International Journal of Geology, Earth and Environmental Sciences ISSN: 2277-2081 (Online)
An Online International Journal Available at http://www.cibtech.org/jgee.htm
2012 Vol. 2 (3) September- December, pp.25-35/Tahir et al.
Research Article

TRANSPORT SECTOR AND AIR QUALITY IN METRO CITIES: A CASE STUDY OF DELHI INDIA

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ABSTRACT
Air pollution from motor vehicle in cities specially in developing countries has been a major source of urban air pollution and hence a cause of concern for the administrators of the cities as well as for researchers. In spite of a continuous development in all sectors of Indian economy at the turn of twenty 21th century some of the environmental problems have been appeared like sanitation and waste disposal, water pollution, increasing air pollution and so on. A big segment of environment, quality of air has been deteriorating due to enhancement of emission from the transport sector particularly in large metro cities, has been a big challenge for scientists, politicians, planners and even for common men. Keeping in the view importance of enhancing vehicular numbers and its effect on human health the work was conducted with the objectives, i.e., to find out increasing trend of vehicles in metro cities, to explore the emission added to air by vehicles and to describe the effects of quality of air of Delhi specifically.

Key Words: *Air Quality, Urbanization, Vehicular Pollution and Human Health*

INTRODUCTION
Transport heralds the development of a region and has a vital role for to the economic development and social integration of the country. Road transport, with other modes of transport, provides indispensable mobility of people as well as goods and contributes to the economic prosperity of a nation. It is a key factor to social, regional and economic cohesion, including the development of rural areas. Transport sector accounts for a share of 6.4% in India's Gross Domestic Product (GDP). On one hand transport plays a significant role in the overall development of a nation's economy, but on the other this sector accounts for a substantial and growing proportion of air pollution in cities. For vehicular motors emits various pollutants, such as carbon monoxide, nitric-oxide, carbon dioxide and several organic compounds (Hussain and Mary, 2003).
The transport sector in India consumes about 16.9%. Energy consumption also varies with the modes of transport and public transport system has least average energy consumption/ passenger/km (Singh, 2006). Various energy sources used in this sector are coal, diesel, petroleum (gasoline) and electricity. Road, rail and air modes of transport are responsible for emission of 80%, 13% and 6% respectively (TEDDY, 2006). Vehicular emissions account for about 60% of the GHG's from various activities in India (Patankar, 1991). The dependence of fossil fuel based energy sources for transport sector has increased rapidly in recently as result high emissions of green house gases (GHG). The atmospheric pollutants associated with motor vehicles such as carbon dioxide, nitrous oxide, sulphur dioxide, particulate matter and lead often exceed in many large cities of developing countries against the guidelines of WHO, i.e., in Mexico City, Sao Paulo, Delhi, Mumbai, Lagos, Bangkok, Jakarta, Manila, Seoul, Ankara, Caito, Tehran, Belgrade, Bud'lpest, and Istanbul. Some of these pollutants concur in several physio-chemical phenomena that take place in the air, thus contributing to the formation of other pollutants (Horowitz, 1982). Many of these pollutants have injurious effects on human health, vegetation an materials, besides contributing to altering the atmospheric characteristics (Seinfeld, 1986).
Another point of importance is that these pollutants are basically greenhouse gases which have the property of increasing the amount of counter radiation by the atmosphere. This sector is a major consumer of petroleum fuels, for almost half of the total consumption of petroleum products in India is attributed to

this sector mostly in the form of high speed diesel and motor spirit (Kandlikar and Ramachandran, 2000). Air pollution from motor vehicle emissions is growing at an alarming rate because of rapid urbanization and increasing use of motor transportation in the third world cities. Lax environmental protection laws and policies, and poor maintenance of vehicles are exacerbating the situation. Although inspection and maintenance programs to reduce emissions are an integral element of air pollution control programs in many industrialized countries, the same is not true for developing countries (Mittal and Sharma, 2003).

Objectives of the Work

Keeping the view importance of enhancing vehicular numbers and its effect on human health, the study was conducted with the objectives, i.e, to find out increasing trend of vehicles in metro cities, to explore the emission added to air by vehicles and to describe the effects of deteriorating quality of air of Delhi. It also deals with the planning measures that should be adopted in India to solve the problem of increasing vehicular pollution.

MATERIAL AND METHODS

The entire work is based on secondary sources of data that were collected from Ministry of Urban Development, Ministry of Shipping, Road Transport and Highways, Central Pollution Control Board, Census of India, and Handbook on transport statistics in India, Transport year book, and Transport and development office related to transport and environment and published materials. Gathered information was analyzed on the basis the descriptive research method by using simple statistical technique.

DISCUSSION

Growth Profile of Transport Sector in Metro Cities of India

Urban growth in India is quite alarming as at the time of Independence, urban population was less than 60 million which has been reached 336.43 million in 2011. The urban population consists 27.8% of total population of India, is concentrated in 3 mega cities and 35 million cities, more than 5,100 towns and over 380 urban agglomerations (Census of India, 2011). The urban population trends commonly found in most developing countries, in the process of adjustment from an agricultural to an industrial economy, it has become a problem in India because of its rapidity in relation to local experience in urban development. The continued expansion of large urban areas poses the risk of physical, economic and social breakdowns with serious political consequences. Major metropolitan cities of India are colonial creation rather than the product of indigenous economic development (Ramanathan, 2000).

The major threat to the human environment today is closely linked with the way in which the cities in India are built (Fernandes, 1992). For example Delhi's population has multiplied ten times since Independence; its land consumption is still greater. The large cities require high energy inputs to remain viable. In turn, high energy consumption is causing ecological change in these cities. The continuous stream of migrants from rural areas to metro cities creates various types of problems. To satisfy the transportation requirements of commuters in metro cities of India there has been a continuous growth of vehicles of all types. But the network of roads in these cities is unable to bear with the rising vehicular population. This is mainly because of narrow roads, lack of space for further road widening, improper planning etc. The net result is that of traffic jams, congestion, increasing air pollution etc (Husain, 1992). The data of the total registered motor vehicles in metropolitan cities in 2006 is given in Fig 1. It is vividly clear from Figure-1 that larger the city, greater had the number of vehicles. The total number of the registered vehicles in Delhi was 4487000 which were almost equal to the total vehicular population of Chennai, Mumbai and Kolkata. Delhi was followed by Bengaluru where total registered vehicles were 26, 17,000 which account for 10.60% of the total vehicles. Kolkata, Pune and Ahmedabad accounted for 3.84%, 3.54% and 7.21 % respectively in the total number of registered vehicles of the metropolitan cities (Figure- 1).

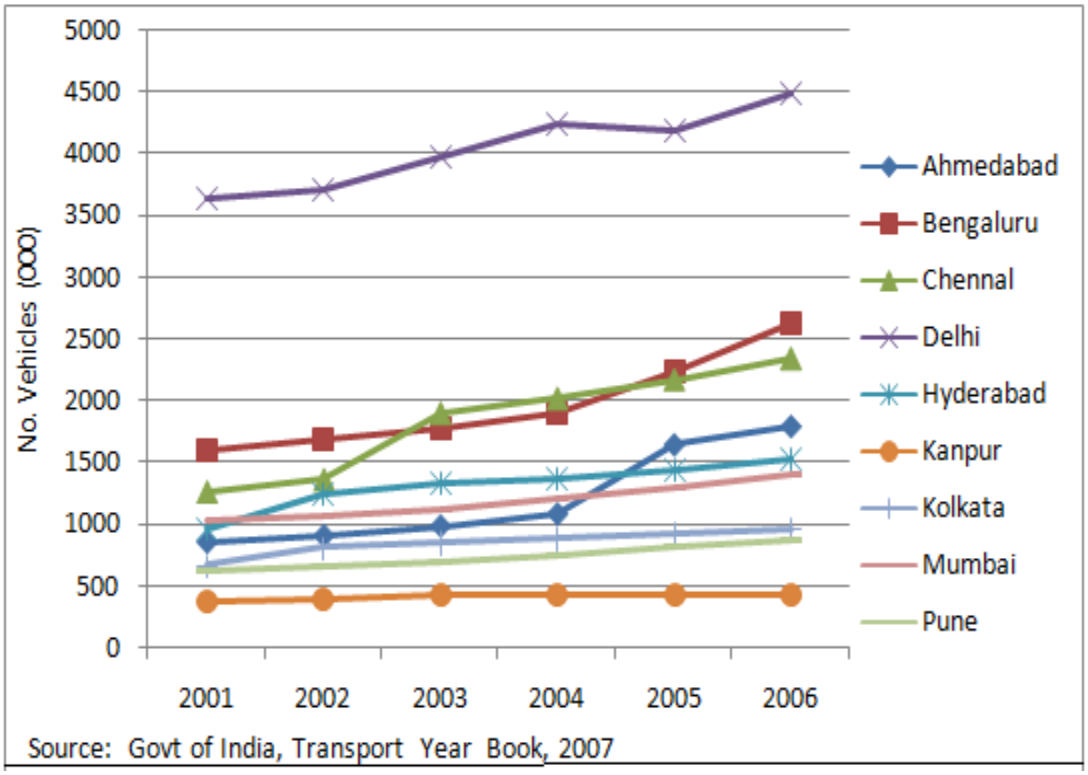

Figure 1: Registered Motor Vehicles in Metropolitan Cities (*in thousands*)

Increasing Vehicular Population in Metro Cities of India

Globalization and liberalization policies of the government have increased the number of vehicles on the roads nearly 92.6% from 1980-81 to 2003-04. India has become 5th largest motor vehicle/car manufacturer in the world by 2011. Indian auto manufacturers produced a record 14.82 million motor vehicles in 2010. 3.54 million cars and commercial vehicles were manufactured in 2010 out of which 3.05 million were cars. Domestic passenger vehicle sales hit a new record in 2009-10, when over 1.95 million vehicles were sold. India is the largest manufacturer of three-wheelers (444,000) and 8th largest commercial vehicle (0.53 million) and tractors manufacturing country (around 1/3 of global output) having produced around 370,000 units in 2009-10. A large and efficiently managed public transport system would be the ultimate solution for reducing air pollution by reducing growth of private vehicles on the roads (Singh et al., 2008).

The major road network in most of the cities even now is characterized by narrow carriageways, poor surface quality, absence or inadequacy of footpaths and low journey speeds. In some cities, a large proportion of road length has right-of-way (ROW) less than 10 m. Road surface quality is generally poor. Most of the road network has not been provided with footpaths. Even the available limited road capacity is reduced by way of on-street parking and encroachments. Surveys have shown that about 30 % of a carriageway of major roads in Indian cities was encroached (Sibal and Sachdeva, 2001).

Figure-2 presents the number of registered motor vehicles in nine largest metropolitan cities of India. It can be seen that in most of the cities, scooters/motor cycles comprise more than 70% of total motor vehicles. By 2006, the number of registered vehicles in Delhi had increased to 4.48 million from 3.63 million in 2001 and 1.9 million in 1991. The number of vehicles on Delhi's road increased by 212% in the 18 years from 1.923 million in 1991 to over 6 million by 2008.

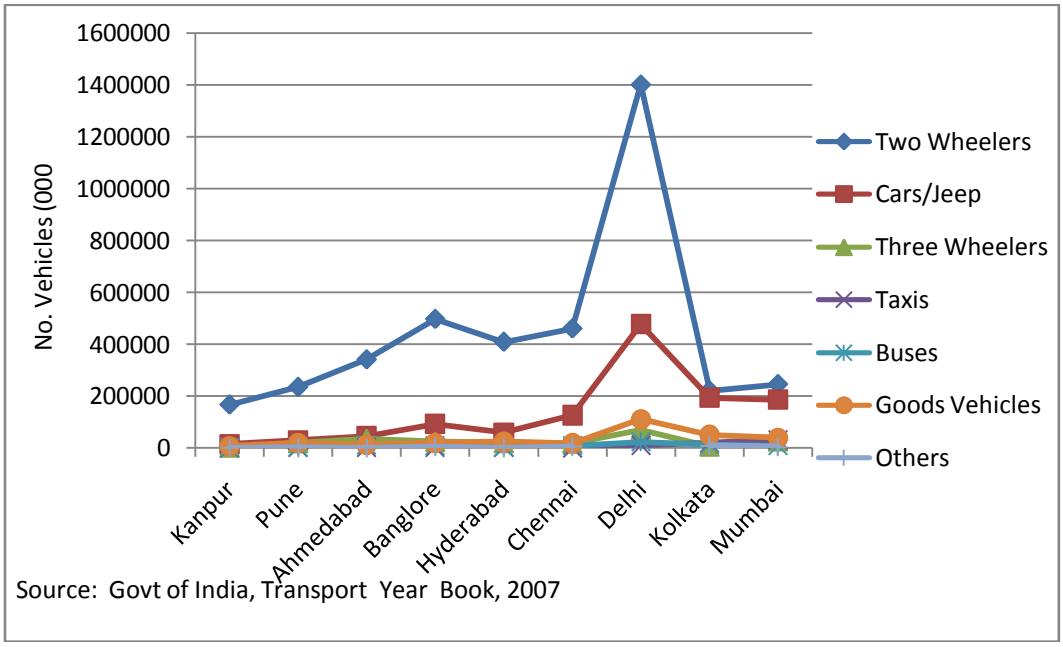

Figure 2: Registered Motor Vehicles in Metropolitan Cities of India

Increasing Vehicular Emissions in Indian Metropolitan Cities

Air pollution is a growing problem in most cities (big and small). Vehicular emissions depend on two basic factors-transport demand in terms of vehicle per km for each vehicle category and emission rates for different pollutants. The former depends upon the modal share and the latter upon vehicle technology, speed, and age/condition and road conditions (Goyal and Sidhartha, 2003)

GHG Emission per Unit Area

Emission per unit area for metropolitan cities is summarized in Table1. Chennai, Bangalore, Kolkata, Delhi and Hyderabad are the five major metropolitan cities of India with large number of industries and play a vital role in Indian economy. In the case of Mumbai, GDP has increased from 90.2 to 149.9 billion rupees during 1997 to 2005, while human population has increased from 10.8 to 11.9 million (Das and Parikh, 2004). These increases have also recorded the total passenger travel demand from 32 to 61 billion passenger km. Similar situation prevails in other major metropolitan cities in India.

With the increase in economic activities number of transport is increasing in restricted area of metropolitan cities. It increases the transport emission load of Indian cities. The introduction of vehicles with stricter emission control may decrease the overall emissions, but the vehicle population growth rate might neutralize that impact in overall emissions (Sharma and Pundir, 2008).

Existing estimated daily vehicular emissions by different modes of transport are presented in Tables 2 and Figure 3.It is seen that over 95% of total emissions pertaining to Carbon mono-oxide (CO) and hydrocarbons (HC) which are largely emitted by personalized modes of transport i.e. two wheelers and cars. Contribution of these personalized modes is as high as 84-91 % in total emissions in cities of various sizes. Buses contribute only around 2% in total emissions (Kandlikar and Ramachandran, 2000).

With deteriorating level of mass transport services and increasing use of personalized motor vehicles, vehicular pollution is assuming serious dimensions in most of the cities. Estimated daily motor vehicle emissions loads for 9 metropolitan cities in India are presented in Figure 3 which shows relatively higher pollution levels in cities with poor mass transport systems. The contribution of motor vehicles in total Pollution in Delhi has increased from 23% in 1970-71 to 63% in 1990-91.

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Table 1: Emission from Vehicular Transport of Metropolitan Cities

Metropolitan city	Vehicles in metropolitan city	Ratio	Geographical area of metropolitan city (km^2)	CO_2 (Mg km^2)	CO (Mg km^2)	CH_4 (Mg km^2)	HC (Mg km^2)	NOx (Mg km^2)	PM (Mg km^2)	SO_2 (Mg km^2)
Hyderabad*	1355700	0.24	172.70	18258.86	281.47	13.26	78.05	197.12	13.91	55.94
Visakhapatnam	411691	0.07	182.70	5034.01	77.60	3.66	21.52	54.35	3.84	15.42
Patna	335623	0.45	108.34	18244.82	189.16	5.91	32.91	149.03	10.42	55.60
Delhi**	4236675	1.00	431.09	20843.82	284.43	15.56	87.74	129.99	9.13	42.38
Ahmedabad	1075213	0.15	281.08	12438.69	165.52	6.67	35.49	93.20	7.52	32.99
Surat	692118	0.10	212.52	10967.65	145.94	5.88	31.30	82.18	6.63	29.09
Vadodara	586438	0.08	113.87	2481.43	21.33	0.81	5.52	29.16	1.47	8.66
Bangalore	1890692	0.48	226.24	32013.25	405.25	16.14	86.03	323.75	22.18	93.29
Bhopal	391579	0.10	298.48	3786.22	47.58	1.92	11.60	27.29	2.19	12.26
Indore	644771	0.17	160.45	11973.75	150.46	6.06	36.69	86.31	6.92	38.77
Mumbai	1199416	0.13	438.00	8562.01	118.91	4.95	24.69	67.80	5.41	23.67
Nagpur	543322	0.06	217.56	7955.70	110.49	4.60	22.94	63.00	5.03	22.00
Pune	754902	0.08	430.00	5366.96	74.54	3.10	15.48	42.50	3.39	14.84
Ludhiana	770784	0.22	159.37	14847.91	183.90	7.52	43.43	98.33	8.09	38.70
Jaipur	823715	0.21	484.64	6571.53	72.76	2.83	17.61	65.61	4.13	18.35
Chennai	2014776	0.23	174.00	34903.50	429.13	18.99	118.95	353.67	23.01	108.04
Kanpur	424652	0.07	266.74	4570.50	59.85	2.56	15.07	32.01	2.65	12.30
Lucknow	614794	0.10	310.10	5616.32	73.55	3.15	18.52	39.34	3.26	15.12
Varanasi	365913	0.06	91.90	11370.76	148.91	6.38	37.49	79.64	6.60	30.61
Kolkata	875156	0.34	186.23	22402.15	213.94	9.10	59.66	273.55	14.23	72.07
Total	20007930	0.34	4946.01	258209.86	3254.71	139.04	800.68	2287.85	160.00	740.09

**Area figure covers area falling in Hyderabad District*
Ratio= proportion of vehicles in metropolitan city (to that of the state)
***Urbanareaasin1991.*
Source: MoUD, 2008/Census of India 2001; MoSRTH, 2007

Table 2: Estimated Daily Vehicular Emissions in Cities of Various Sizes in India

City Pop. (million)	No. of cities	CO	HC	Other pollutants	Total	Average
0.1-0.5	281	1075	643	87	1805	6
0.5 - 1.0	34	684	379	49	1112	33
1.0 - 2.0	15	786	468	32	1285	86
2.0 - 5.0	5	548	298	32	879	176
Above 5.0	5	1385	746	80	2211	442
Total	340	4478	2534	280	7292	215

Source: Traffic and Transportation Policies and Strategies in Urban Areas in India; Final Report, Ministry of Urban Development, Government of India, New Delhi; March 1998

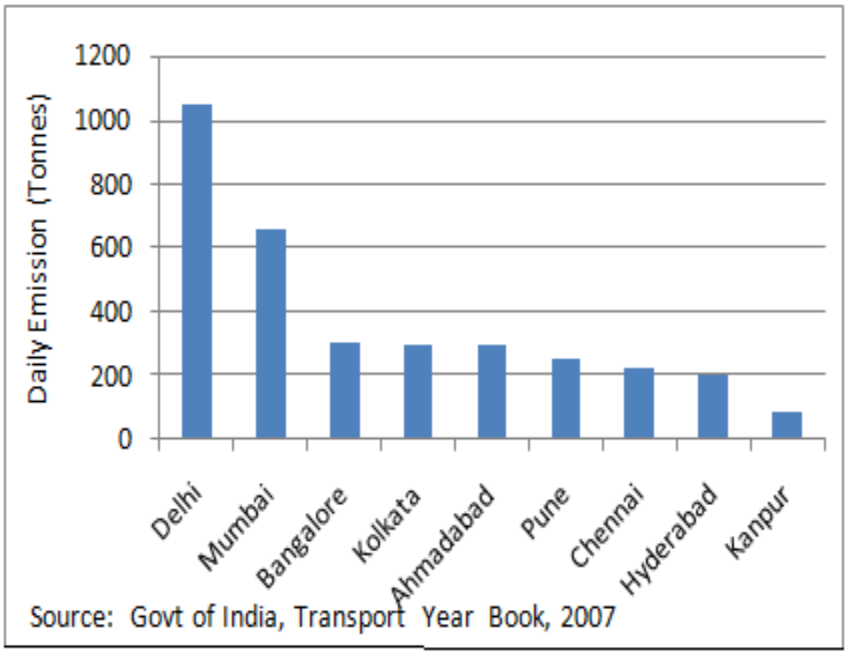

Figure 3: Daily Vehicle Emission Load in Some Metropolitan Cities in India

Metro City Delhi

Even in 1986-87, Delhi accounted for as high as 3% of the total number of vehicles of the metro cities and the vehicular emission in Delhi was the highest (Figure 3). The pollution load in tones/day has been given for various pollutants like carbon monoxide, nitrogen oxide etc. The worst pollutants in terms of carbon monoxide (CO) and lead fumes, are from cars and two wheelers, not from buses and trucks because heavy vehicles emit mostly sulphur dioxide (S02) nitrogen oxide ($N0_2$) and suspended particulate matter (SPM) mainly consisting of unburnt carbon. Each two-wheeler emits twice as much of carbon monoxide and eleven times of hydrocarbons as other vehicles.

Delhi's fascination for new cars and bikes seems to be growing with each passing day. According to Delhi Statistical Handbook 2011 released by Delhi Government's department of economics and statistics, last fiscal (2010-2011), 480,823 new vehicles rolled out on Delhi roads, taking the total number of vehicles registered in Delhi to a whopping 69.32 lakh. Simply put, 1,317 new vehicles-cars, two-wheelers and commercial combined-were added to Delhi's vehicular population every day.

Table 3: Motor Vehicles on Roads in Delhi

Year	Private car	Motor Cycle/scooter	Taxis	TSR	Goods Vehicles and Delivery vans	Buses, Mini Buses, Pvt Buses& others	Total Motor Vehicles
1981	123655	364010	6583	20920	38072	8528	561768
1991	427743	1294066	10426	65829	100052	19671	1923787
1994	557543	1580817	12225	74408	122444	25553	2372990
1997	765470	1991710	16654	80210	146668	32333	3033045
1999	857353	2169162	17482	87785	154695	36933	3323410
2000	909892	2261776	18037	90052	160720	39299	3479776
2006	1287724	2851920	15569	96149	67144	168906	4487412

Source: Handbook on transport statistics in India.
**Figures for 2006 are computed by the authors*

Vehicle Growth in Delhi

The number of vehicles on Delhi's road increased by 212% in the 18 years from 1.923 million in 1991 to over 6 million by 2008. Roads in Delhi occupy 21% of the city, thus there is little scope of future expansion. The length of roads in Delhi increased from 22,487 km in 1991 to 31,183 km in 2008, a modest increase of 17% in the same period. Delhi's vehicular population has been increasing at a steady pace for almost a decade now.

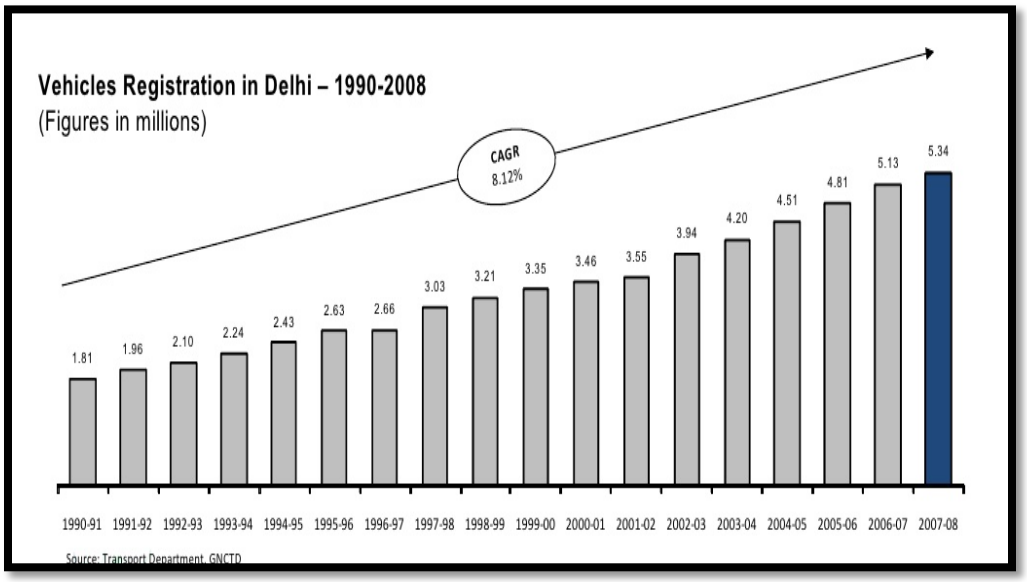

Figure 4: Growth of Registered Vehicle in Delhi

Delhi's registered vehicular population has nearly doubled to 4.5 million from 2.2 million in 1994, registering a growth rate of 10% per annum. About two-third of the motor vehicles are two-wheelers. Vehicular pollution is considered to be a major source of air pollution in Delhi. As per Central Pollution Control Board, the vehicular pollution load in Delhi increased by nearly 50% in 1995-96 from 1990-91. To mitigate the pollution generated from transport activity, Delhi has implemented numerous policies to help reduce vehicular emissions in the city. These policies include the removal of leaded-petrol, the phasing out of commercial vehicles older than 15 years old, replacement of all autos and taxis made before 1990 with new vehicles using cleaner fuel, switching all buses to compressed natural gases (CNG) or other forms of cleaner fuels, and increasing the number of buses in the city for public transport from 6,600 to 10,000 (Kathuria, 2002).

Figure 5: Projected Vehicle Stock in Delhi

With a view to reduce vehicular pollution in Delhi, the Hon'ble Supreme Court of India vide its orders in CWP No. 13029 of 1985 has banned the plying of following categories of vehicles in Delhi:-

1. More than 15 years old commercial/transport vehicles form 01-01-1999.
2. Pre-90 autos and taxis from 01-04-2000.
3. More than 8 years old buses from 01-02-2000 (except on clean fuels).

The main source, contributing to the deterioration of air quality in Delhi, is vehicular transport, which is responsible for almost 70% of the total air pollution load in the city. Vehicular pollution in Delhi has increased phenomenally from 2.3 million in to 4.2 million in 2004, which has been estimated 7.2 million in 2016 on the basis of transport data obtained from Transport Department, 2004. Vehicular pollution is based on the fuel quality and quantity. The fuel consumption of vehicular transport was estimated on the basis of total number of vehicles, fuel efficiencies and the average distance traveled per day (MoSRTH, 2004).

Table 4: Vehicular Emission in Delhi

	Category of Vehicles	Registered vehicles in Delhi	Pollution load (tonnes per day)				
A.	Petrol Driven		SPM	SO_2	NO_2	CO	HC
1.	Cars, Jeeps and Wagons	2174	1.49	0.36	14.47	180.85	27.10
2.	Taxis	8809	0.09	0.021	0.86	10.70	1.16
3.	Two Wheelers	770110	3.02	0.302	1.05	256.76	151.0
4.	Three Wheelers	45151	0.311	0.031	0.11	33.10	15.57
B.	Diesel Driven						
1.	Buses	16266	1.4	2.8	38.9	23.50	3.90
2.	Goods Vehicles	64555	2.27	3.96	59.00	39.90	8.80
	Total	1111664	8.58	7.47	150.38	535.90	207.98

Source: Central Pollution Control Board (CPCB), 2006

In 2002, Supreme Court issued an order to convert all diesel buses to compressed natural gas (CNG) to reduce air pollution. However, in less than a decade, the gains from the CNG program were lost: by August 2008, the average total suspended particulate (TSP) level in Delhi was 378 micrograms per cubic

meter- approximately five times the World Health Organization's (WHO) annual average standard. It is estimated that over 3,000 metric tons of air pollutants are emitted in Delhi.

Effects of vehicular Pollution on Human Health

Vehicular pollution is increasing in Indian cities, which may lead to increase number of patients with diseases related to air pollution. The vehicular pollutants have detrimental impact on both human health and ecology. The human health effects of air pollution vary in the degree of severity, covering a range of minor effects to serious illness as well as premature death in certain cases (table 5).

Table 5: Effects of vehicular Pollution on Human Health

Pollutant	Effect on Human Health
Carbon Monoxide(CO)	Affects the cardio vascular system, exacerbating cardiovascular disease symptoms, particularly angina; may also particularly affect foetuses, sick, anemic and young children, affects nervous system impairing physical coordination, vision and judgment, creating nausea and headaches, reducing productivity and increasing personal discomfort.
Nitrogen Oxides (NO_x)	Increased susceptibility to infections, pulmonary diseases, impairment of lung function and eye, nose and throat irritations.
Sulphur Dioxide(SO_2)	Affect lung function adversely.
Particulate Matter and Respirable Particulate Matter (SPM and RPM)	Fine particulate matter may be toxic in itself or may carry toxic (including carcinogenic) trace substance, and can alter the immune system. Fine particulates penetrate deep into the respiratory system irritating lung tissue and causing long-term disorders.
Lead(Hg)	Impairs liver and kidney, causes brain damage in children resulting in lower I.Q., hyperactivity and reduced ability to concentrate.
Benzene	Bothe toxic and carcinogenic. Excessive incidence of leukemia (blood cancer) in high exposure areas.

These pollutants are believed to directly affect the respiratory and cardiovascular systems. In particular, high levels of sulphur dioxide and suspended particulate matter (SPM) are associated with increased mortality, morbidity and impaired pulmonary function. Environmentalists claim that living in an Indian metropolitan city is like smoking 10-20 cigarettes every day. More than 40,000 people die pre-maturely every year because of air pollution, says a World Bank report, of which Delhi's share is the highest i.e.19% (David, 1994).

CONCLUSION

It is transport that has considerable function for overall development of a nation's economy, the transportation requirements in metro cities of India there has been a continuous growth of vehicles of all types that account for a large growing proportion of air pollution in cities. The present work analyses that over 95% of total emissions pertain to Carbon mono-oxide (CO) and hydrocarbons (HC) which are largely emitted by personalized modes of transport i.e. two wheelers and cars. Contribution of these personalized modes is as high as 84 -91% in total emissions in cities of various sizes. In most of the cities, scooters/motor cycles comprise more than 70% of total motor vehicles. By 2006, the number of registered vehicles in Delhi had increased to 4.48 million from 3.63 million in 2001 and 1.9 million in 1991. The number of vehicles on Delhi's road increased by 212% in the 18 years from 1.923 million in 1991 to over 6 million by 2008.The various pollutants, such as carbon monoxide, nitric-oxide, carbon dioxide and several organic compounds were recorded in Delhi, Mumbai and Kanpur, which are considered the worst polluted cities in the country. Vehicular pollution is considered to be a major source of air pollution in

Delhi. As per Central Pollution Control Board, the vehicular pollution load in Delhi increased by nearly 50% in 1995-96 from 1990-91. To mitigate the pollution generated from transport activity, Delhi has implemented numerous policies to help reduce vehicular emissions in the city. These policies include the removal of leaded-petrol, the phasing out of commercial vehicles older than 15 years old, replacement of all autos and taxis made before 1990 with new vehicles using cleaner fuel, switching all buses to compressed natural gases (CNG) or other forms of cleaner fuels, and increasing the number of buses in the city for public transport

Supreme Court issued an order to convert all diesel buses to compressed natural gas (CNG) to reduce air pollution. However, in less than a decade, the gains from the CNG program were lost: by August 2008, the average total suspended particulate (TSP) level in Delhi was 378 micrograms per cubic meter- approximately five times the World Health Organization's (WHO) annual average standard. It is estimated that over 3,000 metric tons of air pollutants are emitted in Delhi. The emitted pollutants directly affect the respiratory and cardiovascular systems. In particular, high levels of sulphur dioxide and suspended particulate matter (SPM) are associated with increased mortality, morbidity and impaired pulmonary function. Environmentalists claim that living in an Indian metropolitan city is like smoking 10-20 cigarettes every day. More than 40,000 people die pre-maturely every year because of air pollution where Delhi's share is the highest 19%.

Remedial Measures

The following measures should be taken to transport sector and negative effect on the environment in metro cities particular.

Decentralization of industrial and commercial units, government, semi-government offices to the satellite towns or to the rural areas can help in reducing migration to the city centers and at the same time reducing air pollution to a great extent.

There has been a phenomenal growth in the number of personalized vehicles. So in the case of metropolitan cities, where the demand is large, particularly in the peak hours, the MRTs (mass rapid transport system) should be introduced.

More flyovers at busy traffic intersections can also help in reducing the pollution to some extent. The success of the sub-urban rail network is needed in every metro city for encouraging precedent direction. As the railways are seven to eight times more fuel efficient than road transportation.

a system should also be introduced in metros which would not only help in conservation of fuel, but to check air pollution also. More pollution can be avoided by making light bus bodies, use of steel-belated radical tyres, electronic control devices and time to time testing of emission level.

From the study it was found that one of the main contributors of emissions in Indian transport is from the road sector. Encouraging the use of efficient public transport in place of private transport will help to reduce the number of vehicles. Introduction of more efficient vehicles and fuels, such as CNG or battery operated vehicles, will reduce emissions. However, various urban policies such as metro railway, transport management and emission control practices will further curtail transport emissions.

Sharma and Pundir, (2008) have rightly pointed out that with the increase in economic activities number of transport is increasing in restricted area of metropolitan cities. It increases the transport emission load of Indian cities. The introduction of vehicles with stricter emission control may decrease the overall emissions, but the vehicle population growth rate might neutralize that impact in overall emissions. And it is happening. So it is the need of the time to take some wise steps by Ministry of Urban Transport to minimize the sufferings of the commuters

A large and efficiently managed public transport system would be the ultimate solution for reducing air pollution by reducing growth of private vehicles on the roads. Measures directed at alternatives to single-occupancy vehicles, reducing the demand for travel, or creating disincentives to car use have become important policy options.

Alternative fuels are a potential means of reducing local pollution and greenhouse gas emissions. Emission reductions are highest for gaseous fuels and electric vehicles using renewable energy sources.

While some alternative fuels can be cost-competitive with gasoline, they have relatively small environmental advantages. Car owner-drivers will prefer fuels that can be used in existing vehicles such as reformulated gasoline.

Last, but not the least if explosive growth rate of population in metro cities is not controlled, above suggested measures will be ineffective.

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