Avoid Vehicle Kilometres for Commuting, Shopping and Accessing Services

For

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

Lead

FICCI

Knowledge Partners

IPPMG

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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 fifth component on "Avoid Vehicle Kilometres for Commuting, Shopping and Accessing Services".

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 centres are the growth engines of a nation, spawning opportunities to learn, to work, and live. As population increases and urbanisation grows rapidly, the travel demand is also increasing in cities: whether for work, education, healthcare, leisure, and so on. The increasing urban population in India is projected to cross 50% of the overall population (currently at 31.16% urbanisation, Census 2011). This will lead to an increase in the demand for transport, an increase in average trip distances projecting a multifold increase of passenger kilometres. The National Transport Development Policy development committee has estimated that the travel demand could grow almost 16 times by 2032. According to the report, the total passenger traffic in the country is expected to grow at about 15% per annum to reach 168,875 billion passenger kilometre (bpkm) in 2031-32 from 10,375 bpkm in 2011-12. This growth demands a multifold increase in investments for smart and integrated transport infrastructure matched by an increase in transport assets.

CHAPTER 1

HEART OF THE PROBLEM

Inside every problem, lies an opportunity.

The vehicle conundrum

Across the country today, the increase in travel demand in cities is being served in one major way - by adding vehicle kilometres leading to more congestion and pollution, in turn affecting the health of the people. Thus, **passenger travel demand** is the measure of the movement of passengers across different modes measured by passenger kilometres. But to achieve an efficient and sustainable transport system, this demand should be served by minimum vehicle kilometres or VKT **(Vehicle Kilometre Travelled).**

VKT can be calculated by multiplying the total number of trips to the average trip length.

VKT = Total number of trips x Average trip length

VKT is the total kilometres travelled by motor vehicles in a given period of time. It gives an estimate of the overall pressure on the environment from all forms of road transport and is a mobility indicator to measure the performance of the transportation system. It is extensively used in transport planning for allocating resources, estimating vehicle emissions, computing energy consumption, assessing traffic impact and road safety policy. It needs to be noted that the transport network of the future is based on high personal mobility characterised by a high share of low occupancy personal transport modes in the traffic mix. This will require the creation of capital-intensive road infrastructure to support the explosive growth in vehicular traffic, and result in pressure on the environment.

It is critical to cater to the increasing demand with the minimum possible supply in vehicle kilometres.

CHAPTER 2

IN RESPONSE

Learn from the past to lead the future.

The traditional approach to deal with travel demand has always been supply-oriented: where the travel demand has been met by providing additional road infrastructure. Unfortunately, far from being beneficial, it has led to increased private vehicles on the road, leading to more congestion and GHG (greenhouse gas) emissions.

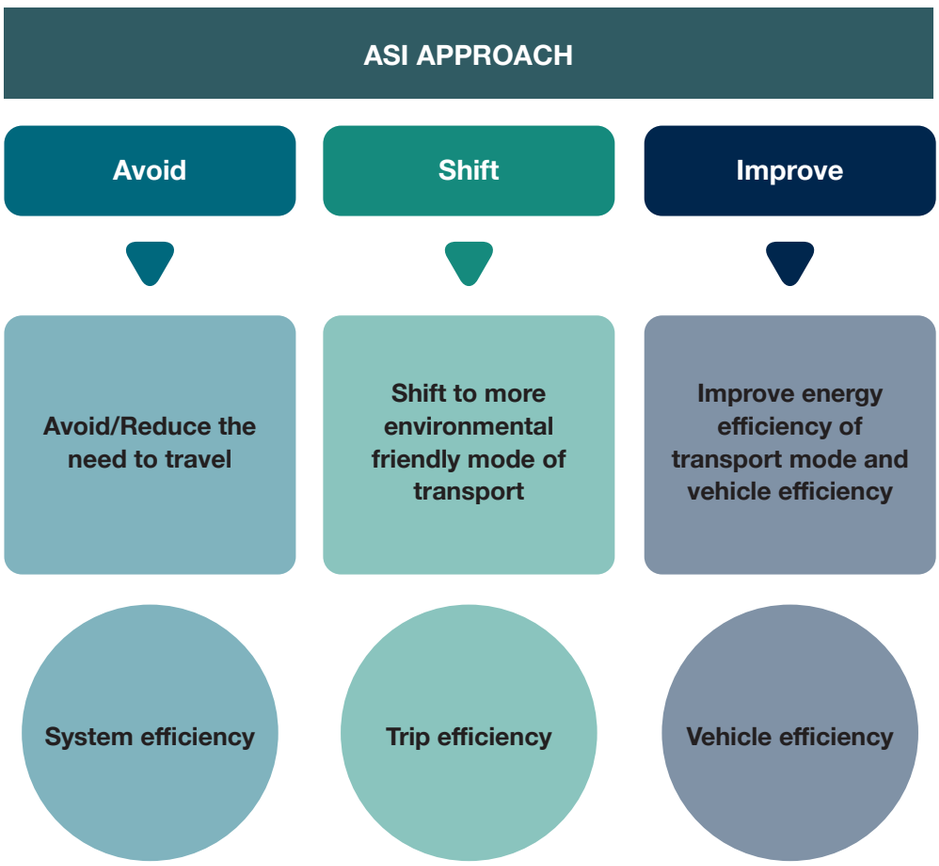
Based on the principles of sustainability, GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) has suggested an alternative approach to address the increasing travel demand. Unlike the traditional approach, the focus is on the demand side that constitutes three components designed specifically for encouraging clean mobility solutions: and is known as the **A**void, **S**hift and **I**mprove framework (ASI framework).

The demand-oriented ASI approach can help promote alternate mobility solutions and develop sustainable transport systems, through three components.

1) **Avoid: the need to reduce the need to travel.** Through mixed-land use planning and smart transport demand management, the need to travel and the trip length can be reduced. This will help in improving the overall **system efficiency.**
2) **Shift: shifting from the most energy-consuming transport mode to a more environmental-friendly mode of transport.** The shift can happen towards alternative modes like non-motorised transport (walking, cycling), public transport (bus, metro), personalised public transport (shared cabs, auto-rickshaws, cycle rickshaws and bike taxis). This shift will help in improved utilisation of the asset, reducing the per person kilometres travelled and carbon footprint. There will be an overall improvement in the **trip efficiency.**
3) **Improve: improving the energy efficiency of transport mode and vehicle technology.** This can be done by sourcing power for vehicles from a clean source such as renewable energy. Implementing strict vehicular emission standards and improving vehicle technology will contribute towards reducing the vehicular emission thereby improving the overall **vehicle efficiency.**

The figure below highlights the co-benefits of using the ASI approach to build a sustainable transport system.

As per NITI Aayog's report, congestion has a huge cost in the form of reduced productivity and fuel waste. The study estimates that the economic loss due to congestion is over USD 22 billion[1] annually at our top four metros. This ASI approach will lead to better energy security by devising alternatives leading to lower energy costs and less imported fuel. It will affect the country's economic development through increased private investment and reduced congestion which will save time – a precious commodity for all today.



Source: Sustainable Urban Transport, sutp.org

[1] http://niti.gov.in/writereaddata/files/document_publication/BCG.pdf

CHAPTER 3

CHALLENGES ALONG THE WAY & ROUTES TO CHANGE

Simplicity is the soul of efficiency.

To solve the vehicle kilometres puzzle, it is important to know it better. Now vehicle kilometres travelled depends on many individual components which together contribute to high vehicle usage. To understand the existing challenges across system efficiency, trip efficiency and vehicle efficiency, there is a need to look at these individual aspects and analyse them in their specific context.

3.1 System Efficiency

It means improving the efficiency of the whole mobility system by reducing the need to travel. The key components influencing this are:

3.1.1 Increasing Need for Travel and Ways to Curb it

Challenges

Work trips contribute a major share of the trip profile in urban centres in India. As India urbanises further, the need for travel is only going to double or treble, and so would the resulting consumption of energy, emissions from transport, congestion, and a loss of productivity, with direct and indirect social costs, i.e. health costs. There is an urgent need to investigate and reconsider work-based travel behaviour and find ways to curb the same.

In rural areas, low densities provide lower opportunities for optimising vehicle kilometres. Rural economy, unlike the urban economy, is not service-based and many strategies applicable in urban areas presented here may not be applicable to rural areas. However, the principles of sustainable mobility remain the same. The mechanism of delivery of shared services in the rural areas may vary and participation by local communities is essential. Small scale entrepreneurship models initiated by Governments and Financial Institutions can help create a robust rural shared transport network.

There is a need to minimise kilometres and not just minimise the carbon footprint.

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The 'Alwar Vahini' implemented in Alwar, Rajasthan is an example of promoting mobility and economic opportunity in rural areas.

How to introduce efficiency

Solutions

Around the world, several TDM (Travel Demand Management) strategies are deployed and have been tested. These strategies which could be voluntary or enforced through regulations aim to reduce the demand for automotive travel. Some regulations also rely on prices to reduce motorised travel demand. TDM as a strategy aims at reducing demand for single occupancy vehicle use.

Strategies: In these strategies, employers emerge as the primary stakeholders that can affect change at scale. Some TDM strategies that employers and cities can adopt are:

- **Measures by Employers for Vehicle Kilometres Reduction:** These include telecommuting, which features remote work, e-conferencing, virtual meetings, remote work assignments to reduce work-based vehicle kilometres for employees in specific industries. Ride-sharing or Carpooling / vanpooling, shuttle service, incentivising employees to switch to sustainable modes: walking, cycling and public transport are other viable measures. Park and ride facilities and amenities within the organisation such as shopping, daycare, library, food outlets, etc. will also help in cutting vehicle kilometres.

- **Policy Measures:** These include parking fees at workplaces, trip reduction policy, alternate or flexible work schedule, restricting single occupancy and support clean fuel technologies.

- **Intelligent Transport Systems** (ITS) can be used for information and decision-making.

- **Better public transport** including shared mobility services will go a long way too.

- **Land Use Measures** can be introduced including transit-oriented development, multimodal integration and development of non-motorised transport and infrastructure.

CROSSROADS OF CHANGE



Cross-country learnings

United States: In the 1920s, Reader's Digest started the earliest TDM Employer Programme where it subsidised a private bus system from Manhattan to Westchester County, New York, to transport relocated workers.

Tennessee Valley Authority programme was initiated to reduce parking demand. 3-M company is regarded today as the Founder of employer-sponsored van-pooling. Energy crises of the 1970s prompted a slew of initiatives like public efforts by employers to promote ride-sharing.

In 2012 alone, a substantial reduction in vehicle miles travelled in the US was achieved by these employers:[2]

• US WEST Communications - 47% reduction of trips and Vehicle Miles Travelled (VMT)

• University of California, Los Angeles - 5% reduction of trips and VMT

• Nuclear Regulatory Commission - 43% reduction of trips and VMT

[2] https://www.sciencedirect.com/science/article/pii/S1877042813045813

3.1.2 Lack of City Planning and Design

Challenges

Another challenge for improving system efficiency is the absence of sustainable planning, design approach and existence of economy driven car-oriented development of every city. The current city planning does not encourage sustainable mobility options for accessing services and shopping. Additionally, it does not have any infrastructure to support walking and cycling even for shorter distances or for last mile connectivity to public transport.

Urban Sprawl: Cities have been expanding recklessly over the last two decades, because of the high rate of migration and increase of population in general. Unavailability of a larger vision and master plan, combined with cheaper land spreading into rural or agricultural areas, has fuelled this growth. This type of development is controlled by market forces and not as per planned strategies, ultimately leading to a dependency on car usage, congestion and growth in road fatalities.

Most cities have very less population density, affecting financially as well as physically, the adequacy of an efficient and affordable public transport network along with the last mile solutions.

Land Use Zoning: The problem further intensifies with segregation of land use - for instance, residential, commercial and industrial areas are allotted lands with long travel distances. This leads to an increase in daily travel for people and more dependency on private vehicles due to multiple trips in different directions.

Lack of Human Scale: Lack of master planning and economic driven development, means that cities did not have any option but to experience patches of gated communities during their expansion. Many problems arose due to that.

Block Sizes: Gated communities guaranteed safety, amenities which city authorities did not have to offer during inception, and more so exclusivity for income groups. The gates and boundaries encompass huge areas with exclusive accessibility only for residents. As a result, the block sizes formed are comparatively very large, sometimes even more than 2 km in length, reducing the porosity factor to access shorter distances by walking and cycling and thus completely countering the process of achieving walkability.

Wider Roads: The city authorities have repeatedly relied on the concept of widening roads to deal with the problem of congestion and achieving efficient connectivity. Unfortunately, instead of linking different parts of cites, the scale of these roads has dissociated both the edges, adding to the vehicular count. The scale also does not work for pedestrians as it eliminates the idea of an enclosure, leading to security as well as comfort issues.

Ineffective Street Design: City streets are conceived as conduits of movement for motorised vehicles, specifically private cars, achieving high speed movement for them is considered the most important parameter. Standard designs adopted are influenced by highway construction aiming to commute between two cities or towns. Accordingly, the infrastructure for walking, cycling and public transport is kept at least priority making our streets incompatible to support sustainable mobility solutions. This ultimately adds to the inefficiency of public transport and road safety issues, impacting the mode share and influencing people to choose safer, comfortable and reliable travel modes like private cars.

Non-contextual Solutions: Cities and fabric within a city are categorised as existing, newly-built and upcoming. The method applied for their development is never contextualised enough to be fully accepted by the system on place, as well as end-users. This further leads to more contradictions in the urban environment, adding to the chaos and emerging misconceptions about rightful solutions.

How to introduce efficiency

Solutions

Sustainable city

To begin with, cities should grow in a controlled and efficient manner to utilise the available resources wisely by defining rigid boundaries.

Compact: Urban densification should be adopted as a tool and more development and redevelopment projects should be identified within the existing city structure rather than its suburbs. Various strategies

should be adopted for fast growing cities such as setting up goals for compactness at national as well as city level, making policies that encourage development within the city centre rather than on fringes, aiming to regenerate existing residential areas and working out a master plan for intensive usage of urban land.

Self-sustaining neighbourhoods

Diverse and Mixed use: Planned neighbourhoods should contain mixed land use including everyday activities such as housing, work, school, shop and other amenities in reasonably walkable or cycle-able distance. Different activities can be vertically or horizontally distributed and linked through accessible infrastructure. It should also include a range of employment, education, recreational and retail opportunities along with various dwelling types as per affordability. A mix of public spaces for all age groups with diverse needs should be considered.

Transit-oriented Development: This planning and design approach enables cluster development along the efficient public transport corridors of a city. High-density concentration around high-quality public transport system also mutually reinforces each other. Mass transit supports a high concentration of movement, comfortably without congestion and high ridership makes the public transport financially viable.

Creating Porosity: To increase walkability, the block size – the built form between surrounded by accessible streets for all - should be designed to achieve maximum permeability for people to walk and cycle, providing multiple options to reach a place.

A commonly accepted rule is that all the required services should be within the distance of a 20 minute-walk and thus, the street structure should be porous enough to reduce the required distance to be travelled.

Additionally, it can be achieved by porous skin of built form, porous boundaries, passages through built form, passages through a range of public spaces such as parks, plazas or public buildings and creating dedicated green links which cut through a shorter distance avoiding main streets.

Hierarchy of Streets and Public Spaces: Defined hierarchy of streets based on a range of public transport options rather than the width of a road, with designed infrastructure for all kinds of road users should be planned. This network of urban streets would support the range of public transport systems with facilities for last mile connectivity through neighbourhood lanes by walking and cycling. It should be supported by a series of public spaces catering to city level, area level and neighbourhood level gatherings. This would holistically develop a network of places to be claimed by people.

Inclusive Street Design: A complete street has four main components: Motor vehicle zone, Non-Motor/ activity zone, building edges and the connectors across these edges. These should be the focus to make streets safer, accessible, inclusive and sustainable. They should be designed as per the contextual requirement of road users. For instance, a street with 90% of pedestrians or street with a school site or street with residences all around would demand different interventions.

Inclusive street design is covered by six key principles:

1. Streets for all – Designing streets for all kinds of road users prioritising vulnerable groups such as pedestrians and cyclists followed by public transport is vital.

2. Continuity and alignment – The design should aim to maintain a continuous carriageway as well as a footpath by providing elements for smooth grade change.

3. Safety – Aiming at safer commute for all, the design should incorporate universal standards and safety elements like pedestrian crossings, traffic calming measures and signages.

4. Consider stoppage – Streets should consider infrastructure for people to stop for transfers and provide elements like bus stand, cycle stands, metro stations and parking spaces.

5. Utility integration – Streets are also a conduit for services for a city and these should be given designated space, well incorporated in cross-section, above and beneath the surface.

6. Placemaking – Designing the street as a public space to address the cultural, social, security and functional needs of the users is crucial too.

Need for Contextual Interventions: Diverse conditions of a city are managed using different approaches:

• **Retrofitting** – These are measures taken by modifying the existing structure of an area. This does not disturb the current patterns. Implementation is done in a short span of time, and leads to scaling up through replication in other parts of the city and can be adopted in Tier I, II or III cities with highly dense areas.

• **Redevelopment** – It encompasses the process of creating a new built environment by replacing the present scenario while adopting sustainable city principles and utilising the resources in a better way. It should be implemented only where retrofitting does not permit major advancement in the conditions.

• **New Development** – If new cities are required to be built or a city needs expansion, it provides an opportunity to introduce innovative sustainable solutions for planning and designing. This usually is a greenfield development, requiring rearrangements in land utilisation such as converting agriculture open land to an urban fabric. It needs to be done only when the existing built is saturated and should be in coherence with the ecosystem of the green field.

3.1.3 Lack of Multiple Mode Commute and Associated Infrastructure

Challenges

Existing city structures do not provide or support the idea of public transport. They also don't make provisions for intermodal passenger transport or multi-mode commute. There is a lack of integrated as well as hierarchical options to reach door to door - which ill competes with the reliability, comfort, affordability and stature of a private vehicle. This is why even with a large amount of investment on mass rapid transit systems such as metro, cities are unable to achieve change in mode share, adding financial pressure on the existing infrastructure and further reducing its affordability. These systems are not supported by walking, cycling and other modes of transport for supporting the last mile connectivity in a resourceful way. This exclusive transport system lacks empathy for physically, economically and socially disadvantaged people as well.

Not Enough Options: Currently, Indian cities do not have a holistic approach towards the provision of a public transport system. The few attempts made do not provide many options either. People do not have choices for commuting from the various origin and destination points as the current system follows fixed routes and schedules which does not offer convenience. Further, there is no clarity among decision-makers to define a priority among the list of options available - and are influenced based on market forces and imageability. Metro system has been the first choice since the last two decades. However, due to high construction costs, it is also not a feasible option to spread across a city and can be viable only for intercity commute.

Lack of Integration: Metro and buses are the two systems providing services in the majority of cities but they are the least integrated. Metro projects have not been able to achieve the targeted ridership over the years. One of the main reasons has been a disintegrated approach with other modes of travel from its stations. There is no coherence in the route maps of various services available; nor does the design resolve convenient as well as fast transition from one mode to another.

Not Supported by Last Mile Connectivity: There is a lack of provisions for people to commute between transit systems and the start or end location of their journey. There is no street infrastructure to support walking or non-motorised solutions. Further, there are no provisions for secondary public transport such as an efficient bus feeder system. Add to this, there is a lack of accessibility options for all kinds of road users - from door to a mass transit system. All in all, this affects the travel time, cost and comfort of the total trip, consequently making it convenient for people to use a private vehicle.

Not Embracing Newer Systems: With advancing information technology there is more innovation, making people book a cab or bus from their smartphones with upfront fare information. Unfortunately, even with upcoming trends, there are no changes in the attitude of regulatory bodies. There is a lack of comprehensive efforts to integrate these holistically by providing facilities like pick and drop points, to continue as a provision for the last mile effectively.

How to introduce efficiency

Solutions

• **Hierarchy of Public Transport:** All cities must plan for public transport modes. Public Transport (PT) consists of mass rapid transit (MRT); Para-transit and personalised PT.

– MRT, both rail and road based along with city bus is the backbone of city transport as they are

the only modes that carry a very large number of people using minimum space.

– Para-transit Modes i.e. tempos and minibuses supplement MRT in large cities and can be the main mode of PT in medium and small size cities. Personalised PT i.e. autos and taxis and cycle rickshaw cater to the demand of commuters seeking a substitute for personal transport. To create a massive shift from private vehicles to public transport, there needs to be a substantial improvement in the quality of service and not so much for low fares. It is, therefore, necessary to think of different types of public transport services for different segments of commuters.

Cities should look at globally proven technologies, including using available waterways. They should adopt a technology that would best suit the city requirements in the next 30 years.

Well Integrated Systems: A good public transport system is one that is perceived by the user as a single system and allows seamless travel between one mode and the other as also between systems managed by different operators. If a proper inter-change infrastructure is available, users can use a single ticket over all such systems. Overlapping of routes and schedules can be permitted. Integration needs to be done at all levels that include: Operational, Physical, Fare, Information and Institutional. It plays an important role in promoting the use of public transport, as a commuter's travel choices are made based on their relative convenience for the entire trip, and not just a segment of that trip.

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On-demand, shared models such as cab aggregators like Ola and Uber are offering carpool services, bus aggregators like Shuttl and Commut are offering on-demand bus services and bicycle sharing models are emerging too. These need to be incorporated within the system through policies and provisions of facilities such as parking and pick and drop locations within transit hubs.

Last Mile Connectivity Solutions: A system needs to provide multiple solutions for commuting from a transit hub to the first and last destination. This can be catered to by providing comfortable, accessible and safer infrastructure for walking and cycling around the transit hubs, as well as provisions of stops and parking spaces for intermediate public transport such as auto-rickshaws, cycle rickshaws and minibuses.

Incorporating Innovative Solutions: There are new innovative solutions based on information technology available as shared mobility options.

3.1.4 Lack of Coordinated and Common Governance Structure

Challenges

Outdated laws, multiplicity of institutions and poor institutional capacity present a slew of challenges, such as the present permit system, including but not limited to fitness certificates, endorsement of RC with license for regulation of transport does not allow governments and regulators the flexibility to deal with the problems of urban transport of the 21st century and also hinder regulators from making full use of the technologies and innovative models at our disposal. Fragmented functional and tiered responsibilities, lack of substantive regulation and innovation at execution level results in waste of time and energy. Diffused and inadequate institutional capacity results in delays in getting approvals and compliances, resulting in higher regulatory uncertainty and costs for players in the mobility sector. Lack of coordination between the regulators and the enforcement authorities often leads to forward-looking policy changes not being transmitted to the ground level.

How to introduce efficiency

Solutions

Improving efficiency through a single-window clearance for registration, permits and regulatory endorsement, vehicle transfer, can work as one-shop facilitation. The defined checklist of documents should be uploaded online with self-declaration along with time limitation of 24hrs. This should be compulsory to perform the above-said task starting from fitness to issuance of a permit. Thus, the irregularity can be eradicated at the RTO Level and turnaround time (TAT) can be made competitive as per Global Standards.

3.2 Trip Efficiency

Trip efficiency is defined as shifting from the most energy consuming to a more environment-friendly mode of transport, thereby improving the trip efficiency of the transport mode. Despite taking proactive steps towards improving planning processes and system efficiency, it can be assumed that passenger demand will rise multifold, considering the population growth. Serving the growing passenger demand through optimised trips, by improving occupancy through sharing and higher utilisation of seats and assets is the way forward.

Addressing the challenge directly translates to serving a majority of the passenger travel demand through mass transit and shared modes.

Mass transit and shared transport together can enable a shift from reliance on personal transport modes that often cater to the individual needs of users and technically operate at low occupancies.

In contrast, shared modes aim at higher occupancies and better asset utilisation to serve multiple passengers with a single trip and/or utilise the same vehicle across users. A long-term strategy that focuses on the above objectives can help reduce vehicle kilometres while serving the required passenger demand.

Challenges

3.2.1 Lack of Efficient Utilisation of Asset

Permits restricting cross utilisation of assets: Permits are regulatory licenses provided to vehicles that define the services which can be provided using the vehicle. The permit types have been formulated under the Motor Vehicles Act 1988, which precedes the shared mobility revolution. The key to shared mobility is the service of multiple user trips by the same vehicle. However, in certain cases, permits act as an impediment, limiting the use of vehicles for multiple purposes - and becoming a barrier to shared mobility.

Personal vehicles unable to address shared mobility: Personal vehicles in India are not permitted to offer commercial mobility services. These, especially cars, are one of the most underutilised assets- lying unused for 95% of their lifetime.[3] Adequate mechanisms can be leveraged to utilise such assets for mobility when needed.

3.2.2 Growth of Private Modes

Growing income levels and vehicle ownership: India is one of the fastest growing economies, witnessing strong growth in per capita income levels. As has been observed in other economies, growth in income levels directly corresponds to growth in vehicle ownership levels. Although ownership levels in India are currently 1/5th the levels of developed economies such as the United States, increasing income levels and access to financing is fueling an explosive growth in vehicles. According to a study in 2016 by the International Energy Agency (IEA) – "passenger car ownership in India will grow by 775% over the next 24 years".[4] More vehicles added to urban infrastructure is leading to congestion, longer travel times and economic loss for cities.

Over-reliance on private modes: Personal mobility offers reliability, comfort and flexibility to its users. Most users who can afford a form of personal mobility end up relying on their personal modes for all trips. Benefits such as free parking and low cost of usage (usually personal users consider only fuel expenses or trip level expenses) make users heavily dependent on their private vehicle. However, costs caused due to the network effect of personal vehicles at the city scale on existing infrastructure are rarely paid directly by the user. In effect, personal vehicle users rarely pay the complete economic cost of using their vehicles for commuting.

More road infrastructure encourages more in private users: Commonly, cities have planned and constructed road infrastructure to cater to the growing traffic. However, the shortsighted approach that fixes traffic rather than mobility, creates more infrastructure, which encourages higher usage from personal vehicles, especially private car users who occupy the highest space (in per space/passenger). The intervention is eventually plagued by the same problems it tries to solve, in a matter of a few years.

3.2.3 Lack of Travel Demand Data and Customisation

Data for Travel Demand Management: The application of technology in transportation generates

[3] http://www.ukayamut.com/wp-content/uploads/2016/02/the-sharing-economy-and-sustainability-feb-7-2016.pdf

[4] https://auto.ndtv.com/news/indias-passenger-car-ownership-to-grow-775-per-cent-by-2040-study-1425954

large quantities of disjointed data used in isolation. However, despite the existence of such data, it is not used as a tool for decision-makers that are assessing and planning the transport needs of cities or regions. Collation of data at a city scale can be used effectively for managing travel demand and decision making for matching demand and supply, and selection of future infrastructure in a city.

For Shared use cases: Shared services provided by various private entities are not shared publicly. However, a user planning a trip will require all available options on one platform to decide what option works best for him. Consolidation of data will also enable service providers to plan their services more efficiently, by optimising dead mileage and matching last-mile connectivity services with mass transit modes.

3.2.4 Quality/efficiency and Adoption of Public Transport Services

Productivity of end-user which affects the commute time, waiting time: Overall travel time is one of the key factors for selecting the mode and route for a trip and directly impacts an individual's productivity. Overall commute time using public transit or shared modes will be higher when compared to using a personal mode of transport for most trips. Waiting times, multiple stops, and layovers contribute to excess trip time and act as a penalty for public transport or shared mobility users. However, these are not encountered by personal mode users.

Absence of seamless intermodal connectivity: Public Transport systems are rigid, get optimised by route-based approach and are not designed to serve the origin and destination of all users directly. An inherent character of such systems is the need for first and last mile connectivity. However, the existing infrastructure in cities is inefficiently designed and of poor quality - whether in handling pedestrians or users using other non-motorised or motorised modes to access public transport. Adding up the poor quality of assets and overcrowding during the journey, the overall physical experience of public transport is poor.

Lack of willingness to switch to shared mobility/ public transportation: The inadequacy of services, absence of service information and poor overall experience of public transport in India hinder higher adoption of services. The projection of personal mobility as a state of freedom, independence and affluence, makes it more difficult for shared mobility and public transport to compete with personal mobility. This is epitomised by the lack of willingness of users to switch to shared mobility/public transportation.

3.2.5 Lack of Intelligent Transport Systems (ITS)

Intelligent Transport System (ITS) aims to achieve traffic efficiency by minimising traffic problems. It aims to reduce the time of commuters and enhances their safety and comfort, and is widely accepted and used in many countries today.

Lack of Online Routing Information and Inadequate Technical Capacity: The widespread use of smartphones in urban areas has opened up a world of information for users. yet, Public Transit schedule information for most cities is unavailable online. Lack of information is the foremost reason for lack of adoption of public transport for commute. Public Transport agencies have inadequate knowledge to apply ITS applications for service improvements or public information and solutions implemented in the country have been limited to generation of operational reports.

Absence of integrated ticketing: A common ticketing and payment system across different modes of transport in the city eases the experience of travelling in a city. But despite the launch of a National Common Mobility Card (NCMC), its adoption has been limited.

Absence of Inter-Modal optimisation: Technology can be leveraged to provide a seamless end-to-end experience for the user, wherein schedules of transit can be synchronised and last-mile connectivity options are available on demand. This will decrease waiting times and enhance user experience during inter-modal change for such users.

How to introduce efficiency

Solutions

The recommendations to support public transport and shared mobility in the country have been structured to address each challenge:

1. Promote High Asset Utilisation: To optimise existing transport assets and future vehicles, high utilisation and occupancy should be enabled through policies and permits that support high and cross utilisation for different purposes.

Leverage personal vehicles to serve overall travel demand in cities, enabling the use of such assets during 95% of their life when not used for personal trips.

2. Encourage Non-usage of Personal Modes:

The focus should be on incentivising vehicle usage rather than vehicle ownership. A number of instruments to capture the externalities produced by personal vehicle users should be introduced to curb the use of personal vehicles.

This would provide a "push effect" for people to embrace shared mobility.

- Fiscal measures for deterring the use of personal vehicles, such as cess on purchase of vehicles to support sustainable city infrastructure, high parking charges, congestion charges and so on

- Non-Fiscal measures such as limiting and regulating public parking through parking management, proof of private parking space for the purchase of a vehicle, creation of zero-emission, shared mobility and non-motorised transport-only zones

3. Transport Data Consolidation for Planning and Optimisation: The vast array of transport data generated from different sources should be shared with adequate privacy measures on a single platform. Such a platform can be hosted and used by city-level Institution and service providers for planning and executing transport projects, travel demand management and ensuring adequate services are accessible by residents of each and every area of the city. Creation of platform by City Governments and the creation of regulations around formats and privacy measures for data sharing by service providers is critical while allowing access for service providers to plan operations adequately.

4. Development of Quality and Integrated public transit: Public transit and shared mobility solutions complement each other to provide an alternative for personal vehicles to users.

Existing bus systems operated by State Transport or Municipal Undertakings must be strengthened and expanded to achieve adequate supply for users. In addition, an environment which allows shared mobility solutions provided by private companies to flourish and opportunity to innovate should be created.

- Institutional and financial capacity building of State-operated public transport services. Leveraging private sector efficiency in operations and implementing more successful Public Private Partnerships (PPP) models.

- Ensure regulations and permissions for multiple shared mobility models to co-exist and serve the needs of different use cases and segments of society.

- Creation of public transit and shared services friendly infrastructure which together can provide a seamless and quality experience for users. Such intermodal terminals would prioritise users of non-motorised transport, shared transport and private transport and can be developed using PPP models.

5. Application of Intelligent Transport Systems for Demand Management: Technology in transportation is currently being used in silos and providing piecemeal solutions to parts of the transportation problem. Integrated use of ITS should be leveraged to the advantage of both users and transport providers. Information on accessibility and availability of public transport and shared mobility options on a single platform will aid decision-making. It will help the users choose their travel mode and encourage the use of shared systems. Infact, ease of transactions and payments through technology has already benefitted many sectors and initiatives such as common ticketing by mobility cards, mobile phones or other relevant means impacts the ease of use of such systems for commuters.

6. Information Education and Communication (IEC) for Shared Mobility: IEC programmes initiated by City, State and Central Government to emphasise the health and environmental benefits of using shared transport modes will impact the perception of using such modes in a positive manner and will enhance the adoption of non-personal modes for commuting.

3.3 Vehicle Efficiency

Vehicle efficiency means improving the energy efficiency of the transport mode thereby improving vehicle efficiency. In order to improve environmental efficiency, there is a need to improve the vehicle and fuel technology. This can be done by enhancing the fuel economy of conventional engines; reducing the weight of vehicles and developing alternatives such as electric and hybrid vehicles, biofuels, and hydrogen fuel technologies which will help reduce the environmental impact of each kilometre travelled.

Efficiency gains can also be achieved through an improvement in the occupancy rate of vehicles, or environmentally-friendly driving habits (eco-driving). Vehicle efficiency can be improved by using clean fuels. However, improving efficiency by using clean fuel comes with a range of challenges.

Challenges

• **Integrating renewable energy to add clean kilometres to VKT:** Improving vehicle efficiency by using clean fuel will not have a direct impact on reducing VKT but will improve the environmental performance of transport modes. Integrating renewable energy and including other technological improvements to reduce GHG emissions and air pollution will help in adding clean kilometres to vehicle kilometres travelled.

• **Scaling up of EVs:** (in all segments starting from 2-wheelers, 3-wheelers, 4-wheelers) is a major challenge due to several associated factors such as:

Lack of charging stations and other charging infrastructure is a major deterrent in the adoption of EVs. This is especially true for personal EVs and those under the Rent-a-Cab Scheme/ Commercial Operations.

Lack of standardised tariffs for electricity consumption for charging EVs and Swap stations. Implementation is unclear, hence the declared rates for electricity consumptions are rarely accounted for, in the actual bills raised. EVs should be allowed to get benefits to pay tax (GST liability on services) from Carbon Credit. Carbon Credits shall be calculated basis the kilometres driven by the EVs and CO_2 emission avoided. Carbon credit markets are a well-tested device to encourage the adoption of carbon-free and carbon-reducing modes of transport. These markets work by issuing credits to those companies or organisations which use carbon saving methods, devices, vehicles and so on. These credits may then be traded by these organisations with others who are not as carbon-efficient. In addition to the same, there are negative incentives in the form of taxes or fees for those continuing to use less carbon-efficient methods, which can be offset by buying carbon credits on the market. Such a step would almost certainly incentivise the fleet owners and other large-scale users of ICE vehicles to make the shift to EVs. However, given the complexity of the same and the time required to set up such a mechanism, the State Governments should waive the levy of SGST upon the use of EVs for commercial purposes. They should simultaneously bring the carbon credit mechanism in place so that EVs operators can set off their tax liability with the use of accumulated carbon credit, viz “X” points will be accrued per KM per EV run.

How to introduce efficiency

Solutions

Several pointed measures can support renewable energy integration to the system, adding clean kilometres to the environment and indirectly enhancing the vehicle efficiency:

- **Regulatory Measures:** Regulatory instruments defining fuel standards and vehicle emission standards can be used to restrict the use of certain motorised vehicles and influence the types of vehicles used thereby promoting the integration of renewable energy.
- **Economic Measures:** Economic instruments such as vehicle and fuel taxes, road user charges and parking fees can be used to discourage the use of fossil fuel-powered vehicles. Revenues from such instruments can be used to improve alternative transport modes, shared mobility and clean fuel-powered vehicles.
- **Information Measures:** Information instruments such as marketing can be used to increase public awareness on the impact of clean kilometres travelled and its effect on the environment in terms of reducing air pollution. Separate labels on energy-efficient vehicles can help consumers chose the most environmentally efficient vehicle.
- **Technology Measures:** Technology instruments including the development of more efficient engines, fuels and vehicle design can help reduce the environmental burden of every kilometre driven.
- **Policy Measures:** Policy prioritising to improve vehicle efficiency by (i) promoting and enforcing vehicle efficiency standards, (ii) setting fuel standards, (iii) promoting new vehicle technology and infrastructure, (iv) R&D on new fuels, (v) developing intelligent transport systems. Together, these can support renewable energy integration to the system, adding clean kilometres to the environment and eventually enhancing vehicle efficiency.

CHAPTER 4

DESTINATION: LESSER VEHICLE KILOMETRES

The seed of progress lies in action.

ACTIONABLE RECOMMENDATIONS

The three different pillars of the system, trip and vehicle efficiency will go hand in hand in providing an integrated solution of VKT. Target smart cities of the country have been identified and the infrastructure is being built keeping not just the current needs, but the future needs in mind. The infrastructure will give way to more efficiently managed trips and the subsequent demand will drive innovation in trip efficiency. More awareness and the right guidance from the policy will help in realising the below recommendations into potentially viable solutions.

Regulatory Measures: Considering the dynamics of technology progress, innovative solutions must be encouraged and procured through regulatory measures at different levels:

• **National Level:** Guidance documents are needed such as National Urban Transport Policy and National Transit Oriented Development Policy

• **State Level:** Enabling through legislation such as Town and Country Planning Acts and Budgetary Allocations.

• **City Level:** Enabling through Development Plans which look into the context in detail such as Master Plans/Development Plans, Zonal Plans, Local Area Plans, Development Control regulations and Budgetary allocations.

Policy Measures: At the National level, the guidance/ policy documents must detail the need and purpose of adopting a compact development approach. Policy level documents must mandate the adoption of compact development measures for undertaking urban development. These include the National Transit Oriented Development Policy and Metro Rail Policy.

Financial Measures: Budgets must prioritise and incentivise compact developments, wherein dedicated funds must be created to enable smooth implementations.

CROSSROADS OF CHANGE



Many cities are working towards creating dedicated Transit Oriented Development funds, as JnNURM is giving impetus to better city buses.

Technology Measures: A comprehensive and coordinated development approach should be adopted w.r.t. sustainable habitat developments, service delivery, operations and maintenance. The focus should be customer based interfaces for service delivery like app-based bus systems, PBS, metro services, rail services etc. And innovative solutions must be used for making the developments sustainable.

Capacity Building: Stakeholders must review their current knowledge capacities and highlight areas for which the capacity building is required. These can be based on state or city priority areas. Officials from all tiers must undertake required training programmes. The programmes can be designed as classroom training, web-based training or site-visit training, based training based on the requirement.

Short-Term (2020-22)

- Notify a mandate to adopt sustainable transport models with focus on usage of public transport, shared mobility to reduce the numbers of private vehicles on road. This can be done by restricting the parking spots in offices by 50%, which will encourage employees to use public transport or other shared mobility options.
- Introduce emission standards for polluting vehicles like old buses, commercial vehicles. Notify a mandate to scrap all buses and commercial vehicles older than 15 years. This will help in prioritising clean fuel usage and shifting to cleaner and efficient modes of transport like EVs (which will add clean kilometres on the road)
- An integrated-system approach using National Common Mobility Card should be adopted. Like airline miles, public transport miles should be introduced to avail discounts on usage of public transport. This will be an incentive for people to use public transport
- Intelligent Transport Systems should be adopted for seamless travel in public transport. This should include digital payments and real time information on seat availability, wait time etc.
- Provide flexible working options will also help in reducing the need to travel

Medium-Term (2022-30)

- Transit-oriented development plans including mixed land use, non-motorised infrastructure
- Revisiting the city master plans to revise them as per the current needs
- City wise targets to double the modal share of public transport
- City-level electrification targets for buses, commercial fleets and other public transport modes (for example – 20% of fleets to be electric in the next 5 years).
- Adopting sustainable designs, policies, systems to promote compact city approach, integrated public transport development plans and clean fuel infrastructure plans

Long-Term (2030-50)

- Implementation and execution of master plan documents for planning, enforcement, awareness and engagement strategies

In conclusion, discussions around different problems around mobility systems can offshoot in different directions. VKT helps in unifying and measuring them into one single metric. This enables a more focused effort in solving the mobility system. The right start is being made by identifying the gaps and collaborating with stakeholders across different segments of the ecosystem. Focusing on this key metric and bringing this down will help several other related metrics fall in line and create visible changes.

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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.

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WORKING GROUP

Working Group on "Avoid Vehicle Kilometres for Commuting, Shopping and Accessing Services"



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ACRONYMS

BPKM: billion passenger kilometre
CAGR: compound annual growth rate
EV: electronic vehicles
GHG: greenhouse gas
GIZ: Deutsche Gesellschaft fuer International Zusammenarbeit
IEA: International Energy Agency
IEC: Information Education and Communication
ITS: Intelligent Transport System
MRT: Mass Rapid Transit
NCMC: National Common Mobility Card
NITI: National Institution for Transforming India
PPP: public private partnerships
PT: public transport
TDM: Travel Demand Management
VKT: Vehicle Kilometres Travelled
VMT: Vehicle Miles Travelled

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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