

Smart Urban Mobility and Public Transportation: A Perspective on India

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ABSTRACT

Transportation in urban areas is highly complex due to involvement of various modes and pattern of traffic movement. However, cities are also locations of production, consumption and distribution activities which require seamless and constant connectivity between different areas of the city. The urban transport system is intricately linked with urban areas and spatial zones. Movement of people has always been fundamental component of the economic and social life of cities. Contemporary economic processes have been accompanied by a significant increase in mobility and higher levels of accessibility. It is also significant to highlight that improvements in transportation had been interdependent with economic, social, and development changes. Societies have become increasingly reliant on their transport systems to support a wide variety of activities such as commuting, employment, tourism, and distribution of goods and services etc. There cannot be any apprehension in regard to utility of public transportation in mass mobility specially in urban areas however, developing a smart mobility alternative which is sustainable, economical, accessible and connected poses significant challenges for the governmental agencies, policy planners and researchers. This paper is a conceptual paper to assess the utility, significance and challenges pertaining to the smart mobility in India through analysis of domestic policies, regulations, and prevailing scenario of public transportation.

Introduction

The World Bank estimate suggests that 55% of the population lives in urban areas today and by 2050, 68% of the world's population will be urban. With more than 80% of global GDP generated in cities, urbanization can contribute to sustainable growth provided if managed well by better governance, adopting innovations and integrated planning. Based on the above emerging development urban transportation issues are of significant importance to support the mobility requirements of urban areas. Having the objective of 100 smart cities and the rising urban population, the scenario of public transport and urban mobility needs improvement and further investment in India. The National Transport Development Policy Committee that presented its India

Transport Report – Moving India to 2032, reported that the total passenger traffic is expected to grow at about 15% per annum. The data also suggests that growth in rail passenger traffic is expected to be around 9% per annum, and for road traffic, 15.4%. There is a requirement of about US\$ 570 billion by 2031-32. A large portion of this investment should go in improving the public transportation by introducing smart technology. Developed economies have realized the importance of smart transportation. And various means and modes of transportation are emerging on the transportation front involving the use of electric cars, use of quick, easy mass transit systems, rapid metro rails and the use of advanced technology for seamless mobility across the cities. India is not an exception to this evolving phenomena of urban public transportation. Existing and upcoming metro rail network in various Indian cities indicates the seriousness of the effort made by government. A combination of strong policies, regulation, public and private sector investments and public awareness will bring the anticipated change for implementing the vision of smart transportation in the urban areas.

Urban Transportation Overview

Cities are centres of economic activities and require the support of transport network to sustain their growth process. The larger the city, the greater its complexity of dealing with transport challenges. Further transport terminals such as sea ports, airports, and rail yards are located within cities, contributing to a different set of problems, like congestion, delayed commuting, rising cost of commuting and pollution.

Traffic congestion

Congestion is one of the most widespread transport problems in cities, especially in regard to 1 million plus cities. By the 21st century, drivers would spend about 3 times more time in congestion as they did in the later part of the 20th century. Congestion can be considered one of the most disturbing phenomenon of urban transport system in Indian cities. The extension of roads in urban areas could not compete with the influx of vehicular population.

The automobile is preferred in comparison to other modes of transportation. The majority of automobile related congestion is due to time slot preferences and parking concerns. It is estimated that for majority of the time (95% of the time) an automobile remains idle and unnecessarily consumes the parking space either in office, road or society parking.

Congestion is particularly linked with increase in motorized vehicles which has increased the demand for transport network and infrastructures. The availability of public transport has not been able to cope up with the growth of transport requirements in Indian cities.

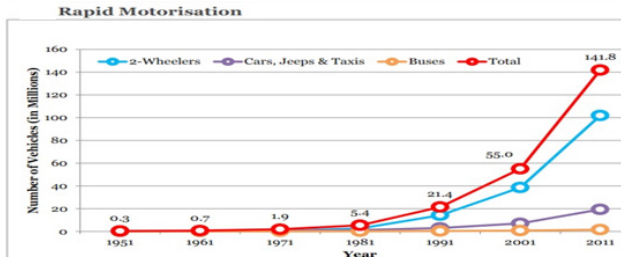
Table: 1

Automobile Domestic Sales Trends

Category	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Passenger Vehicles	26,65,015	25,03,509	26,01,236	27,89,208	30,47,582	32,87,965

Source: Society of Indian Automobiles Manufacturers

Figure: 1

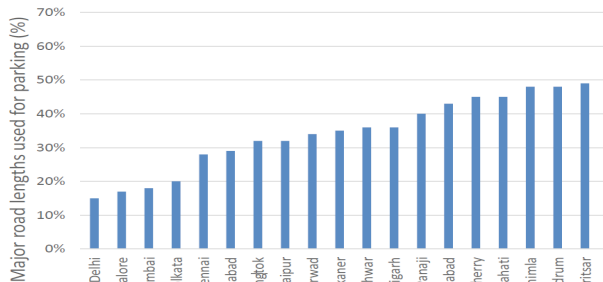


Source: Urban Transport in India Challenges and Recommendations IIHS RF Paper on Urban Transport

Parking Limitations

Parking is developing as serious problem in most of the countries, in fact congestion and parking are interrelated since street parking restrict the capacity of the road for transport purposes it aggravates the crisis of congestion. Since vehicles occupy majority of the time being in parked condition hence motorization has stretched the demand for parking space, which has resulted in space constraints especially in the central areas of cities. Identifying the reasons behind congestion is a strategic concern for urban planning since congestion basically takes place due to lack of parking or poorly governed traffic system.

Figure: 2



Source: Urban Transport in India Challenges and Recommendations IIHS RF Paper on Urban Transport

High maintenance and upgrade costs

Cities are also grappling with the problem of aging public transport infrastructure. The maintenance cost of existing fleet and technology driven futuristic upgrade requires significant capital investment which further contributes to the financial vulnerabilities of public transit system. For instance many city transit system in India are shifting towards cleaner and greener technology like battery driven e- Buses. This would necessitate sizable capital infusion either from central or state government to support the clean technology because most of the city transit system are operating under huge financial losses.

Environmental hazards

Air pollution, along with noise, generated by public transit has become a serious problem for the quality of life. Most cities are moving towards cleaner fuel and greener technologies. However this requires complete overhaul of their entire fleet in order to support the eco-friendly measures which is financially a daunting task considering the poor financial health of public transit in cities. WHO reports suggest that most of the Indian cities are alarmingly high in pollution indicators and automobile exhaust is one the major reason of pollution.

Road accidents and safety

Rising traffic in urban areas is associated with a growing number of accidents and fatalities, especially in India which hold the dubious distinction of having highest number of accidents casualties. As traffic increases, people feel anxious due to delays in traffic congestion and breach traffic rules in order to reach destination quickly thereby becoming prone to the accidents.

Inadequacy of Public Transport

There has been the trend across major metro of the world that public transit systems generally operates below to its capacity. However lower occupancy of public transportation system poses a threat of making them financially unsustainable. Despite the subsidies extended by government most of the public transit system finds it difficult to generate revenues for meeting its operating cost.

Urban Transports Challenge

As cities are increasing in terms of population, hence forth the cost of building and operating public transportation systems increase. Majority of metro rails are in the developed countries due to heavy capital requirements developing countries find it difficult to manage financial resources. Furthermore, scattered

residential patterns makes urban public transportation less convenient and increases dependence of automobile.

Table: 2

Benchmarking of public transport systems across the globe

City	Metropolitan area		Bus		MRT		Bus Fleet/1000 persons	MRT Km/10 persons
	Population ('000)	Area (km ²)	Fleet Size	Daily Ridership (mn)	Km	Daily Ridership (mn)		
Beijing	20186	16411	21628	13.8	554	6.7	1.07	0.03
Hong Kong	7184	1104	5743	3.8	178	4	0.80	0.02
Shanghai	23475	6341	16235	7.6	588	6.2	0.69	0.03
Singapore	5312	716	4212	3.5	167	2.2	0.79	0.03
London	8302	1572	7500	6.4	402	3.2	0.90	0.05
New York	8337	790	4344	1.8	370	4.5	0.52	0.04
Seoul	10442	605	7512	4.6	327	6.9	0.72	0.03
Tokyo	13277	2189	1462	0.6	305	2.2	0.11	0.02
Delhi	16788	1483	5842	4.8	215	2.7	0.95	0.01

Source: KPMG Reimagining public transport in India, 2017

Dependence on urban transit is high in Asian subcontinent, in the average range in Europe and relatively low in North America. It has been observed that in various cities investments in public transportation did not result in considerable increase in the commuters. In fact the ridership has fallen in many cities for instance the BRTS of Ahmedabad. The economic viability of public transit is under question. Most urban transit had little, impacts on alleviating congestion in spite of increasing costs and heavy subsidies.

Lack of flexibility

The routes, pathways of various public transit systems, mainly rail and metro-rail is dedicated and fixed, while cities are dynamic entities. This indicates that as and when travel patterns changes and the transit system built for a definite arrangement may become obsolete.

Lack of connectivity

Public transportation systems are designed in such a manner that quite often they operate independent from other various other modes of transit. It is difficult to transfer passengers from one system to the other. This creates complexity for riders to while shifting from one transport to other.

Automobile competition

Public transit face tough competition and loss of ridership due to private

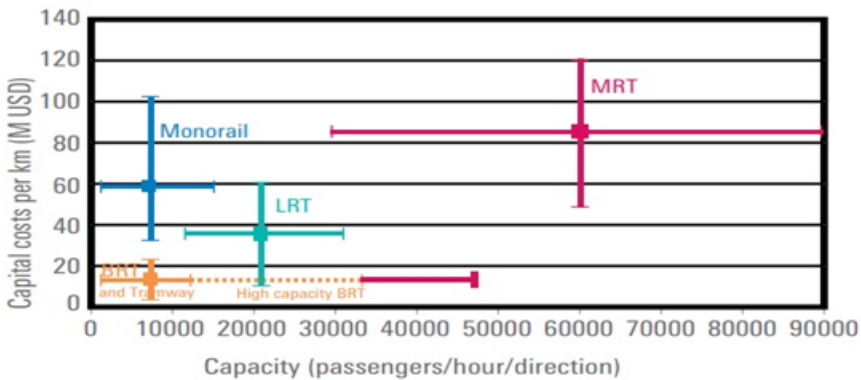
automobiles. The convenience offered through personally owned vehicles has simply outpaced the public transport in many cities.

High Construction and maintenance costs

Public transit systems, particularly metro rail, are quite ambitious projects in terms of capital infusion for constructing and operating the metro rail. Costs are subject to conditions such as pricing of land, population density and policies, but average construction costs stand around between \$250-280 million per km.

Figure: 3

Cost and capacity of mass transit systems



Source: International experience with bus rapid transit Northwestern University, Gerhard Menckhoff, 2010

Research based evidence highlight that the cost of operating public transportation is increasing, indicating that the relative cost advantage of public transportation over the automobile is lost. Which makes it even more difficult to justify the public spending on public transportation.

Public Transit and its forms

The urban milieu is appropriate for transit because it provides **high density** and **short distance mobility requirements**. Since transit is a **pooled/shared service**, it is benefited from cities having economies of scale and service driven occupational arrangement. One significant benefit of public transport is that higher the demand, the more economic sustainability. Lower demand results in a public transit systems incurring losses and requiring subsidies support. While researches indicate that the ideal modal share of public transport should be around 70%, however it is around only 35%–40% in India's metro cities.

Table: 3

Desirable Share of Public Transit

City Size	Share of PT trips
<1 million	30%
1 million	35%
1.5 million	40%
3 million	50%
6 million	70%
9 million	75-80%

Source: Report on Alternative Systems of Urban Transport, GOI, 1984

The objective of collective transportation is to provide publicly accessible mobility. The efficiency and efficacy of public transport lies in ferrying large number of riders with minimal cost. Urban mobility is characterised by three modes which are collective, individual and goods transportation. This paper attempt to assess and analyse the prospect and challenges of metro rail and ride hailing-sharing taxis on collective or public transport.

Bus based Transport

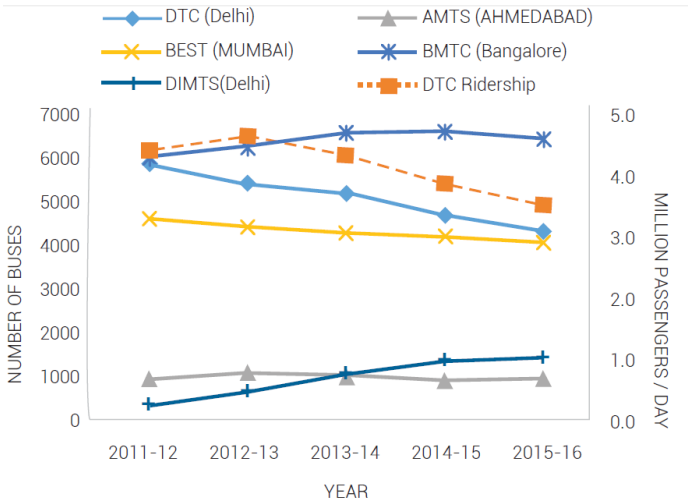
One of the most popular and convenient common form of urban transport includes buses operating on dedicated routes. They usually share road with other modes of transport hence susceptible to create congestion. On the other hand Bus rapid transit systems (BRTS) operate on dedicated pathways and enjoy the benefit of being free from traffic.

Bus-based public transport system provides mobility to people and offers a cost effective alternative to various modes of transport in urban and rural areas. In urban and metro cities, bus-based public transport system offers a viable solution to the enormous problems of traffic congestion and pollution, and in rural areas it provides an affordable and convenient means to transport people and goods. According to the report of working group on Road Transport for the 12th five year plan, GOI, 2012-17. In terms of per passenger kilometre, it is estimated that on an average a car consumes approximately 6 times more energy than a bus.

State Road Transport Undertakings (SRTUs) are the dominant players in bus-based public transport system in most States and Union Territories. There are altogether 54 SRTUs comprising of 24 State Road Transport Corporations (SRTC), 12 Companies, 8 Government Departmental Undertakings and 10 Municipal Undertakings, providing passenger transport services for rural, inter-city and urban areas.

The SRTUs plying in 8 metropolitan cities, namely, Ahmedabad, BEST Undertaking, Bangalore Metropolitan TC, Calcutta TC, Chandigarh TU, Delhi TC, Metro TC (Chennai) and Pune Mahamandal, accounted for 16 per cent of total fleet and 26 per cent of passenger carried.

Figure: 4



Source: Based on GNCTD 2017, GOI 2017 and DIMTS 2018

Rail transit and India’s Metro System

It include Vehicles of fixed guide ways that usually have their dedicated corridor. Heavy rail systems are referred as subways or metro as these also operate both in elevated and under-ground conditions. When compared to private automobiles, this mode of transportation is also quite inexpensive. Based on all these reasons, the popularity of the Metro rail has gone up considerably. Such significant has been the growth of Metro that government formulated a Metro Rail Policy, in 2017, with an aim to speed up work and control cost overruns. 231 km of the entire 429.26 km – is concentrated in national capital region Delhi. In comparison, financial capital Mumbai currently has only 20 km of operational Metro route.

Currently, the Metro rail is functional in various cities like Delhi, Mumbai, Bengaluru, Kolkata, Chennai, Lucknow, Kochi, Hyderabad, Jaipur and Gurgaon. Estimates suggest currently Metro projects of more than Rs 2 trillion are under approval in 15 cities.

India belongs to the group of 55 countries that have a Metro rail. Nevertheless, its share in the global rail network is only three per cent. The Delhi Metro, India’s first modern Metro, which started its operations in 2002, is the fourth-largest Metro network in the world after Shanghai, Beijing, and London.

However the data suggest that 14% of all commuters in Delhi use the Metro while the global average is 16%. In other cities, the Metro’s role as main

transporting medium has yet to gain significance. Heavy road traffic congestion in Delhi, having a population of approximately 20 million, and with more motor vehicles than Mumbai, Calcutta and Chennai combined, overcrowding and pollution was restricting the ability of Delhi to reach its potential. Therefore Delhi Metro Rail Corporation (DMRC) was established by the Government of India and the Government of Delhi in 1995 to build a new metro system in India's capital city with an investment around \$2.7bn for I and II phase. Thirty percent of the total investment was financed by Government of India (GOI) and Government of Delhi, while 60% was funded by a loan from Japan International Cooperation Agency (JICA).

Rising city population and growing size of economy has invariably called for a shift from private modes of transportation to public transport. A look at the major nations suggests that well planned Mass Rapid Transit Systems (MRTS) exist successfully across the globe. India however (like several other developing countries) has lagged behind in launching metro projects. Although the first metro, the Kolkata Metro, started working almost 25 years ago. The reasons could be due to lack of capital resources, improper planning, a long gestation period and complex technology. Other reasons include the lack of integration between various systems of mass transportation and the absence of comprehensive traffic and transportation policies

Ride Hailing- App based taxi complementing or hurting public transit

Ride-hailing services like Uber and Ola are determining the way that people move in cities. However, due to the rise in the popularity ride-hailing services, the comparatively sluggish pace of regulation, and credible data, city planners and policy makers and researchers have been constrained in their ability to provide valuable insights into how ride-hailing is changing travel preferences and its impact on overall city transportation.

The interface between ride hailing services and public transit affects congestion and pollution in cities.³ In fact Uber can increase congestion and pollution simply by increasing the number of trips taken. However, its impact on congestion and pollution will be far greater if ride hailing services becomes a net substitute for transit.

Uber, Ola and other taxi services could affect public transit through in two ways. On one hand Uber is an alternative mode of travel, and riders might leave public transport for the new taxi based transportation. On the other hand, riders could use Uber to overcome the last mile connectivity problem caused by public transportation's fixed-route service.

Uber admits that it is impossible to tell whether rider is using its taxi for reaching to a transit stop or for a destination which is near to a transit stop (Smith 2015). A Pew (2016) survey has clearly reflected that that use of public transportation is highly correlated with Uber use, with 9 percent of those who do not use Uber at all, take public transit each week and 56 percent of those who use Uber weekly take public transit each week. Murphy and Feigon (2016) found that 15 percent of those who use ride-hailing apps, car-sharing, or bike-sharing report that they ride public transportation.

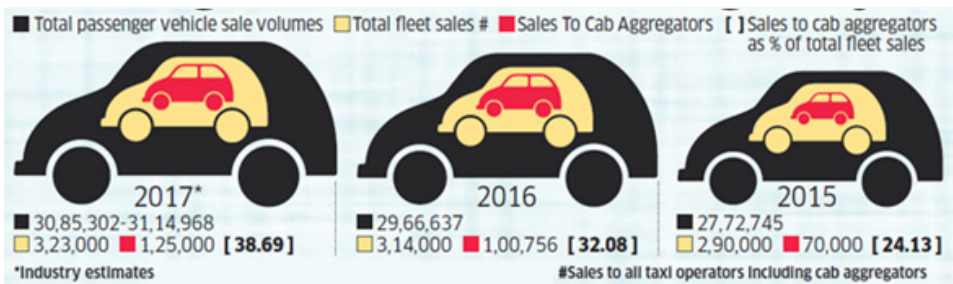
The research based data and ride-hailing companies themselves suggest that ride-hailing can be complementary to public transit. However, than appears true to some extent however the sale of passenger car vehicles suggest that more cars now on the roads indicating that the net effect is an overall reduction in public transportation use and a shift towards increasing number of cars.

According to a report by market research and advisory firm Red Seer Management Consulting Pvt. Ltd. Ride-hailing services like Ola and Uber together achieved a nearly fourfold increase in the number of rides booked through their online platforms in 2016 from 2015. In terms of number Ola and Uber together completed about 500 million rides in 2016, as against about 130 million rides in 2015.

Demand from Uber and Ola pushing car sales

Uber and Ola have not only disturbed taxi and three-wheeler markets across Indian cities, but they are also pushing overall car sales at a time when automakers are finding it difficult to expand their sales.

Figure: 5



Source: Society of Indian Automobiles Manufacturers adopted from Economic Times, 2017

According to carmakers ride-hailing app based operators accounted for over 100,000 cars, or almost one-third of total sales to fleet operators last year, up from around 70,000, or about one-fourth of total taxi sales in 2015. This year,

sales to cab aggregators are expected to increase by at least 25 per cent while overall passenger vehicle sales are expected to grow in single digits. “App-based aggregators have added around 600,000 vehicles in the last four years. And as per the Ministry of Road Transport and Highways, India has added around 20 million cars in the last 15 years but the average occupancy of a car is just 28% suggesting that a car can carry 4 people, it only carries 1.15 persons. Promotion of shared mobility and a shift from personalized transport to public transport and ensuring optimal utilization are two of the core principles of the taxi policy [guidelines](#) proposed by the committee constituted in 2016 by the Ministry of Road Transport and Highways to promote urban mobility in India. Since the launch of Uber pool currently 31% of car rides takes place on Uber Pool.

In Bengaluru, Uber has joined hands with the Bangalore Metro Rail Corporation to provide last mile connectivity. Booking counters have been opened at metro rail stations for those who do not have access to the app of Uber. According to Uber India the future of urban mobility, is ridesharing. A significant aspect of this is to bring private vehicles with in the ambit of ride sharing – a model that is quite popular is the US. Uber has been strongly advocating of this and has been engaging with the government to overcome legal challenges involved with private ridesharing for that an amendment to the Motor Vehicles Act, 1988, is required so that ride sharing with private cars becomes a reality.

Conclusion

India has been grappling with traffic congestions and air pollution. The severity of the situation is in the public domain since air pollution in India crossed alarming levels and bypassed most indicators of air quality as per WHO standards. The government, has been trying to curb the congestion and air pollution through redesigning of urban mobility policies by adopting smart modes of public transportation, implementation of better emission norms and promoting electronic vehicles etc.

MRTS is the best way to deal with various problems associated with urban transport. However, a number of considerations require concerted deliberations and planning in order to run a successful MRTS. Viability of metro projects depend upon accurate defining of traffic corridors, technology utilized, availability of land, volume of traffic, capacity utilisation, maintenance and acceptance mode by the city commuters.

It is also believed that sharing vehicles can help to address our growing transportation problem in Indian cities however, the research shows that sharing vehicles is not enough. We require development patterns and policy

interventions that can integrate and prioritize public transit in a broader framework of urban development and city transportation.

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