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PROBLEMS OF URBANIZATION IN DEVELOPING COUNTRIES: A CASE STUDY IN INDIA

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ABSTRACT
Urban population is growing at a rapid pace from 17 percent (1951) to 28 percent (2001) and approaching 41 percent by 2030. The technological and industrial boom has brought enormous problems to urban citizens causing degradation of the environment. Number of slums has increased in metropolitan cities. Acute shortage of space for housing, lack of sewage treatment facilities, polluted water and transport constraints are serious concerns of the urban population. Poor sanitation and contaminated drinking water arising from human activity and natural phenomena create serious problems on human health. The present paper deals with problems faced by Indian citizens.

KEY WORDS: Urban population, slum, metropolitan, human activity etc.

INTRODUCTION

Indian urban population is growing at an average rate of three percent per annum and has almost doubled from 165 million to 285 million between 1981 and 2001 and is expected to reach 575 million by 2030 (UN, 2002). The urban population has increased from 17 percent of our national total population in 1951 to 28 percent in 2001 and is estmated to reach 41 percent by the end of 2030.

The urban infrastructure is expanding in tune with the increasing urban population. This has resulted in increased employment opportunities at different levels, higher wages and improved mode of availability of commodities to the consumers. The impact of international trade is visible in the Indian market in terms of price and quality. In cities, the new concept of big shopping malls has attracted consumers and is growing at a faster rate. As the spending power of individuals has improved, the market is enhancing the growing demand. This is not only applicable to day to day commodities, but also in automobile industry, cosmetics, gold and silver ornaments and rare metals.

On the other hand, in most of the developing countries including India, steep growth of urban population has resulted in depletion of the natural resources, increasing number and size of slums (Mukherji, 2006), hazardous effects of the city waste on the urban population (Muthukumaran and Ambujam, 2003) and so on. This study is an effort to bring out highlight the housing problem, drinking water associated problem, sanitation situation available and industry related pollution affecting the urban population. Few suggestions to deal with the major worries is also discussed.

MATERIAL AND METHODS

The data for the study is obtained from the Town Directories -2001 census and the website www.India.Stat.com. The data was analyzed using Microsoft.

RESULTS AND DISCUSSION

Housing problems

The most expensive and inevitable requirement in a city is a house. Migration of people from rural areas to cities in search of employment has resulted in increase in population size and coupled with increase in nuclear families has compounded the scarcity of housing. The Government of India has constructed 53,882 houses in 1994 and has decided to complete 69,002 houses by the end of 21st century. The number of permits issued for construction of residential buildings in population of million plus cities in different states is shown in Table 1. Most of the metropolitan cities except Ahmedabad and Greater Mumbai have shown increased trend of residential buildings from 1994 to 2001. Apart from Metro cities, the other fast developing cities like Coimbatore, Jaipur, Nagpur, Surat and Vadodara have shown double the growth from 1994 to 2001. However, these figures under count are actual number of built houses with legal permits. Many of the houses are built without permission from the city or town planning authorities. In Karnataka alone, most of the cities have such illegally constructed houses and the Government of Karnataka is now evolving a procedure to legalize these houses. A Similar trend has been observed in other towns in different States and Union Territories. Living facilities also differs with the growth of cities.

As per the survey conducted during 1990-91 on migrants of Mumbai, it is found that, 49 percent of the migrants are living in only one room house, 44 percent are dwelling in kutcha houses or semi pacca houses (Mukherji, 2006). Thirty two percent of them have used gunny bags, straw, tin or mud as the wall material, whereas 45 percent of them have used gunny bags, straw, tin or mud as roof materials. These houses are not safe and unhygienic. Only 18.5 percent of houses have attached bathroom facility in rural India, while in cities, it is three times higher than the rural part. In urban areas, detached bathrooms are less as

compared to rural areas. People, who do not have bathroom facility used to take bath at the road side water tap or open wells (Table 2).

To improve the housing facilities for the people living in urban areas, the Government has framed certain policies and also implemented laws for providing land, housing loan at lower rate of interest and tax concessions. In this direction, many State Governments have constructed '**Janata Housing Colonies'** for the poor and slum people or houseless people. However, for the growing population it is difficult to solve the housing problem in a short period.

TABLE 1: City-wise Number of Residential Building Permits Issued in India from 1994 to 2001

City with Million Plus Population	Building Completion Certificates Issued During the Years							
	1994	1995	1996	1997	1998	1999	2000	2001*
Ahmedabad	1862	1275	1338	1252	872	1174	1069	1038
Bangalore	6284	6330	7287	7337	7391	7444	7496	7443
Bhopal	2027	2453	1273	2252	2815	1405	2144	2121
Chennai	5175	5842	5986	5941	5760	6453	6557	6256
Coimbatore	599	1279	1289	1316	1337	1357	1378	1356
Delhi	2464	3216	2840	3719	3743	3434	3331	3503
Greater Mumbai	4378	4439	2351	1092	1084	1509	1648	1414
Hyderabad	6077	6293	6386	6611	6845	7089	7647	7194
Indore	2429	1720	4223	5562	6208	5108	4110	5142
Jaipur	1044	1087	1781	1853	1929	2007	2090	2009
Kanpur	1612	1651	2160	2212	2264	2319	2373	2318
Kochi	3867	3900	3945	3985	4018	4057	4097	4056
Kolkata	2604	2680	3969	4085	4205	4326	4452	4328
Lucknow	1607	1705	2312	2452	2603	2761	2927	2764
Ludhiana	2200	811	1349	2634	2778	2934	3097	2936
Madurai	987	1012	785	1507	1529	1549	1571	1550
Nagpur	498	512	966	995	1023	1053	1084	1054
Patna	1178	1198	1278	1299	1320	1343	1366	1344
Pune	1092	1116	1388	1506	1459	1451	1472	1461
Surat	603	2595	2773	2961	3161	1104	1008	1758
Vadodara	2981	2712	2567	3672	5085	5247	4893	5075
Varanasi	811	1384	1416	1448	1295	1188	1220	1234
Visakhapatnam	1503	1546	1559	1604	1651	1649	1644	1648
Total	53882	56756	61221	67295	70375	67961	68674	69002

Source: Metropolitan Housing statistics 2002 Ministary of Urban Development & Poverty Alleviation, Government of India.

TABLE 2: Distributions of Households by Bathroom Facility in India, 2002 (in %)

Bathroom	Rural	Urban
Attached	18.5	52.8
Detached	22.8	11.8
No bathroom	58.7	35.4
Total	100	100

Source: Economic Survey of Maharashtra 2003-03, Directorate of Economics & Statistics, Planning Department, Govt. of Maharashtra

TABLE 3: Distribution of Households by Location of Drinking Water in India 2002

Type	Percentage
Away from the premises	16.70
Near the premises of the household	44.30
Within the premises of the household	39.00
	100

Source: Economic Survey of Maharashtra 2003-03, Directorate of Economics & Statistics, Planning Department, Govt. of Maharashtra.

WATER AND SANITATION PROBLEMS

In India, water supply in many of the cities is through the pipeline system from the nearest water tank or pond or river. The water supply from different rivers or reservoirs largely depends on the quantity of rainfall received in that year, and this source is declining for the past several years as a result of scanty rainfall (Megeri, 2002). Many of the

cities in India are facing an acute shortage of safe drinking water, especially during summer season. There are cities in India where there is no proper water source; many of such cities are far from rivers and other possible sources. The supply of water in many cities is found to be once in every 7 to 10 days due to shortage of water.

Forty percent of Indian cities get water through tap water and tube well, about 21 percent of cities are supplied with only tap water and 12 percent are supplied with tube well water alone (Table 4). Many of the urban poor and middle class families are finding it difficult to store the collected water for the future days and this makes them to use water economically for essential day-today use. As per 2001 census, about 60 percent of the cities store water in the over head tanks. Nine percent of the cities stores through service reservoirs and 14 percent of the cities lack specific storage facility (Table 4).

TABLE 4: Number and Percentage of Cities having different Water and Sanitary facilities

	Type of Category	Number of Cities	Percentage*
A) Source of Water Supply			
1	Tap Water -T	1106	21.40
2	Tube Well Water-TW	616	11.90
3	Tank Water-TK	158	03.10
4	Well Water-W	90	01.70
5	T,TW	2069	39.90
6	W,TW	242	04.70
7	W,T	339	06.50
8	TK,TW	123	02.40
9	T,TK	148	02.90
10	All Other Combinations & NA	288	05.60
B) Water Storage System			
1	Over Head Tank- OHT	3114	60.10
2	Service Reservoir- SR	449	08.70
3	River Infiltration Gallery-RIG	57	01.10
4	Bore Well Pumping System-BWP	167	03.20
5	Pressure Tank-PT	54	01.00
6	OHT,BWP	300	05.80
7	OHT,SR	298	05.80
8	All Other Combinations & NA	740	14.30
C) System of Sewerage			
1	Sewers- S	29	00.60
2	Open Surface Drains- OSD	3659	70.70
3	Box Surface Drains- BSD	189	03.60
4	Sylk Drains- SD	63	01.20
5	Cesspool Method- CP	82	01.60
6	Pit System- Pt	14	00.30
7	Others- O	397	07.70
8	OSD,PT	206	04.00
9	OSD,S	340	06.60
10	OSD,O	60	01.30
11	S,PT	26	00.40
12	All Other Combinations & NA	114	01.20
D) Methods of Disposal of Night Soil			
1	Head Loads- HL	15	00.30
2	Basket- B	35	00.70
3	Wheel Barrows- WB	72	01.40
4	Septic Tank- ST	2066	39.90
5	Pit System- Pt	154	03.00
6	Sewerage- S	123	02.40
7	Others- O	62	01.20
8	B,ST	248	04.80
9	S,ST	229	04.40
10	PT,ST	862	16.60
11	ST,WB	442	08.50
12	ST,O	265	05.10
13	ST,HL	144	02.80
14	All Other Combinations & NA	462	08.90

* Percentage is computed for total 5179 cities in India at 2001 census.

Many of the urbanities do not have access to safe drinking water, sewage services, and other facilities. Distribution of drinking water in cities of each state varies from locality to locality. For instance, in two metropolitan cities viz., Ahmadabad and Calcutta, 25 percent of the city population consumes 90 percent of water available in the source while 75 percent of population living largely in slum and other under developed localities has to adjust with remaining 10 percent of water (Mutatkar, 1995). Similarly, in the prime city of Kolkata, water supply in slums is 20 gallons per day, while in other areas it is 60 gallons per day. This clearly indicates the uneven distribution of drinking water between the different areas of the city.

Proximity to the drinking water in India reveals that, thirty nine percent of the houses have water availability within their premises, while 44 percent collect from the nearby places by standing long hours in queue, thereby wasting their valuable time, 14 percent have to collect water away from their premises (Table 3).

In India only twenty nine cities have sewerage system. Out of 5179 cities studied, open surface drainage system is found in 3659 cities (71 percent) followed by box surface system in 189 cities, cess pool method in 82 cities, only 14 cities have pit system, and 397 cities have other method of sewerage. Among the several methods of disposal of night soil, septic tank methods are more common in most of the cities in India, covering about 40 percent of cities. Seventeen percent of the cities have both septic tank and pit system methods. About nine percent of the cities have septic tank and wheel barrow methods. Indeed, India has made striking progress since independence in disposal of night soil by men by banning this method. Still out of 5179 cities in India, head loads and basket methods of disposal is seen in 15 and 35 cities respectively.

Availability of latrine in India by 2002 reveals that still 86 percent of rural population have been denied from this facility and only 11 percent posses own latrines (Table 5) About 19 percent of urban population have shared latrines, whereas in rural areas, this number is very small (about 2 percent). About 44 percent of urban people have their own, only 1 percent of houses have the other type of latrine facility like pit latrine or water closet, but still 14 percent of urban community do not have any type of latrine facilities.

TABLE 5: Distribution of Households by Type of Latrine in India 2002 (in %)

Type of latrine	Rural	Urban
Public/community	1.4	22.3
Shared	1.5	18.7
Owned	11.1	43.7
Other	0.3	1
No latrine	85.7	14.3
Total	100	100

Source: Economic Survey of Maharashtra 2003-03, Directorate of Economics & Statistics, Planning Department, Govt. of Maharashtra.

The main source of water pollution is the non scientific sewage system, which pollutes well and rivers. Pandey (2006) estimated that in a small country like Nepal, about 150 tons of waste is produced every day, out of which 50 percent is dumped into the river. More than 40 million liters of wastewater is generated per day and whopping over 80 percent of this is generated by domestic wastes which are not disposed safely. Waste water management is today's prime concern. In the metro city in Mumbai alone, it has been estimated that every day, about 200 tons of garbage is left on the streets (Mutatkar, 1995). Due to shortage of water, it is difficult to keep the community latrines clean in the slums. As a result, people who migrate from rural areas defecate in open space and create more pollution. Most of the people in the towns prefer surface drains. The problem of excreta disposal is a matter of great concern and causes great damage to mankind and the need for careful disposal is highlighted in many religious books (Pandey, 2006). The proper management of excreta will prevent the spread of pathogens in the environment. It directly facilitates disease transmission not only through person to person contact but also entering into water and food chain. The sanitation and water supply systems have contaminated the ground water supplies. People are suffering from the epidemics of cholera, typhoid and hepatitis. The recurring endemic diseases like gastroenteritis, dysentery, diarrhea and malaria are caused frequently by the use of contaminated water.

In 1990, UNICEF had launched Urban Basic Services for the Poor (UBSP) and was implemented in 245 towns in India, but the state governments failed to release the funds in time and municipalities could not share their funds. Hence, UBSP scheme was closed in 1997 and was replaced by two new schemes Swarna Jayanthi Sampurna Yojana (SJSY) and Swarna Jayanthi Rojagar Yojana (SJRY). In 2003, the Government of India initiated the scheme of total sanitation. Government has again modified the scheme as National Rural Employment Guarantee Scheme (NREGS) and is being implemented from 2006 onwards.A recent research conducted by the community development organization has indicated that the chemicals discharged by the factories are more harmful than the sewage that flows into the river (Pandey, 2006). Most of the factories discharge the untreated water into the river which contains detergents, non-biodegradable materials and toxic chemicals which are harmful to health. The different pollutants have different effects on the health of the people. The effect of high fluoride content leads to dental and skeletal florosis, bone deformation and other disorders. Excess nitrate causes holes in heart, discolors the skin and impairs the digestive system. Saline water can cause an imbalance in the salt content of the body. Most of the districts and cities in India are affected by contamination of ground water and is shown in Table 6. Similarly the toxic levels of poisonous compound like Fluoride, Salt, Iron, Arsenic and Nitrate contents in the water is depicted in Table 7. Fluoride and salt content in

the ground water is more in villages of Rajasthan compared to other states in India. The contaminated fluoride water is more in 9 districts of Gujarat and Madhya chemicals to the rivers. Six districts of seven states viz, Andhra Pradesh, Haryana, Punjab, Rajasthan, Tamil Nadu, Pradesh (Table 6), this may be due to the maximum number of textile factories and a large number of chemical factories, that discharge the detergents and Gujarat and Karnataka are also facing the problem of contaminated water due to the disposal by industries.

TABLE 6: Districts where Ground Water has been found contaminated with Fluoride by State in India

State	Districts
Andhra Pradesh	Prakasam, Nellore, Anantpur, Nalgonda, Ranga Reddy, Adilabad
Assam	Karbi, Anglong, Nowgaon
Bihar (Including Jharkhand)	Giridih, Jamui, Dhanbad
Gujarat	Kachch, Surendranagar, Rajkot, Ahmedabad, Mehsana, Banaskantha, Sabarkantha, Panchmahal, Kheda
Haryana	Rohtak, Jind, Hissar, Bhivani, Mahendragarh, Faridabad
Karnataka	Tumkur, Kolar, Bangalore, Gulbarga, Bellary, Raichur
Kerala	Palghat
Madhya Pradesh (Including Chatisgarh)	Bhind, Morena, Guna, Jhabua, Chindwara, Seoni, Mandla, Raipur, Vidisha
Maharashtra	Bhandara, Chandrapur, Nanded, Aurangabad
Orissa	Bolangir
Punjab	Ludhiana, Faridkot, Bhatinda,Sangrur, Jalandhar, Amritsar
Rajasthan	Barmer, Bikaner, Ganganagar, Jalore, Nagaur, Pali, Sirohi
Tamil Nadu	Dharmapuri, Salem, North Arcot, Villupuram, Tiruchirapalli, Pudukkottai
Uttar Pradesh	Bulandshahar, Aligarh, Agra, Unnao,Rae-Bareli
West Bengal	Birbhum
NCT of Delhi	City, Sahadra & Mehrauli blocks

Source: Lok Sabha Unstarred Question No.3059, Dated: 05.08.2002

Improvements in the safe drinking water through household water treatment can lead to reduction in diarrhea by 35 percent. Improved sanitation reduce diarrhea by 32 percent and hygiene interventions including hygiene education and promotion of hand washing reduces diarrhea cases by 45 percent. In a developing country like India, 10 percent of the population is severely infected with intestinal worms, in turn lead to malnutrition, anemia and retarded growth. These water borne diseases can be controlled through better management of water resources like recharge of underground water, water supplied to domestic purposes through the pipes and taking care of seepages.

INDUSTRIAL POLLUATION

The increase in the number of Industries has led to the growth of urban population and economy. Table 8 indicates the annual growth rate of industries in India from 1995 to 2003. Among all the cities in India, Calcutta is found to be the most polluted city with as many as 11,516 factories and 5,25,000 cars (or Vehicles) (Mutatkar, 1995). Seventy percent of the population use coal as cooking fuel and it gets mixed up with other pollutants. Different industries are producing different pollutants and releasing into the environment.

TABLE 8: Industrial Growth Rate in India

Year	Growth Rate (Percent)
1995-96	13
1996-97	6.1
1997-98	6.7
1998-99	4.1
1999-00	6.7
2000-01	5.0
2001-02	2.8
2002-03	5.8
2003-04	6.9

Source: Annual Report 2003-04, Ministry of Heavy Industries and Public Enterprises, Govt. of India

If we look at the pollution level in cities with the population size of million plus, city like Surat releases maximum sulphur dioxide in the form of ash, smoke, automobiles exhaust, household burning of coal and wood (Table 9). Other cities like Calcutta, Mumbai and Ahemadabad, also have maximum polluting elements to the atmosphere. The increase in sulphur dioxide level in the atmosphere results in diseases like asthma, chronic bronchitis, respiratory problem and lung cancer among city dwellers. Six cities viz Mumbai, Delhi, Hyderabad, Surat, Kochi and Vishakhaptnam have nitrous oxide levels beyond the permissible limit and causes

discoloration of skin. Patna and Surat have almost four times higher than maximum permissible limit of SPM (Suspended Mass Particles) followed by other cities like Delhi, Calcutta, Indore, Kanpur, Lucknow and Jaipur. SPM consists of benzene soluble organic matter which is highly toxic and carcinogenic (Table 9). Industrial workers are exposed to poisonous gases, chemicals and dust that produce serious headache, chest pain, eye, nose and skin irritation.

TABLE 9: Level of Air Pollution in Million Plus Cities in India

	(micrograms/m^3)		
City	SO_2	No_2	SPM
NAAQ/Standards	15.0 - 80.0	15.0 - 80.0	70.0 - 360.0
Mumbai	6.1 - 111.7	5.4 - 115.8	60.6 - 473.2
Calcutta	6.0 - 122.0	6.0 - 73.1	77.3 - 833.3
Delhi	10.1 - 85.1	20.1 -104.5	145.3 - 929.8
Hyderabad	5.1 - 70.7	7.5 - 124.1	59.3 - 458.0
Ahmedabad	5.4 - 110.9	3.6 - 70.0	72.4 - 575.4
Pune	17.1 - 29.0	10.1 - 34.0	112.0 - 166.5
Kanpur	8.2 - 22.4	7.7 - 63.0	233.7 - 809.2
Lucknow	23.2 - 37.4	23.0 - 34.4	382.6 - 672.7
Nagpur	4.3 - 18.8	3.2 - 43.2	38.2 - 403.2
Surat	22.4 - 304.0	10.0 -135.7	81.7 - 1215.3
Jaipur	6.1 - 53.7	4.0 - 64.3	81.6 - 570.1
Kochi	3.2 - 54.3	1.7 - 137.0	10.5 - 271.1
Indore	2.6 - 10.2	4.4 - 17.4	77.0 - 812.0
Coimbatore	0.0 - 8.9	0.3 - 19.1	2.5 - 133.0
Patna	12.7 - 46.4	8.5 - 55.7	132.0 - 1307.0
Bhopal	8.1 - 22.0	12.2 - 32.4	85.0 - 393.3
Visakhapatnam	5.5 - 80.8	5.1 - 92.0	46.7 - 482.7
Varanasi	18.3 - 27.1	10.6 - 28.8	155.0 - 349.0

Source: Urban Statistics, Hand Book 2000, National institute of Urban Affairs
SO_2 = Sulphur dioxide **No_2** = Nitrous oxide **SPM** = Suspended Mass Particles

Similarly, effective way of collection and treatment of industrial waste water is a severe problem in most of the developing countries like India (Muthukumaran and Ambujam, 2003). Effluent and waste water treatment is expensive and hence it is not followed in many industries. Most of the treated waste water should be recycled to meet its own requirement. Reuse of waste water for the purpose of agriculture and use has been well recognized in some of the developing countries.

TRANSPORTATION PROBLEMS

In India, number of metropolitan cities with a population exceeding one million have increased over the years (5 in 1951 to 23 in 1991 and 37 in 2001) and is expected to reach to 51 by 2021. This growth has envisaged the demand for transport from one place to the other. Till today, many of the Indian cities have not been connected with other cities. Moreover, they are less accessible to the surrounding rural areas due to inadequate roads and transportation facilities. Within and between cities, mobility of individuals has increased tremendously, and the people are experiencing severe problems such as delay in reaching the destination, traffic congestion, air pollution, noise pollution and energy waste etc (Sudarsanam Padam and Singh, 2002, Jyotirmoy Mukherjee, 2005 and Mutatkar, 1995). Bus services in particular areas have been reduced their frequency as the commuters are opting for their own vehicles (two wheeler, four wheeler, or three wheeler) adding further to traffic congestion which has its impact on the human health.

The transport policy in India should aim at improving the economic status and well being of urban inhabitants. Improper transport policy adversely affects traffic congestion and also causes significant disruption of business and commercial activities. Further, this policy should aim at reducing the social costs of accidents and pollution.

The road way in India has grown up by eight folds from 400,000 kms in 1951 to 3,300,000 by 2000 (Mukesh Kapoor, 2002).

National Highways	52000 kms
State Highways	1,28,000 kms
District Roads, Other Roads and Village Roads	29,20,000* kms
Urban Roads	200,000 kms

TABLE 7: State wise Quality affected Habitations of Villages in India (No. of villages)

States/UTs	Fluoride		Salinity		Iron		Arsenic		Nitrate		Total		Remarks
	Pre*	Cur**	Pre*	Cur**	Pre*	Cur**	Pre*	Cur**	Pre*	Cur**	Pre*	Cur**	
Tamilnadu	1835	3555	5219	3420	1000	2532	-	-	4000	6933	12054	16440	Overall Increase-Power Pump Source less polluted than hand pumps
Rajasthan	16560	22021	14412	19249	-	103	-	-	-	3862	30972	45235	Overall Increase
Gujarat	2826	2383	1048	1739	-	-	-	-	762	603	4636	4725	Overall Increase , Nearly 70 percent of earlier Identified Problem Villages already covered
West Bengal	52	369	-	809	-	18647	3133	4243	-	-	3185	24068	Overall Increase
Pondicherry	14	6	5	6	17	17	-	-	-	-	36	29	Overall decrease
Delhi	-	5	-	19	-	1	-	-	-	23	-	48	Previous fig not available as state
Himachal Pradesh													According to State no Quality Problem taken as fully covered
Goa													
Arunachal Pradesh													
Uttaranchal													
Lakshadeep	0	0	10	-	-	-	-	-	-	-	10	-	Effectively tackeled no Quality Problem taken as fully covered
D & Nagar Haveli													According to State no Quality Problem taken as fully covered
Chandigarh													
Diu & Daman													
Karnataka	954	5822	1002	4401	483	6629	417	-	-	4077	2439	20929	Over all Increase, Nitrate emerging as a Major Problem Arsenic in 417 reported inadvertently
Punjab	997	46	776	3269	28	285	0	-	0	1	1801	3600	Overall Increase, Fully Covered
Haryana	131	202	-	69	-	-	-	-	-	-	131	271	Overall Increase, Fully Covered
Madhya Pradesh	1679	5692	762	-	65	-	-	-	-	-	2506	5692	Overall Increase
Chhatisgarh	-	21	-	-	-	-	-	-	-	-	21	21	
Andhra Pradesh	8301	5794	5518	3884	441	243	-	-	-	-	14260	9921	Overall decrease

Note: (Previous). * : As on 01.04.1999, (Current). ** : As on 04.03.2003

Source : Lok Sabha Unstarred Question No. 1961, dated 04.3.2003

About 9,00,000 kms of earth tracks have been constructed under Jawahar Rozgar Yojana programme. However, only 4 percent of the National Highways have four lanes, 66 percent are two lanes, while 30 percent is still single lane. Similarly, the state highways have 1 percent four lanes, 19 percent two lane and 80 percent single lane. National highway is running through the length and breadth of the country connecting the state capitals, industrial towns and tourist centers. The State highways are linked to district headquarters and important cities within the state (Table 10). The National Highways are estimated to reach the figure of about 75,000 kms in the next 20 years with four lining (or more) of all lengths, where the passenger car units are more than 350,000 and two lanes for the remaining stretches.

The high density metro and other cities need express high ways, ring roads and metro train facilities. About 10,000 kms of expressways are proposed to be constructed by the end of 2020. Some expressways like Mumbai-Pune, Bangalore-Mysore have already started operating. The Highways under the NHAI have achieved early clearances of projects and are developing rapidly through mechanization in road building. Increase in the traffic is in geometric progression compared to arithmetic progression of highways resulting in increased casualties and health hazards.

TABLE 10: Road Length and Percentage Share of Each Category of Roads of Total Road Length in India 1951-2002

Year	NH (B)	SH (C)	PWD (D)	Major Roads (E) B+C+D	Panchyat Raj Roads (F)	G =E+F	Urban Roads (H)	Projects (I)	Total G+H+I
	19811	NA	173723	193534	206408	399942	-	-	399942
1951	4.95		43.44	48.39	51.61	100	0	0	100
	23798	NA	257125	280923	197194	478117	46361	-	524478
1961	4.54		49.02	53.56	37.6	91.16	8.84	0	100
	23838	56765	276833	357436	354530	711966	72120	130893	914979
1971	2.61	6.2	30.26	39.06	38.75	77.81	7.88	14.31	100
	29132	89215	340499	458846	484770	943616	97490	163745	1204851
1976	2.42	7.4	28.26	38.08	40.23	78.32	8.09	13.59	100
	31671	94359	421895	547925	628865	1176790	123120	185511	1485421
1981	2.13	6.35	28.4	36.89	42.34	79.22	8.29	12.49	100
	31852	99262	489807	620921	727077	1347998	135299	203651	1686948
1985	1.89	5.88	29.04	36.81	43.1	79.91	8.02	12.07	100
	32088	100461	500869	633418	747710	1381128	138647	206276	1726051
1986	1.86	5.82	29.02	36.7	43.32	80.02	8.03	11.95	100
	33479	124266	497476	655221	941410	1596631	181171	206065	1983867
1990	1.69	6.26	25.08	33.03	47.45	80.48	9.13	10.39	100
	33650	127311	509435	670396	931288	1801684	186799	209737	2327382*
1991	1.45	5.47	21.89	28.8	40.01	68.82	8.03	9.01	100
	33666	128622	521028	683316	936288	1619804	189352	212485	2462289*
1992	1.35	5.17	21.16	27.75	38.03	65.78	7.89	8.83	100
	33916	129876	495836	659628	1037663	1697291	195150	222057	2678843*
1993	1.25	4.78	18.51	24.53	38.74	63.38	7.29	8.29	100
	34249	132401	500615	667265	1048907	1718172	202013	224606	2955231*
1994	1.17	4.54	18.94	22.58	35.49	58.07	6.84	7.8	100
	34282	134065	511046	679393	1063790	1743183	202671	225481	3067411*
1995	1.12	4.39	18.71	22.22	34.79	57.02	6.63	7.37	100
	34508	135187	716701	886396	1021807	1908203	212920	245673	2366796
1996	1.46	5.71	30.28	37.45	43.17	80.62	9	10.38	100
	34849	137119	758264	930232	987103	1917335	231573	249880	2398788
1997	1.45	5.72	31.61	38.78	41.15	79.93	9.65	10.42	100
	38517	136489	780848	955954	996359	1952213	236055	269427	2457695
1998	1.65	5.86	27.98	35.5	42.79	78.29	10.14	11.57	100
	49585	137950	801655	989190	1028410	2017600	237866	270523	2525989
1999	207	5.76	28.05	35.88	42.91	78.79	9.92	11.29	100
	52010	132797	730680	915487	1038356	1953843	248408	213827	2416078
2000	2.15	5.5	30.24	37.89	42.98	80.87	10.28	8.85	100
	57737	132100	736001	925838	1041167	1967005	252001	223665	2442671
2001	2.36	5.41	30.13	37.9	42.62	80.53	10.32	9.16	100
	58112	137711	725425	921248	1060161	1981409	250122	225116	2456647
2002	2.37	5.61	29.53	37.5	43.15	80.66	10.18	9.16	100

Source : Basic Road Transport Statistics of India 1999-00, 2000-01 and 2001-02,
Ministry of Shipping, Road Transport and Highways, Govt. of India & Past Volumes.

The increase in the number of vehicles and number of road accidents occurred over a period of time (1970 to 2002) is presented in Table 11. During this period, the number of vehicles of all types has increased from 18.65 lakh in 1971 to 372.31 lakh in 1997 showing an exponentially increasing trend. Similarly, the number of accidents has increase from 1.14 lakh in 1970 to 4.08 lakh in 2002 (Fig 3)

TABLE 11: Road Accidents in India 1970 to 2002

Year	Road Accidents (In ' 000)	No. of Deaths (In ' 000)	Registered Motor Vehicles (In ' 000)	Accidents per 1000 Vehicles	Persons Injured (In ' 000)	Vehicle Population (In Lakh)
1970	114.1	14.5	-	-	70.1	-
1971	120.2	15	-	-	70.7	18.65
1972	122.3	16.1	-	-	76.4	20.45
1973	121.6	17.6	-	-	79.3	21.09
1974	114.3	17.3	-	-	76.7	23.27
1975	116.8	16.9	-	-	77	24.72
1976	124.7	17.8	-	-	82.5	27
1977	135.4	20.1	-	-	95.6	32.6
1978	146.3	21.8	-	-	99.5	36.14
1979	144.4	22.6	-	-	102.9	40.59
1980	153.2	24.6	4521	33.89	109.1	45.21
1981	161.2	28.4	5391	29.9	114	53.91
1982	166.2	30.7	6055	27.45	126	60.55
1983	177	32.8	6973	25.38	134.1	69.73
1984	195	35.1	7949	24.53	156.2	79.49
1985	207	39.2	9170	22.57	163.4	91.7
1986	215.5	40	10577	20.37	176.4	105.77
1987	234	44.4	12618	18.54	189	126.18
1988	246.7	46.6	14818	16.65	214.8	148.18
1989	270	50.7	16920	15.96	229.7	169.2
1990	282.6	54.1	19152	14.76	244.1	191.52
1991	293.4	56.4	21374	13.73	255	213.74
1992	260.3	57.2	23507	11.07	267.2	235.07
1993	280.1	60.7	25505	10.98	287.8	255.05
1994	320.4	64	27660	11.58	311.5	276.6
1995	348.9	70.6	30295	11.52	323.2	302.95
1996	371.2	74.6	33783	10.51	369.5	337.83
1997	373.7	77	37231	7.8	378.4	372.31
1998	385	79.9	NA	NA	390.7	NA
1999	386.4	82	NA	NA	375	NA
2000	391.4	78.9	NA	NA	399.3	NA
2001	405.6	80.9	NA	NA	405.2	NA
2002	407.5	84.7	NA	NA	408.7	NA

Source: Ministry of Shipping, Road Transport & Highways, Govt. of India.

In most of the developing countries like India, population and vehicles are increasing parallely (Fig 1 and Fig 2). Number of deaths due to road accidents shows an increasing trend in cities. A large number of vehicles are forcibly placed into the narrow and poorly maintained roads. Lack of traffic sense and poor condition of vehicles escalates the problem. Table 11 indicates a positive correlation of no. of deaths with increase in vehicle population.

In cities, emission of suspended particles from the vehicles is the main source of air pollution. Table 12 gives contribution of different pollutants by vehicles. Two wheelers contribute 85 percent carbon monoxide emission while 90 percent of nitrogen oxides by diesel driven vehicles. Two stroke petrol engines are emitting higher levels of carbon monoxide and higher levels of hydrogen chloride compared to other vehicles in (Table 13). The heavy vehicles like trucks, buses and public carrier goods are emitting higher levels of nitrous oxide compared to other vehicles. Two stroke engines and public carrier goods are emitting higher levels of benzene.

TABLE 12: Urban Air Pollution from Vehicular Emissions

Pollutant	Source of Emission	Contribution (percent) of the source to Total Emissions	Remarks
Carbon Monoxide	Petrol-driven vehicles	85	Contribution of two-wheelers is expected to rise
Unburnt Hydrocarbons	Two and Three-wheelers	35 to 65	-
Nitrogen Oxides	Diesel-driven vehicles	90 or more	-
Particulates	Diesel-driven vehicles	-	-

Source: Urban Statistics, Hand Book 2000, National Institute of Urban Affairs.

TABLE 13: Category-wise Pollution Load of Vehicles 2005 (in 1000 tonnes)

Vehicles	CO	HC	NOX	PM	Benzene	BUTDN	Ozone Potential
Buses	24.7472	5.527692	76.4352	6.3844	0.02617	0.0048	19.1597
Taxis	2.20435	0.421481	1.020249	0.510331	0.0244	0.007556	1.4609
PCG	595.193	102.9881	114.5861	5.37958	6.35751	0.93816	357.0164
PCD	2.8754	0.50072	1.431865	0.571527	0.02863	0.008752	1.7357
MUV-G	16.0095	2.242921	3.108215	0.168137	0.16763	0.024967	7.7751
MUV-D	30.1595	1.804338	16.11801	7.291563	0.17547	0.058491	6.25488
3W	63.4142	44.8064	0.968903	1.129543	1.57593	0.069132	155.3234
4S/2W	40.2412	11.3397	4.773367	0.926914	0.66908	0.088262	39.3099
2S/2W	391.206	281.8195	4.46923	6.65697	4.01395	0.435521	1028.249
Trucks	55.2522	11.58194	74.72162	11.86569	0.05888	0.011176	40.1496
LCV	104.609	3.303424	30.03871	7.829501	0.16517	0.047691	11.4513
Total	1325.91	466.3362	327.6715	48.71416	13.2628	1.694508	1667.886

Source: Transport fuel quality for year 2005. Central Pollution control board, Ministry of Environment and Forests, Government of India.

There is a direct relationship between the number of vehicles and air pollution. Vehicular emissions depend on the kind of vehicle, vehicle speed, age of vehicle and emission rate. Traffic congestion besides decreasing the speed, it increases the pollution level. To overcome these problems, we have to implement the application of Transport System Management (TSM) strategy such as one way paths, improvement of signals and traffic engineering improvement measures. Provision of service roads, bye-passes, ring roads, bus buys, widening of roads, construction of foot paths, removal of encroachment, proper transport policies and good surface drainage systems may result in the possible reduction in pollution.

. **FIGURE 1**: Vehicle Population in India from 1971 to 1997.

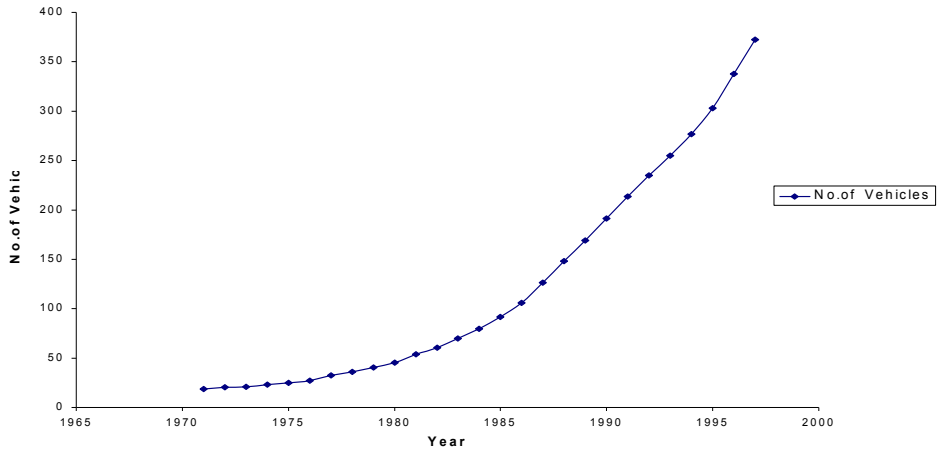


FIGURE 2: Population of two wheeler and three wheeler in India from 1951-1991

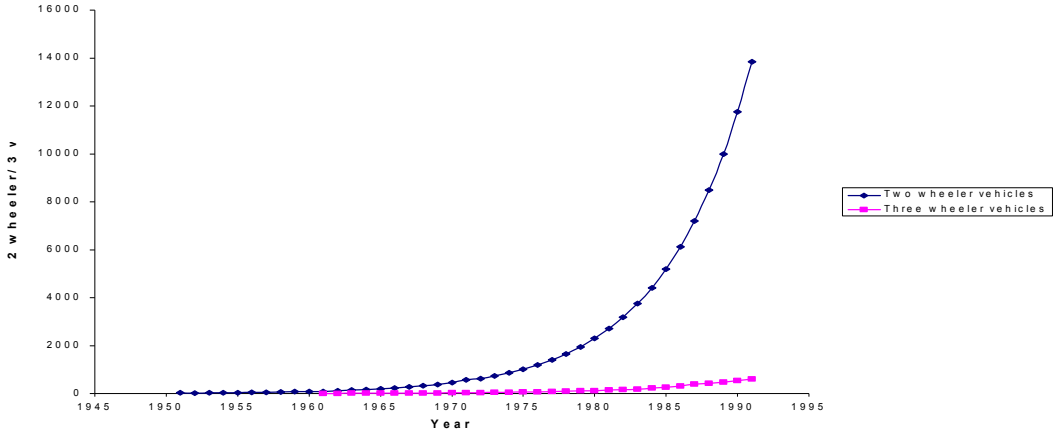
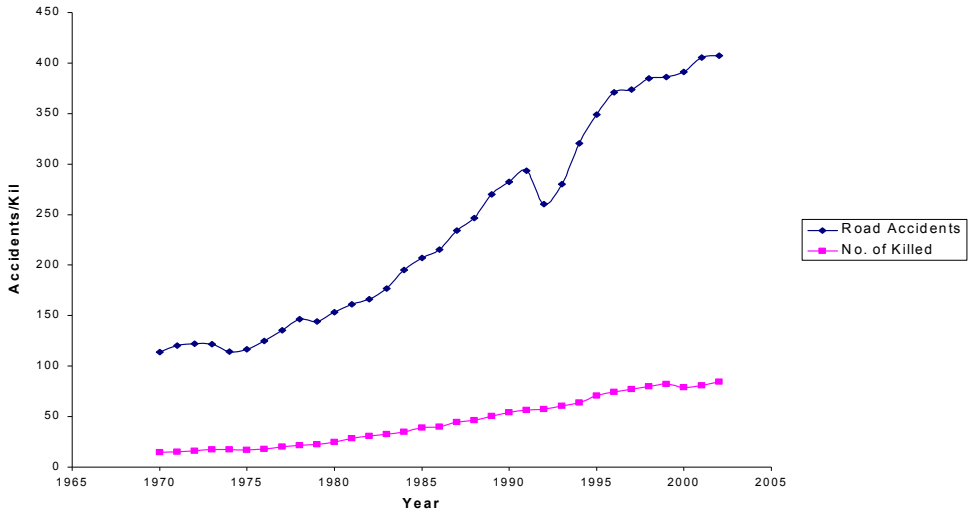


FIGURE 3: Road Accidents and Number of persons Killed in India from 1970- 2002



PROBLEM OF GLOBAL WARMING

The protective atmospheric ozone layer is becoming thin resulting in the rise of global temperatures and green house effect. The UNO is keen on environmental protection. The increase in the urban sprawl increases the number of buildings, extensive road networks and other paved surfaces. Urban areas generally have higher solar radiation; heat is stored during day time and is released by night (Andrew Manu and et al, 2006). Built up areas in urban belt tend to have relatively higher temperatures compared to those

of non urban areas. This thermal difference combined with heat generated by the urban houses, burning of fossil fuel in automobiles and industrial pollution contributes to the development of heat in urban area.

To protect the ozone layer from the environmental pollution, the Government has to think on proper zoning policies, use of building materials and paved surfaces that minimizes the absorption of heat. The Government should insist on the use of light colour to the buildings and roofing materials in commercial and residential properties restrict use of reflective glasses on private and commercial properties, encourage tree planting in residential areas to provide shade and keep the city cool and educate the people about effect of urban heat.

Molly Meara (1991) explains the technology through Geographical Information System (GIS) that links urban population with environmental problems and it displays the data in a coloured map form. A GIS data base, in Quito, Ecuador, integrates the Epidemiological data from the department of health with data on water and waste service provision and data on poverty, employment. GIS provides useful colour pictures which can be used to educate the people regarding environmental problem. The health status of a citizen can be known by integrating geographic information on polluting factories, major road ways, air and water quality monitoring. The pollution control agency shows detailed information on the sources of pollution. These maps should be made available to the public so that they can help the Government to initiate steps for pollution control measures.

CONCLUSIONS

The present paper highlights the problems associated with urban population in India. Some suggestions have been provided in this paper to improve housing facilities in urban areas like '**Janata Housing Colonies'** for the poor slum people.

Improvements in quality of drinking water through household water treatment, improved sanitation and hygiene interventions including hygiene education waste water management, urban waste management has to be scientifically applied in the interest of growing urban population.

The application of Transport System Management (TSM) to improve the commuter system of the urban areas is highlighted. To protect the ozone layer due to environmental pollution, the measures to be taken by Government such as proper zoning policies, insist on the use of building materials and paved surfaces that minimizes absorption of heat are also suggested. The Government should also insist on light colour to the buildings and roofing materials in commercial and residential properties and must discourage the use of reflective glasses on private and commercial properties. It should encourage tree planting in residential areas to provide shade, besides promote evapotranspiration process in plants to keep the city cool. It should develop effective program to educate the general public regarding the effect of heat in urban areas.

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