Role of ICT in Mobility

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Abstract—*The Indian economy has been growing steadily at a rapid rate for the past decade and is expected to grow further in the future to emerge as a leader in global economy (World Development Indicators, World Bank) which would, in turn, lead to rapid urbanization. India is just about 30% urbanized and is expected to reach 40% by the year 2040. India is still overwhelmingly un-urbanized, and the quality and success of this urbanization is also in question. It can be concluded that majority of India is still needed to be built as per the futuristic requirements of 2040 – there is a dearth at both fronts, qualitative as well as quantitative. But this scenario is projected to change, and the urban India is predicted to grow rapidly and successfully. Such rapid growth in urban population would lead to increased demand and numerous challenges related to sectors of infrastructure and economic development. Mobility is said to be the backbone of growth of any city and its importance is predicted to increase in future, especially for developing nations like India. Also, ICT (Information, Communication and Technology) as a tool is increasing in importance in urban management to make cities inclusive, smart and environmentally sustainable, so its integration with mobility is inevitable in the emerging scenario. The current paper discusses the issues related to mobility in the Indian Context with a special focus on Gurgaon which is an emerging Indian city with a very high per capita income but a very basic transportation and mobility infrastructure in place to serve the growing populace. Various emerging ICT techniques and solutions, in the field of mobility, shall be analyzed from different parts of the world.*

1. INTRODUCTION

According to recent reports, 31% of the Indian population lives in urban areas which contributes to a massive 63% of the nation's Gross Domestic Product. With projected trends, this would increase to 40% of the urban populace accounting for 75% of the GDP by the year 2040. The current population of India is 1.21 billion which is projected to grow at the rate of 1.5-1.8% per annum. Therefore, the estimated population of the country in the year 2040 will be in the range of 1.5-1.7 billion.

Rapidly growing urban population together with the increasing economic activities and expanding city boundaries, have increased the demand for mobility – more efficient and more effective. This rapid increase in passenger mobility demand in Indian cities have not been matched by an equivalent increase in the supply side of the provisions for transport infrastructure and services, thus failing to achieve the standards of economic and environmental efficiency that would be desirable in the opinion of the experts, as well as by their citizens and institutions. Mobility can be critically analyzed in terms of speed, growing traffic congestion, travel time, road accidents, and pollution; and most important of all - high dependence on fossil energy.

Increase in congestion on roads, escalation in the number of road accidents, increasing threat to safety and security, and the ever worsening scenario of global warming and climate change requires a comprehensive and integrated solution. Building more roads can serve only as a temporary reprieve from congestion and it will never be a long-term solution as by providing more roads problems have only multiplied. Building additional roads all across the length and breadth of the city may only be a piecemeal solution, which unfortunately, is happening in most Indian cities. The problem seems to be not with the infrastructure in place, but in the inefficient way it is being utilized. Here comes the role of ICT – enhancing the efficacy of usage, especially in an emerging country like India which is growing digitally by leaps and bounds.

2. MOBILITY

"Mobility is not simply one mode that moves a person or goods from A to B. It is much more interesting and useful than that. It is a system, or rather a 'system of systems' connecting modes, services, technologies and designs according to the best option for the purpose."[1]

2.1 Indian scenario

An analysis of the road safety scenario in the country throws some deeply disturbing numbers and unfortunately, the trend seems to be on a rise. India witnesses the highest number of deaths due to road accidents, with more than 1.4 lakhs lives being lost due to road fatalities in the year 2012 (Ministry of

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1 Susan Zielinski, managing director, SMART, University of Michigan

Urban Development, Govt. of India). It means one person dies on one of the roads in India every 10 minutes.
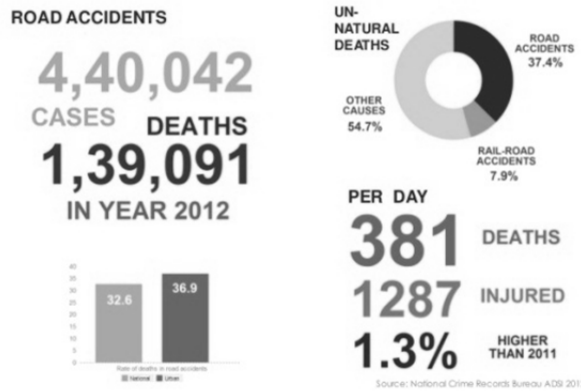

Fig. 1: Road accidents in India

According to the MoUD, the average journey speed on important city corridors in the country, is in the range of 17–26 kmph, which is considerably lower than their intended designed speeds and the average congestion index in India on a scale of 0–0.6 is a lowly 0.25, where '0' indicates good and '0.6' indicates poor index value; which indicates a severe problem of congestion. Two major cities of India, Bangalore and New Delhi rank in top 10 cities in 'Commuter Pain Index' as shown in Fig. 2.
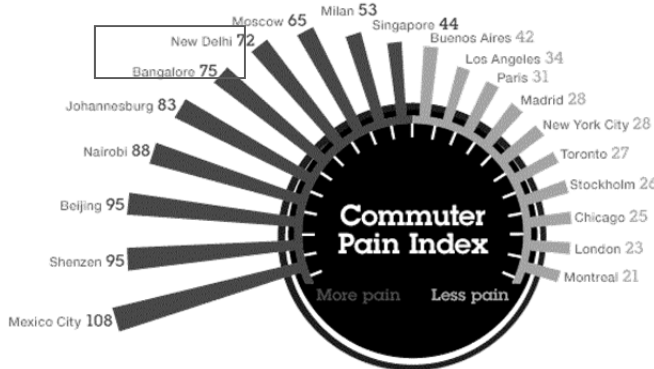

Fig. 2: Commuter Pain Index

If we consider the current scenario of the distribution of sector-wise carbon emissions, it can be observed that the transport sector has a dominant share of 26% of total carbon emissions as compared to other sectors. Also, within the emissions from the transport sector, road transport has an overwhelming majority share of 65%, much more as compared to other modes of transportation – rail, air and water.[2]

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[2]Discussion Paper 2011-18: Geetam Tiwari – ©OECD/ITF 2011

2.2 Gurgaon

Gurgaon is emerging as leading Information Technology hub in India and a sought after destination for upcoming and young professionals. With the emerging job opportunities, problems related to infrastructure and civic life are also on the upsurge in the city and mobility, in specific, is one of the pressing issues in city. Public transportation share in the total traffic volume of the city is just 10%, while the personal vehicles comprise 60%, for smaller trips up to 7 Km, which leads to chronic congestion and chaos on roads. Gurgaon faces challenges with regards to deficient public transport, traffic congestion, deteriorating roads and pollution (Fig. 3).

Fig. 3: News clipping showing problem of congestion and jams in Gurgaon

Gurgaon has most road accidents in Haryana
In 2014, 716 accidents took place on the highways in the district. Of these 257 were fatal.
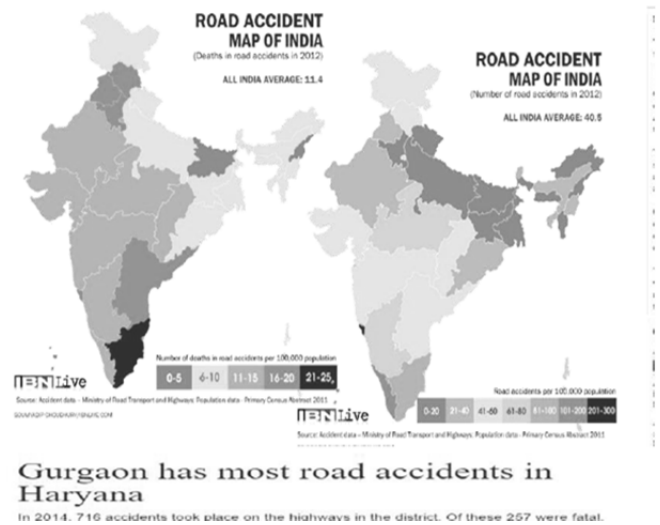
Fig. 4: News clipping regarding accidents in Gurgaon

From the maps shown in Fig. 4 it can be observed that though the number of road accidents in Gurgaon is lesser than some even worse Indian cities, the nature of accidents in Gurgaon is

generally lethal, as the number of deaths is higher. This adds another dimension to the complexity of the nature of intervention that might be needed in Gurgaon or similar cities. It is evident, though, that usage of private vehicles is very high in Gurgaon which leads to high congestions and accidents in the area. To overcome all these problem it is imperative to deal with the mobility of Gurgaon.

3. ICT (INFORMATION, COMMUNICATION & TECHNOLOGY

"ICT ... is the technology required for information processing, in particular, the use of electronic computers, communication devices and software applications to convert, store, protect, process, transmit and retrieve information from anywhere, anytime.[3]

The OECD (organization for Economic Co-operation and Development) defines the ICT sector as a combination of manufacturing and services industries that capture transmit and display data and information electronically.

Four key aspects should be used in the field of ICT sector:

- **Awareness** - People must know what can be done with ICT as a tool and also, they must be open to using ICT.
- **Availability** – ICT must be offered within reasonable proximity, with appropriate hardware/software.
- **Accessibility** - relates to the ability to use the ICT (spanning literacy, e-literacy, language, interfaces, etc.).
- **Affordability** - Technology should not be expensive or heavily priced considering the income of the users (under 10% maximum on average)[4]

3.1 Emerging scenario

With increasing urbanization, the number of users of cell phones and internet is also on the rise (Fig. 5 and Fig. 6). Communication has gone on to become almost as important for people as food and clothing. The users of cellphones have increased to almost 900 million and that of the internet users has increased to 243 million in 2014. It is worth noting that within past 3 to 4 years it has increased by 80 – 100 million as shown in Fig. 7, and the trend is expected to grow further. So, to tackle the pace of emerging problems with urbanization ICT can be an important tool as mobile and internet usage can be harnessed to improve upon ICT applications, by using the concepts like Big Data analysis etc.
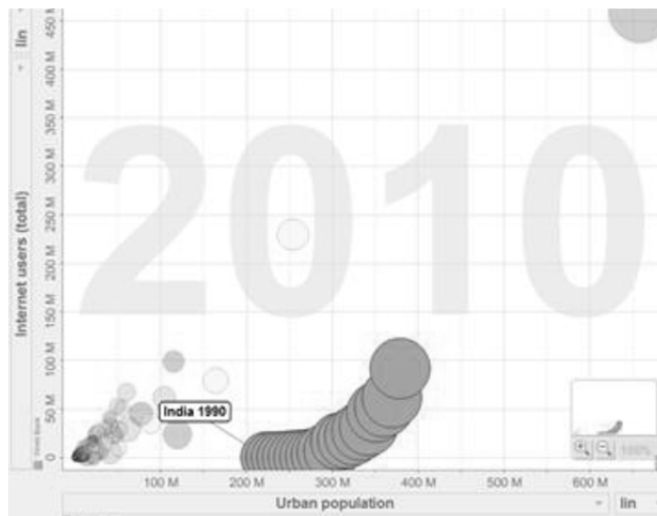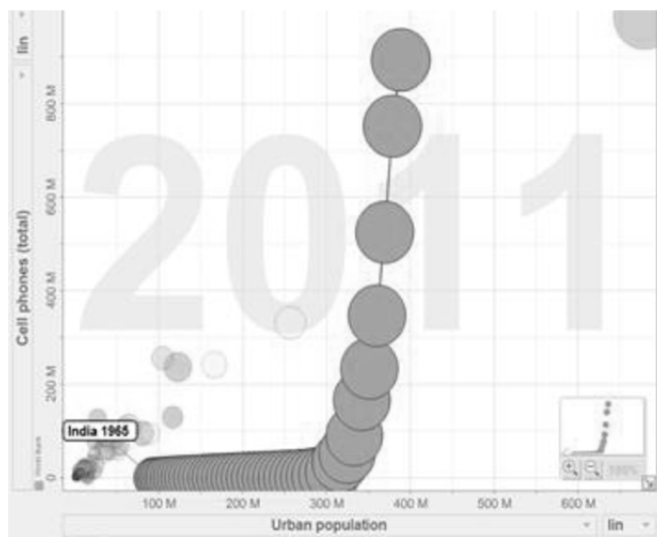

Fig. 5: Increase in number of internet users

Fig. 6: Increase in number of cellphone users.

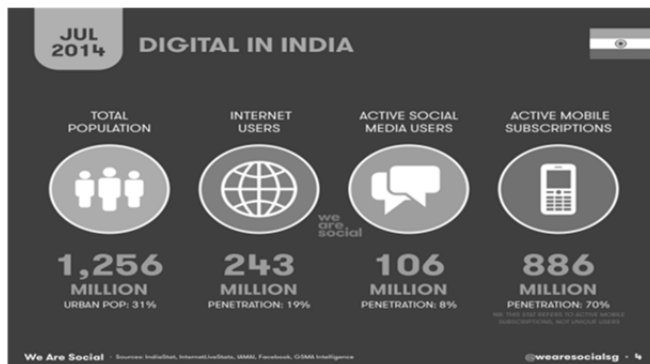(*Source*: Author, using Gap minder software)

Fig. 7: Statistics showing internet and cell phone users in 2014

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[3] Information & Communication Technology Sector Strategy Paper of the World Bank Group, April 2002.
[4] Sustainable ICT for Emerging Economic: Myfootogy and Realty of the Digital Divide Problem - A Diccvccion More (2004). Raj Redcty. V. S. Arunachalam. Rahul Tongia. Eswaran Subrahmanian. and N. Balakrishnan.

The latest initiative of the Indian government - "Digital India", which aims to transform India into a digitally empowered smart society, endorses the need of technology and communication in the society. As per a research survey conducted by the Economic Intelligence Unit sponsored by Siemens, some 74% of citizens globally claim that they would likely change their lifestyle habits if their access to information about their own usage improved and 67% people acknowledged that ICT solutions are known to be effective.

3.2 Functions of ICT

Information, Communication and Technology in the field of transportation have two aspects of Travel Demand and Travel Management, as shown in Fig. 8.
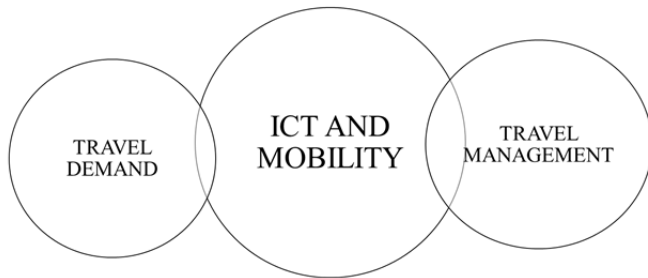

Fig. 8: Broad classification of ICT in sector of Mobility

With increasing urbanization, demand of transportation facilities are increasing rapidly but the existing public transportation systems are not capable enough to withstand this massive demand, which leads to the excessive reliance on private vehicles. Travel demand includes the facilities which promote public transportation and encourage people to shift their mode from private to public.

To promote and implement facilities it is necessary to create awareness among the public regarding ICT facilities for eg. Routes, timings of public transportation, automated reservation and payment system, parking facilities, online parking booking, on demand travel facilities etc. Considering all these points we can further categorize travel demand into further parts as shown in Fig. 9.

In case of travel demand, creating awareness amongst people is a very important step and Government policies and agencies may play a pivotal role in this. Car-free days, using bicycle and car-pooling days, free pollution check and vehicle inspection days, film festivals promoting public and alternate mode of transportation, free-public-transport days, and media attention are very important aspects in the process of creating awareness.
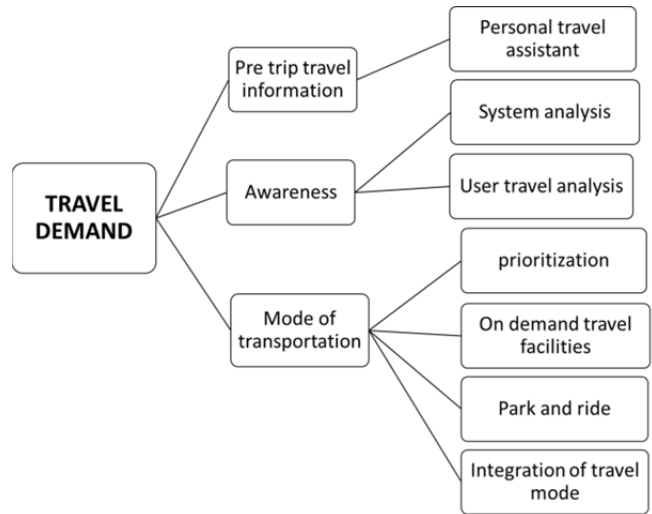

Fig. 9: Classification of travel demand

Second phase in providing efficient mobility is the management of travel of commuters which includes all the facilities to make the trip more efficient, safe and reliable. Travel management can be further divided into 5 sub categories as shown in Fig. 10.
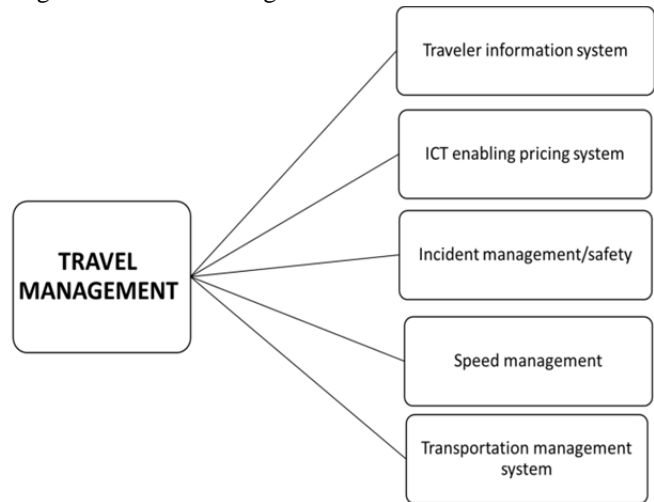

Fig. 10: Classification of travel management

Further we can categorize these categories into subcategories associating it with various techniques as shown in Fig. 11 and Fig. 12.
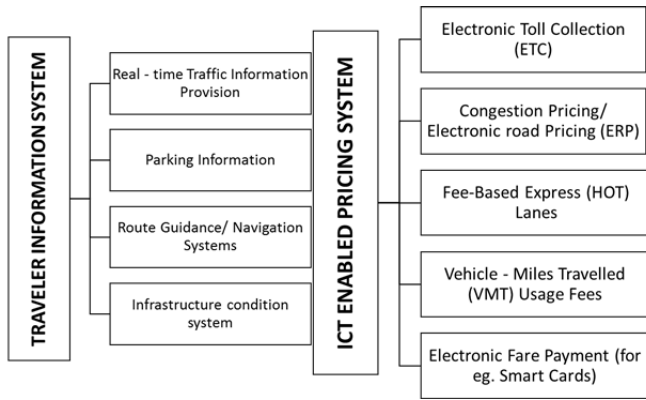
Fig. 11: Subcategorization of travel management categories. (Source: IVHS America)
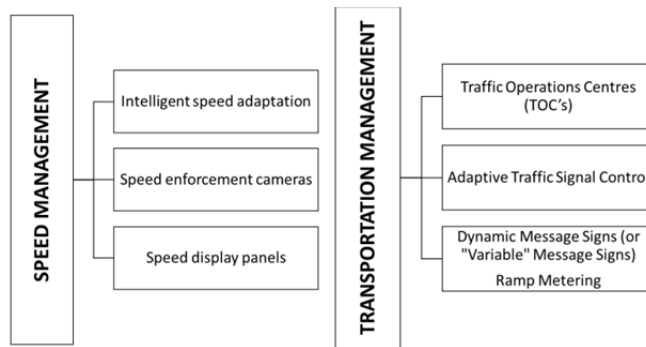

Fig. 12: Sub categorization of travel management categories. (Source: IVHS America)

4. EXEMPLAR STUDIES

Many countries have adopted use of ICT in sector of mobility and various successful examples can be seen around the world in this sector. Hong Kong stands first in mobility index chart created by Arthur. D. Little.

Hong Kong has a total of 12 million trips on daily basis but only 10% of trips are through cars and 90 % is through public transport. Car ownership is very low in Hong Kong. It had adopted usage of ICT in mobility sectors many years ago and now it has succeeded in connecting all his public transport facilities through ICT and make people adaptive to all the facilities.

It has a **"HONG KONG E-TRANSPORT"** mobile application which make the people aware about all public transportation in terms of the routes display, traffic congestion, shortest possible route, travel time, distance, CCTV snapshots, on street parking spaces, real time navigation and all. Other than this it has 18000 electronic parking meters and OCTOPUS card launched in September 1997 which is a smart card used everywhere for ridesharing payment, metro payment, super store payment etc. They have a centralized data warehouse known as Transport Information System (TIS) in which they

collect the data, process it and then disseminate the comprehensive transport information. Red light cameras and speed enforcement cameras were introduced in Hong Kong in 1993 and 1999 respectively. Number of red light jumping cases at these sites was substantially reduced by about 43% to 55% [5]

Speed light panels are provided along the highways and main streets which gather and analyses real time traffic information and estimated journey times along with the speed of traffic and congestion degree with different colour codes such as red for highly congested traffic with very slow traffic, amber showing slow traffic and green showing smooth traffic as shown in Fig. 13.

Over these provision of CCTV cameras throughout the city of Hong Kong by the government with automatic toll collection facility and journey time indicator systems throughout the city.

Fig. 13: Speed map display panels (Source: Transport department, Hong Kong)

The most interesting ICT application in Hong Kong is ELECTRONIC AUDIBLE TRAFFIC SIGNAL (ATS).

This application makes the visually impaired persons (VIPs) aware about the prevailing pedestrian signals states at the junctions and crossings as shown in Fig. 14. This facility is capable of working under ambient noise conditions, it increases its volume as per the noisy environment.

Fig. 14: Electronic audible traffic signal system

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[5] td.gov.hk

Singapore also stands in top 10 in the mobility index chart. It has two very interesting applications. First one is GREEN MAN +**,** this is for elderly people or for all those who need more time for crossing the signals. This application provide 13 seconds more of green light for crossing and second is **"YOUR SPEED SIGN"** displays installed at frequent intervals. It is basically an electronic device which display the real speed of vehicle and alert drivers if they are speeding as shown in Fig. 15.

In European countries as well there are many examples showing the success stories of ICT sector in mobility. The world's first touch and sound atlas of its public transport network is developed by France to enable all the segments of people participation in in local transportation services.
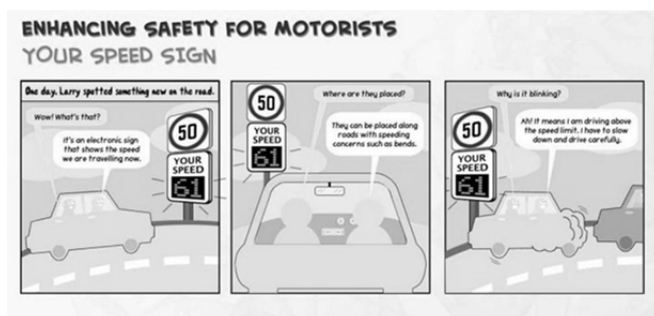

Fig. 15: Your speed sign displays in Singapore

To reduce congestion and overcrowding congestion charges scheme was adopted by London in February 2003 and it led to 20 % reduction of 4 wheelers in charging zone. Due to dramatic increase in car ownership and usuage Prague provide PARK & RIDE facilities near all the public transport points and electronic signage are provided throughout to inform about the location of these facilities, their distance and timing of next public transport mode into the city.

Amsterdam is also working very efficiently in this sector. It has smart app for booking parking space in advance and decrease the time looking for parking space and an app known as STREET BUMP which detect the potholes, untrimmed trees, broken street lights and pavement issue and report to local government for repair and management. In Amsterdam sustainable fuel pumps are installed at every petrol pump known as ORANGEGAS to tackle the increasing environmental problems.

In order to organize parking facilities Belgrade administration has installed display panels along the parking spaces which display the vacant slot save the time looking for parking space and as well the fuel.

WEEKLY NO DRIVING DAY PROGRAM is a very interesting step is taken by Seoul government in 2003. Under this scheme citizens have to refrain from driving their cars once in a week and different incentives in terms of free parking, discounted petrol etc is given to citizens in return to this. Since July 2003, this scheme has reduced the congestion, improved air quality of Seoul. Under this scheme every year 2 million cars out of 9.8 million population stay away from road which is a very amazing achievement from such a simple initiative.

5. CONCLUSION

A holistic and visionary approach is the requirement of 21st century to improve public transport system and integrating different modes for facilitating seamless journey and a shift towards public transportation. Very small initiatives such as congestion charges and speed sign displays can be very effective techniques. As per Singapore transportation department 72% of motorist surveyed claim that YSS is very helpful in controlling speed and also help in avoiding road accident which is the major concern in India. On success plot of congestion charges in LONDON, Chennai also adopted the same in 2015 which is a great initiative to proceed.

In developing countries like India, lower-cost activities and small government initiatives such as car free days, free public transportation days are likely to be more feasible and constructive. Every major city in India have population over millions like Seoul so initiatives like weekly no driving day or free public transport days can be very effective in decreasing traffic from the roads in Indian scenario.

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