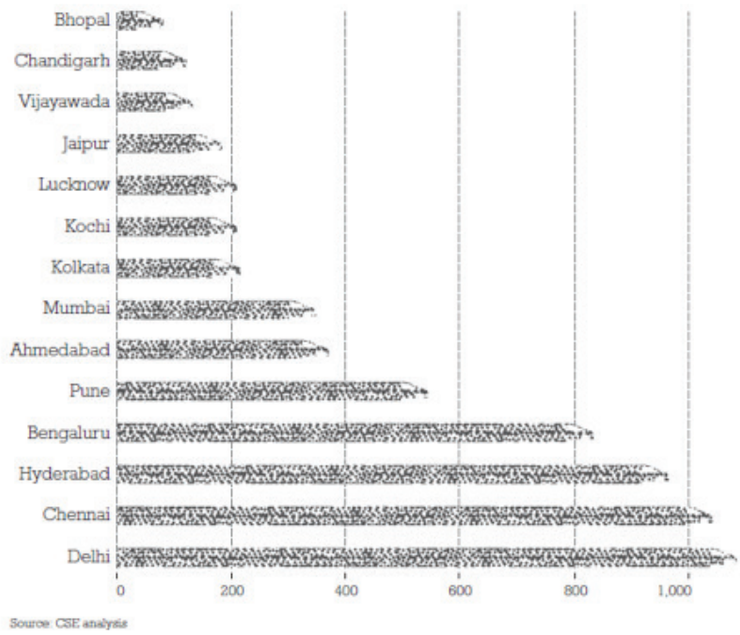
As evident from the figures, the rise in 2 Wheelers and 3 Wheelers has been exponential in the last 10 years. Consider this: starting from 1951, it took 55 years for India to reach 10 million cars. It took only another decade to reach the next 10 million, and only 5 years to reach the next 10 million.

Innovative sustainable low carbon transport solutions can enhance the quality of life in existing cities, and provide smart, safe and sustainable cities of tomorrow.

Implementing these sustainable and low-carbon solutions can create numerous economic and social benefits such as improved air quality, job creation, and poverty alleviation in addition to reducing GHG emissions.

Thus, there is an urgent need to evolve a common well-empowered governance structure for urban transport, policies to incentivise public, shared and sustainable transport, improving infrastructure for public, shared, and NMT, creation of low and zero-emission zones in peak hours, enhancing last-mile connectivity, and ensuring smooth interoperability for payments/ technology solutions.

Figure 3
Total Particulate Emission Load (kg/day)
from Urban Commuting



Source: Centre for Science and Environment (CSE) (2018). The Urban Commute.
https://www.cseindia.org/the-urban-commute-8950

CROSSROADS *OF CHANGE*



Speaking at the Global Mobility Summit-MOVE in September 2018 at New Delhi, the Hon'ble Prime Minister Shri. Narendra Modi outlined the vision for the future of mobility in India based on 7 Cs: Common, Connected, Convenient, Congestion-free, Charged, Clean, and Cutting-edge.

1. **Common public transport** must be the cornerstone of our mobility initiatives. New business models driven by digitisation, are re-inventing the current paradigm. Big Data is enabling smarter decision-making by better understanding our patterns and needs.
2. **Connected mobility** implies integration of geographies as well as modes of transport. The Internet-enabled 'connected sharing economy' is emerging as the fulcrum of mobility.
3. **Convenient mobility** means safe, affordable and accessible mobility for all sections of the society. This includes the elderly, the women and the specially-abled. We need to ensure that public transport is preferred to private modes of travel.
4. **Congestion-free mobility** is critical to check the economic and environment costs of congestion. Hence, there should be emphasis on ending bottlenecks of networks. This would result in fewer traffic jams and lower levels of stress for people travelling. It would also lead to greater efficiency in logistics and freight.
5. **Charged mobility** is the way forward. We want to drive investments across the value chain from batteries to smart charging to EV (electric vehicle) manufacturing. India's business leaders and manufacturers are now poised to develop and deploy break-through battery technology.
6. **Clean mobility** powered by Clean Energy is our most powerful weapon in our fight against climate change! This means a pollution-free clean drive, leading to clean air and better living standards for our people.
7. **Cutting-edge mobility** is like the Internet in its early days. It is the next big innovation sector. Events like the 'Move Hack' and 'Pitch to Move' show how young minds are coming up with creative solutions.

1.2 BAU (business as usual) Scenario by 2030/2050

The urban population and its associated economic activities are projected to grow rapidly in the coming decades. Currently, India has three megacities with a population exceeding 10 million inhabitants. By 2030, 40.76% of country's population is expected to be residing in urban areas,[2] while four more cities (Ahmedabad, Bangalore, Chennai, and Hyderabad) are likely to join the megacity club[3] even as the existing three megacities grow to new levels of unprecedented expansion. India's urban population is predicted to contribute as high as 75% of the GDP.[4] A research report by McKinsey Global Institute (MGI) estimates that by 2030, demand for vehicles would rise multi-fold while average speeds could come down drastically, and very quickly move towards a crisis in transport. As the situation grows increasingly unsustainable, only drastic action can help weather this impending storm. With rising urbanisation in India, traffic movement across 87 cities could more than double from a 2007 baseline of 229 million trips to 482 million trips in 2030. The BAU scenario projected by the government assumes that owing to increased congestion, average speeds on major city corridors could decrease from 26-17 km/hr in 2007 to just 8-6 km/hr by 2030, with emission levels rising seven times in that time frame.[5]

It is increasingly apparent that our cities need drastic action on the mobility front. If decisive and well-planned action is not initiated, it is highly likely that cities will end up in a gridlock, in more ways than one.

Solutions will need to be devised locally in order to drastically enhance mobility standards by augmenting public transportation services, while at the same time redefining the city growth.

ALONG THE ROAD



In 2008, the Ministry of Urban Development (MoUD) released a report titled "Study on Traffic and Transportation Policies and Strategies in Urban Areas in India". The report provides projections of how transport demand will evolve in India under the umbrella of the National Urban Transport Policy. The findings of the BAU scenario projected from 2007 to 2030 in this study are as follows:[6]

- The per capita trip rate for all modes (defined as a one-way trip made by a person from origin to destination by a single-mode) including NMT is estimated to increase from 0.8-1.5 to 1.0-2.0 for cities of various sizes.
- The future public transport share will decrease from 5-46% to 2-26%.
- Expected average journey speeds on major corridors in future for various city categories will fall from 26-17 kmph to 8-6 kmph.
- Daily trips in the 87 urban centres are anticipated to double from 228.6 to 481.9 million.

[2]UNFPA (2007). State of World Population 2007: Unleashing the Potential of Urban Growth. United Nations Population Fund. https://www.unfpa.org/sites/default/files/pub-pdf/695_filename_sowp2007_eng.pdf
[3]United Nations (2014). World Urbanization Prospects, 2014.DESA/Population Division.
[4]India-2030--exploring-the-future, CREDAI, 2019
[5]Future of India The Winning Leap, PwC, 2014
[6]MoUD (2008). Study on tTaffic and Transportation Policies and Strategies in urban Areas in India. New Delhi: Ministry of Urban Development. http://mohua.gov.in/upload/uploadfiles/files/final_Report.pdf

1.3 Implication For Urban India

An urban centre's productivity and efficacy is highly dependent on the effectiveness of its transport system. A poor transportation system stunts the economic growth of the nation. Urban mobility in Indian cities is becoming increasingly challenging in terms of convenience, cost and time, and is characterised by exponential rise of private transport, high level of congestion, lack of public transit options, environment pollution, traffic fatalities and inequity. India suffers a serious deficiency in the availability of reliable, affordable, safe public transport that can meet the needs of an emerging India. The Indian transportation system, thus, has some major hurdles on its way to optimisation and these include:

The Pollution Problem:

Air pollution is a serious environmental health problem in India. It is the 3rd leading risk factor for mortality, accounting for almost 13% of deaths (1.2 million) in India in 2017. Air pollution exposures, including exposure to outdoor PM2.5 (particulate matter) and HAP (household air pollution) have been linked to increased hospitalisations, disability, and early death from respiratory diseases, heart disease, stroke, lung cancer, and diabetes. Exposure to ambient ozone is linked to COPD (chronic obstructive pulmonary disease). Individually, outdoor air pollution is ranked as the 4th leading risk factor. As per the "State of Global Air Report 2019", there were 673,100 deaths due to exposure to outdoor PM2.5. Exposure to outdoor PM also accounted for a loss of nearly 1 year and 6 months in life expectancy.[7]

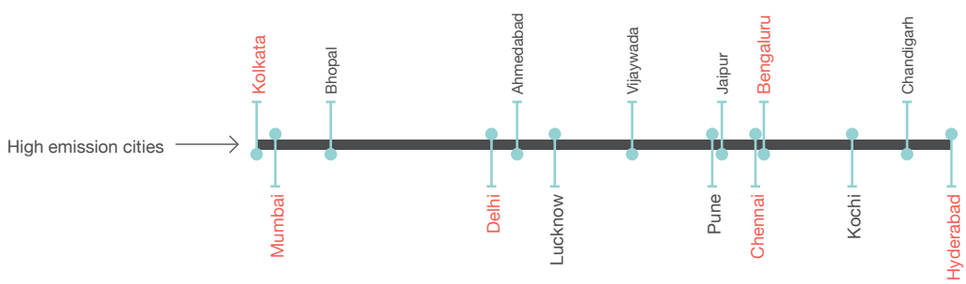
A global report on air pollution by the World Health Organization (WHO) shows that 14 of the 15 cities with the highest levels of PM (particulate matter) 2.5 pollutants in 2016 were in India. Many cities in India exceed the WHO's guidelines for PM. More importantly, many Indian cities also exceeded the country's less stringent National Ambient Air Quality Standards. The Central Pollution Control Board (CPCB) has identified 122 such non-attainment cities.

The transport sector is one of the major contributors to pollutants such as outdoor PM2.5, oxides of Nitrogen and Sulphur. In addition, it also contributes to secondary pollutants such as ambient ozone and secondary particulates. Moreover, the burning of fossil fuels leads to emissions of CO_2 (carbon dioxide), one of the GHG gases responsible for global warming.

Suffice it to say that the transportation sector contributed to 10.8% of the total GHG emissions in CO_2 equivalent (with LULUCF—land use, land-use change, and forestry) for the year 2014; however, if left unchecked, this percentage is likely to continue to rise as more fossil fuel based private vehicles get added.[8]

While a large number of urban areas are already exposed to pollution levels that do not conform to air quality standards, the situation is expected to further worsen in the absence of a comprehensive time-bound implementation of remedial measures.

Figure 4
Ranking Based on Per-Travel Trip Emissions and Energy Consumption



Source: Centre for Science and Environment (CSE) (2018). The Urban Commute. https://www.cseindia.org/the-urban-commute-8950

[7] Health Effects Institute (2019). State of Global Air/2019. https://www.stateofglobalair.org/sites/default/files/soga_2019_india.pdf
[8] MoEFCC (2018). India: Second Biennial Update Report to the United Nations Framework Convention on Climate Change. New Delhi: Ministry of Environment, Forest and Climate Change, Government of India.

ALONG THE ROAD

The Urban Commute, CSE, 2018

In 2018, CSE released a report titled "The Urban Commute and How it Contributes to Pollution and Energy" that assessed 14 cities which are among the most populous in different regions, based on emission of CO_2, PM and nitrogen oxides, as well as energy-guzzling from urban commuting. Six megacities (Delhi, Mumbai, Kolkata, Chennai, Bengaluru, and Hyderabad) and eight metropolitan cities (Bhopal, Lucknow, Jaipur, Chandigarh, Ahmedabad, Pune, Kochi, and Vijayawada) were evaluated. It was observed that particulate emission load per trip from private vehicles was much higher than of public modes of transport.

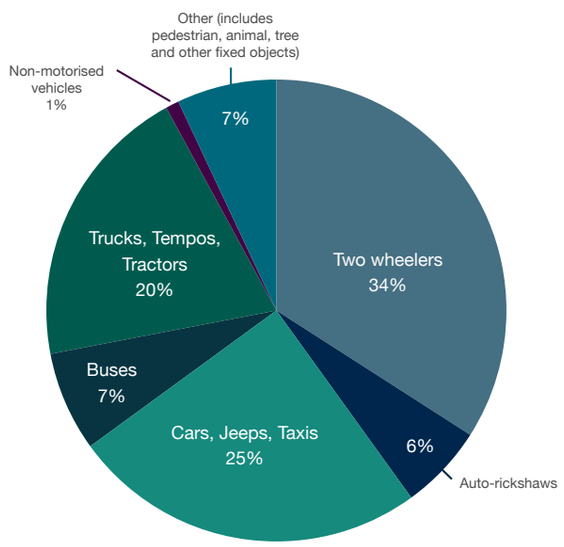
Though metropolitan cities scored better than megacities due to lower population, lower travel volume and lower vehicle numbers, they were at risk due to a much higher share of personal vehicle trips. Delhi ranked at the bottom of the table for overall emissions while Bhopal had the least overall emissions.

The report highlighted that while some cities have begun taking mitigation action, there is no clear policy yet about the level of stringency and the cuts in emissions that are needed.

Road Safety Concerns:

In 2012, the International Road Federation (IRF) estimated that traffic collision results in an annual monetary loss of $20 billion in India. In 2017, a total of 82,286 road accidents were recorded in the 50 one million-plus cities out of which 15,996 were fatal accidents, i.e., caused death of one person or more. These accidents resulted in the loss of 16,971 lives and caused injuries to 73,945 persons.[9] These were telling signs of the grave impact of inadequate stringent road safety rules.

Figure 5
Share of Different Vehicle Types in Road Accidents 2017



Source: MoRTH (2018). Road Accidents in India, 2017. New Delhi: Transport Research Wing, Ministry of Road Transport and Highways.http://www.indiaenvironmentportal.org.in/files/file/road%20accidents%20in%20India%202017.pdf

[9] MoRTH (2018). Road Accidents in India, 2017. New Delhi: Transport Research Wing, Ministry of Road Transport and Highways.http://www.indiaenvironmentportal.org.in/files/file/road%20accidents%20in%20India%202017.pdf

Impact of Congestion:
Congestion causes delays, unproductivity, unpredictability and poses difficulties in conducting business, eventually affecting the GDP growth. In fact, the cost of congestion is estimated to be INR 1,470 billion annually in Delhi, Mumbai, Kolkata, and Bengaluru.[10] According to the Revised Master Plan, 2031 by Bangalore Development Authority, 1.18 crore citizens waste 0.6 billion man-hours annually: translating to INR 37 billion, including INR 13.5 billion on fuel alone, and the rest on productivity (man-hours) loss.

And yet each of these factors can be battled can be resolved through many possible solutions:

Electric Vehicles:
The world is shifting towards electricity-driven vehicles. Provided that electricity generation is green, these vehicles will pollute negligibly and will help towards limiting the emissions. The vehicles can range from the electric bike for personal mobility to electric cars and electric buses for mass mobility.

While a large number of urban areas are already exposed to pollution levels that do not conform to air quality standards, the situation is expected to get much worse in absence of comprehensive time-bound implementation of remedial measures.

NMT:
NMT modes, such as walking and cycling, not only promote health, but are also affordable, clean, and efficient. The cities worldwide are acknowledging the importance of NMT and designing cities and transport infrastructure around it.

Shared Mobility:
New businesses are developing which gives the users an opportunity to shift from ownership to ridership. Same assets are shared leading to optimal use of time and resources.

Mass Mobility:
Given the limited resources in terms of fuel and space mass mobility solutions like metros, Bus Rapid Transits, Light Rails etc. are being used worldwide to tackle the problem of congestion and efficiency.

Intelligent Traffic Management Systems (ITS):
With the fast-paced development of Internet technologies like Internet of Things, smart devices etc., systems are able to interact with each other and share data for optimum utilisation. Intelligent Traffic Management Systems will integrate different modes of transport and will also manage traffic for safe, fast, and clean travel experience.

Recent years have seen positive developments in terms of policy initiatives, emphasis on building transport infrastructure such as metros and BRTS (bus rapid transport systems), innovations in technology like FASTag and business models for promoting shared mobility solutions, emerging solutions in the domain of Information technology, EVs, etc. However, some fundamental structural issues remain that need to be resolved by a paradigm shift in our thinking. There is a need to shift from transport of vehicles towards mobility of passengers and goods for overcoming the roadblocks towards urban transformation for healthier, inclusive lifestyle and efficient, resilient, prosperous cities.

[10] The Boston Consulting Group (2018). Unlocking Cities: The Impact of Ridesharing across India, April. http://image-src.bcg.com/Images/BCG-UnlockingCities-Ridesharing-India_tcm9-185213.pdf

CHAPTER 2

IN RESPONSE

Responding to a problem opens the doors to change.

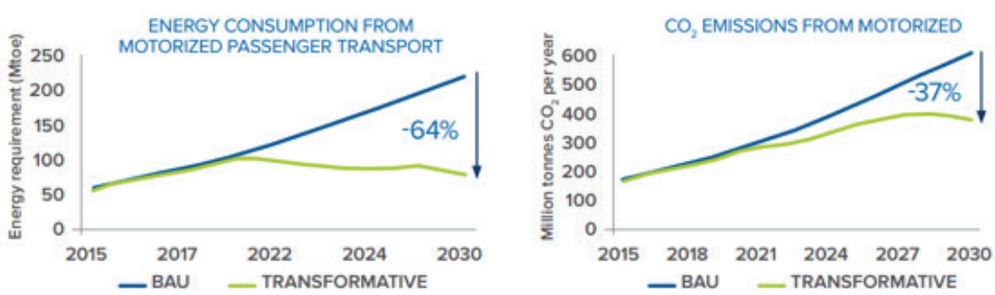
India, which has traditionally valued low carbon and sustainable lifestyles, has committed to follow a low carbon trajectory as declared in its Nationally Determined Contribution (NDC). Significant efforts are underway in multiple sectors towards decarbonising the Indian economy. The successful transformation story of the growth of renewable energy highlights the importance of setting ambitious targets and undertaking dedicated efforts to achieve the same. However, in the transport sector, the government has a larger vision for sustainable transport which is reflected in its various schemes and policies. To achieve that, a clear target for accelerated decarbonisation needs to be formulated.

As per a vision document by NITI Aayog called "India Leaps Ahead"*, it is estimated that India can save 64% of anticipated passenger road-based mobility-related energy demand and 37% of carbon emissions in 2030 by pursuing a future with shared, electric, and connected mobility.

This would result in a reduction of 156 Mtoe (millions of tonnes of oil equivalent) in diesel and petrol consumption for that year. At USD 52/bbl of crude, this would imply a net savings of roughly Rs 3.9 lakh crore (approximately 60 billion USD) in 2030.[11] For achieving these transformative changes, holistic development of a smart transportation system will be required with far-reaching changes ranging from fundamental ones such as governance to softer ones such as seeking a change in commuter perceptions about public transport.

Reviewing the various policy initiatives undertaken by India to address the imperatives of low carbon transport systems will help understand how to meet the growing needs for sustainable mobility systems in urban India.

Figure 6
Consumption and Emission from Transport in Transformative Scenarios



Source: NITI Aayog and Rocky Mountain Institute (2017). India Leaps Ahead: Transformative Mobility Solutions for All.

[11] *NITI Aayog and Rocky Mountain Institute (2017). India Leaps Ahead: Transformative Mobility Solutions for All.

2.1 Policy Response

Many government policies are relevant to sustainable mobility in urban areas. These include:

NUTP (National Urban Transport Policy):
The Ministry of Urban Development devised a comprehensive NUTP in 2006 to ensure safe, affordable, quick, comfortable, reliable and sustainable access for more city residents to jobs, education, recreation and such other needs within our cities. This was sought to be achieved, inter-alia, by:

- Reducing pollution levels through changes in travelling practices, better enforcement, stricter norms, technological improvements, and more
- Promoting the use of cleaner technologies
- Encourage greater use of public transport and non-motorised modes by offering central financial assistance for this purpose
- Introducing ITS for traffic management

National Electric Mobility Mission Plan (NEMMP):
Launched in 2013, the NEMMP 2020 is one of the most important and ambitious initiatives undertaken by the Government of India with a potential to bring about a transformational paradigm shift in the automotive and transportation industry in the country. This is a culmination of comprehensive collaborative planning for promotion of hybrid and electric mobility in India. It has been done through a combination of policies aimed at gradually ensuring a vehicle population of about 6-7 million electric/hybrid vehicles in India by 2020 along with a certain level of indigenisation of technology. This will enable India to ensure global leadership in some vehicle segments. NEMMP is a composite scheme using different policy-levers such as:

- Demand side incentives to facilitate the acquisition of hybrid/EVs.
- Promoting R&D (research & development) in technology including battery technology, power electronics, motors, systems integration, battery management system, testing infrastructure, and ensuring industry participation in the same.
- Promoting charging infrastructure.
- Supply side incentives.
- Encouraging retro-fitment of on-road vehicles with hybrid kit.

ALONG THE ROAD

National Urban Policy Framework (NUPF) 2018

Ministry of Housing and Urban Affairs (MoHUA) has prepared a draft urban policy framework that outlines an integrated and coherent approach towards urban planning in India. Transportation and mobility are amongst the 10 functional areas discussed in the policy framework.

The NUPF seeks to overcome the current state of urban congestion as well as unequal levels of mobility across social groups. To this end, the public transport system has to become accessible, affordable, and efficient for all. This requires placing people, not vehicles, in the centre of transport planning. Different modes of public transport have to be integrated into one system under strong leadership—the Unified Metropolitan Transport Authority (UMTA). The broad objective is to promote public transport and ITS with provision for pedestrian and street infrastructure. It calls for internalising urban transport as a key variable in urban planning exercises and establishing institutional mechanisms, as also capacity building for better planning and management of transport systems.

FAME (Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicles) India Phase 2:
Following the success of FAME 1, FAME 2 was initiated in 2019 for Faster Adoption and Manufacturing of EVs in India. It has been launched with a total outlay of INR 100 billion is being implemented over a period of three years.

FAME 2 plans to support 1 million e-2W, half a million e-3W, 55,000 4Ws and 7,000 buses. To encourage advanced technologies, the benefits of incentives will be extended to only those vehicles which are fitted with advance Lithium Ion and other new technology batteries.

The scheme proposes establishing charging infrastructure, whereby about 2,700 charging stations will be established in metros, million-plus smaller cities, smart cities and cities of hilly states across the country so that there is at least one charging station in a grid of 3 km x 3 km.

Atal Mission for Rejuvenation and Urban Transformation (AMRUT):

AMRUT launched in June 2015 aims to drive economic growth and foster inclusive urban development.

AMRUT adopts a project approach to ensure basic infrastructure services relating to water supply, sewerage, septage management, stormwater drains, transport and development of green spaces and parks with special provision for meeting the needs of children.

Jawaharlal Nehru National Urban Renewal Mission (JnNURM):

JnNURM was a state sector scheme for urban renewal initiated by Ministry of Housing and Urban Poverty Alleviation (MoHUPA), GoI implemented over nine years between 2005 and 2014. The scheme focused on fast track development of cities across the country, with a focus on bringing about efficiency in urban infrastructure. It provided financial assistance to ULBs (urban local bodies) and para-statal agencies.

National Hydrogen Energy Road Map (NHREM):

The NHERM is a programme initiated by the National Hydrogen Energy Board (NHEB) in 2003. It was approved in 2006 for bridging the technological gaps in different areas of hydrogen energy, including its production, storage, transportation and delivery, applications, safety, codes and standards and capacity building up to the year 2020. The project aims to reduce India's dependence on import of petroleum products, promote the use of diverse, domestic, and sustainable new and renewable energy sources. It also aims to provide electricity to remote, far-flung, rural and other electricity deficient areas, and promote the use of hydrogen as a fuel for transport and power generation. Another focus area is to reduce carbon emissions from energy production and consumption, to increase reliability and efficiency of electricity generation; to generate 1000 MW electricity using fuel cells by 2020 and 1 million vehicles running on hydrogen-based IC (internal combustion) engines and fuel cells by 2020.

Biofuels initiatives:

In order to promote biofuels in the country, a National Policy on Biofuels was made by the Ministry of New and Renewable Energy in 2009. Globally, biofuels have grabbed the limelight in the last decade and it is imperative to keep up with the pace of developments in the field. With a thrust on 'advanced biofuels', the policy indicates a viability gap funding scheme for 2G ethanol biorefineries of INR 50 billion in 6 years in addition to additional tax incentives, higher purchase price as compared to 1G biofuels. The policy encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, used cooking oil, short gestation crops.

Metro Rail Policy 2017:

The policy seeks to enable the realisation of growing metro rail aspirations of a large number of cities in a responsible manner. It focuses on compact urban development, cost reduction and multimodal integration. It opens a big window for private investments across a range of metro operations making PPP (public-private partnership) component mandatory for availing central assistance for new metro projects. Private investment and other innovative forms of financing of metro projects have been made compulsory to meet the huge resource demand for capital intensive high capacity metro projects.

CROSSROADS OF CHANGE



At present, metro projects with a total length of 370 kilometres are operational in 8 cities viz., Delhi (217 kilometres), Bengaluru (42.30 kilometres), Kolkata (27.39 kilometres), Chennai (27.36 kilometres), Kochi (13.30 kilometres), Mumbai (Metro Line 1-11.40 kilometre, Mono Rail Phase 1-9.0 kilometre), Jaipur (9.00 kilometres), and Gurugram (Rapid Metro-1.60 kilometre). Metro projects with a total length of 537 kilometres are in progress in 13 cities including the 8 mentioned above. New cities acquiring metro services are: Hyderabad (71 kilometres), Nagpur (38 kilometres), Ahmedabad (36 kilometres), Pune (31.25 kilometres), and Lucknow (23 kilometres).

National Transit Oriented Development Policy (2017):
National Transit Oriented Development Policy integrates land use and transport planning to develop compact growth centres within the influence zone of 500-800 m on either side of the transit stations i.e. areas within walking distance. TOD (transit oriented development) will be financed by channelising a part of the increase in property values - resulting from investments in transit corridors through betterment levies and value capture financing tools. Increased private sector participation will result in economic development and employment generation. States and Union Territories are required to incorporate TOD in the Master Plans and Development Plans of cities besides identifying 'influence zones' from transit corridors for tapping revenue streams.

National Clean Air Programme (NCAP):
A time-bound national-level strategy for pan India implementation, NCAP intends to tackle the increasing air pollution problem across the country. The tentative national level target of 20–30% reduction of PM2.5 and PM10 concentration by 2024 is proposed under the NCAP taking 2017 as the base year for the comparison of concentration.

India's post-2020 climate goals:
For the post-2020 period, in response to the decisions of the Conference to the Parties, India submitted its NDC to the United Nations Framework Convention on Climate Change (UNFCCC) on 2 October 2015. It outlined the climate actions intended to be taken under the Paris agreement.

Some goals put forth by India in its NDC are:

- To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation
- To adopt a climate-friendly and a cleaner path than the one followed hitherto by others at a corresponding level of economic development
- To reduce the emissions intensity of its GDP by 33 to 40% by 2030 from 2005
- To achieve about 40% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030 with the help of the transfer of technology and low-cost international finance including from Green Climate Fund (GCF)
- To mobilise domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap
- To build capacities, create a domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future

ALONG THE ROAD



In 2016, the Ministry of Environment, Forest and Climate Change (MoEF&CC) constituted an NDC Implementation Committee chaired by the Secretary, EF&CC, and six thematic Sub-committees to prepare the roadmap for implementation of India's NDC in the post-2020 period. The committee and sub-committees, involving key Ministries and Departments of the GoI, are working to identify specific policies and actions aimed at achieving NDC goals. They are also working on to indicate the financial outlays and technology interventions needed from domestic and international sources at various stages to achieve these goals.

(Source: http://moef.gov.in/environment/climate-change/ accessed on 29.4.19).

National Mission on Transformative Mobility and Battery Storage:

This unique mission aims to drive clean, connected, shared, sustainable and holistic mobility initiatives. It will recommend and drive the strategies for transformative mobility and Phased Manufacturing Programmes for EVs, EV Components and Batteries. The mission will facilitate cooperative federalism, extensive stakeholder and inter-ministerial consultations and implement end-to-end policy framework for transforming the mobility landscape with a focus on:

- Manufacturing
- Specification & standards
- Fiscal incentives
- Overall demand creation and projections
- Regulatory framework
- Research & Development

The Motor Vehicles (Amendment) Act, 2019:

The Act was passed in August 2019 to make further amendments in the Motor Vehicles Act (MVA) 1988. In order to deter traffic violations, the Act has increased the fines for drunken driving, driving without a licence, dangerous driving, over-speeding, and so on. It also promises to protect those people who render emergency medical or non-medical assistance to a victim of an accident, from any civil or criminal liability. For offences by juveniles, the guardian or owner of the vehicle shall be deemed to be guilty and punished with fine and imprisonment. The juvenile would be tried under the Juvenile Justice Act, 2000 and the registration of the motor vehicle will be cancelled for a period of 12 months. The Bill increases the minimum compensation for hit-and-run cases. It allows the Central Government to order for recall of defected motor vehicles which may harm the environment, or the driver, or other road users. The National Road Safety Board will also be created by the Central Government to advise the Central and state governments on all aspects of road safety and traffic management.

2.2 Sustainable Mobility: On Ground Projects in India

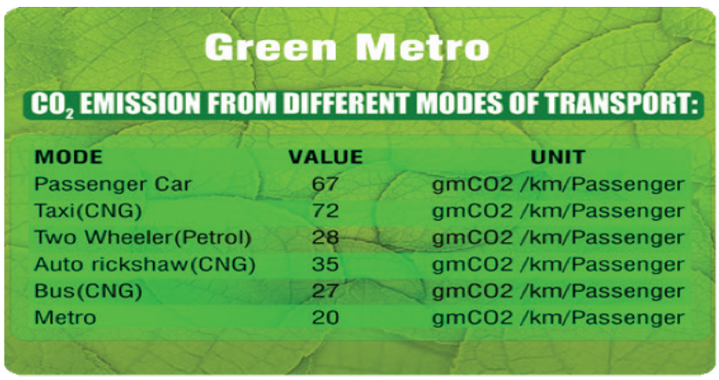
While several policy initiatives have been taken up in the past, many projects have also been implemented or are being implemented on the ground. Here are some sustainable projects that have been initiated in various states and cities in India:

CROSSROADS
OF CHANGE



Metro: Kolkata was the first Indian city to have a metro system, starting in 1984. Currently, 10 Indian cities have a functional metro system in place. Most significant of all, Delhi Metro started its operations in 2002. The network has expanded to about 343 kilometre and serves an average of 2.5 million passengers daily. Several Metro projects are being planned notably in Meerut, Agra, Kanpur, Bhopal, Indore Vijayawada, Jammu, Guwahati, Varanasi. These projects when completed are expected to provide relief for urban transport. However, in order to ensure that these are well utilised, they will need to be augmented with last-mile connectivity projects such as urban ropeways or BRTs.

Figure 7
Delhi Metro CO_2 Emission Comparison



Source http://www.delhimetrorail.com/greeninitiative.aspx

Bus Rapid Transport (BRT): Bus Rapid Transit is a public transport system with user-friendly features such as dedicated lanes for buses, priority at intersections, levelled boarding points etc. BRT supports the bus public transport by making it faster and reliable.

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Operational in 8 Indian cities, the Ahmedabad BRT is considered the largest. The city has 89 kilometre dedicated corridor which operates 223 buses serving approximately 0.13 million passengers daily.[12] About 20 to 22% of the commuters have moved from using their motorcycles to the bus. With an average trip length on the bus of 7 kilometre, this translates into a saving of almost 200,000 vehicle kilometres per day.

(Source: https://unfccc.int/climate-action/momentum-for-change/lighthouse-activities/the-ahmedabad-bus-rapid-transit-system-in-india)
12 http://www.ahmedabadbrts.org/ . Retrieved 15 May 2019

Public Bike Sharing (PBS): Under the PBS system, one can easily use a bicycle from bike stations and drop it to a station nearest to his destination.

CROSSROADS OF CHANGE



Bengaluru, Delhi, Chennai, Pune, Ahmedabad, Coimbatore, and Indore are some cities which have more than 10,000 bicycles for sharing. In Pune, between December 2017, when the PBS scheme was launched and March 2018, 0.35 million bicycle trips were completed.

ITS: In January 2019, Gurgaon started a pilot on ITS by using 'smart' traffic signals being installed at four places. The system involves automatic and real-time management of traffic signals based on estimations of traffic congestion and demand. As per the official source, each signal is equipped with a vehicle detector, with all signals interacting with each other through optical fibres. This process of interaction, as opposed to the usual practice of information going to a control room which then manipulates signals, saves time. The sensors detect traffic volume at those points and communicate the same to their counterparts, which calculate signal control parameters accordingly. If traffic volume is high, the light remains green for longer, reducing traffic congestion as well as pollution. The impact of the project will be evaluated for six months.

Electric Bus:
Electric buses are easy to incorporate in the public transport system given pre-defined routes and charging opportunity at the depot. Multiple cities in India are looking forward towards electric buses fleet in India.

CROSSROADS OF CHANGE



In Delhi, Lucknow, Sabrimala, Manali, Dehradun, and Hyderabad manufacturers like Ashok Leyland, BYD, Tata Motors etc. are working with the respective state government by running trials. In some cities, the government has already placed fresh orders for further procurement like Guwahati and Jaipur.

City Gas Distribution (CGD) Network:
The goal is to promote the usage of environment-friendly clean fuel i.e. natural gas as a fuel/feedstock across the country to move towards a gas-based economy. Expansion plans for setting up of 10,000 CNG filling stations in 10 years are underway as CNG for transportation accounts for 3/4th of the total demand of CGD network. With the increasing confidence in government's plan for CNG, vehicle manufacturers like Ford, Honda, Mahindra and Eicher have launched CNG variants of passenger cars and commercial trucks joining Maruti and Hyundai, which had mostly dominated the factory-fitted CNG vehicles category for years.

By definition, sustainable mobility is a system characterised by:
- **Universal Access** – no one is excluded from its benefits
- **Efficiency** – scarce resources are well utilised
- **Safety** – transport does not claim lives

Green Mobility helps check pollution and climate change. By combining many different ideas, initiatives and processes, by taking bold and clear steps, in tandem with different bodies, India finally has the opportunity to inch closer to a future where mobility is sustainable.

CHAPTER 3

CHALLENGES ALONG THE WAY

Every time a challenge is met, the goal comes closer.

When the road has many challenges, it's the right road. On the way towards a future with sustainable mobility, India has to brace for many challenges. Many are multi-dimensional in nature covering aspects such as governance, regulatory and institutional framework; lack of infrastructure, hindrances in the adoption of newer technologies and business models; including issues related to capacity building and awareness.

3.1 Challenges in Governance

Today, the institutional framework for managing urban transport is fragmented, leading to diffusion of responsibilities. With over a dozen government agencies involved in planning, infrastructure, regulation, licensing and permits, it is practically impossible for a city to effectively plan its transport infrastructure and effectively deploy and organise its transport resources. Consequently, there is a complete absence of a well-structured, well-planned, and well-orchestrated transport service deployment system. The absence of a single unifying lead authority that can provide direction and decision-making may cause confusion and delays for other factors involved.

There is no legislation, institution, or an institutional framework that covers the requirements of urban transport comprehensively.

The MVA deals with the licensing of vehicles, Railway Act covers inter-city mainline railway traffic, Metro Act deals with the specific issues related to Metro rail, Tramways Act deals with tramways within the road surface with free access across it. But other modes of mass rapid transit such as the bus rapid transit, the light rail transit, the monorail, urban ropeways and several other guided modes of transport and issues of transport planning, multimodal integration, safety, tariff and financing are not covered under any Act.

Since mobility comprises different modes of transport, it is normal to have different legislations for different modes of transport. However, there is a case for having an enabling Act that defines or focuses on delivering a minimum quality of mobility service or transport to urban inhabitants. Additionally, there is no single urban institution that is responsible, accountable or answerable for providing safe, integrated and sustainable transport service to its citizens.
The division on the roles and responsibilities of various Central, state and local institutions is illustrated.

Figure 11
Fragmented Institutional Framework

Urban Transport Functions	Central	State	Local
Policy	Ministry of Urban Development (MoUD)	Urban Development Department (UDD)(P)	Municipal Corporation (MC)
Transport planning		Urban Development Department (UDD)	Development Authority (DA) (P)
Road investment infrastructure	MORTH, NHAI	Public Works Department (PWD)(P)	Municipal Corporation (MC)
Road infrastructure (O & M)	MORTH, NHAI	Public Works Department (PWD)	Municipal Corporation (MC) (P)
Suburban rail system	Indian Railways (IR)		
Bus transport (city)		State Road Transport Corporation (SRTC)	Bus Corp.(MC) (P)
Bus transport service operations (regional)		State Road Transport Corporation (SRTC)	Bus Corp.(P)
Bus regulations and licensing	MORTH	State Transport Authority (STA) (P)	
Bus terminals and depot operations			Bus Corp (MC)
Traffic management		Police (P)	Municipal Corporation (MC)
Traffic engineering		Police	Municipal Corporation (MC) (P)
Traffic enforcement		Police	
Motor vehicle registration , safety and emission regulations		State Transport Authority (STA)	

Source: World Resources Institute (WRI), EMBARQ input document

It is notable from the Table above that at the city level there is no one single Authority that addresses the transport needs of urban citizens.

Considering that mobility is a local requirement, it has to be addressed through a unifying local authority at a city level, mandated by the need for an overarching and well-defined framework related to the quality of mobility service.

3.2 Challenges in Public Transport

Urban India's increased traffic congestion can often be attributed to an inadequate focus on public transport infrastructure. Most development plans for road network end up giving greater primacy to private vehicles while paying less heed to the mobility needs and aspirations of the urban India. This approach tends to incentivise the purchase of private vehicles adding to congestion.

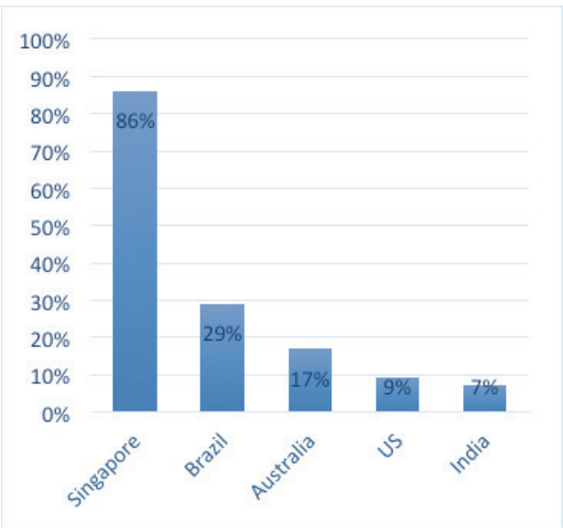
It is necessary to shift the focus of policy formulation and development plans on moving people rather than vehicles.

This, however, is easier said than done, considering the impending challenges that public transport faces today:

Poor road infrastructure development and management:

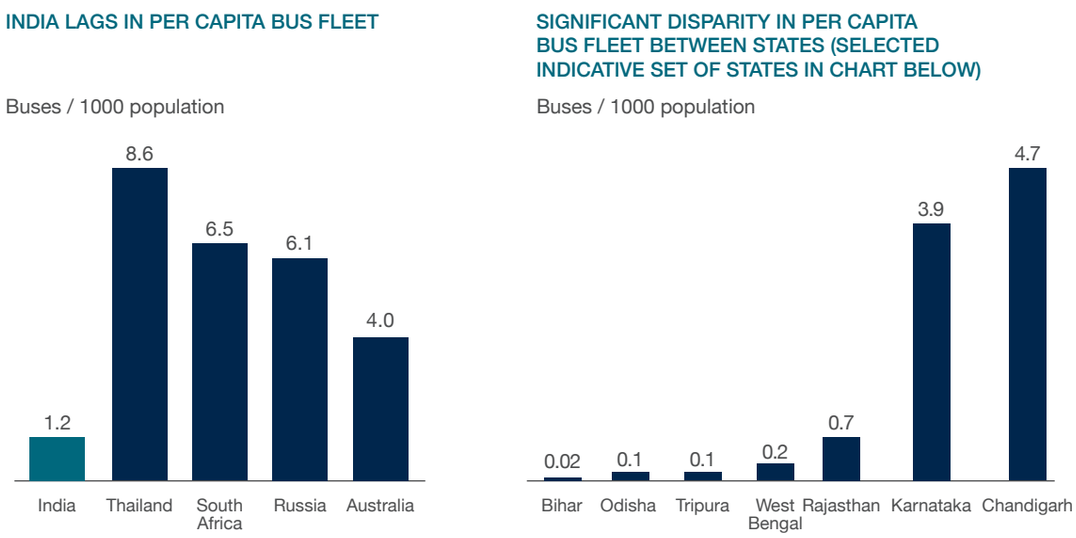
Due to a lack of holistic planning, the infrastructure development and management cause multiple challenges like encroachments by parked vehicles, hawkers, pavement dwellers, and even stray animals on the roads. There is a lack of lane markings and traffic signs, which leads to low-speed traffic movement. Further, road traffic and parking rules are also neither strictly followed nor enforced. Old and ill-maintained vehicles that comply with obsolete emission standards still run on the road and PUC (pollution under control) mandates are not implemented strictly either. There is a lack of provision for pedestrians & NMT to use the roads safely.

Figure 8
Share of Public Transport in Countries



Source: KPMG (2017). Reimagining Public Transport in India https://assets.kpmg/content/dam/kpmg/in/pdf/2017/10/Reimagining-public-transport.pdf

Figure 9
Number of Buses per 1,000 Population across Countries & Indian States



Source: NITI Aayog

Shortage of public transport:
As evident from Figures 8 and 9, there is a shortage of public transport which leads to overburdening of the present system.

Urban rail services in multi-million populated cities have been limited, public transport infrastructure has aged and not been upgraded leading to decrease in its potential share in mobility. Indeed, the only motivation today for using public transport is low fares.

The thrust so far has been on addressing the segment at the bottom of the pyramid which is very sensitive to fares. Public transport is developed around this philosophy and thus does not cater to the other sections of society. Fact is, that there is another segment of users who can afford higher fares provided they get optimum reliability and quality of public service. This segment which uses private vehicles, indirectly contributes to high congestion and air pollution. It demands quality of service, convenience and comfort, reliability and is willing to pay higher fare prices. And yet, has no supply of public transport services that meets its needs. This segment which could potentially cross-subsidise transport services for the segment at the bottom of the pyramid, has been completely neglected in urban public transport plans, and has been the biggest contributor to congestion as well as fossil fuel based private transport pollution.

Fares:
Public transport ridership is very sensitive to fares. As such, public transport systems are unable to maintain an acceptable quality of service, particularly in the absence of limited state funding. As a result of inadequate funding, State Transport Undertakings are under perpetual pressure to cut cost. Consequently, the quality of service, as well as the perceived customer perception of public transport users takes a beating.

Tax policies are distorted:
Public transport is made to bear a disproportionately high tax burden as compared to private transport. Available data for the state or city-level taxation bears out this challenge where the annual road tax on a bus is higher than the one-time road tax a car pays in any given year.[13] Moreover, the uniform regulation for buses have not been notified officially.

Limited choices for public transport:
Not only is there inadequate public transport, but there are also very limited choices available for its users. As an example, Delhi Government had, as part of the Cluster Scheme introduced AC and normal buses at different rates; yet, in terms of the safety, reliability or quality of service, these services were found wanting. Differentiated services for different market segments such as office goers, regular travellers, high-end customers who demand facilities such as internet connectivity, fewer stops seek premium public transport – are all conspicuous by their absence.

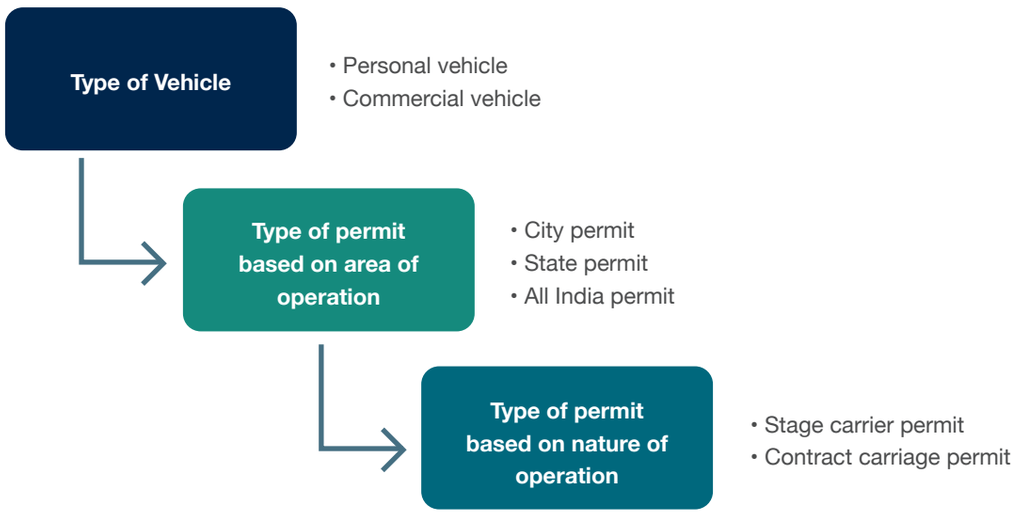
Permits:
The permits and licensing system for operating public transport is out of tune with the current imperatives and are often more of a hindrance than support in serving the cause of public transport. The existing permit scheme disincentives private players from providing buses and is considered as a major hindrance in flexible operations. In theory, the MVA does not limit the existence of Stage Carriage Licences; in practice, it is practically impossible for new bus operators to ply buses in urban conglomerates, unless the State Transport Corporations grants them the licence for Stage Carriage. The different types of licences/permits permitted under the Central Motor Vehicle Rules (CMVR) are:

Contract Carriage: The permit holder can operate a vehicle under a contract with his client for a fixed destination within or outside the State. This agreement should be executed between the clients and the operators and the list of passengers is required to be made available to the State Transport Authority. Any breach of any of the provisions listed for a Contract Carriage can result in a penalty for the operators.

Stage carriage: A motor vehicle is constructed or adapted to carry more than six passengers. This excludes the driver for hire or reward at separate fares paid by or for individual passengers. This is either for the whole journey or across stages of the journey. Typically, Stage Carriage Permits are difficult to get because they serve as competitors to the State Transport Corporation buses.

[13] https://timesofindia.indiatimes.com/india/Buses-pay-maximum-road-taxes/articleshow/3051831.cms

Figure 10
Classification of Passenger Commercial Vehicle Permits in India



Source: Regulatory frameworks for integrated shared mobility governance in india, uitp, 2018

ALONG THE ROAD



Karnataka gives Uber, Ola 3 days to halt ride-sharing services

LiveMint, 31 Jan, 2017: "According to the transport department, the ride-hailing firms have contract carriage permits, which do not allow them to pick up and drop passengers during the course of a trip. Such a permit only allows for point-to-point pick-ups and drops. The stage carriage permit, which allows pick-ups and drop-offs along a particular route, can only be accorded to Bangalore Metropolitan Transport Corp. and school and college buses".

Indirectly, the licensing system dissuades the expansion of public transport by restricting the number of urban buses deployed. There is an artificial scarcity created in issuing stage carriage licences to private operators and this gets reflected in the abysmally low number of buses plying in urban India.

Consider the per capita index for urban India that is 1.2 buses/1000 people versus 6 buses /1000 people in China. A similar gap is visible when one compares other countries. Figure 9 presents the significant shortage of buses in urban India in comparison to other economies.

Not only is there an inadequate number of buses, the current format of regulation also leads to underutilisation of assets. Even though there is huge demand for shared mobility, the buses which are used for transporting office workers on a fixed route or for ferrying school children under a contract carriage cannot be utilised for any other activity during the day such as functioning as a local bus for all public in a certain region.

3.3. Challenges for Shared Mobility and NMT

The world is moving towards shared modes so as to reduce the ownership levels, and consequently address congestion and optimally utilise resources. All modes including cycles, bikes and cars are being offered on sharing basis.

The global shift towards shared mobility can find fertile ground in India. Modern technology makes it easier for commuters to share vehicles. Digitisation of IPT (intermediate public transport) has strengthened the uptake of shared mobility. Cab aggregator businesses are a striking example of this. The ridership for aggregator businesses has risen from 1 million in 2015 to 3.5 million in 2018, pointing towards a preference for on-demand digitised services. Digitised IPT organises the already existing paratransit demand and presents it to the users on a unified platform.

With public transport being in short supply, new solutions that offer shared mobility are evolving - often in an unregulated and an administered manner, such as the ubiquitous electric three-wheelers, which have mushroomed across several cities in India.

Other forms of IPT cater to the underserved areas of public transport and provide a feeder service to mass transit. In tier I and II cities, IPT ends up serving as public transport itself. Digitisation has enabled people to raise demand and avail door-to-door service. The original regulations and policies did not envision this rapid growth of the IPT, and therefore it has become essential to regulate their expansion. Some changes to affect that are as follows:

State government's policies on IPT and NMT are arbitrary:
They are not sustainable or forward-looking, and are inconsistent across states. Transport, being a concurrent subject, also poses several policy challenges. The Central Government's policies (MoRTH's) only act as guidelines for states and are not binding.

Restriction on the usage of All India Tourist Permit (AITP) Vehicles:
Limiting the use of AITP cars for tourist purposes alone, creates a vacuum in the contract carriage sector leading to increased personalised car ownership. Caps on city taxi permits and not allowing AITP taxis to ply have led to artificial scarcity and underutilisation of supply.

Figure 11
Regulatory Asks for Transport Aggregator Business

Regulatory Scenario for AITP:

Karnataka	Delhi	Mumbai & Maharashtra*	West Bengal*	Rajasthan*	Rest of India
AITP not permitted on aggregator platforms	AITP not permitted in Delhi on aggregator platforms** AITP permits capped in NCR (National Capital Region)	AITP not permitted on aggregator platforms	AITP permitted on aggregator platforms	AITP permitted on aggregator platforms but not clear whether P2P is permitted	Assam (not permitted); Chandigarh (allowed with entry fee); However, only Punjab and Haryana registered AITP vehicles are allowed.

* Rules currently stayed or not enforced.
** Rules are in draft phase

Source: OLA Mobility Institute

Carpooling:
At present, CMVR does not legalise carpooling. Regulated by the Act, contract carriages and public service vehicles can carry passengers for 'hire and reward'. The definition of the two, however, excludes "a private car which is only used occasionally for giving the lift against some payments." Although MoRTH Taxi Guidelines and Moving Together Forward, a report by NITI Aayog, launched at the MOVE Global Mobility summit, revealed a political will to implement carpooling in India. However, due to a lack of clarity around the nature and probabilities of outcomes of the new intervention, carpooling has ended up being associated with various risks.

Inadequate Supply of Shared Mobility:
While shared mobility has picked up in recent years due to app-based aggregators, there is immense potential in the growth of these services to include two-wheelers as well as buses. The lack of information poses as a hurdle in enabling users in making a shift to these sustainable mobility options.

Lack of Infrastructure for NMT modes:
The options for NMT have been limited due to lack of infrastructure like dedicated walking and cycling lanes: a challenge fuelled by lack of dedicated financial support.

NMT facilities include cycleways, car-free areas, walkways, cycle rickshaws etc. Cities lack infrastructures for NMT, which may limit the adoption of bike/cycle sharing schemes. Lack of other infrastructures like vehicle pick-up and drop-off points, auto-rickshaw stands, parking spaces, etc. could also be a bottleneck to the proliferation of new shared mobility solutions.

Ride-Sharing:
Inconsistencies in data standards and guidelines for best practices between public and private transportation providers can be a barrier for promoting shared mobility. There are further limitations concerning the collection and processing of mobility data.

3.4 Challenges in Adopting New Solutions:

Technological advancement has led to the development of innovative solutions - but not all are easily adapted as the tendering models are structured as procurement of assets rather than structured as procurement of solutions. This limits the flexibility of procurement.

Lack of Interoperability:
No interoperability between transport modes in terms of quality, schedule alignment, and integrated ticketing means that intermodal travel and feeder system for first and last-mile connectivity are not seamless.

Lack of Standards:
Lack of standards in EV charging, connectors, and power quality and a plethora of options available today prevents EVs from scaling up. Presently, there is a lack of common standards for fleet operations. This needs to be designed in a manner that optimises the space for charging and looks at options such as swapping station which occupy less space.

Human Capital:
The capability of undertaking a coordinated approach and a complete understanding of issues involved is lacking at the State Government and City level. There is a gap between capacity and understanding of innovators, planners, policymakers, and regulators which leads to friction in the uptake of sustainable solutions. The commuters, as well as service providers, are unable to fully utilise the potential of data and connectivity in the transport space. Inconsistencies in data standards and guidelines for best practices between public and private transportation providers, become a barrier for promoting shared mobility. There are further limitations with regard to the collection and processing of mobility data. Most of the relevant workforce needs to upgrade skills consistently to get acquainted with new technologies in manufacturing and maintenance of EVs, operation and troubleshooting of smart vehicles, etc.

Together, these challenges hinder the present and future shift towards sustainable mobility. As each challenge is surmounted over time, the path to sustainable mobility will keep paving itself.

CHAPTER 4

ROUTES TO CHANGE

Change is possible, at any given moment.

"To attain the Vision 2030 for Urban Transport, policies, planning and investments need to be directed towards sustainable urban transport – with a clear emphasis on public transport, walking and cycling. This needs to be supplemented with cleaner technologies, a stringent fiscal regime and use of intelligent transport systems."

- National Transport Development Policy Committee (NTDPC).
Working Group on Urban Transport

The current focus of transport is predominated towards catering to the road infrastructure needs for vehicles, rather than addressing the mobility needs of the city inhabitants. More roads designed for vehicles only leads to increased traffic congestion because private transport is more increasingly used. However, as we move forward, it is necessary that the road map for sustainable transport delivers citizen-friendly mobility solutions, such as incorporating cycle tracks, NMT zones, predefined parking spaces, and shared bus ports for private as well as public buses, in its plans. In other words, instead of putting vehicles as the centre of focus, citizens' mobility must be the key area of focus. Because while investment in roads is imperative, it needs to be recognised that the ultimate purpose of investment in road infrastructure is to carry goods and people, rather than to carry vehicles.

A paradigm shift is needed in the approach to urban mobility with three key strategies, namely, Avoid, Shift and Improve.

In order to undertake the huge challenge and to manage the massive investments needed in urban transport, there is an urgent need to create a strong and unified institutional framework in cities, states and at the centre, and enable the upgradation of skills. The present approach needs to be changed with the aim to:

- Remove the inefficiencies of the present system
- Address the hurdles in adopting new solutions
- Promoting new solutions
- Ensure better co-ordinated connectivity
- Bring focus on integrated mobility at a structured and practical level

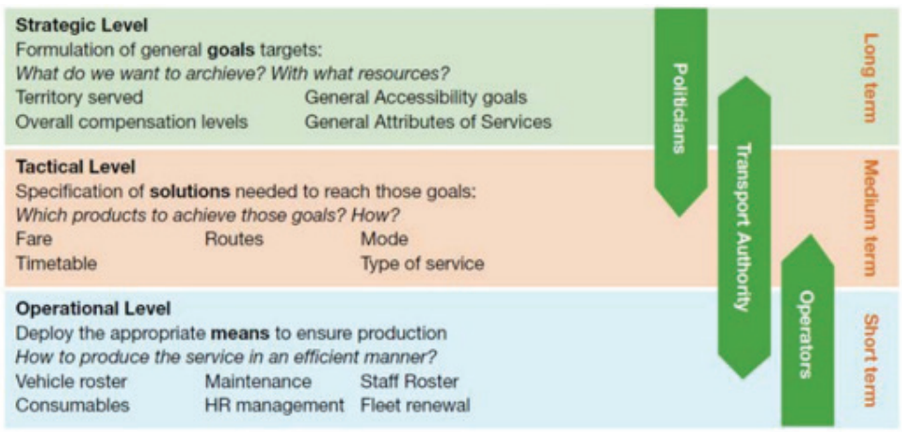
4.1 Changes in Governance

Institutional mechanisms need to be modified for enhanced coordination in the planning and management of transport services. Today, there is no single organisation at a city level that is responsible for delivering quality customer experience to users of various modes of transport. Different public transport agencies/authorities (bus, metro, ferry etc.) operate in silos and this schema is unable to help develop a common and well-defined approach to building transport infrastructure. Often these agencies are seen to be competing and working at cross-purposes. It also hinders the delivery of quality customer experience to the urban citizen. There have been some efforts towards streamlining the roles, responsibilities and creating a common vision through the Comprehensive Mobility Plans (CMP) for a number of cities. The CMPs emphasise the importance of pedestrian facilities, NMT and public transport. However, the absence of an overarching legislative framework and a unifying institutional framework results in distortions in planning, financing, implementation, and pricing of mobility solutions. This further limits the deployment of infrastructure, technology, and mobility services in an integrated manner.

A proven way to correct this is to draw a cue from the European Union Model, which starts by detailing out Mobility Goals at the Strategic, Tactical & Operational Level. Figure 16 illustrates the kind of goals that need to be defined for urban transport – starting from goals related to the service that the State aspires to provide, to highly operational goals specific to a city that defines the maintenance levels, the vehicle and the staff roster system.

A similar approach needs to be followed at the National level as well as State and City levels to define a mandate for urban mobility. This mandate can then form the blueprint that would determine and dictate the functioning of the Urban Metropolitan Transport Authority.

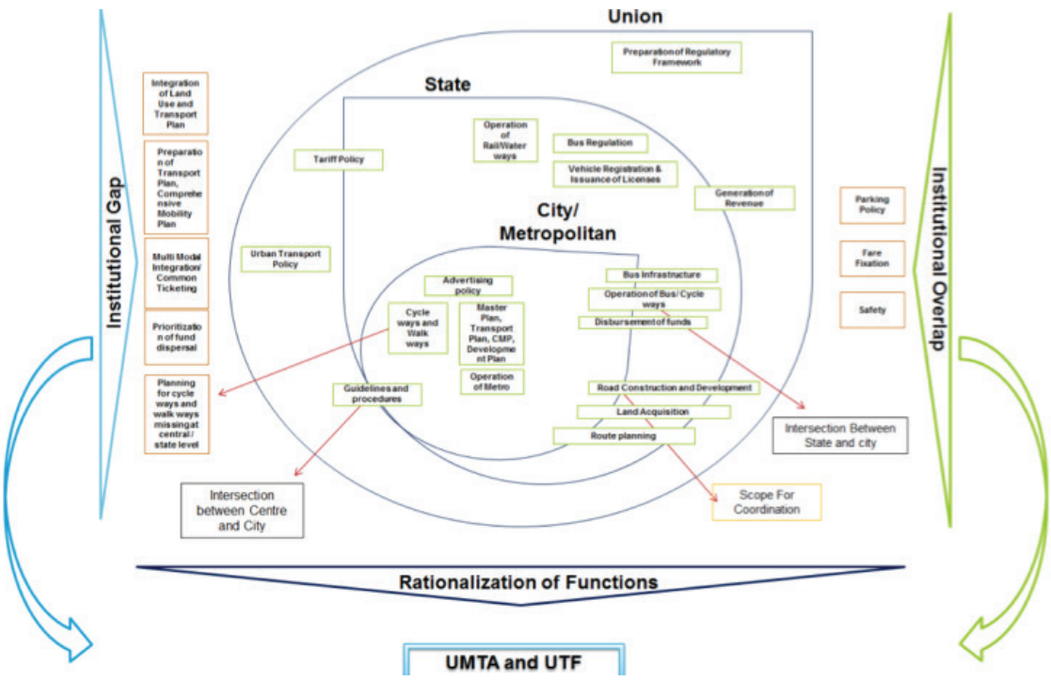
Figure 12
European Union Model for Public Transport Authorities



Source: UITP 2005

Understanding the model better: A charter for urban mobility links political decision-makers and PTA to provide the framework to organise and coordinate different mobility options. This is done across a defined geographical area to ensure delivery of efficient, comfortable, and high-quality public transport. The PTA's role is to act within the public interest to ensure that different modes are well-integrated, affordable, and accessible and to organise this in a manner that complies with strategic-level goals and targets set by politicians. These strategic-level goals can relate to public transport and accessibility targets but also can be connected to policies in related fields such as environment, land use, social inclusion, parking, or traffic planning. A similar framework should be applied to India at the level of each city. However, this must be supplemented with an overarching legislative authority whose role must be not only to build mobility infrastructure, but also operate it for the larger benefit of all citizens of that city.

Figure 13
Need for UMTA



Source: http://www.sutpindia.com/skin/pdf/Operations_Document_for_UMTA.pdf

UMTA: The concept of UMTA for Indian cities was first introduced in the NUTP 2006 as follows:

"The Central Government will, therefore, recommend the setting up of Unified Metropolitan Transport Authorities (UMTA's) in all million-plus cities, to facilitate more coordinated planning and implementation of urban transport programmes and projects along with an integrated management of urban transport systems. Such Metropolitan Transport Authorities would need statutory backing in order to be meaningful."

However, the role of UMTA in the few cities where such an Authority has been established has generally been restricted to infrastructure planning and financing decisions. Here too, the Authority does not seem to be empowered enough for it to be able to allocate land for, say, transport infrastructure. Regulatory aspects have also not been a priority area.

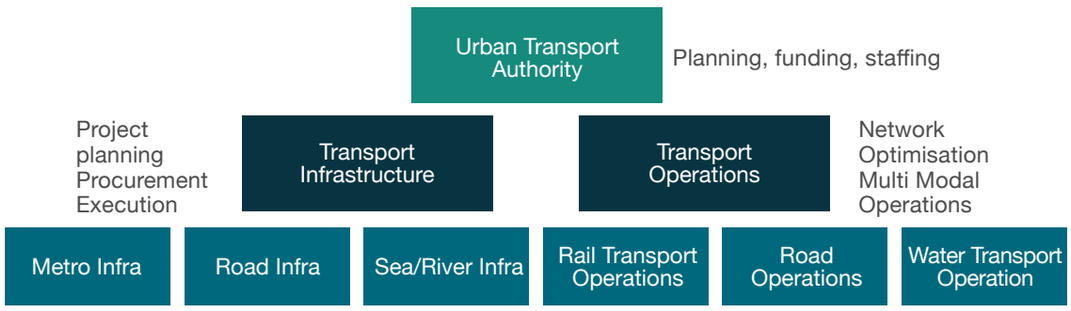
In its ideal format, UMTA should be responsible for Integration and approval of proposals by city agencies.

These include the Municipality, Development Authority, Regional development authority and Traffic police; Handling NMT and Shared Mobility; Strategy and Policy Functions; Transport Demand Management; Organising urban transport services; Providing Common Services; Resolution of day to day matters and Monitor the work assigned to implementing agencies both for the city and the surrounding region. The UMTA should have the authority to make decisions on traffic flow planning, currently under the control of the traffic police.

Further, UMTA should be backed by UTF (Urban Transport Fund) that can be used to supplement capital and operational financing of public transport agencies. These funds will also incentivise agencies in charge of shared mobility to participate in the integrated decision-making process. The likely revenue streams of the UTF can come through grants from the Government, levying a 'green tax' on high polluting vehicles, a surcharge on property tax and stamp duty etc.[14] UMTA needs to have the additional responsibility to be the authority for collecting and dispersing of UTF to various agencies in the city to undertake various urban transport-related activities.

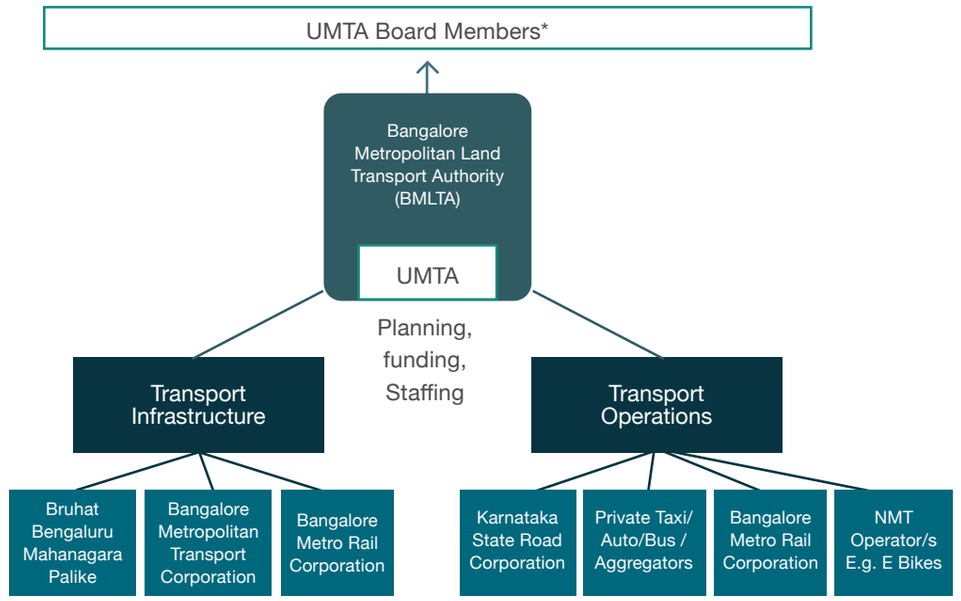
[14] https://india.uitp.org/articles/regulatory-and-financial-frameworks-for-shared-mobility-in-india

Figure 14
Envisioned Governance Structure for UMTA



Taking the city of Bangalore to illustrate the governance structure for managing urban mobility, a model governance structure is drawn out as below:

Figure 15
UMTA Governance structure for Bengaluru



This overarching mobility body for Bangalore is drawn out on the lines of TfL (Transport for London) in London which is entrusted with the following responsibilities:

- Providing public transportation: Operating all public transportation services directly or via subsidiaries.
- Licensing authority for taxis and private hire vehicles.
- Imposing congestion charge.

As the roles and responsibilities of the city mayors in India are not at par with the European cities, reforms may eventually also be needed to establish the office of a City Mayor who holds overall responsibility of governance in a city.

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UMTA Case of Bengaluru

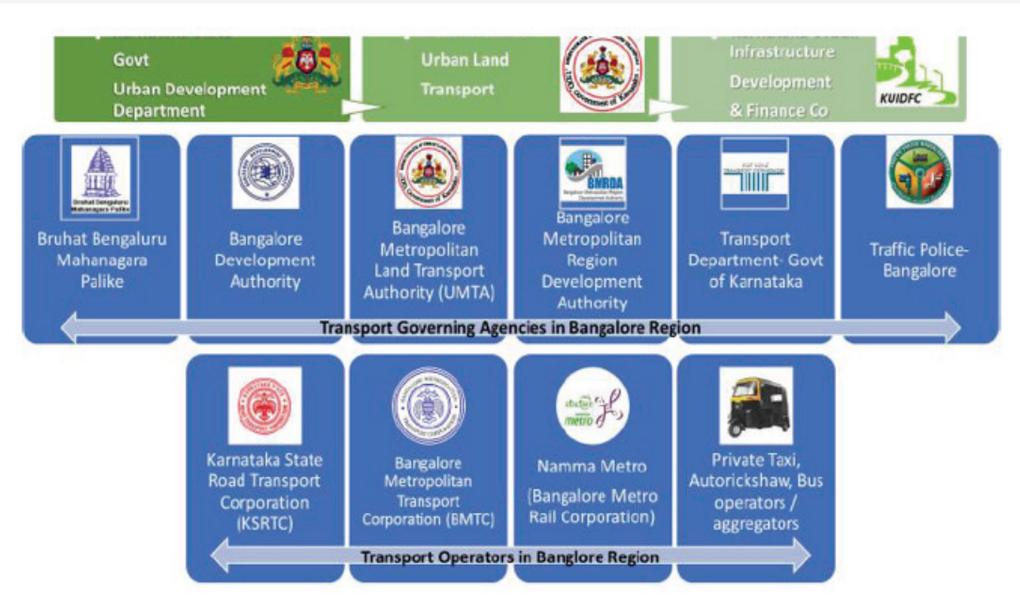
Bengaluru city in Karnataka has a population of over 10 million and has registered over 7 million vehicles (Times of India 2017). The modes of transport in Bengaluru include: private vehicles, private and public buses, Metro, taxis - licenced as well as app-based, auto-rickshaws, scooter and bicycle shares.

Karnataka set up the Directorate of Urban Land Transport (DULT) in 2007 soon after the NUTP came into force in 2006. DULT was set up to coordinate the planning and implementation of urban transport in all cities in the state.

In 2008, the Bangalore Metropolitan Land Transport Authority (BMLTA) was set up as a committee under the aegis of DULT, with members of other Government departments. However, BMLTA lacked financial and legislative power and after an initial push, meetings stopped.

There are a number of organisations and agencies responsible for urban mobility in the city: Traffic Police, Transport Department, Bangalore Metropolitan Region Development Authority, Bangalore Metropolitan Land Transport Authority, Bangalore Development Authority, Bruhat Bengaluru Mahanagara Palike, Namma Metro, Karnataka State Road Transport Corporation etc. Now, the Karnataka government has once again announced the creation of a central regulatory authority for Bangalore-Unified Metropolitan Transport Authority.

In Bangalore, UMTA has been set up under the State Department of Urban Land Transport, but it is not clear yet as to whether it will be open to public participation, or will have a focus on non-motorised mobility or if it will be able to work with planning agencies such as Bangalore Development Authority and Bangalore Metropolitan Region Development Authority.



Source: http://www.sutpindia.com/skin/pdf/Operations_Document_for_UMTA.pdf

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Case of Transport for London:

Greater London has a population of 8.8 million (in 2016) and it is the most populous city in Europe. TfL is a statutory body created under the Greater London Authority Act 1999. The Act empowers the Mayor of London to develop safe, integrated, efficient and economic transport facilities. TfL replaced the London Regional Transport organisation, which was under the control of the government transport ministry. TfL, in contrast, has the Mayor of London as the Chairman of the Board, with several independent directors from industry, health and safety, air quality and housing sectors.

Regulator	Established	Role	Operated transport services	Source of funds
Tfl	Statutory body created under the Greater London Authority Act 1999	1. Provide public transportation 2. Licensing authority for taxis and provate hire vehicles 3. Impose congestion change	Yes Operates all public transportation services in London (Metro, light rail, suburban rail, buses, cycles, water, transport)	1. Passenger revenue 2. Advertising, property rental 3. Congestion charge 4. Grant funding

Implementation: According to the Generic Operations Documents for UMTA by MoHUA, a Task Force has been envisaged to proficiently undertake all planning and management required for setting up UMTA. Based upon the generic UMTA legislation published by MoHUA, the Task Force may need to customise the document for city-specific legislation related to Geographical Boundary, Governing Board Structure, Institutional Arrangement, Functions and Powers, Funding Sources and Utilisation Structure.[15]

A Citizen Charter for UMTA needs to be prepared which will:

- Clearly define the expectations of service users and minimum service standards for all public transport;
- Provide framework for consultations with citizens in key decisions;
- Encourage public transport operators to measure and assess performance;
- Make public transport agencies more transparent;
- Push public transport agencies to improve performance; and
- Increase satisfaction of all Public Transport service users

In addition to UMTA at a City level, a central institution is imperative to regulate mobility standards at a National level. This would work on the lines of the Telecom Regulatory Authority of India as well as the Electricity Regulatory Authorities at the National level and State level. The details about the role of such regulator are detailed in Component 3 which deals with improving Intermodal and mode-wise system efficiencies.

Transit oriented development (TOD): Urban transport needs to be incorporated as an important element of urban planning. Estimates from IIT Delhi[16] show that more than half of all travel trips in most cities are below 5 kilometre average due to compactness of the cities. But this advantage is rapidly getting eroded as cities are sprawling and adopting the gated community approach. Sprawl is increasing distances and overall vehicle miles travelled. In the growing cities, TOD should be made an integral part of any mass transit system and urban planning system which is funded by the Central Government. At the same time, road networks are being expanded to allow vehicles to move at high speed, often at the expense of pedestrian movement and public transport access. A disproportionate share of the right-of-way is taken up by the carriageway and its continuous widening.

[15] MoHUA (2016). Operations Document for United Metropolitan Transport Authority (UMTA)
[16] The Urban Commute, CSE

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Transit-Oriented Development in India:

TOD in Karkardooma, located in East Delhi, is being implemented by Delhi Development Authority (DDA). It proposes mixed-use developments with a variety of housing types and civic amenities, located next to an interchange station of a city-wide metro network and a major bus terminal. This model of development would encourage walking and use of mass transit system (buses and metro).

Source: National Institute of Urban Affairs, 2016

Rajkot in Gujarat also recommends linking affordable housing with the transit-oriented zone which is proposed around the Ring Road in the city. This initiative would enhance the appeal of affordable housing projects and promote the use of public transport.

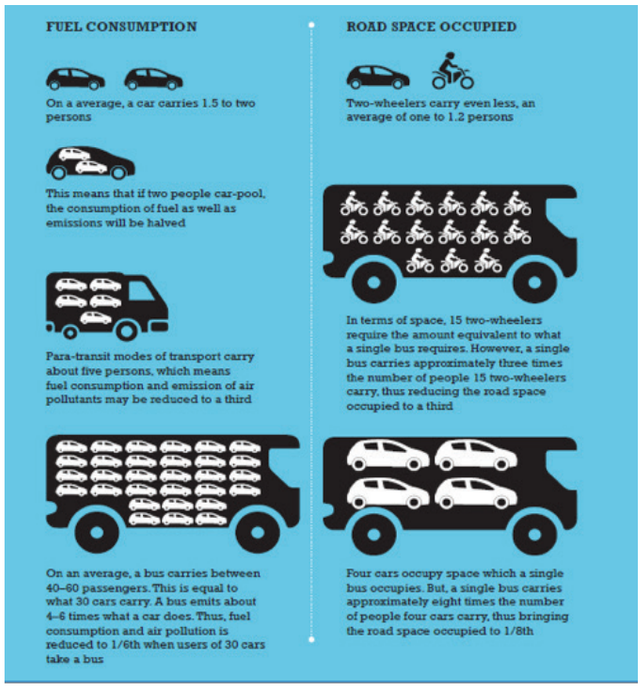
Source: http://www.rajkotuda.com/pdf/RUDA-Report-PART-2-14-07-2015-board-sanction-2031.pdf

A mandate to integrate urban planning with transportation planning: Cities need more deliberate and explicit policies to link urban design with compact city design that minimises the need for motorised transport.[17] As transport is a localised service, local solutions need to be specific to each city. For example, cities like Patna are evaluating proposals for a metro project even before they have evaluated other options such as enhancing bus fleet, or ropeways or LRT. It is worth noting here that planning for a Metro project without taking an integrated view of the overall mobility needs of a city will result in inadequate and insufficient planning and will not resolve the issues that our cities face today.

4.2 Changes Required to Increase Public Transport and Shared Mobility

Recent findings of the National Transport Development Policy Committee, indicate that India should target a public transport share of 60% of motorised trips and 35% of total trips.[18] This works in favour of sustainable mobility targets, because public transport needs less fuel and space, and emits less GHG as well. For example, a bus transports 50-60 people, while the same number of people would require about 30 cars. Thus, a shift from personal vehicles to other mass transit and non-motorised modes is necessary to reduce energy demand and allocating equitable road space in cities.

Figure 16
Road Space utilisation by Private Versus Public Transport



Source: Centre for Science and Environment (CSE) (2018). The Urban Commute. https://www.cseindia.org/the-urban-commute-8950

[17] Centre for Science and Environment (CSE) (2018). The Urban Commute. https://www.cseindia.org/the-urban-commute-8950
[18] National Transport Development Policy Committee (NTDPC), Working Group on Urban Transport.

Improving Public Road Transport: Multimodality as a concept does not have to be restricted to creating feeder services to metro rail systems alone; rather, the focus should be on providing end-to-end connectivity through public transport as well as non-motorised transport. To kickstart, urban India needs two types of bus services:

Scheduled Services: These buses will ply at high frequency – depending on traffic demand - with a basic focus on reliability and adherence to the timetable. This service can be offered by State Transport Undertakings or Private Operators or a combination of the two. Their performance must be evaluated by UMTA in terms of their adherence to the timetable. The Private Operators can be issued permits so as to regulate the number of buses and also ensure that there is no 'competition' between competing Bus Operators to pick up passengers at Bus Stops. Performance of these Private Operators needs to be assessed based on the Passenger Feedback collected by UMTA from time to time.

Metered or App-Based Services: These Services would be Metered and app-based, requiring the users to 'book' their seats on the bus. These services could be covered by a separate Permit that qualifies Operators based on the quality of services and the customer experience that they offer. This would be a self-regulating segment that is regulated by market forces and would be impacted by private operators.

In both cases, Private Operators would need to meet the minimum qualification criteria. Given the extremely inadequate size of urban bus fleets in the country, this would potentially liberalise private operations by refining permits. Performance standards for these buses need to be predefined at the national level and then fine-tuned at the local level, in line with the local needs.[19]

National Programmes to Support a Shift to Public Transport: Many structured programmes can be implemented to draw interest in public transport – some of them are as follows:
Different business models in bus transport need to be explored to address different income groups. The Government should encourage start-ups in the mobility space. Initiatives like a common mobility card and real-time information should be implemented. CMVR would need to include scope for innovations such as e-rickshaws and smaller vehicles - which are specified out of, or arise from the solution requirement of the last-mile and penetration into remote suburbs, for example. Public bus operators should introduce ITS into their fleets in order to monitor bus performance and revenue accurately.

The Bus Port concept needs to be introduced so that the existing bus depots and bus stands which are monopolised by State Transport Units (STUs) are modernised as separate land parcels that allow private investors to commercially develop the area around these Bus Ports. Like railway stations, modernisation projects should open up the space above railway stations for commercial usage, in the same manner, Bus Ports could be developed potentially under PPP arrangement and could prove to be a good revenue source for STUs.

Charging Standards: India has devised the charging standards for Electric Vehicles. However, care should be taken to define the minimal performance and safety requirements. For example, chargers or power capacity should not be standardised over fleet size. Instead, retain focus on high asset utilisation models.

Urban Freight: Cities depend on Urban Freight for transportation of goods for collection and distribution. But, urban freight also contributes towards congestion as they share the same network as for transport of people. Thus, changes should be made for smooth flow of goods in cities. One approach is to use the hub and spoke model where the goods are collected in the warehouses outside of the urban regions. Small capacity vehicles which occupy less road space and less pollution are then used to supply goods within the city. Loading and parking spaces for these vehicles also need to be included during the localised area planning. Last mile delivery of goods needs to be reinvented by encouraging cleaner transport options.

Augmenting the Rail Network: Suburban metro rail systems should be established in all multi-million populated cities. Development of railway infrastructure should be in line with international standards (like High Speed Rail Corridor, etc.) and nationwide electrification. Proper railway traffic management needs to optimise the running routes and time abidance.

Development of Transport Hubs for Inter-Modal Connectivity: This will enable the user to avail public transport to the maximum distance by connecting to the next mode with minimum effort and time.

Urban Ropeways: One of the important points that UMTA needs to address as part of its optimization and integrated transport planning approach must be a focus on last mile connectivity. This has been an area of neglect as a result of which the metro systems, despite huge investments, stay underutilised. Even in megacities, reaching the metro station is a daily challenge for commuters. There is therefore a strong case for exploring Urban Ropeways that stretch two to five kilometres of either side of the Metro Tracks. With a capacity

[18] National Urban Policy Framework, MoHUA, 2018

to carry up to 3000 persons per direction per hour, urban ropeways are becoming quite popular in several European and South American cities. These are low in investment and fast to implement and at the same time, help to unclutter city roads as well as Metro Stations

.**For Promoting Shared Mobility:** There is a need to define a holistic safety framework encompassing the needs of all stakeholders. A detailed policy framework needs to be laid out to help local authorities decide routes and pilot the initiative. Specified trunk routes for work should be identified for encouraging carpooling by using High Occupancy Vehicle Lane.

Developing First/Last Mile Connectivity: Based on Ola Mobility Institute's Ease of Moving Index report, out of 43,000+ people interviewed, 79% of people said that improvement of first and last-mile connectivity is crucial to encourage people for using public transport. Effectively:

- Start-ups should be encouraged to develop first/ last-mile connectivity.
- NMT such as bicycle renting should be promoted
- City and neighbourhood development plans must compulsorily include suitable allocations with dedicated funds for creating street furniture such as footpaths, streetlights, etc.
- Road 'improvement' projects should not occur at the expense of footpath space or cycle tracks. Some design standards (e.g. DDA, Indian Red Cross Society) must be followed in the construction and financing of footpaths and cycle tracks.[20]
- Cities lack infrastructure for NMT, which tends to limit the adoption of bike/cycle sharing schemes. An inadequate NMT Ecosystem leads to increased risk exposure to accidents due to common road space, in turn decreasing the acceptability of NMT.
- Lack of other infrastructure like vehicle pick-up and drop-off points, auto-rickshaw stands, parking spaces, etc. could also be a bottleneck to the proliferation of new shared mobility solutions. At the same time, new technologies such as dockless bicycle sharing, E-bikes, Segways, Urban Ropeways etc. need to be evaluated for last-mile connectivity.

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Several cities in the world—Medellin, Caracas, Constantine, etc.—have adopted urban ropeways for catering to the last-mile connectivity. Urban ropeways are low CAPEX intensive, and easy to insert in congested cities. They serve as good feeders to BRTs and Metro Stations, particularly in cities which have urban sprawl and contour terrain.

4.3 Changes Required in Regulations

Role of Regional Transport Office: With increasing sophistication in automotive technology and the much-needed thrust on mobility rather than transport, the role of the Regional Transport Authority (RTA) must be reviewed. Currently, the Regional Transport Office (RTO) is viewed as an office to facilitate Revenue Generation rather than for organised regulation in line with the Motor Vehicles Act (MVA). RTO needs to shift from its current role of I issuing licences, vehicle passing, registration taxation, imposing penalties issue of permits and so on – to qualify bus operators under the guidance and direction of the Urban Mass Transit Authority.

Stricter rules for private modes of transport: As uncontrolled growth of private vehicles results in creating major bottlenecks in urban mobility, permits for private vehicles need to made more complex with a city-wise cap on the number of licences distributed for private car ownership. At the same time, private players will need to be encouraged and incentivised to offer urban public transport. Private Operators must be incentivised to provide app-based public transport services so long as the services satisfy the minimum criterion for passenger safety, comfort and experience. Similarly, for scheduled services, a mechanism needs to be implemented to qualify operators and maintain a "reliability benchmark" for these services.

[20] National Urban Policy Framework, 2018, Draft open for comments, https://smartnet.niua.org/nupf, accessed on 29/4/19

Compliance and enforcement:

As India develop and adopts more digitalisation, compliance can be made effective by leveraging innovations in technology. Since vehicles are already being delivered by RFID (radio-frequency identification), intelligent remote cameras can be mounted at various locations in a city for checking compliance, enforcing fines on violators.

All India Transport Permit (AITP) vehicles should be allowed to operate on aggregator platforms across states: Distinction between city cab permit and AITP is artificial. AITP permits may be allowed to be converted to city taxi permits or convert city taxi permits to AITP as recommended by NITI Aayog so as to reduce the risk of regulatory burden. This may be permitted subject to fuel and safety norms prescribed by respective State governments.

Operation of bike-taxis and other forms of last-mile connectivity: Bike Policy on aggregators must be notified in all states, especially in Karnataka, Maharashtra, Delhi. Out of the 155 million two-wheelers on the Indian roads, only 0.15 million (excluding Goa) ply commercially. Out of these 0.15 million commercial two-wheelers, 85% are used for e-commerce and 10% for food delivery. Hence, there exists a huge supply that can easily be converted into taxis. Until 2015, Goa was the only State in India to allow Bike Taxis.

Merits of Bike Taxis -

Bike taxis provide a low-cost solution for the last-mile connectivity problem. The cost of the trip is about Rs 3-5 per kilometre - significantly lower compared to 3-wheelers or 4-wheeler taxis. The 2-wheeler taxis would especially reduce the financial burden on low-income groups. The average speed of travel in Indian cities is about 22.7 kilometre/ hour for 4-wheelers. However, the average speed for 2-wheelers is about 30 kilometre/hour. The increased average speeds will reduce the commute time significantly, especially during peak hours. The average speeds may further increase with the introduction of bike taxis to improve adoption of public transport.

CROSSROADS OF CHANGE



The Supreme Court, in Mukund Dewangan versus Oriental Insurance Company Limited, has held that there is no requirement to obtain a separate endorsement to drive a transport vehicle. If a driver holds a license to drive a light motor vehicle, he can drive a transport vehicle of such class without any endorsement to that effect. In view of the position as settled by the Hon'ble Supreme Court in the above judgement, the requirement under the Motor Vehicles Act, 1988 to obtain the transport licence would arise in case of medium/heavy goods and passenger vehicles only. No other vehicle will require separate endorsement, even if they are used for commercial purposes. The exemption from the requirement to obtain the endorsement for commercial vehicles would apply to following vehicles: (i) Motorcycle without gear, (ii) Motorcycle with gear, (iii) Light motor vehicle (goods/passenger), (iv) e-rickshaw/e-cart.

Ministry of Road Transport and Highways has issued an advisory to all States on 16 April, 2018 for issuing instructions to licencing authorities and comply with the judgement of Hon'ble Supreme Court.

Fares: A 2-tier approach should be taken for deciding fares. Premium Public Transport services can be provided at fares decided by the market, while for the Scheduled Services, a low-cost public transport fare needs to be set up. These decisions need to be delegated to the UMTA at each city level.

Introduction of Vehicle Scrapping Policy: Many old vehicles with outdated pollution certificates continue to ply on the road even after their fitness expires. These vehicles cause pollution as well as congestion, occupying parking spaces in the cities or add to the congestion by parked in the wrong area. Thus, a strict vehicle scrappage policy is required. The road transport and highways ministry recently issued draft guidelines to set up vehicle scrapping centres in the country - a move aimed at protecting the environment and promoting legally-backed dismantling and scrapping industry. According to the Draft, Vehicles can be offered for scrapping if they are impounded or abandoned by enforcement agencies, beyond repair, the registration certificate has not been renewed, damaged due to fire, natural calamity, without fitness certificate, among others.

Disincentivising private vehicle ownership:
Major costs in the vehicle ownership are externalised in the form of the road space occupied as well as the parking area usurped, many times from public spaces. These costs of private vehicle ownership should clearly be reflected in the price of the private vehicle so that there is an inbuilt disincentive to buy private vehicles.

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Reforming parking rules and raising parking pricing is potentially a more effective strategy that can simultaneously address the funding needs as well as ensure that problems related to equitable access are addressed as has been done in cities San Francisco and Paris.

When parking is regulated and parking spaces are monetised, it can restrain car use, generate revenue to support sustainable alternatives, and promote walking and cycling by freeing up sidewalk space according to complete street principles.

ALONG THE ROAD



Delhi has 7.5 million active vehicles, but parking space for less than a lakh

The four municipal bodies in Delhi have places for 94,000 vehicles in 434 surface, stack and multilevel parking lots. Delhi Metro stations also provide an additional few thousand parking spaces. However, the city has 3.16 million four-wheelers alone among 7.5 million registered vehicles. The Environmental Pollution (Prevention and Control) Authority, a Supreme Court mandated body, said in a recent report that parking in residential areas is necessary to cope with the aggravating problem. The parking in such areas should be the joint responsibility of the municipal corporations, DDA and other land-owning agencies and the residents' welfare associations and shopkeepers' associations.

(Source: Times of India, 11 September 2019)

Increasing accessibility by older and differently-abled citizens:
The accessibility of public transport and related infrastructure should be increased for specially abled and older citizens. Design changes need to be made for easy and safe transfer of people using public transport to increase equity. For e.g. Delhi metro has made efforts to increase accessibility of specially-abled by providing foot markings, tactile paving wheelchairs and so on.

Low and zero-emission zones in peak hours:
Low-emission and zero-emission zones lead to decongestion of traffic and reduction in the number of private cars on the roads. Commuters are incentivised to seek public transport. Clearly, these zones need to be defined in accordance with local/city concerns.

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To help improve air quality, Ultra-Low Emission Zone (ULEZ) **now operates 24 hours a day, 7 days a week, every day of the year** within the same area of central London as the Congestion Charge. Most vehicles, including cars and vans, need to meet the ULEZ emissions standards or their drivers must pay a daily charge to drive within the zone.

- £12.50 for most vehicle types, including cars, motorcycles and vans (up to and including 3.5 tonnes)
- £100 for heavier vehicles, including lorries (over 3.5 tonnes) and buses/coaches (over 5 tonnes)

Source: https://tfl.gov.uk/modes/driving/ultra-low-emission-zone

[21] http://www.indiaenvironmentportal.org.in/files/file/Study_on_International_Practices_for_Low_Emission_Zone_and_Congestion_Charging.pdf

Congestion Timing-based pricing: Extra charges can be levied from private vehicles if they enter the congestion zones in peak hours. Congestion charges can also be levied on certain routes based on the timing of travel.

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The aim would be to alleviate congestion through curbing travel demand without increasing infrastructure supply. This action has had a positive influence in London, Singapore, Stockholm and Milan and needs to be evaluated in terms of its ability to be implemented, particularly now that all vehicles are mandated to have FastTag on them.

The revenue collected from congestion charging can be utilised by UMTA for improving the transport systems in the city and for procuring additional buses/ NMT/low emission zones. Guidelines encompassing fiscal measures and enforcement mechanisms to limit the number of new vehicular licences would need to be explored as well.

ALONG THE ROAD



Recommendations made by NTPDC: The report by NTDPC for Government of India proposes the following:[22]

A Green Cess on existing personalised vehicles: All vehicles in India would need to be insured every year. There are several public and private sector enterprises in India which provides insurance to vehicles at the rate of 3 percent of the annual insured value both for car and two-wheelers. It is proposed that an additional 4 percent of the vehicle's insured value shall be collected as Green Cess.

Urban Transport Tax on Purchase of New Cars and Two-Wheelers: As Urban Transport Tax on purchase of a new personalised vehicle, a 7.5% additional tax on petrol vehicles and additional 20% in case of personalised diesel vehicles is proposed. The levies will serve dual purpose of generating a dedicated and sustained stream of resources for the dedicated urban transport fund and on the other hand, serve as a disincentive for using personalised vehicles as a demand containment measure. This is because merely adding to the supply side of urban transport is not enough to bring commuters on board.

4.4 Changes Required in Adopting New Solutions

Mechanisms for assessment and approval of new propositions: In general, governments do not have a well-defined mechanism for procuring innovative solutions. As a result, most solutions, whether in the area of alternative fuels, alternative modes of transport or new technologies related to ITS are difficult to induct in the city transport system. Procurement of innovation needs to be promoted by establishing state-level innovation parks with specific funds for mobility. Once the new solution has been incubated, it can be deployed on a larger scale across the city.

A Time for Change

India is moving towards a transport revolution. This is the time for numerous innovations to step up. Cities today are full in their capacity, and there is an urgent need for innovative mobility plans to cater to the ever-growing transport demand.

[22] National Transport Development Policy Committee (NTDPC).Working Group on Urban Transport.

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Procurement of Innovative Mobility solutions

There are international examples of Government opening up innovations and technology to improve accessibility to transport services and create better liveable cities for the residents. In India, the Station Access and Mobility Programme (STAMP) is one such initiative led by WRI India and the Toyota Mobility Foundation (TMF) to promote multimodal integration of the metro rail with other modes of transportation in Indian cities. The programme was initiated in 2017 and has been conducted in 4 cities (Bengaluru, Hyderabad, Kochi and Mumbai) to enable station accessibility through a partnership model with the innovation and entrepreneurial ecosystem.

STAMP is conducted over 4 stages of deployment:

1. **Identify:** Identifying the gaps and opportunities that impact accessibility to metro stations through data gathering.
2. **Enable:** Help define problem statement through stakeholder discussions.
3. **Catalyse:** Conduct a national level challenge in partnership with concerned authorities (Urban local bodies and/or Metro agencies) to source innovative and sustainable entrepreneurial solutions.
4. **Demonstrate:** Demonstrate the viability of business models emerging from the challenge.

Deploying entrepreneurial and innovative solutions through such collaborations will help develop data-based deployable solutions. This will help increase ridership, improve access and customer experience and help metro infrastructure to optimise operations and station utilisation. Learnings from the pilots would be documented and used by Metro Agencies to develop strategies in planning last-mile solutions, mode integration and people management.

Funding for initiating the first pilot of any such innovative mobility solutions will help bring forth many such innovations for the city's benefits that are otherwise lost due to lack of funding. This is one valid example of incentivising the procurement of innovative mobility solutions.

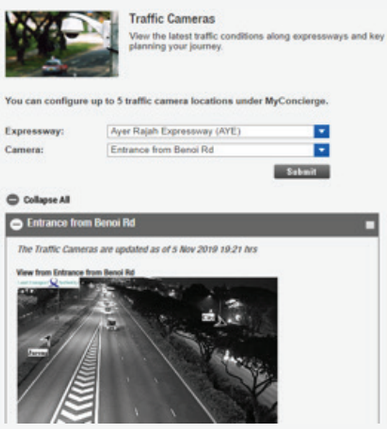
New transport models based on open data, shared vehicle ownership, and digital solutions are fundamentally reshaping the mobility environment, and cities should embrace the opportunity to maximise their benefits for all by partnering with new mobility services providers. Demonstrated early wins include cashless ticketing using mobile phones, as a way to improve passenger security and reduce transfer costs, and ride-matching and e-hailing services to improve the first/last-mile connectivity of formal transit.

CROSSROADS OF CHANGE



Use of ITS in Singapore

Developed by the Land Transport Authority (LTA) of Singapore, a website MyTransport.sg provides information and e-Services for all land transport users, such as commuters, motorists or cyclists. The portal features essential tools for users, such as interactive maps to get around Singapore, the latest public transport campaigns and initiatives, plus real-time information on Bus Arrival timings for all bus stops. One of the innovative features of the initiative is the DATA Mall—a collection of land transport-related data available for users and companies to use for research or development of applications to benefit the public. The portal also offers the live streaming of traffic cameras around the city for commuters to see traffic conditions.



Interoperability and Integration of different modes: Integration requires a paradigm shift in city government thinking and organisation. Governments must take responsibility for developing and nurturing their entire multimodal transport network, including both formal and informal transit and private operators. Moving away from mode-based planning silos to mobility planning in cities is a crucial first step in identifying opportunities to link up services, and for fostering cooperation across stakeholders. Dedicated and empowered multimodal urban transport authorities have proved to be an effective institutional innovation for achieving such cooperation, thus reinforcing the need for the formation of UMTA.

- **Fare integration:** Instead of each operator jealously guarding its own farebox revenue, cities should move towards establishing a citywide farebox that distributes revenues to operators according to clear rules. This provides opportunities to set fares at consistent levels, introduce free or reduced-fare transfers, reward good operator behaviour, and subsidise certain classes of passengers if desired. To build trust, the revenue clearinghouse can be administered by an independent institution such as a bank.

- Shared modes of transportation should complement each other to provide a comprehensive system where users can take multiple modes in an efficient manner, meeting their transportation expectations and needs. Linking different modes can lead to seamless multimodal transit where users have a choice to take their preferred modes. This can be enabled by data sharing

- Onetime payment to be used for trips involving various modes. Payment mechanisms to be flexible.

4.5 Upgrading the Human Capital:

- Training in mobility solutions for the future: Training and skilling of the workforce in mobility solutions will be required for bridging the gap between present and future mobility. People will need to be trained in handling EVs both in manufacturing and maintenance as well as in developing infrastructure for the same.

- Awareness needs to be generated among urban transport users for highlighting:
  - Pollution and its impacts, impact of Congestions on health and well being
  - On utilisation of shared transport and various options for NMT.

- Research and development institution in the field of urban mobility: Presently, the country has institutions but the research is lagging behind the industry, thus an active interaction between industry and these institutions should be enhanced.

- Govt. officials' capacity building is required on:
  - Linkages between climate change, urban development and planning for climate resilience
  - Knowledge and data handling: Central data repositories will need to be created by the government for the success of Intelligent Transport. Thus, knowledge about data management, security, access etc. is to be delivered. Transaction data can be use to generate trends and suggest areas of improvement.

- Involvement of designers, planners and all stakeholders on climate-resilient mobility planning for urban areas.

Over the past 2 decades, there have been many improvements in the field of public transport and urban transport in general. It has been a gradual and incremental process. The improvement has been primarily looking into improving existing infrastructure to meet growing demand. With emerging technologies and many cities reaching their threshold capacity, there has been increasing focus on mobility and now the operators and transport agencies need to focus on moving people rather than vehicles: the right road forward.

CHAPTER 5

DESTINATION URBAN TRANSFORMATION

An idea is the seed of transformation.

ACTIONABLE RECOMMENDATIONS

With urban transformation at the heart of a new future, healthier and more inclusive lifestyles are only possible when actionable goals are realised with responsibilities and target dates, phases, ease of acting, and criticality. Every time a key action is evaluated for its impact and a stakeholder is held responsible, change comes closer.

The following highlights the recommendations for urban transformation from a sustainable mobility context.

SHORT TERM (2020-2022)	
HIGH PRIORITY ACTION **What:** Form UMTA and set up a task force. Citizen Charter for Urban Mobility (CCUM) at Strategic, Tactical and Operational Level **Who:** State Government (Legislation)	**IMPACT** A transformational impact will be created on integrated urban mobility: by forming UMTA. Development of Citizen Charter for Urban Mobility (CCUM) at Strategic, Tactical & Operational Level. There will be market access for public bus operators for providing app-based public transport, backed by the availability of bus-ports. Bus Ports should be made available to the private bus operators from the government.
What: Change in the permit system. One Country One Permit to incentivise interstate shared mobility and public Transport Redefine RTO's role in qualify bus operators for providing MAAS under direction of the Urban Mass Transit Authority **Who:** State Transport Department and UMTA	This will provide improved access to quality public and shared transport. There will be a sustained improvement in the quality of service and increased supply of quality private operators. Here, the role of the RTO will be redefined by digitisation and automation of licensing, fitness certification with minimal F2F contact.
What: Establish state-level innovation parks with specific funds for mobility **Who:** State Government and UMTA	This will lead to reduced congestion and emissions.

MEDIUM TERM (2020-2030)

- Extend incentives for public transport, limit registration of private vehicles in large metros, enforce congestion charging and implement Scrap Policy rigorously
- Set up Scheduled Services and app-based Services for Public Transport
- Implement new technologies for last-mile connectivity, such as urban ropeways, shared mobility, and infrastructure and technologies for non-motorised transport
- Increase utility of Bus Ports through allowing there use by private operators under PPP model
- Rigorous implementation of TOD
- Develop and implement Integrated Transport Mobility Plan

LONG TERM (2030-2050)

Invest in advanced technologies for electric mobility and intelligent transport systems.

As the wheels of change turn to move forward, efficient, resilient, and prosperous cities will no longer be a figment of imagination, but truly come alive in all their glory.

ACKNOWLEDGEMENTS

We would like to express our gratitude and appreciation to all those who have contributed to this initiative. We thank the Chair of the Core Group for India Roadmap on Low Carbon and Sustainable Mobility, Mr. Bharat Salhotra, MD of Ronmas India, whose continued guidance, inputs, support and proactive engagement have helped us in the final culmination of the India Roadmap and the eight theme reports, and for his patience and perseverance in seeing this through. Sincere thanks are expressed to the Leads of the eight working groups who dedicated their time and energy to this effort from the beginning, and to all the members of each working group who have contributed their insights, inputs, and direction for the respective theme reports and for specific components in the final India Roadmap.

We thank WWF India for providing support to this project as well as its role as Knowledge Partner in steering the work of the two Working Groups (Working Group 1 on Urban Transformation for Healthier, Inclusive Lifestyles and Efficient, Resilient, Prosperous Cities and Working Group 6 on Provide Low-Carbon Solutions for the Rural (Non-Urban) Populations). WWF-India also helped in organising a stakeholder consultation in Bengaluru, conducting Working Group 1 and 6 meetings and finalising theme reports of these components.

We express our gratitude and appreciation to Shakti Sustainable Energy Foundation for providing support and inputs for the theme reports and the Roadmap.

The FICCI Environment and Climate Change Secretariat steered the entire initiative of the India Roadmap, convening meetings of the Core Group, working groups, stakeholder consultations, and experts' consultation, providing information and background research of government programmes and schemes, gathering feedback of stakeholders and collation and compilation of the reports and roadmap. FICCI also reached out to various government departments during the course of the project, and organised a kick-off event with Shri Nitin Jairam Gadkari, Minister for Road Transport and Highways, Government of India, meetings with Shri C K Mishra, Secretary, Ministry of Environment, Forest and Climate Change, Government of India, and Mr Anil Srivastava, Mission Director, National Mission for Transformative Mobility, Niti Aayog. We thank them for their blessings and feedback. FICCI helped in the finalisation of the theme reports under the guidance of the working group Leads and Members, with complete coordination for six of the eight working groups (Working Groups 2, 3, 4, 5, 7 and 8). The individual meetings of the working groups as well as joint meetings and workshops of all working groups was also coordinated and organised by FICCI.

The formation of working groups was preceded by a brainstorming session of experts in May 2018, thereafter the working groups after being formed met numerous times in the 20 months that followed. A joint workshop of the working groups took place in May 2019 to assess the development of the theme reports and Roadmap halfway through the project. Thereafter, extensive deliberations of the working groups were held alongside stakeholder consultations until the culmination of the final eight theme reports and the India Roadmap. The 8 Leads of the working groups met numerous times through the project period. The joint meetings of the working groups and frequent meetings of the Leads ensured there was no silo in the deliberations or formulation of the eight components of the Roadmap. We are thankful to all of them for devoting their time and energy in this manner.

We thank Mr Patrick Oliva of PPMC, Mr Nicolas Beaumont of PPMC/Michelin, and Mr. Pierre Cannet of WWF-France for providing their feedback on the working group reports. FICCI and the Knowledge Partners would like to thank Michelin Foundation for its support on the successful completion of this project and for its commitment for sustainable mobility in India. The support and inputs provided by WWF France are gratefully acknowledged.

We are grateful for the candid feedback and inputs of participants of the three stakeholder consultations – in Navi Mumbai organised by FICCI and BOCI at Prawaas 2019 on July 26, 2019, in Bengaluru organised by WWF-India on September 26, 2019, in Delhi organised by FICCI on October 22, 2019 – and the experts' consultation organised by FICCI and Shakti Sustainable Energy Foundation on March 6, 2020.

We acknowledge the inputs, feedback and experience sharing by international stakeholders who participated in the events organised by FICCI on the development of the India Roadmap at the Movin'On – World Summit on Sustainable Mobility in Montreal, Canada in 2018 and 2019 and the side events organised by FICCI in UNFCCC COP-24 in Katowice, Poland in December 2018 and UNFCCC COP-25 in Madrid, Spain in December 2019.

We thank Mr Mahesh Babu, CEO, Mahindra Electric for his guidance as Co-Chair during the first year of the project. We also acknowledge the hard work by ex-FICCI colleagues Krishna Chandran and Mallika Bose who were part of this initiative from the start.

WORKING GROUP

Working Group on "Urban Transformation for Healthier, Inclusive Lifestyles and Efficient, Resilient, Prosperous Cities"



Working Group Lead: Mr Bharat Salhotra, Chair, FICCI Core Group on Sustainable Mobility and Managing Director, Ronmas

Members:

1. Delhi Metro Rail Corporation Limited (DMRC)
   Sharat Sharma

2. Ola Mobility Institute (OMI)
   Shilpi Samantray
   Aishwarya Raman

3. Ashok Leyland
   Karthick A

4. Maruti Suzuki
   Tapan Sahoo
   Sumit Sharma
   Ajeet Singh

5. WRI India
   Amit Bhatt
   Revathy Pradeep

FICCI Secretariat

Ms Rita Roy Choudhury
Assistant Secretary General

Mr Asim Sharma
Deputy Director

WWF-India Secretariat

Dr T S Panwar
Director – Climate Change & Energy

Mr Aviral Yadav
Programme Officer – Climate Change & Energy

Shakti Sustainable Energy Foundation Secretariat

Vivek M Chandran
Associate Director - Transport Program

Avni Mehta
Program Manager - Transport

SECRETARIAT

FICCI Secretariat



Ms Rita Roy Choudhury
Assistant Secretary General



Mr Asim Sharma
Deputy Director

WWF-India Secretariat



Dr T S Panwar
Director – Climate Change & Energy



Mr Aviral Yadav
Programme Officer – Climate Change & Energy

Shakti Sustainable Energy Foundation Secretariat



Mr Vivek M Chandran
Associate Director - Transport Program



Ms Avni Mehta
Program Manager - Transport

ACRONYMS

AITP: All India Tourist Permit
AMRUT: Atal Mission for Rejuvenation and Urban Transformation
BAU: business as usual
BRT: Bus Rapid Transport
CGD: City Gas Distribution
CPCB: Central Pollution Control Board
FICCI: Federation of Indian Chamber of Commerce & Industry
GHG: Greenhouse Gas
ITS: Intelligent Traffic Management Systems
JnNURM: Jawaharlal Nehru National Urban Renewal Mission
LULUCF: Land Use, Land-Use Change, and Forestry
MGI: McKinsey Global Institute
MoEF&CC: Ministry of Environment, Forest and Climate Change
MoHUPA: Ministry of Housing and Urban Poverty Alleviation
MoUD: Ministry of Urban Development
MVA: Motor Vehicles Act
NEEMP: National Electric Mobility Mission Plan
NHEB: National Hydrogen Energy Board
NHREM: National Energy Road Map
NITI (National Institution for Transforming India) Aayog
NTDPC: National Transport Development Policy Committee
NUPF: National Urban Policy Framework
NUTP: National Urban Transport Policy
PBS: Public Bike Sharing
PPP: public-private partnership
PTA: Public Transport Operators
RFID: Radio-frequency identification
STAMP: Station Access and Mobility Programme
TfL: Transport for London
TMF: Toyota Mobility Foundation
TOD: transit-oriented development
ULBs: urban local bodies
UMTA: Unified Metropolitan Transport Authority
UTF: Urban Transport Fund
WHO: World Health Organisation

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ABOUT PARTNERS

FICCI

Established in 1927, FICCI is the largest and oldest apex business organisation in India. Its history is closely interwoven with India's struggle for independence, its industrialisation, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate, engaging with policy makers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian Private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policy makers and the international business community.

PPMC

The PPMC is an open and inclusive platform that actively invites all organisations and initiatives that support effective action on transport and climate change to join in the process. The PPMC is created to strengthen the voice of the sustainable transport community in the UNFCCC process, especially with a view to the upcoming Conference of Parties (COP21) in December 2015 in Paris. COP21 is expected to result in a new global agreement on climate change, which will shape climate policy in the years to come at a global, regional and national level. By bringing together different actors and stakeholders in the sustainable transport community it will be possible for the transport sector to have its voice heard and speak with one voice on the important contribution that sustainable mobility can make to the mitigation of, and adaptation to climate change.

The PPMC contributes to realising a Global Agreement on Climate Change that empowers transport sector to take action on climate change. The realisation of this objective requires an active engagement of the PPMC before, during and after COP21. It will be equally important to advocate for an agreement that incentivises the transport sector as well as work with the transport and climate community on the implementation of a new global agreement on climate change at the global, regional, national and local levels.

WWF-India

WWF-India is one of the leading conservation organizations in the country. It is a science-based organization that addresses issues such as the conservation of species and its habitats, climate change, water, and environmental education, among many others. Over the years, its perspective has broadened to reflect a more holistic understanding of the various conservation issues facing the country and seeks to proactively encourage environmental conservation by working with different stakeholders- Governments, NGOs, schools and colleges, corporates, students and other individuals.

Shakti Sustainable Energy Foundation

Shakti Sustainable Energy Foundation (Shakti) seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following areas: clean power, energy efficiency, sustainable urban transport, climate change mitigation and clean energy finance.

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CONTACT US

Ms Rita Roy Choudhury
Assistant Secretary General
FICCI
Email: rita.roychoudhury@ficci.com
environment@ficci.com

Mr Asim Sharma
Deputy Director
FICCI
Email: asim.sharma@ficci.com

