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Urban Transportation Infrastructure Development in Delhi/ NCR: Trends, Challenges and Opportunities

Anil Malik

(Urban Planner- Architect), Master of Planning (Urban Planning) – MNIT, Jaipur; Bachelor of Architecture – CRSCE, Murthal,

CoA Registration No.- CA/2012/56381

ABSTRACT

Metro cities in India are facing acute traffic and transportation problems leading to deteriorated quality of life and weak socio-- economic structure. The problems range from inefficiency of roads and transport infrastructure to deal with exorbitantly increasing in magnitude of vehicles especially the personal ones , lack of mass transportation systems , encroachments on roads ,lack of pedestrian facilities and weak traffic management systems Delhi being the capital city is the center of socio economic, cultural and political activities of the country. The city also acts as a major center of trade and commerce and is the nodal point for five national highways and intercity rail corridors, carrying large volumes of heterogeneous passenger and goods traffic. The national highways and other major road network carry intra city and intercity traffic traversing to and from the different parts of the country. The transport system of Delhi consists of a well-developed transport network system, based on ring and radial pattern, large fleet of buses (DTC & CNG) and a suburban rail system including MRTS. The majority share of travel needs of Delhi commuters is met by road based transport systems. There has been a major improvement in transport infrastructure in recent years in terms of flyovers, road widening, new roads development and development of metro rail corridors along major routes of travel in the city. Due to continuous increase in population, employment opportunities and number of vehicles, there is a constant increase in demand over the years; and infrastructure has not grown in adequate proportions making the existing network system function beyond its capacity. This has led to serious traffic problems of congestion, delays, safety, pollution and system management. This paper provides an overview of urban transportation issues and challenges in Delhi/ NCR. Rather than covering every aspect of urban transportation, it primarily focuses on those areas that are important from policy point of view. The paper first reviews the trends of vehicular growth and availability of transport infrastructure in Delhi/ NCR. This is followed by a discussion on the nature and magnitude of urban transport problems such as congestion, pollution and road accidents. Building on this background, the paper proposes policy measures to improve urban transportation in Delhi/ NCR.

Keywords: Urban Transportation, Transport Network, Transport Policy, Delhi/ NCR

I. INTRODUCTION

The Regional Plan-2021 for NCR formulated a set of policies for the control of land uses and development of infrastructure in the region. The Functional Plan on Transport prepared and approved by the NCR Planning Board envisaged an organized transport network to improve accessibility and the movement of goods and

passengers within the region. The Functional Plan on Transport suggested construction of road and rail linkages along the high-density routes, in and around the Capital and also in the National Capital Region. The vision of the Plan is to develop the entire NCR as a region of global excellence. The Plan aims to promote economic growth and balanced development of the Region and seeks to attain these through providing suitable economic base for future growth by identification and development of regional settlements capable of absorbing the economic development impulse of Delhi; providing efficient and economic rail and road based transportation networks (including mass transport systems) well integrated with the land use patterns to support balanced regional development in such identified settlements; minimizing the adverse environmental impact that may occur in the process of development of the NCR; developing selected urban settlements with urban infrastructure facilities such as transport, power, communication, drinking water, sewerage and drainage comparable with Delhi; providing a rational land use pattern; and promoting sustainable development in the region for improving the quality of life.

II. EXISTING INFRASTUCTURE/ TRENDS

The transport system of NCR as of today consists of well-knit road network and radial rail corridors catering to inter-city and intra-city commuters and long-distance traffic. The freight traffic is also substantial in the region and this is mostly carried by road. Delhi acts as collection and distribution centre for the northern region.

(A) Road Network: Existing road network in the region shows convergence of five national highways i.e., NH-1, 2, 8,10 and 24 on Delhi and two National Highways namely NH58 and NH91 meet NH24 at Ghaziabad. These national highways have four lane divided carriageway on most of the stretches of NCR. The Delhi-Rohtak (NH10), from Delhi to Delhi-Haryana border is four to six lane divided carriageway, Ghaziabad-Meerut (NH58) is four lane divided carriageway up to Meerut excluding Meerut bypass, which is two lane, and Ghaziabad-Bulandshahar (NH91) which is two lane highway. In addition to this, NH71, NH71A and NH71B also pass through the region. Ten state highways also serve in strengthening the regional road network. Most of the state highways are of single lane or intermediate lane.

(B) Rail Network: The NCR rail network covers three zonal railways (northern, western and central) zones and five divisions. The rail network in the region consists of both broad and metre gauges. Five broad gauge railway lines converge at Delhi [Map 6.2 National Capital Region: Existing Transport Network (Rail) 2002]. The rail network has two specially identified lines known as the Goods Avoiding lines (GAL) and Delhi Avoiding Lines (DAL). The GAL provides a direct entry from Ghaziabad to New Delhi bypassing the congested Delhi Railway Station Complex. The DAL provides a direct passage from the major yards - Tughlakabad and Ghaziabad directly into the Delhi-Ambala-Kalka section and through Lajpat Nagar, Patel Nagar, Daya Basti and Azadpur link.

(C) Airport:

At present two airports are located at Delhi-Indira Gandhi Airport is for international flights and Palam Airport for domestic flights.

III. CHALLENGES

Congestion: The number of vehicles in cities has increased by over 26 times since 1981, as against the road space, which has increased by only 3.35 times. Reduced road space for motor vehicles coupled with longer and increased frequency of trips has resulted in severe congestion in cities.

Year	Car	Sc/Mc	3 Whlr.	Taxi	Goods	Buses	Total
1980	117	334	20	6	36	8	521
1985	175	637	31	9	59	14	925
1990	384	1191	62	10	99	19	1765
1995	618	1708	78	13	132	28	2576
1998	805	2077	86	17	149	35	3167
2000	910	2262	90	18	161	39	3480

Source : Delhi Statistical Handbook & Tpt. Dept.

Reduced Travel Speeds: Indian roads are characterized to have heterogeneity in traffic such as bicycles, cycle rickshaws, autorickshaws, taxis, motorbikes, twowheelers, cars and buses and all compete for the same road space. Vehicles capable of travelling at high speeds end up travelling at the speed of the slowest vehicle on the road. In most of our cities, both large and small, travel speeds are slower than most of the international cities. In fact, in many of the Indian cities, the speeds are comparable to average cycling speeds (i.e. 15-16 kmph). Between 2001 and 2011, the number of road accidents increased by 22 per cent and the worst affected are the pedestrians and two wheelers.

Year	Population (Lakh)	No. of Vehicles (Lakh)	Road Deaths	Fatality Rate		Total Accidents
				Per lakh population	Per 1000 vehicles	
1980	60.35	5.21	747	12.37	14.32	4300
1985	74.63	9.25	1269	17.0	13.71	6254
1990	89.10	17.65	1670	18.74	9.11	7659
1995	110.61	25.76	2070	18.71	8.04	10138
1998	122.81	31.67	2123	17.28	6.70	10217
2001	137.8	37.0	1842	13.37	4.98	9744

Source : Delhi Statistical Handbook

Air Pollution: Statistics show that about 70 per cent of the air pollution is caused by road transport. Uncontrolled air pollution has adversely affected the health of the people and the quality of life of city inhabitants. For example, with about 9.0 million registered vehicles, Delhi has acquired the dubious distinction of being the fourth most polluted city in the world. The data on air quality shows that although SO2 and NO2 levels are below the National Ambient Air Quality Standard (NAAQS) in most of the cities, the Suspended Particulate Matter (both respirable and non respirable) is disturbingly higher in many cities.

Energy Consumption: The consumption of petroleum fuels in India went up from 6.6 million tonnes in 1981 to 56.32 million in 2011. Since India is a net importer of petroleum fuels, the steep increase in fuel consumption has resulted in a huge drain on the country's foreign exchange reserves, the import bill having gone up from Rs. 53 Billion (USD 883 Million) in 1980-81 to almost Rs. 7,400 Billion (USD 123 Billion)in 2011-12, i.e. nearly 140 times (Ministry of Petroleum, 2011-12). The rapid motorisation in our cities presents a serious threat to our energy security. World Bank statistics show that on an average, India has 18 cars per 1000 people (2009), yet Indian cities are congested with vehicular traffic and pollution. The conventional ways to solve transport problems such as construction of flyovers and widening of roads have only fuelled the growth of motorised vehicles, reducing non motorised transport and public transport use. The increase in private car usage is a major contributor to the growth in Green House Gas (GHG) emissions, and is detrimental to the environment both in India and globally. Most of the nations have already realised that road capacity cannot be provided to cater for the predicted increase in private cars. The answer is to provide improved better quality and efficient public transport as well as Non-Motorised Transport Networks and reduce need for travel.

Surface Infrastructure: The city of Delhi has one of the largest road networks in India. The road network already occupies 21% of the total city area, limiting the potential for future increase. Nonetheless, the modal share of Delhi is much better than any developed country as only 25% of the population is using private vehicles while the rest are using public or non-motorized transport (NMT).

The Bus Service faces Multiple Challenges: Competition among different bus operators: DMRC feeder buses and Delhi government buses are often seen competing for passengers on overlapping routes. They indulge in rash driving and sometimes skip bus stops as well, causing inconvenience to the passengers.

No Coordinating Authority: The transport system in the city is highly fragmented. Presence of multiple bus operators, including many contractors, which are only concerned about their own routes and profitability has led to under servicing of lower-income group areas.

Increasing Modal Competition: Fall in attractiveness of the bus service due to its poor quality, slow speed and poor last-mile connectivity has led to some of the affluent passengers to transition to the metro even for short trips. The modal share of the bus has fallen from 59.8% in 2001 to 41.5% in 2008. Whereas, the share of metro stood at 4.1% in 2008. A further fall needs to be averted such that people transition from their private vehicles to the metro and not from buses to metro.

Opposition to BRTS: The 5.8km dedicated BRTS, from the very beginning, faced a lot of opposition from the car lobby as it was seen as taking away their road space. The corridor was carrying more people per hour than all the vehicles put together but the efficiency of this network was not considered before deciding to scrap it. That a social challenge, coming from those upper-middle-income groups living adjacent to the corridor, could lead to scrapping of the entire project must not have been anticipated during the initial stages of the project. This

submission of the government to the private vehicle lobby without attempting to discuss the benefits of a BRTS have clouded the future of any other BRTS network. This will prove to be highly detrimental to the public transport system in Delhi.

Urban Sprawl and Mobility needs: The extension of NCT of Delhi into the National Capital Region (NCR) displays the sprawl tendencies of urban growth in Delhi. Sprawled over 34,000 sq. km area, NCR is the country's largest planning region with a population of 46 million. Delhi has expanded geographically to a large extent. Delhi is faced with rising challenge of traffic congestion. The number of private vehicles (both two-wheelers and cars) is continuously rising in the city. As of 31 March 2015, Delhi had 8.83 million vehicles, up from 0.56 million in 1981, and this is only expected to rise. Frequent traffic jams across Delhi due to increase in number of personal vehicles further reduce the attractiveness of buses as the time taken by them increases due to absence to dedicated bus corridors. This in turn makes people shift to private modes of transport, further adding to congestion.

Influx of Intermediary Public Transport (IPT): Auto rickshaws, e-ricks, cycle rickshaws have added to the congestion on the roads as some of them are nonregistered and flout a lot of traffic and parking norms. Poor infrastructure for pedestrians and cycling is a major challenge that needs to be addressed to aid 35% of commuters walking to their destinations and 4% of those cycling in the city. Unsafe and inadequate cycling-friendly infrastructure has led to many short trips being made on private vehicles. To keep the modal share favourable to NMT, it is crucial to invest in dedicated cycling lanes and pedestrian pathways.

Environmental Challenge: Although burning of agricultural waste in the neighbouring state of Punjab played a big role, the increasing number of diesel vehicles on the streets were also to be blamed. This is not the first time that Delhi's pollution hit an all-time high. In late 1990s and early 2000s, industrial emissions and effluents from vehicles often left Delhi skies clouded with smog. So in 2002, a benchmark decision was taken to shift the entire public road transport system on CNG Fuel System. Now all auto-rickshaws, buses and even some cars are run on CNG. This had a tangible effect on Delhi's air pollution level. However, the ever-increasing number of diesel vehicles due to subsidies on diesel has again led to high levels of air pollution in recent times. Both particulate matter (PM10 and PM2.5) as well as nitrogen oxides are increasing steadily. In fact, PM2.5 levels are normally 3 to 4 times the standards during winter times and are as high as 7 to 8 times the standards during smog. Ozone levels have also been rising. This has serious consequences for public health.

Information and Communication Technology: Integration of IT solutions with public transport system is missing across the city. The BRTS had limited success with LCD screens that displayed time for the next bus. Attempt was also made to link the bus system and the metro with a single smart card, but it hasn't been operationalised. Much can be done with CCTV cameras installed on some of the streets and if their coverage is expanded, a robust control room can help in streamlining the transportation system of Delhi.

IV. OPPORTUNITIES

Need for National Urban Transport Policy (NUTP) 2006:

- To create Major shift from personal vehicles to Public Transport and Non- Motorised Transport.
- To provide Greater public transport capacity, which has a higher quality and more efficiency; as well as high quality non motorised transport network.
- Achieving sustainable urban transport became a primary objective with the adoption of National Urban Transport Policy (NUTP) by the Government of India (Government of India) in 2006.
- Efforts to reduce or contain environmental risks form an important component of this objective.

The vision of NUTP is:

- To recognize that people occupy centre-stage in our cities and all plans would be for their common benefit and well-being.
- To make our cities the most liveable in the world and enable them to become the "engines of economic growth" that power India's development in the 21st century.
- To allow our cities to evolve into an urban form that is best suited for the unique geography of their locations and is best placed to support the main social and economic activities that take place in the city.

Intelligent Transportation Systems (ITS):

Intelligent transportation systems (ITS) are advanced applications which aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated, and 'smarter' use of transport networks. Application of ITS improves the utilization of existing transit infrastructure and facilities through better fleet and crew scheduling, deployment and monitoring. It helps in improving access to transit related information through various means such as website, helpline, social media, displays inside transit vehicles and transit stations. The system also improves safety and security environment through use of CCTV in vehicles and transit stations and provides an overall reduction in pollution and energy conservation. ITS has been implemented across various cities in the country including Delhi.

Public Transport:

Public Transport is the more suitable form of transport for our country in view of the ever-increasing population as well as inability of a large chunk of the same to afford personal modes of transport, apart from severe crunch of road space in metropolitan cities. Therefore, it is imperative for the Government to explore maximum ways to improve public transport and make it attractive. In so far as providing statutory support to urban transport system is concerned, reportedly, the Delhi O&M Act is being amended to extend it to all the cities in the country for all types of guided urban transit systems, as a legislative cover. that the cities are already aware of the merits

of a well-integrated and seamless public transport for the users and are working towards proper inter-change infrastructure between different modes of public transport.

Bus Transport:

Bus transport constitutes one of the most important and basic forms of public transport. Thus, the city bus services need to be strengthened. Sadly, the share of buses in all vehicles has declined by 15% during 1995-2004. One major problem which discourages bus transport is that the present taxation system is not conducive for the promotion of bus system. In Delhi, for example, the tax burden on a bus is 26 times more than a car. As per World Bank estimates, the total tax burden per vehicle km is 2.3 times higher for public transport buses than cars in Indian cities. Thus, the taxation system needs to be rationalized and harmonized with a view to improving public transport bus system. The cost of modern buses needs to be brought down through tax and duty concessions so as to make their introduction financially viable. The Government's initiative of reducing the excise duty from 16% to 12% on the buses in the Budget 2008-09, is appreciable and must be carried forward in future through phasing out VAT and Central Excise Duty on buses. The input cost of bus transport particularly the fuel cost needs to be brought down through measures like fuel subsidy to make it viable.

Bus Rapid Transit System (BRTS):

BRTS which entails dedicated lanes for high capacity buses, is a crucial mode providing smooth and affordable transport facility to the public. Considering its low cost, ease of implementation, wide area coverage, flexibility and overall sustainability, this system should be encouraged. However, its merits notwithstanding, this concept should be cautiously and selectively applied in cities and that there are certain basic parameters and prerequisites necessary to make this system successful. In line with the advice of NUTP, the factors such as the urban form, terrain, level of demand, direction and extent of sprawl, width of road available, extent of population density have been taken into consideration in BRTS projects. Apart from Delhi, BRTS projects in 8 other cities have been approved. Before implementing these BRTS projects, a thorough scientific feasibility study of each respective city has been taken up in the light of the above-mentioned parameters with due incorporation of public opinion as well. In the backdrop of the criticism of BRTS project in Delhi, everyone expect that utmost care would be taken in the implementation of these projects.

Establishment of Unified Metropolitan Transport Authority (UMTA):

A high degree of fragmentation within Urban Transport management and separate enactments for various modes of Urban Transport as also the multiplicity of Urban Transport agencies render a coordinated planning and implementation of Urban Transport infrastructure difficult, ultimately defeating the prime purpose of a unified integrated Urban Transport System. The NUTP recommends the setting up of Unified Metropolitan Transport Authority (UMTA) backed by an Act in all million plus cities to facilitate better coordination in the planning and implementation of Urban Transport systems. Even after more than two years of the NUTP's recommendation for UMTA, the drafting and enactment of the said Act in all million-plus cities, except Hyderabad, is yet to be done which would provide requisite statutory backing to the UMTAs for facilitating

more coordination, planning, implementation and management of urban transport system/projects. Reportedly, Hyderabad is the only example where UMTA Act is in place.

Urban Transport Planning: Need for a long-term system approach:

In the light of the uncontrollable urban transport related problems, a long-term system approach to urban transport planning is urgently required. In this connection, experts have emphasized before the Committee that any Comprehensive Mobility Plan, including an integrated master plan, should be developed keeping in view the population, area, urban form, topography and mobility needs of each city. Government should systematically encourage the integration of land use and transport planning in all cities so that travel distances are minimized and access to livelihood, education and other social needs, specially, for the marginal segments of the urban population is improved by encouraging the concept of walk-to-work. For a systematic and successful urban transport planning, future perspective technology issues, engineering issues, financial issues, legal/ Administrative/Regulatory, capacity building and awareness issues need to be adequately addressed.

Public Private Partnership:

The merits of private participation in Urban Transport in bridging the resource gap in investment and improving the operational and managerial efficiency vis-à-vis the rapidly growing Urban Transport demand have already been recognized. At present the Government is stated to be pursuing policies to promote private sector involvement in Urban Transport. An appropriate regulatory framework is required for a cooperative public-private mixed operation. While the Government should coordinate and monitor the operation, private operators should also be consulted for planning the system. Though privatization appears to have good potential for improving the efficiency of public transport, experience to date has shown the crucial need for public regulation of safety, route and schedule coordination and service quality. The focus of PPP should be on those sectors of Urban Transport which encourage inter-modal public transport, cleaner technologies, modern parking facilities and Intelligent Transport Systems.

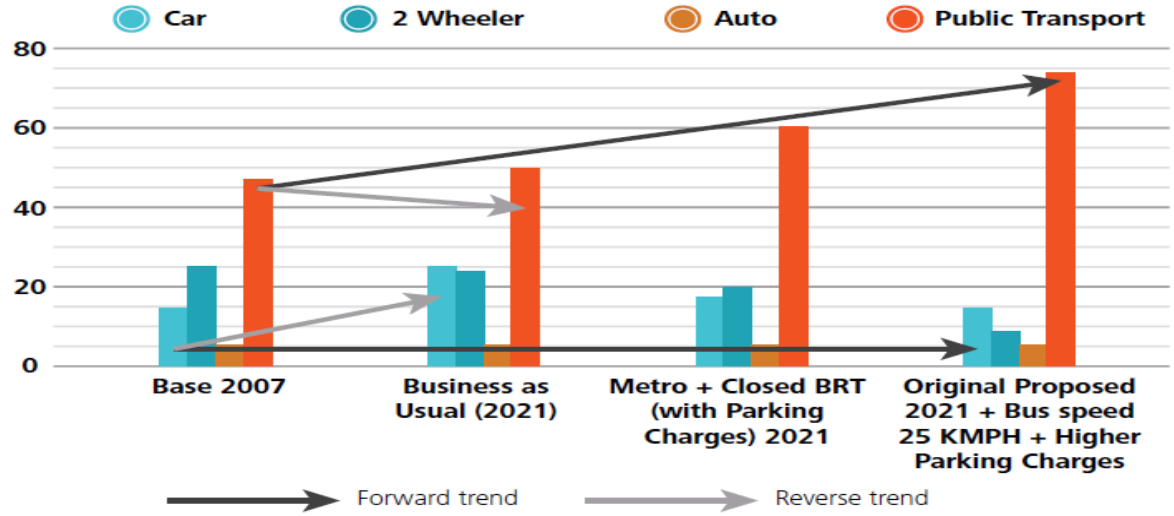

Figure 2: Modal Shift Scenarios

Source: GNCTD TDF Study, 2007

Parking Provision:

Inadequate parking space has aggravated the congestion problem in cities. In this context, an urgent and proactive role by the Ministry in laying down such guidelines that encourage formulation of State level urban transport policies containing features like a differential charging of parking fees for various vehicles, preferential treatment for public transport and non-motorized modes etc. In this connection, the Government of Delhi has escalated the parking fee in Central Business Districts. The building bye laws must make it mandatory to leave ample space for parking of at least two vehicles per dwelling units. Besides, the purchaser of a vehicle must be asked to produce relevant documents related to availability of parking space at home. The multi-level parking complexes on PPP basis must be made a mandatory requirement in city centres that have several high-rise commercial complexes.

V. CONCLUSION

Indian cities are facing a transport crisis in recent times. As an inevitable consequence of rapid urbanization, which is reportedly expected to reach from 28% in 2001 to 34% by 2021, the country is witnessing great jump in travel demand. However, inadequate public transport facilities, as well as uncoordinated land use and transport planning are some of the most severe problems faced by a city-dweller today. This has led to a tremendous increase in personalized vehicles. The growth of private motor vehicles has far outpaced the growth in public transport facilities in the major cities. According to the Ministry of Road Transport and Highways, while motorcycle ownership has shown a 16-fold increase between 1981 and 2002, car ownership has shown a 7-fold increase during the same period. The impact of such imbalance has resulted in choking up of already congested roads, increase in traffic accidents, environmental pollution due to greenhouse gas emissions, noise pollution and rise in demand for petroleum products thereby putting an increasing pressure on our foreign exchange reserves. The urban poor suffer the most from the worsening transport problems in cities as they cannot afford personal vehicles and remain dependent on public transport for travel.

Traffic congestion is the most visible transport problem plaguing our cities on a daily basis. The most important cause of congestion is the presence of mind-boggling number of private motor vehicles sharing road space with other modes of transport. According to the Annual Report of the Ministry, 5.3 crore two wheelers and 60 lakh cars will be on the road in our metropolitan cities in the next 15 years. The government should explore the possibility of issuing suitable guidelines for levy of 'congestion tax' on personal vehicles in the form of a toll tax in the congested areas or roads. This mechanism should be evolved in such a manner that the charges change according to the time of the day to reflect congestion levels so that the private vehicle users are inclined to consider other options for transport.

The non-motorized modes of transport like bicycles, cycle rickshaws, etc. are environmentally friendly and economically favourable for the lower income group population. Hence, these modes need to be encouraged. However, the fact that non-motorized modes of transport are fast losing their importance not only as a natural consequence of the increasing urban sprawl and rising income levels but also as a result of lack of desired importance given to non-motorized modes in the overall urban transport policy, planning and investment.

The safety concerns of cyclists and pedestrians should be addressed urgently and adequately. The segregated right of way for bicycles and pedestrians are constructed in all the million plus cities. Facilities like secure parking, shade giving landscaping, provision for drinking water and resting stations along bicycle corridors should be encouraged. Further, the use of lighter bicycles with gears and tubeless tyres as also the use of electric bicycles should be incentivized. Besides, local neighbourhood roads need to be strengthened. People taking cars for small distances need to be discouraged by building safe, comfortable and exclusive walking and cycling paths. There should be a clear provision for rights as well as responsibilities of pedestrians and cyclists in the traffic rules. Under the NUTP, the Central Government has committed to give priority to the construction of cycle tracks and pedestrian paths in all cities, apart from encouraging public-bicycle programmes. The Bus Rapid Transit System (BRTS) projects in 8 million-plus cities reportedly have provision for cycle tracks.

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