

Study of Metropolitan Transportation in Major Cities in India

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Abstract

The growing urban population of India lives in the major metropolitan cities. In the coming years, these cities will play a critical role in sustaining high rates of economic growth, since they contribute a major share in the GDP of India. But, it can be sustained if and only if cities function efficiently –that it depends largely upon the effectiveness of its transportation and infrastructure. This article provides an overview of metropolitan transportation and its infrastructure in India. Rather than covering every aspect of metropolitan transportation, it primarily focuses on those areas that are important for a policy point of view. This article first reviews the availability of transport infrastructure in these cities. This is followed by a discussion on the infrastructure and magnitude of transport problems such as congestion, and road accidents. Three cities i.e., Delhi, Mumbai and Kolkata have been considered for the study.

Keywords: Urban, transportation, traffic, accidents, congestion

I. INTRODUCTION

Transportation infrastructure is one of the most important factors for a country's progress. In the modern context, transport demand in metropolitan cities has increased substantially, due to increase in population. These cities account for a larger share of total urban population- a trend that has been observed since independence. The present form of transportation system includes private and public transport has emerged as a result of intense development in the urban areas and offers both merits

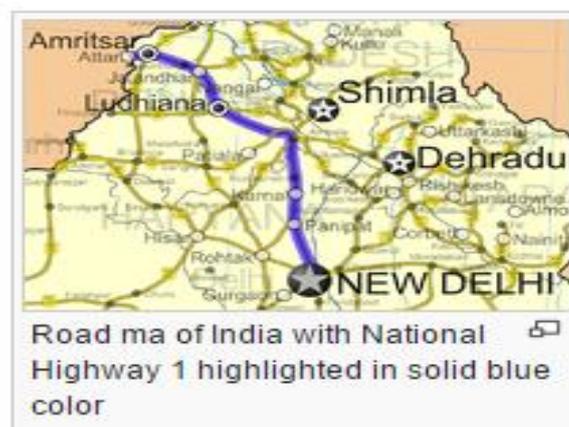
and demerits. The existing transportation system in these cities experiences numerous traffic and environmental problems such as severe traffic congestion and road accidents.

II. METROPOLITAN TRANSPORTATION AND INFRASTRUCTURE

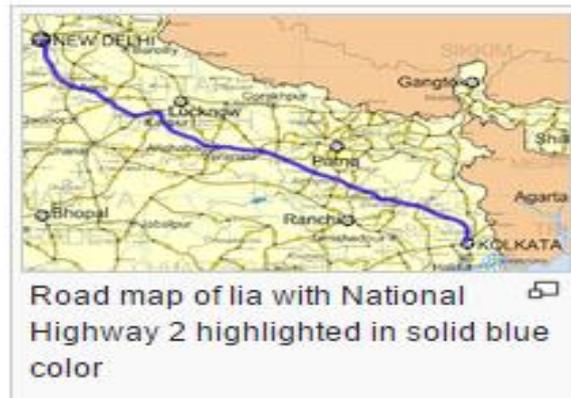
Metropolitan cities in India have grown at an unprecedented rate in recent years. A number of initiatives and projects have been taken in the field of urban transport and related infrastructure to solve the transportation issues and mobility. In general, the percentage of space used for transportation is far less and insufficient. Out of the three cities undertaken for study Mumbai, Kolkata are served by railway systems. Delhi with a population of about 12.7 million is the alone mega city which does not have an urban railway system. Delhi and Kolkata are served by well organized bus services. Virtually, if we look through then, there are no buses in India specifically designed for urban conditions.

Delhi: Delhi has a significant reliance on its transportation infrastructure. It has a developed a highly efficient public transportation system with a rapid modernization and expansion. There are 16.6 million vehicles registered in the city, which is the highest in the world which does not follow any pollution norms. Delhi is connected to various parts of country through several national highways. Most of the highways from Delhi lead to Haryana or Uttar Pradesh and continue from there. Delhi is directly connected to the state of Haryana by The Delhi-Gurgaon Expressway and National Highway 8 to city of Gurgaon, National Highway 2 to the city of Faridabad, National Highway 1 to the city of Panipat, and National Highway 10 to the city of Rohtak. Delhi is directly connected to the state of Uttar Pradesh by the DND Flyway to the city of Noida. delhi has 5 highways:

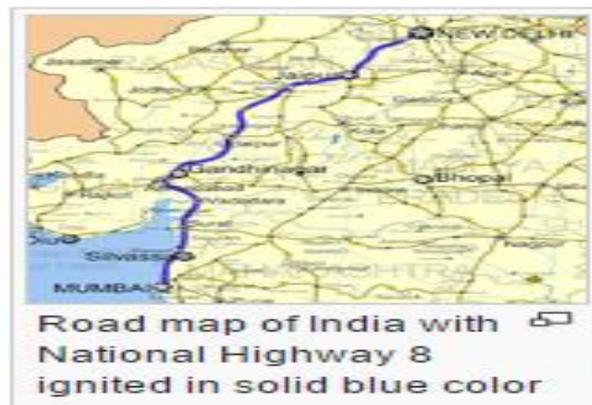
Highway 1:



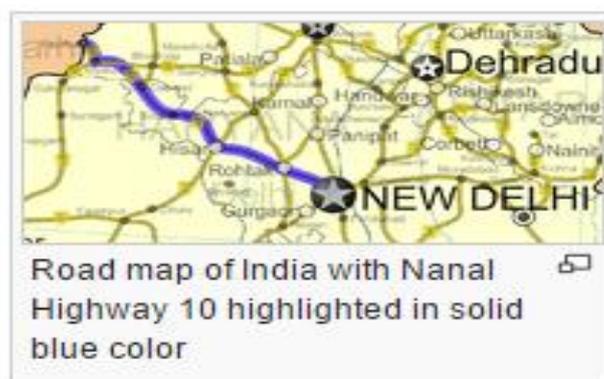
Highway 2 :



Highway 8 :



Highway10:



Kolkata: in the modern context, Kolkata possesses its own heritage of old transportation facilities like rickshaws. It is the only city with the possession of a tram network. The ecofriendly nature of these unique trams attracts many people but they are slow moving and occupy a lot of space which is already less in Kolkata. In Kolkata

recently larger buses have been introduced under JNURM [Jawaharlal Nehru Urban Renewal Mission].

Mumbai: Mumbai, the financial capital of India is renowned as commercial and industrial hub. Recognizing the increasing pressure on the over burdened infrastructure, the state government has aggressively taken up the implementation of Mumbai Transportation Project. Mumbai area traffic control system is a system of centrally traffic signals using real time data collected through detectors which help to maximize the flow of traffic, reduce congestion and in junction stops and delays to suit traffic conditions of different times of the day.

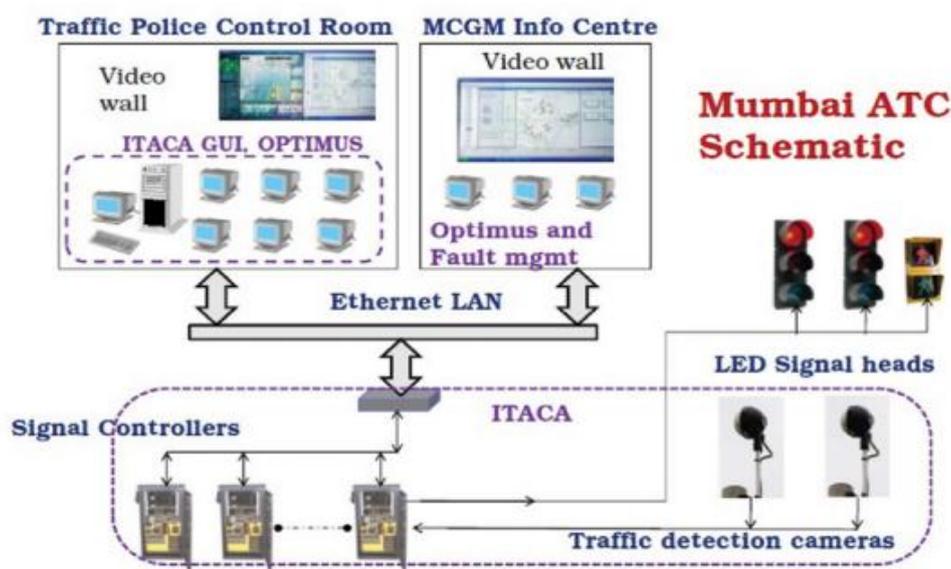


Figure 2: Schematic Representation of the deployed ATC System

URBAN TRANSPORTATION IN INDIAN

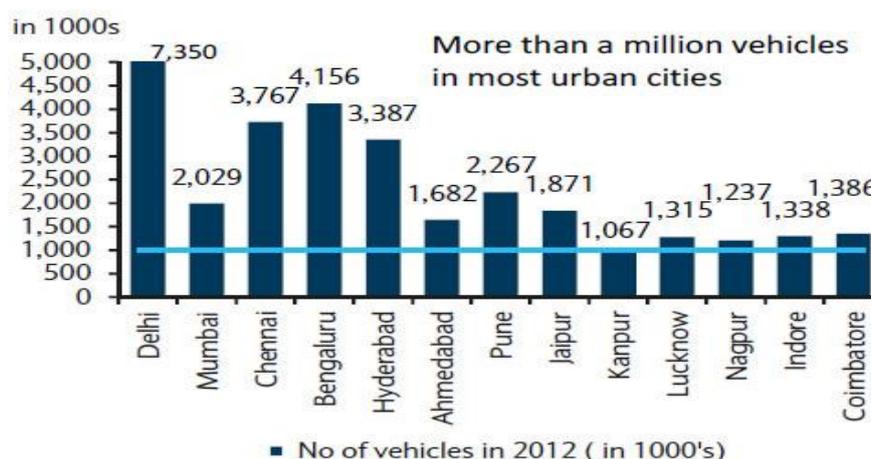
III. ENVIRONMENTAL ISSUES

Vehicular emission

As we all are aware of the economical growth of India and its urbanization, the annual rate of growth of motor vehicles population has increased about 10% during the last decade. The basic problem is not the number of vehicles in the country but their over concentration in the metropolitan cities. A majority of motor vehicles in India are concentrated in urban centre and it is alarming that 32% of these vehicles are crowded only in the metropolitan cities. There are already more than 2.6 million registered motor vehicles in Delhi and about 600 vehicles are being registered per day.

Table 1: Total number of registered motor vehicles in India 1951-2013 (in thousands)

Year (As on 31st March)	All Vehicles	Two Wheelers	Cars, Jeeps and Taxis	Buses	Goods Vehicles	Others
1951	306	27	159	34	82	4
1961	665	88	310	57	168	42
1971	1865	576	682	94	343	170
1981	5391	2618	1160	162	554	897
1991	21374	14200	2954	331	1356	2533
2001	54991	38556	7058	634	2948	5795
2011	141866	101865	19231	1604	7064	12102
2012	159491	115419	21568	1677	7658	13169
2013	182445	132550	24853	1894	8597	14551

More than a million vehicles in most of the leading developed cities in India

Source: MORTH, Barclays Research

The present urban rail services in India are extremely limited. Only three cities - Delhi, Kolkata and Chennai are served by suburban rail systems. The rail services in these three main cities together carry more than 7 million trips per day. Interestingly, the Mumbai Suburban Rail System alone carries about 5.5 million trips per day. A

few other cities also have limited suburban rail systems but they hardly meet the large transport demand existing in these cities.

t	Health effect
ide	This gas is created when fuels containing carbon are burned incompletely. Fetuses and persons afflicted with heart disease are at greater risk. CO hinders oxygen transport from the blood into the tissues. Therefore, more blood is required to be pumped to deliver the same amount of oxygen. Healthy individuals are also affected at higher levels of CO exposure. Large dose of CO can be fatal.
:	This gas is created when fuel containing sulfur is burnt. High concentration of SO ₂ can result in temporary breathing impairment for asthmatic children and adults who are active outdoors. This gas mainly affects the functions of lungs.
ed te	At high concentration, particulate matter can adversely affect human health. There are two classifications for particulate matter, PM ₁₀ and PM _{2.5} . All particles smaller than 10 microns in diameter are classified as PM ₁₀ or coarse size particles. Fine size particles or PM _{2.5} , are those particles less than or equal to 2.5 microns in diameter. Diesel vehicle exhaust is the main source of PM in urban areas. These particles penetrate deeply into the lungs and are captured by lung tissue. The most dangerous aspect of PM pollution from diesel vehicles is the hundreds of different chemicals that are adsorbed to the particle. Exposure to PM pollution has been associated with respiratory and cardiac problems, infections, asthma attacks, lung cancer and decreased life expectancy. Fine particulate (<2.5 microns) is thought to be more dangerous because of its ability to penetrate deeper into lung tissue.
. oxides	Nitrogen oxides contribute to the formation of ozone, production of particulate matter pollution, and acid deposition. Diesel engines produce a disproportionately large amount of NO _x when compared to gasoline engines because of their high temperature combustion process. Nitrogen dioxide has been shown to irritate lung tissue, cause bronchitis and pneumonia, and reduce resistance to respiratory infections. The health effects of ozone are magnified in the presence of nitrogen dioxide. Frequent or long-term exposure to high levels of nitrogen oxides can increase the incidence of acute respiratory illness in children.
arbons	Hydrocarbons are a class of reactive organic gases which are formed solely of hydrogen and carbon. The incomplete burning of any organic matter such as oil produces hydrocarbons. They contribute to the formation of ozone and the resulting smog problem. The primary health effect of hydrocarbons results from the formation of ozone and its related health effects.
cs	Air toxics are generally organic chemicals, including some hydrocarbons that are highly evaporative in nature. Benzene, formaldehyde, acetaldehyde, 1,3-butadiene, and acrolein are typical examples of air toxics. Air toxics are pollutants that cause or are suspected of causing cancer in those exposed to them. Benzene has been shown to cause aplastic anemia and acute myelogenous leukemia. Known health concerns related to aldehydes include cancer, asthma, and respiratory tract irritation. It is also believed that these air toxics have impacts on the reproductive system by causing chromosomal aberrations or mutations.

IV. ROAD ACCIDENTS:

A large number of deaths in the developing countries take place due to the road accidents. The nature of the problem in developing countries is in many ways different from that in the industrialized world. The proportion of commercial and public service vehicles involved in road accidents is often much greater. Pedestrians and cyclists are often the most vulnerable. Given the fact that the poorest of the poor in urban India cannot even afford to use public transport, they resort to cycling or

walking. Since cyclists and pedestrians are the prime victims of road accidents, there must be a serious attempt to either make public transport available to them through targeted subsidization or to make the road safer to cycle and walk.

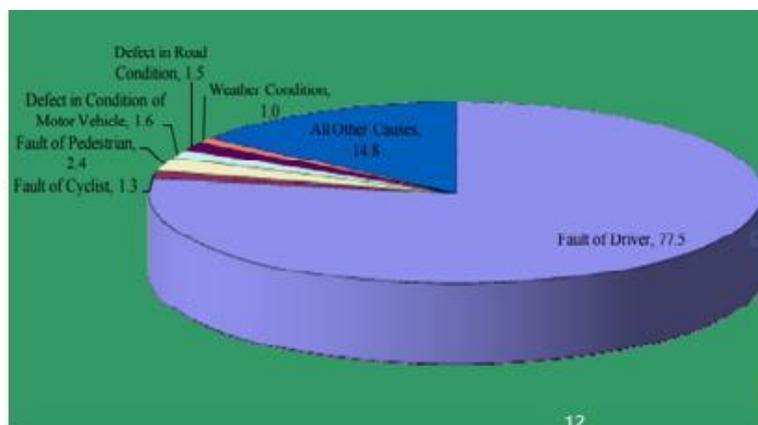


Table 2: Number of Accidents in major cities

Name of City	Fatal Accidents - 2015	Greviously Injured Accidents - 2015	Minor Accidents - 2015	Non-Injurey Accidents - 2015	Total Accidents - 2015	Killed - 2015	Injured - 2015	Severity - 2015
Kolkata	412	1357	1404	1174	4347	422	3329	9.7
Mumbai	586	2034	1213	19635	23468	611	4029	2.6
Chennai	859	2949	3196	324	7328	886	7320	12.1

V.SAFETY AND POLICY MEASURES TO IMPROVE METROPOLITAN TRANSPORTATION

It covers institutional responsibility of road safety action plan, raising safety action plans raising awareness and understanding of road safety problems, road crash data systems, and enforcement of traffic laws. We have to develop a road safety plan which should be prerequisite for achieving measurable long term and midterm road safety targets. A simple but effective monitoring and evaluation system is required to track the progress of road safety activities and to estimate the safety impact. The introduction of self enforcing techniques in road designs is likely to have better short term result than improving vehicle standards.

Policy measures to improve urban transportation in India: to resolve the transportation problems is the highest priority of Indian authorities. Transportation plans should emphasize on public transport system. Very few urban bus transport systems in India have been able to keep pace with the very rapid and substantial increases in travel

demand of the last few years. Furthermore, transport policy should encourage the need for developing 'green' modes like bicycling, walking, through a provision of pedestrian paths and cycle tracks especially in new development areas of larger cities and small and medium towns which should be integrated with the transport network. The application of Transport System Management (TSM) strategy such as one-way systems, improvement of signals, traffic engineering improvement measures for road network, intersections, bus priority lanes, and suitable policies and development of intermediate passenger transport as a short-term measure should be introduced in all cities especially in metropolitan cities so that the existing road capacity and road user safety is increased. Road infrastructure improvement measures like new road alignments, a hierarchy of roads, a provision of service roads, by-passes, ring roads, bus bays, wide medians, intersection improvements, construction and repair of footpaths and roads, removal of encroachments, good surface drainage etc. should also be introduced at least in metropolitan cities. These can be considered as short- and medium-term measures.

VI. CONCLUSION

The transportation system is the lifeline of the metropolitan cities. It is the need of time that several implementations should be done in the transportation system. As a result of urbanization problems like pollution, congestion, road accidents are increasing day by day. The development of the transportation system couldn't make in pace with the rapid population explosion and urbanization. The public transportation system should be given more attention as if it would be developed in a concise and cogent manner so many of the problems can be abandoned. The condition of roads should be improved; crash points should be highlighted in order to reduce the number of accidents. Intelligent traffic system used for efficient traffic management in other developed countries should undergo adaptation and innovation to fit with the contrasting traffic characteristics of India. It is an eminent way to resolve, or at least minimize traffic problems. Its major aim is to evaluate, analyze and integrate information and communication technologies and concepts to achieve the traffic efficiency, improve environmental quality.

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