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Environmental Concerns of Urban Transport and NMT as a Sustainable Transport Initiative in India

Dr Purnima Parida, Senior Scientist, TPE Division, Central Road Research Institute, New Delhi,India punam31@gmail.com

Dr. M Parida, Professor, Civil Engg. Deptt.,.Indian Institute of Technology, Roorkee (U K),India,mprdafce@iitr.ernet.in, mparida@gmail.com

ABSTRACT:

Non motorized modes include trips made by walk, bicycle and cycle rickshaw. These modes are essential part of the sustainable and suitable transport modal mix on consideration of energy, self reliance, environmental concerns, affordability, employment and safety. The important issues are those of giving due official recognition to the NMT in planning, policies, investments, transport and traffic management, institutional structures and regulatory procedures. The present trend in the developed countries of encouraging non-motorized modes is a learning experience for the developing countries. The future transport system to be developed should have a blend of transit modes and NMT, but with a major role assigned to non-motorized transport.

INTRODUCTION

If transport is to become sustainable so that it doesn't harm the environment or use resources that cannot be replenished, there have to be more public transport, more walking and bicycling. Half of the effort towards achieving sustainable transport would come from technological improvements of cars and trucks, fuels and infrastructure. Half would come from making transport smarter by using vehicles more efficiently (fewer empty vehicles, and cars carrying just one person) , by shortening journeys (more compact towns and cities and more local production) and by enhancing the role of non fossil fuel dependent transport modes. . A sustainable transport system should provide *access* to people, places, goods, and services in an environmentally responsible, socially acceptable, and economically viable manner. Mobility for communication and for enabling social contacts, as well as movement of people and goods, is to be considered as a *means* rather than as an *end* in itself.

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India is the second largest populated country in the world. The total urban population of India burgeoned over the past five decades. In 1951 the population of the country was 360.11 million, which has increased to 1027 million in 2001. In the year 2002, 58.8 million vehicles were plying on Indian roads. The annual rate of growth of motor vehicle population in India has been about 10 percent during the last decade. The issue is not the number of vehicles in the country but their concentration in a few metropolitan cities. It is alarming to note that 32 percent of these vehicles are plying in metropolitan cities alone, which constitute about 11 percent of the total population. During the year 2000, more than 6.2 million vehicles were plying in mega cities (Mumbai, Delhi, Kolkata, and Chennai) alone, which constitute more than 12.7 percent of all motor vehicles in the country. Interestingly, Delhi, which contains 1.4 percent of the Indian population, accounts for nearly 7 percent of all motor vehicles in India.. Economic growth has brought about a spurt in vehicle ownership and a fast pace of urbanisation has led to tremendous growth in urban traffic. While vehicle ownership has increased 125 folds in the last 50 years during the same period road infrastructure has expanded only four times. The growth of road length, vehicles and population in India, since 1951, is given in Table 1. The widening gap between supply and demand has manifested itself in many forms of increased traffic congestion, increased air and noise pollution, accidents, delays and subsequently wastage of Fuel

Table 1: Growth of in Population &Transport Sector in India

Year	Population (million)	Vehicular Growth (million)	Road Length (million – km)
1951	360.1	0.3	0.4
1961	430.9	0.7	0.7
1971	548.2	1.9	0.9
1981	683.3	5.3	1.5
1991	846.3	20.3	2.0
2001	1027.0	46.0	3.4

ENVIRONMENTAL CONCERNS OF URBAN TRANSPORT

Urbanization has a strong interrelationship with the travel demands in the country. Higher incomes, mobility, expanding cities and the proliferation of employment centres have increased the demand for motorised transport, resulting in a disproportionately high concentration of vehicles in urban centres. Consequent to the boom in automobiles in the

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urban areas the pollution level in the air has gone up. A study by Central Pollution Control Board reveals that the air pollution shares of transport have gone up from 20 percent to 70 percent in the last four decades. The frequent traffic jams, increase in idling time of vehicles at intersections aggravate the pollution levels further. The contribution of motor vehicles on total pollution in Delhi has increased from 23% in 1970-71 to 63% in 2000-01. Cars and two-wheelers contribute to 11.5% and 77.7% of the total transport related air pollution. The largest share of transport activity is by road. Road transport is responsible for over 80% of fossil fuel energy consumption and responsible for around 64% of the total air pollution load.

A Nationally Coordinated Project on Urban Transport Environment Interaction was undertaken at Indian Institute of Technology, Roorkee for studying traffic noise and air pollution at identified locations in the major cities of India (Delhi, Jaipur, Allahabad, Chandigarh and Lucknow) and to analyze the trend of various air pollutants and noise pollution. Air pollution parameters measured were Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), and Suspended Particulate Matter (SPM). Observed values of 24 hour average pollutant concentrations for a few locations in Delhi are given in Table 2. .Sulphur dioxide levels are within prescribed limit. Locations with high traffic density experienced Nitrogen dioxide and SPM levels above the prescribed standards. Increased share of personalized vehicles and their absolute growth is a big challenge to different initiatives for improving transport infrastructure and reduce environmental pollution.

Table 2: Pollutant Concentrations at Selected Locations in Delhi, 2002

S no.	Locations	Pollutant Concentration ($\mu g/m^3$)		
		NO_X	SO_2	SPM
1.	Ashram Intersection	93.9	14.87	942.0
2.	DPS, Mathura Road	88.42	15.05	1064.0
3.	Jan path	63.67	12.3	949.24
4.	NOIDA Intersection	103.67	15.8	898.4
5.	Sarita Vihar	121.29	17.3	1026.0
6.	Nehru Place	76.57	16.9	1379.38
7.	Moolchand	89.08	17.8	1141.5
8.	RML Hospital	43.91	9.16	773.0

Using the traffic noise and air pollution models projections were made for a sample location

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in Delhi as given in Table 3. In the absence of appropriate mitigative strategies vehicular pollution is likely to further deteriorate the ambient air quality in the country.

Table 3: Traffic & Pollution Levels For 2021

Year	Traffic	Noise (dBA)	Air Pollution (CO) (ppm)	% increase in Sound Pressure Level (SPL)
2001	6284	78.61	3.7	
2011	9426	82.62	4.5	58
2021	14139	84.81	5.8	104

Vehicular pollution is responsible for a number of respiratory and other diseases. All over India, especially in metro cities, people are suffering from different types of diseases as a result of vehicular pollution. Continued exposure to high levels of noise results in annoyance, fatigue and temporary shift of hearing; which may lead to permanent loss of hearing. There is increasing evidence that noise exposure causes physio-biological disturbances like changes in digestion, metabolism, blood circulation etc.

Energy Loss

Road transport is the backbone of economic development of India and meets the 75 percent of transport demand. Transport is the fastest growing energy sub sector. The transport sector is the second largest consumer (50%) of commercial energy. It ranks first in the consumption of petroleum energy, consumes almost entire amount (98%) of the petroleum product in the form of petrol and diesel. Usage of petroleum energy in transport grew at 1.3 % annually during 1971-1981; it has grown at 6-7% annually during 1991-1999, transport energy demand has grown at 1.2 times the GDP growth rate. Transport sector is the highest consumer of the fossil fuels but unfortunately the higher guzzler of the same. The usage is high due to the alarming increase in travel demand and growth of vehicles. The vehicle owners have to overcome congestion and delay on roads. There is considerable loss of fuel due to idling of vehicles at the traffic intersections which results in increase of operating cost and wastage of precious fuel.

Central Road Research Institute, New Delhi conducted studies to estimate the fuel loss on a corridor and at the total signalized intersections of Delhi, the capital of India. The study results indicated that on a stretch of 1 kilometer at Chelmsford road (connecting New Delhi

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Railway Station and outer circle of Cannaught Place, (a Central Business District)), 66,000 vehicles ply in a day. , on an average running speed of 18.60 Km. /hr. Stopped delays were observed to be as high as 158.82 sec./veh.. . The low running speeds and delay accrue a fuel loss of Rs.2, 38, 43,231/-and Rs. 71, 80,694/- annually.

At 600 signalized intersections of varying traffic volumes, 135 million Kilograms of CNG, 47 million Liters of Diesel, and 147 million Liters of Petrol worth Rs. 9945 million is being wasted during idling of vehicles waiting for green signal.

SUSTAINABLE STRATEGIES

Moving people and freight in an environmentally sustainable manner will be one of the biggest challenges for the 21st century. The first ever national urban transport policy of India (NUTP) puts it bluntly, “the use of cheaper non-motorized modes like cycling and walking has become extremely risky, since these modes have to share the same right of way with motorized modes. With each passing day the pedestrians and the non-motorized mode of transport are eased out of the system. In developing cities, average trips distances are extremely short. Often over 60 per cent of trips are less than 3 km long. In well planned German cities for example, over 80 per cent of trips less than 3 km would be made by walking or bicycling. According to GTZ in Bogotá for instance in 1998, 70 per cent of the private car trips were less than 3 km. Closer home, in Mumbai 57 per cent of work trips are 3 km or less. There is thus a tremendous scope for enabling this mode of transport. In fact the modal share of walking and non motorized trips is higher than the private mode of transport for almost all the major Indian cities. In spite of the fact that non motorized modes, as a mode of commuting, constitutes such a high percentage in these cities, the government has no policy for enabling these modes of commuting.

Reinforcing Pedestrian Infrastructure

Increase in modal share of public transport increases walk trips. The basic objective of augmentation of public transport remains defeated until and unless a good network of pedestrian infrastructure is also developed. The explosion in popularity of the automobile in the last 50 years has shifted the focus of street design from pedestrian traffic to automobile traffic. The five year Plan outlays which are not sufficient are utilized in providing infrastructural facilities to more than 50 million vehicles and the safety of one billion

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pedestrians has got a back seat. In comparison to huge walk transport demand, pedestrian facilities in Indian cities are grossly inadequate,

Lack of pedestrian facilities in Indian cities culminates in a high rate of pedestrian fatalities. The number of fatalities has increased from 15,000 in 1971 to about 1, 00,000 in 2004. Nearly 50 percent of the road accident victims are pedestrians' .The need of the hour is to recognize and encourage the most primitive mode of transport. To promote walk trips adequate pedestrian facilities need to be provided. If some of the motorized short distances trips can be made into walk trips it will go a long way in improving the economy and environment quality. Instead of considering the side walk network as a mere strip of concrete some human aspect also need to go into it by adding the qualitative attributes like safety, walk environment and comfort .

To promote the walk trips as well as provide adequate pedestrian facilities the preferences and perceptions of the pedestrians have to be understood and included in the design methodology for pedestrian facilities. A study was formulated, to understand the sidewalk attributes that affect the walking experience of the pedestrians in Delhi. For qualitative evaluation of pedestrian facilities a proforma was designed using rating scale concept. Ten parameters were identified to be included in the questionnaire. Six parameters were pertaining to the physical evaluation of the sidewalk facility, which included sidewalk width, sidewalk surface, obstruction, encroachment, potential of vehicular conflict, and continuity. The four user factors were pedestrian volume, safety, comfort and walking environment. Pedestrians were asked to rate both the importance (how important good performance is to them) and performance (indicating "bad" or "good" condition) on a five-point scale. For quantitative evaluation of sidewalks videography was carried out for sidewalks and later Speed Density, Speed Flow and Flow Space models were developed. Using these models levels of service parameters have been evolved for sidewalks in Delhi. Quantitative as well as qualitative level of service models were used to estimate level of service for five identified location as given in Table 4. A comparison of level of service for all the five locations indicates that quantitative LOS is always higher than qualitative LOS. Quantitative LOS model tend to neglect the effect of subjective sidewalk attributes such as walk environment, safety, comfort etc. this comparison indicates qualitative service models are more efficient in evaluating sidewalk facilities in terms of large number of attributes, being policy sensitive and taking cognizance of human factors. Developing design methodologies with user

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perception shall be useful in creation of pedestrian infrastructure that can receive appropriate patronage and enhance modal share for walk trips.

Table 4: Comparison of Quantitative & Qualitative LOS for Sidewalks

Location	Footpath width	Peak Flow	Quantitative LOS	Qualitative LOS
Ashram	2.5	792	A	C
ITO	5	1992	A	A
CP	4.5	4248	C	B
ISBT	1.4	1651	C	D
AIIMS	2	1462	B	D

Non-Motorized Modes of Transport

There are 65 million cycles, 85 million draft animals, 15 million carts, 3.2 million pack animals and 5 million rickshaws in India. Nearly 10 million cycles are produced annually as against over 2 million motorized vehicles. As cities grow in size, NMT remains relevant but its role shifts towards shorter lead and feeder services and providing access to public transport motorized transport is capital intensive, import oriented, environmentally hazardous and needs enormous investments in infrastructure. In contrast non-motorized transport which is labor intensive, indigenous, and benign to environment and can do with much lower cost in infrastructure besides its inherent qualities like non-fuel dependent and non-polluting makes it environment friendly and does not put any burden on the exchequer is a far more sustainable transport system.

In the US in early 1970's, bicycling underwent a renaissance and the country faced its first oil crisis, bicycling received a lot of attention not only as an attractive recreational activity, but as a viable commute alternative. USEPA calls them the Transportation Control Measures (TCM). Bicycle and pedestrian programs are one type of transportation control measure (TCM) which can be used to reduce air emissions associated with transportation Each trip shifted from a single occupancy vehicle to a bicycle or to walking results in a 100 percent reduction in vehicle emissions for that trip Bicycling and walking realistically can substitute for relatively short trips which make up approximately 60 percent of all trips (i.e.,

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generally less than five miles in length)Although the amount of saved vehicle miles traveled (VMT) may be small, the air emissions benefits can be quite large because cold start and hot soak emissions comprise a large proportion of emissions from a vehicle trip According to USEPA cold start and hot soak trip-end emissions comprise 75 percent of a 5-mile auto trip, 61 percent of a 10-mile trip, and 45 percent of a 20-mile trip of the vehicles total emissions

Continuous improvement of pedestrian, bicycle and such other facilities assures the NMT users about government sincerity in its promotion. Delhi had a Master Plan 2001 covering 20 years period, accordingly to which a network of 5 major cycle paths should have been in position by 2001. But not a start has been made yet.

A flyover costs approximately Rs.30 crores and achieves precious little. This amount may suffice to provide a cycle track network for whole of Delhi urban area. The plans must include adequate network, parking and other ground facilities for non-motorized modes. In Delhi 57% of the journeys are estimated to be within 5 kms, which can ideally be covered by NMT. Considering that average speeds of even motorized transport hardly exceed 15 km/h in Indian towns, time saving has little significance over distances upto 5 km.

Compact Land Use Arrangements

The development of neighbourhood with compact land use arrangements with education, shopping and business located within acceptable distance for walking and bicycling should be a strategy. Also in this process the walking and bicycle facilities must be separated from motorized traffic to provide additional safety.

City size and its economic base are observed to have an appreciable impact upon the supply levels, spatial coverage, content and composition of intermediate public transport operation. Large metropolitan cities having organised public bus services exhibit localised use of the manually operated modes. In contrast to the above the manually operated IPT modes provide a wider coverage in small and medium sized cities. The level of intermixing of motorized and non-motorized modes in Indian cities is usually determined by human haulage, prevailing road network conditions and the level of public transport supply. However, it is common to observe considerably high volumes of cycles and cycle rickshaw operations even in metropolitan cities.

Most Indian cities, especially small and medium sized, have an extremely low area allocated for roads. Moreover, a large proportion of the road network is unsatisfactory in geometrics,

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riding quality and traffic regulations, thus leaving extremely limited routes and options for meeting the travel needs. The concentration of demand along a few selected corridors provides an ideal climate for IPT operations. NMT modes on account of their manoeuvrability in congested and poorly regulated traffic conditions offer a better level of personalised service to road users and are thus in certain cities / areas have become the main mode of travel.

Mass Rapid Transit System (MRTS) has become operational recently in Delhi. Land use in the proximity of metro stations need to be restructured for enhanced ridership of MRTS. Compact land use development along metro corridors shall be useful for the patronage of NMT modes, since they can act as affordable feeder service for the public transport system.

Restraints on Motorized Traffic

Restraining motorized traffic indirectly provides priority and preference to NMT modes in the traffic system operation. Through transportation system Management (TSM) techniques entry to congested areas and central business districts by motorized modes should be restricted permitting only public transport modes and non motorized modes. The motorized private modes should be taxed by way of road user charges and parking fee in the congested areas. Many case studies support this opinion that restriction on auto usage boosts patronage of walking, bicycling, rickshaw usage etc. In a project to promote better environmental quality around Taj Mahal (One of the Seven Wonders of the World situated in Agra, India) motorised traffic has been banned on all the approaches to this monument. At the same time battery operated buses, sufficient vehicle parking spaces, space for walking, bicycling has been developed around the monument to provide alternative modes of transportation. A careful mix of policies has been useful in promoting NMT around Taj Mahal. Implications of the above measures are quite conspicuous and resulted in pleasant walking experience around this heritage site.

In Indian Institute of Technology, Roorkee students are encouraged to use the NMT modes by not allowing them to keep motorised vehicles in the campus. It has gone a long way in keeping the accidents and environmental pollution at bay in the campus. Besides, it inculcates an affinity to use these modes. These examples can be replicated in other academic institutions.

Incentives to non-motorized users and disincentives for personalised motorized modes users

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can be worked out and implemented. These could be in the form of restricted access to motorized modes and closely located parking spaces for NMT modes.

Coherent Fare Policy

The NMT modes in India don't have a fare structure evolved by any designated authority as the other motorised IPT modes and public transport modes have. Therefore they tend to charge arbitrarily and indulging in haggling practices. This sometimes makes the users reluctant to use this mode. There is a need to evolve a fixed fare structure provided by local administration to avoid all these encumbrances and make the users feel that cycle rickshaw is also a conventional mode of transport.

CONCLUSIONS

Urban population in India is growing at a very rapid rate. Added to this the liberalization of economy has contributed to accelerated growth of socio-economic standards of urban residents. The result is increased demand for travel and this in turn requires transport infrastructure for smooth and efficient flow of traffic. Increasing number of metropolitan cities in the country has led towards huge financial requirements for improving urban transport infrastructure. Delhi, the national capital has witnessed unprecedented growth in automobiles. Last decade has witnessed a number of mega projects executed successfully. But still there is not much improvement in the overall transport scenario. There is a need to experiment with innovative ideas that can lead towards sustainable transport development. Approaches that can minimize energy losses, enhance patronage of public transport and promote non motorized modes can pay great dividends in the longer run.

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