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Research Paper

Low Carbon Transportation System for Indian Cities

Engineering

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ABSTRACT

This paper endeavours to illuminate the challenges and issues that need to be addressed to achieve sustainable urban transportation system in Indian cities. This paper will try to trace pattern of urbanization, motorization and their impact on mobility, environment and road safety. Further, the paper will explainvarious efforts taken by government authorities to address the transportation issues and there outcomes. The paper also explains various Transport Demand Management strategies which if be adopted will ensure low carbon growth of urban areas. Low carbon cities will help in enhancing India's energy security and lower its carbon footprint.

Introduction:

India is experiencing the phenomenon of rapid urbanization as it is transforming from traditional rural economies to modern industrial one. Level of urbanization has increased from 27.81% in 2001 to 31.16% in 2011 (Census of India, 2011). Urbanization has an overall positive impact on growth rate of economy. The top 100 largest cities are estimated to produce about 43% of the GDP, with 16% of the population and just 0.24% of the land area (Indian Institute for Human Settlements, 2011).

The pattern of urbanization in India is characterized by continuous concentration of population and higher order activities in large cities (Kundu, 1983). Indian urbanization is often termed as pseudo urbanization(Breese, 1969) or over-urbanization (Kingsley & Golden, 1954)where in people arrives in cities not due to urban pull but due to rural push.

Indian urbanization has displayed remarkable and selective growth of cities. This fast-paced growth has also produced an urban crisis, which is marked by the lack of growth management and adequate infrastructure. The economic prosperity of cities has far outstripped its urban infrastructure. The poverty led migration (Sen & Ghosh, 1993) has induced very poor quality of urbanization and has resulted in urban sprawl.

Urban Sprawl has lead to horizontal expansion of cities leading to wild land – urban interface. The wild land – urban interface has caused large scale deforestation leading to reduction in rain water absorption, loss of traditional land practices, agricultural and forestry jobs. The horizontal expansion of cities is exerting tremendous pressure on existing transportation system leading to frequent congestion, increase in travel time, traffic accident, and sound&air pollution.

Transportation System in Indian cities

The road networks in most of the Indian cities are based on notional hierarchy of roads, ranging from arterial roads designed to carry long distance and fast through traffic to local streets providing access to properties.

Unfortunately the existing road systems do not cater to the needs of bicycles, pedestrians or any other slow moving traffic. The contribution of the NMV (Non-Motorized Vehicles) to the transportation system of the city is ignored therefore no provision has been made for their dedicated lane and parking.As a result slow and fast mode users have to share the same carriageway.

The intermixing of modes of different speeds causes traffic accidents, congestion and reduction in travel speed. Though de facto segregation, NMV uses the left side of the road whichotherwise is used by buses and hence buses are compelled to stop in the middle lane at bus stops, disrupting the smooth flow of traffic in other lanes and rendering NMV vulnerable.

Pedestrians have to contend with narrow pavements which are often made narrower for road widening to reduce the congestion for motorized traffic. The presence of utilities poles, illegal car parking, litter bins and commercial waste creates obstruction for pedestrian movements and causes spill over of pedestrians over carriage wayforcing them to interact with fast moving motorized traffic.

Traffic generally crawls during the peak hours at major intersections but during non-peak hours when streets are relatively empty mid-block speeds tend to be much higher ranging from 50-90 km/h for motorized vehicles (Tiwari G. , 2002) leading to higher fatality rates.

Public buses often remain overcrowded and poorly maintained providing a low level of comfort and service. Even if buses carry significant number of passengers, they get no privileged treatment in terms of traffic management or dedicated lanes.

Pedestrians, bus commuters and NMV users form the majority of road users. But their need for a convenient and safe infrastructure remains ignored. In the name of development, authorities plan infrastructure for fast movement of motorized traffic at the cost of NMV's and pedestrians. Police and traffic management experts often propose time and area restrictions on the movement of NMV's. If the urban design does not meet the requirements of the road users then all modes of transport function in sub-optimal conditions.

Efforts taken by authorities to address urban issues

Indian cities have been preparing various Master plans to effectively manage and guide future physical development of the cities. These Master plans are based on the rigid concept of zoning and had weak land use transportation integration. Land use zoning compels people to commute longer distance for every trip purpose because educational, recreational, commercial zones are located away from each other. The net result has led to horizontal expansion of cities and increased commuting distance.

Increasing commuting distance has made people dependent upon motorized mode oftransportation. Rising cost of transportation has seriously impacted the mobility of poor and has restricted their job opportunity. The job opportunity majorly located at city center act as urban pull attracting people at city centre but higher cost of housing pushes them at peri urban areas for living. Increased travel cost and long working hours has compelled works to live next to the factories majorly on roads making them venerable. Violating the law has becomes pre condition for survival in a city(Tiwari G. , 2001).

The unreliable and suboptimal supply of public transport has lead to the proliferation of personalized automobiles especially two wheelers. The total motor population in India has increased from 0.30 million in 1951 to about 73 million in 2004 (Tiwari G. , 2011). The infrastructure development could not commensurate with the increasing number of automobiles.There has been a staggering 100 fold increase in the population of motorized vehicles between 1951to 2004, while the road network has ex-

panded only eight times (Uddin, 2009).

The net effect of inadequate infrastructure resulted in frequent traffic accidents, congestion, traffic grid lock and increasing travel time. In the city traffic environment, the automotive modes are often subjected to frequent acceleration and deceleration in quick succession. The contribution of CO (Carbon Monoxide) from automobilesis significantly higher in accelerating and decelerating condition of the automotive modes. During winter the automobile exhaust forms heavy smog, leads to accidents, respiratory diseases and mass flight cancellations.

India imports 80% of its petroleum requirements, a significant amount of which is used for transportation (Planning Commission, 2011). The transport sector is the second largest contributor of GHG emissions from the energy sector in India. In 2007 the transport sector emitted 142.04 million tons of CO_2e forming 12.9% of total energy sector (Indian Network of Climate Change Assessment, 2010).

Given the condition that petroleum prices are increasing in international markets, importing of petroleum can cause serious damping to the economic growth. In the oil-constrained future, there is need to reduce transport's dependence on petroleum in order to enhance India's energy security and lower its carbon footprint.

Proposals

Various proposals which should be adopted to insure low carbon growth are mentioned below:

Strategy such as Transit Oriented Development (TOD) should be adoptedto ensure Low carbon growth. TOD refers to high rise, high density residential and commercial development around transit stops, designed to maximize access by public transit and Non Motorized Transportation (NMT), and with other features to encourage transit ridership (Renne, 2009). TOD promotes efficient use of land and transportation infrastructure.

Location efficient neighbourhoods is an area which has compact development with walkable streets, access to transit, and a variety of amenities and have lower transportation costs than inefficient ones. People who live in location inefficient places are auto-dependent, have high transportation costs, and are more susceptible to fluctuations in fuel prices. The Housing + Transportation (H+T) Affordability Index is an innovative tool that measures the true affordability of housing based on its location. The H+T Index enables planners and policy makers to distinguish between location-efficient and -inefficient areas (Center for Neighborhood Technology, 2012).

Efficient locations can be used to target investments, incentivize development that will be more sustainable over the long term. The decision makers could expedite permitting and approvals for new construction on vacant lots, permit denser and mixed-use development "by right" in location-efficient areas(Center for Neighborhood Technology, 2012). Denser and compact development will help in reducing VMT and emissions (Benner, 2009). The data base for H+T index should be developed and maintained for all Indian cities.

Pedestrians are most vulnerable road users and this issue has never been properly addressed by civic authorities and policy makers. The existing infrastructure to support pedestrian movement, the most natural sustainable and cheapest mode of transportation is consistently overlooked by both state and central government. Therefore main focus should be stressed on more equitable allocation of road space to people, rather than vehicles by improving walking and cycling infrastructure. The Government should guarantee"right to walk" to safeguard the interest of pedestrians. Street vendors should be given a valid and legal place in the road environment as they foster and provide services to pedestrians, bicyclists and bus users.

Construction of infrastructure such as roads, highways, buildings/places/ transportation systems for public use should comply with the norms laid down by National Policy for People with Disabilities (2006). In addition to it discrimination on the basis of disability in public transportation services, such as city buses and public rail (subways, commuter trains, etc.) should be prohibited (Americans with Disabilities Act of 1990).

Global Positioning System (GPS) device and panic button should be fitted in an auto-rickshaw to ensure a safe journey for commuters, especially women travelling at late hours. The authority should set up a control room to monitor the movement of auto-rickshaws and start "auto-on-call service"' on the lines of radio taxis. This step will help in managing traffic effectively.

Battery operated auto rickshaw should be encouraged and polluting rickshaws should be put off the roads. Buses complying with Bharat Stage III norms and below should be phased out and replaced with Buses complying Bharat Stage IV norms as Buses complying with Bharat Stage III norms are polluting as compare to Buses complying Bharat Stage IV norms.

To meet ever increasing transportation demand of urban population and provide easily accessible, safe and fast mode of transportation, Mass Rapid Transit System (MRTS) projects should be undertaken. Such projects will help in significantly reducing vehicular pollution and travelling time. The MRTS corridor should be densified and mix land use should be promoted along the MRTS corridor. The mix land use and high density development will generate transit ridership/throughput in both the direction throughout the day.

Intelligent transportation systems (ITS) is defined as the application of advanced and emerging technologies (computers, sensors, control, communications, and electronic devices) in transportation to save lives, time, money, energy and the environment (ITS Canada, 2009). ITS should be installed in all the Indian Cities as it will help in achieving fully integrated transportation demand management system, improving safety, efficiency, general mobility and productivity, at the same time reducing threats to travel security and safety as well as the negative effects to the environment such as pollution.

In a bid to reduce traffic during peak hours strategies such as 'congestion pricing' should be introduced in cities. The congestion pricing would encourage people to use public transport and deter them from taking private vehicles to congested areas of cities. This would result in lesser number of vehicles on roads. After levying congestion pricing, traffic in Central London went down by about 21 per cent and the traffic speed went up by about 10 per cent(The New Indian Express, 2014).

Technologies such as Dedicated Short-Range Communications (DSRC) should be deployed to pay Congestion Pricing fee electronically. DSRC provide communications between a vehicle and the roadside in specific locations, for example toll plazas.In case if DSRC system is not in place or if it is not possible to implement congestion pricing then probably be a better option would be to increase tax on fuel in the city to reduce the use of personalized automobiles and invest the funds generated in public transport.

Due to non availability of parking space, automobiles are generally parked road side reducing effective Right of Way (ROW). Therefore automobile sale should be permitted only if the customer has access to parking slots. Additionally, commercial parking should be charged higher to discourage people from using private mode of transpiration and force them to prefer public transportation.

Strategies such as staggering of school and office timings should be adopted to help assist with a safe and orderly commuting. This strategy will reducetraffic congestion and travel time during peak periods hours. The timings of all public mode of transport such as bus, trains, air planes and para transit should be synchronized to provide hassle free seamless travel.

CONCLUSIONS:

If existing roads are redesign by proving equitable allocation of road space to peopleand Transport Demand Management

(TDM) strategies are adopted then safe and convenient environment for pedestrians and non-motorized modes can be ensured. It will also help in reducing dependency on fossil fuel and transportation crises, improve efficiency of public vehicles and enhanced capacity of the corridor. In addition to it, the mobility of socially and economically weaker sections will be greatly enhancedand a sustainable faster inclusive urbanization can be ensured. Further researches should be carried out aiming to transform existing auto oriented development to TOD, TOD then should then be translated into Transit Oriented Corridor (TOC) and later on into Transit Oriented Metropolis (TOM) to achieve low carbon growth for Indian cities.

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