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October 2013

SHELTER



THEME **URBAN MOBILITY**

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The mobility pattern of each city is different and so are their solutions. For small and medium towns, where most of the trips are still being made by walk or NMT, provisions of planning could include cycle tracks and pedestrian networks. For large cities, which has long trips, there needs to be a dedicated transport system that integrates various modes. To effectively coordinate the interaction of various modes and their integration, a city level transport authority is needed. The authority will have to work on measures like traffic calming, together with attempting to maximize the transition of commuters from motorized modes of transport to non-motorised modes and public transport.

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FROM THE CHIEF EDITOR

The United Nations has designated the first Monday of October every year as World Habitat Day. The purpose of World Habitat Day is to reflect on the state of our towns and cities and the basic right of all to adequate shelter. It is also intended to remind the world that we all have responsibility to shape the future of our cities and towns.

This year, the United Nations chose the theme Urban Mobility because mobility and access to goods and services is essential to the efficient functioning of our cities and towns as they expand. Accessible cities encourage a shift towards more sustainable modes of transportation and draw more and more travellers out of cars and onto trains, buses, bike paths, and sidewalks. But mobility is about more than just the mode of transport we use. Urban planning and design should focus on how to bring people and places together, by creating cities that focus on accessibility, and optimal urban densities, rather than simply increasing the length of urban transport infrastructure.

The invention of the wheel represented a major turning point in human civilization. The first wheels, disks carved from solid wood, may have been built as early as 3500 BC. The earliest use of this device was the potter's wheel, used to spin and shape clay pottery. It was not long before the true potential of the wheel was discovered, and wheeled carts soon replaced the sledge as a means of transportation. By using the wheel, mankind gained the ability to work more efficiently and travel more quickly. Unfortunately, the wheel is in discussion again, but for wrong reason. It has become the leading cause of death for young people aged 15-29, globally. As per World Health Organisation (WHO), more than a million people die each year on World's roads and the cost of dealing with the consequences of these road traffic crashes runs to billions of dollars. Road traffic injuries rank eight amongst the leading causes of death globally and trends suggest that by 2030 it will reach the fifth rank.

In 2010, the United Nations General Assembly unanimously adopted a resolution calling 2011-20 as 'Decade of Action for Road Safety'. The goal of the Decade (2011-20) is to stabilize and reduce the increasing trend in road traffic fatalities, saving an estimated 5 million lives over the period. Some countries like Sweden is much ahead in this direction. Vision Zero is the Swedish approach to road safety and can be summarised in one sentence: No loss of life is acceptable. It is based on the simple fact that we are human and make mistakes. The road system needs to keep us moving and must be designed to protect us at every turn.

This issue of Shelter has tried to address the subject of urban mobility from various perspectives. The theme paper on Urban Mobility gives an overview of options for achieving sustainability. The article by Dr. Sudeshna Mitra and co-authors, gives an overview of transport diversity and its importance for various sections of the society. Dr. Akshaya Sen advocates the effectiveness of road pricing as a tool to improve urban mobility and Dr. Geetam Tiwari argues on the effectiveness of metro system for Indian Cities. Urban mobility pattern on a city scale have been covered by AK Jain. Parking and environment-friendly modes of transport are covered by JB Kshirsagar & Pawan Kumar; Dr. Kulwant Singh; and Sangeeta Maunav respectively. The role of public transport in urban mobility has been strengthened by Dr. Bhargab Maitra & Subhagit Sadhukhan; and meeting the mobility needs of urban poor in Bengaluru has been documented by EMBARQ. The first hand information on Bus Rapid Transit System is provided in an article by Vijay Anadkat and Amit Bhatt. The driving experience in a cab for women and by women can be documented only by a woman and Sangeeta has been able to bring us its insights.

Hope you enjoy reading this issue of Shelter.

URBANIZATION AND TRANSPORTATION DIVERSITY

SUDESHNA MITRA
PARAG PAREEKH
BANDHAN BANDHU
MAJUMDAR

The present urban transportation system, apart from a few exceptions, largely neglects specific groups such as women, children, elderly citizens, people with disabilities, people from lower income group and students whose transport needs are different from the majority.

For an urban transportation system to function efficiently and equitably, it should be capable of meeting the transport needs of the diverse users constituting urban societies. Perhaps the most crucial factor that cannot be neglected is the fact that diversity keeps a balance in the system, a concept derived from evolutionary biology and used in various spheres of life. The same is equally needed for urban transport solutions to make our cities resilient, sustainable, productive and livable. In this paper, the authors argued for 'Transportation Diversity' as a sustained policy of integrating land-use planning with transport planning & policy, besides successfully implementing various traffic management strategies for sustainable urban mobility.

1.0 BACKGROUND AND INTRODUCTION

Recent decades have witnessed rapid urbanization in developing countries with the phenomenon being most pronounced in China and India. The percentage of urban population in India is projected to rise from 31.3 per cent in 2011 to 42.5 per cent (566 million) by 2025⁽¹⁾. With economic development, urbanization is a natural phenomenon which impacts every major sphere of activities in urban context. However, the impact is most visible for transportation in general and transportation infrastructures of developing countries in particular, due to the fact that with increased economic development demand of motorized personalized transport increases, whereas the infrastructure capacity augmentation does not happen at a similar

rate⁽²⁾. This results in demand-supply mismatch—increasing congestion, travel time and degrading quality of urban environment and livability. This becomes critical with the ever rising urban population and constraints in terms of spatial distribution of land uses, diverse road users belonging to wide range of socio-economic groups with varied affordability for transport options. As a result, a unified motorized transport option is just not suitable for such diverse population which calls for more diverse and creative solutions.

While socioeconomic profile varies widely in cities of developing countries, transport infrastructure and travel options are often not so diverse. For example, dedicated right of way for public transport and for non-motorized transport is grossly missing in urban areas. As a result, interactions between motorized and non-motorized modes are very frequent leading to conflicts, accidents and very high traffic related injuries and fatalities. 'Push' factors, such as travel related accidents and 'Pull' factors, such as increased affordability force users to shift to safer and secured mode and demand for motorized personalized transport increases. However, with the help of well-defined policy and planning strategies, it is possible to meet the needs of various segments of road users in an equitable and

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reconciliatory manner. It is in this context that Transportation Diversity becomes relevant for urban India with due cognizance and recognition to societal diversity in terms of age, gender, income, physical capacity, habits and inclination and economic characteristics. While the concept is not new⁽³⁾, we can say that it is not very popular either, since it is not frequently practiced by urban planners and engineers and probably not in the list of high priorities of many transport planning and policy making agencies. Nevertheless, Transportation Diversity has a key role to play in urban land use and transport planning and is the focus of this article.

2.0 TRANSPORTATION DIVERSITY

According to Litman (2003)⁽³⁾ “Transportation Diversity” may be defined as *“The availability of transportation services in a given situation, in terms of their quantity and quality i.e. at a specific time and at a specific location, considering the users’ needs and abilities”*.

Transportation Diversity can be efficiently described in terms of various attributes such as modes, prices, services and location options⁽³⁾. To put transport diversity in perspective, we may consider the current prevalent state of urban transportation, which by and large is moving towards dependence on personalized motorized traffic. So, improving transport diversity would primarily require improvement of alternative modes, i.e public transit, walking and cycling.

Based on the collective empirical observation from around the world, it can also be concluded that a diversified urban transport planning is required to include all sections of population in an urban context.

3.0 RELEVANCE AND BENEFITS OF TRANSPORTATION DIVERSITY

There is no doubt that urban transport is critically linked with the productivity and quality of urban living— still urban mobility is besieged by chronic congestion, high rates of road traffic injuries and fatalities, transport related emission and air pollution as well as high dependence on fossil fuel. In present day context, it is thus very essential that we understand the perceived benefits that transportation diversity can bring, as identified by Litman (2010) and shown in Table 1.

The importance of the concept can be understood better by examining its relationship with commonly used performance measures such as accessibility, efficiency and safety

with various relevant issues in the context of urban transportation such as land use, demand management and prioritization strategies that are interlinked with these performance measures.

3.1 Accessibility and Transportation Diversity

Accessibility is a term that has a multitude of meanings within the transport profession ranging from the physical access onto a public transport vehicle, the ability to get to a given place, to the accessibility of information about a particular public transport service.⁽⁴⁾ In this context, it is essential to understand that affordability is the key in defining accessibility of urban transport. In addition, accessibility is equally important in terms of physical access to transport modes, especially for elderly and disabled.

3.2 Transportation System Efficiency and Transportation Diversity

The term “efficient” is frequently used to define increased vehicular

Table 1: Perceived benefits from Transportation Diversity^[3]

Benefit	Description
User benefit	It brings to the community a wider range of options and choice to save money, reduce stress, health benefits, provides walkable environment.
Efficiency	Offers room for each mode to function and find its target user thus reducing inter-modal conflict.
Equity	A diverse system helps achieve equity objectives by enabling basic mobility.
Livability	Helps in creating neighborhoods conducive for non-motorized travel, thus contributing to better livability.
Resilience	Systems with diversity tend to consume less energy and resources and so are better placed to respond to unexpected changes and disruptions like fuel price rise, oil shock etc.
Economic development	Reduces cost of travel, optimal use of resources, costs arising from congestion, and resource consumption.



Figure 1: Access to public transport (special need based)^[5]

speed. It assumes that faster traffic always increases overall efficiency⁽³⁾. Transportation Diversity can contribute significantly to make the transportation system efficient by improving operating conditions for both road based and rail based public transport for longer travel distance, and providing infrastructure for non-motorized modes for short distance travel. These diversifications ensure efficiency of each mode by reducing inter-modal conflict and, at the same time, enhancing multi-modal options for urban transport.

3.3 Transportation Diversity and Safety

Transportation diversity has high potential to bring better safety compared to automobile dominated transport system. With mode specific planning, it is possible to

provide conducive and amenable operating conditions for Non-motorized Transport (NMT) users, leading to their safety as pedestrians and bicyclists. NMT users are always over-represented in traffic related injuries and fatalities in urban areas in general and that of developing world in particular. This can be done by providing sidewalks, segregated



Figure 2: Traffic calming measure in portland⁽⁶⁾



Figure 3: Advanced stop line⁽⁷⁾

bicycle lanes, advanced stop lines at signalized intersections, quality markings & signage at crosswalks, dedicated bus lanes etc., to name a few. These measures also restrict road space for private motorized vehicles, thereby reducing their speed and severity of accidents.

In this context, many transportation safety experts conclude that roads that are safe for pedestrians and bicyclists are also safe for motorists⁽⁸⁾.

3.4 Transportation Diversity and Land use

When it comes to land use it is observed that decentralized and suburbanized cities tend to have less diverse transport systems mainly due to the fact that in such urban areas, the automobile seems better suited to answer the call of mobility. In general, reduction in commuting time tends to encourage suburbanization, contributing to urban sprawl. The American origin urban planning tradition of zoning (designating permitted use of land to strictly separated single uses like industrial, commercial, residential etc.) and its replications in different parts of the world which had earlier followed a

mixed land use policy (many Asian cities for instance) is largely responsible for the lion's share of road space and right of way (ROW) that the automobile has come to command. Hence it is very important that in urban planning both land-uses and transport planning should be done in a coherent manner so that suitable transport options are planned simultaneously to a proposed land-use, to meet the transport demand generated by it. In typical Indian contexts, mixed land-use has been a common phenomenon which should be used advantageously to plan for both non-motorized and motorized modes. In such contexts various traffic calming measures should also be used in residential areas. However, shared and dedicated NMT facilities should be planned on urban collectors and arterials.

3.5 Transport Demand Management (TDM) and Transportation Diversity

TDM is a strategic tool to meet the needs of Transportation diversity. Figure-4 shares a very strong relationship with transport diversity

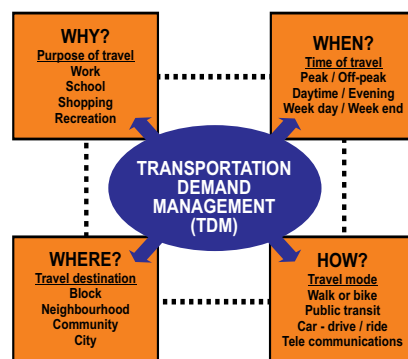


Figure 4: TDM Flow Model⁽⁹⁾



Figure 5: Green Bike Lane in New York City⁽¹⁰⁾



Figure 6: Bus Priority in New South Wales⁽¹¹⁾

and TDM. Some of the measures like implementing HOV lane (High Occupancy Vehicle), HOT (High Occupancy Toll), Road Pricing, Congestion Pricing can ensure basic mobility⁽³⁾. TDM or repackaging travel demand reduces the demand for motorized private travel, reduces traffic congestion, increases mobility, increases road and parking cost savings, promotes consumer savings, increases transport choice, improves efficiency and reduces traffic crashes in addition to its positive impact on environment.

3.6 Prioritization and Transport Diversity

Prioritization refers to strategies to influence transportation policy, planning and programs in order to prioritize allocation of transport resources⁽³⁾. Measures like Road Space Reallocation, Parking Management, Bus Rapid Transit (BRT) (Figure 6), Efficient Pricing (Congestion Pricing, Parking Pricing) are examples of prioritization. Prioritization is also linked with the Green Transportation Hierarchy—a road use hierarchy that favors NMT modes, high-occupancy vehicles, public transit

and service vehicles over single occupant private vehicles in policy and planning decisions.

4.0 POLICY FRAMEWORK IN THE CONTEXT OF TRANSPORTATION DIVERSITY

Transport investment policy and Transportation Diversity share critical linkages. Transport investment policy is the most important determinant of the overall shape of urban transportation systems as it is the policy making bodies that are in charge of all decision making and implementation of major programs and projects in urban areas. Since Transportation Diversity depends upon the formulation and execution of planning and design strategies to promote diversity, its relations with innovative transport policy cannot be overstated.

Table-2 presents various transport related policies and their impact as identified by Litman (2010). Although these policies bring about diversity, it is clear that these policies will also make a transport system sustainable. Hence, it can be concluded that Transportation Diversity would also lead to sustainability.

Table 2: Policies and their impacts on Transport ^[3]

Policies	Impacts
Transit Improvements	Increases motor vehicle speeds.
Car sharing	Reduces congestion
Pedestrian and Cycling Improvements	Improved NMT share
HOV Priority	Repackage the demand efficiently
Parking Management	Ensures safe and secure mobility
Road Pricing (especially HOT lanes)	Discourages automobile dependence

5.0 DISCUSSION AND CONCLUSION

In conclusion, some comparisons and contrasts are being made in the light of Indian urban transport patterns vis-à-vis trends observed in some south east Asian and European cities. McKinsey Global Institute^[12] (2010) claims that on average, the share of public transport in Indian cities has dropped from 40 per cent to 30 per cent between 1994 and 2010— a disturbing trend, considering the importance of public transit in urban India. Predictions by Wilber Smith Associates^[2] (2008) and McKinsey Global Institute^[12] (2010) indicate that private car ownership will continue to increase leading to urban gridlock and acute congestion^[12]. They also predict that peak vehicular densities will reach as high as 610 vehicles per lane km leading to an average journey time during morning peak hour to be as high as 5 hours. This clearly indicates that future of Indian cities is at stake, which is however in stark contrast to trends observed in many urban areas across the globe. For example, Hong Kong leads the world with public transport representing 90 per cent of total modal split in that city. With just 50 cars per 1000 population,

Hong Kong's car ownership rate is among the lowest in the world^[13]. This is strongly related to their good public transport infrastructure that led to high public transport patronage. What makes these trends truly outstanding is the fact that Hong Kong is one of the most densely populated cities in the world with 35000 people per sq. km, but it is still one of world's top economies with top global per capita GDP. The same is true for Singapore, another leader of Asia pacific, which has a modal share of public transport as high as 59 per cent. The transport administration of Singapore aims to increase this figure to 70 per cent by 2020^[14]. They also aim to reduce average public transport journey times from the current 1.8 times to 1.5 times of that by car by 2020 in order to increase the attractiveness of public transport vis-a-vis private car. At 100 cars per 1000 population, Singapore's is among the world's lowest car ownership rates. This is despite the fact that the city state Singapore is among world's leading economies. These urban transport characteristics of both Hong Kong and Singapore can only be attributed to the sustained policy of integrating land-use planning with transport

planning & policy, besides successfully implementing various traffic management strategies.

In cities like Amsterdam, several traffic demand management strategies have been implemented which are aimed at reducing and redirecting personal motorized transport. The combined modal share of non motorized modes (pedestrians and bicyclists) in Amsterdam stands at 54 per cent which is the result of sustained policy to promote and improve transport infrastructure for pedestrians and bicyclists, besides successfully employing traffic demand management strategies to increase the modal share of public transport. In 2009, the city had 35,000 bike racks and 360km of bike lanes, which are being extended further. The city also has a bike-sharing system since 1995 and is currently reforming it. With innovative measures, the city of Copenhagen has reduced car traffic by 6 per cent since 2006. The share of population driving cars to their workplace has fallen from 22 per cent to 16 per cent, whereas the share of commuters by train has risen from 24 per cent to 33 per cent. All these results clearly show how a diversified approach to transport solutions and innovative policies can make tangible difference to any city and make it more livable and sustainable.

In the light of the issues mentioned and discussed in this article, it is clear that for an urban transportation system to function efficiently and equitably, it should be capable of meeting the transport needs of the diverse users constituting urban

societies. Perhaps the most crucial factor that cannot be neglected is the fact that diversity keeps a balance in the system, a concept derived from evolutionary biology and used in various spheres of life. The same is equally needed for urban transport solutions to make our cities resilient, sustainable, productive and livable.

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- It is typed in double space
- All quoted references are written in any of the standardised formats
- All illustrations are drawn in black ink on white paper and the original is sent for publication
- Charts and graphs need to be in MS Office (Word/Excel) and not in 'jpeg' or similar format

All material received will be acknowledged. Those found suitable for publication will appear in subsequent issue of the journal after editing, while those not published will become part of our data base. We try to build a data base on various aspect of human settlement for the benefit of researchers, policy makers and practitioners.

Letters: Readers are encouraged to comment (200 words) on articles published in Shelter.

Book Reviews: Review of books on topics covered in Shelter magazine may be submitted (500 words) for publication.

A CASE FOR ROAD PRICING IN DELHI

AKSHAYA KUMAR SEN

Optimal road tolls would be good for firms, for people, and for the environment. Optimal urban road pricing is likely to increase prices for car use in congested urban conditions which would encourage the car users not to bring their cars on the road and look for alternative transport such as public transport.

The rapid growth of motor vehicles in mega-cities of India owing to increasing pace of urbanisation has resulted in the problems of air pollution, traffic congestion, accidents, noise, health hazards and overall environmental degradation. This is because road users either completely ignore or insufficiently take into account the negative externalities of urban transport while making their travel decisions. This paper builds a case for optimal road pricing based on social marginal cost pricing for correcting identified market failures so as to make urban roads congestion-free and smooth for all road users. The paper underlines the double dividend of urban road pricing: discouraging road use by private vehicles at least at certain times and certain parts of the road network; and transferring cash from private persons to public funds.

1.0 CONTEXT

"I will begin with the proposition that in no other major area are pricing practices so irrational, so out of date, and so conducive to waste as in urban transportation. Resort hotels have off-season rates; theaters charge more on weekends and less for matinees. Telephone calls are cheaper at night... But in transportation, such differentiation as exists is usually perverse." (Prof. William Vickrey, 1963)

Even after 50 years since Professor William Vickrey made the above observation in his celebrated paper on road pricing (1963), the same holds true today. It is generally agreed that saturated and congested urban roads are still a common

sight in most metropolitan cities in India, particularly so in major urban centres like Delhi, despite massive investments in road infrastructure in the form of expansion of road widths, building of flyovers and bridges and expansion of road networks. This observation seems to be in line with Downs' paradox which says that whenever new expressways are built in metropolitan areas, crowded conditions develop quickly when previously suppressed trips are regenerated and daily travelers switch to their private automobiles at desired time of travel. Worse still, when traffic density is high relative to the capacity of a facility, travelers more often than not wind up in a common gluepot in which traffic comes to a virtual standstill during the peak hours.

The rapid pace of urbanization and emergence of mega-cities have resulted in the problems of environmental pollution, traffic congestion, accidents, noise, health hazards and overall environmental degradation resulting from urban transport. Road users either completely ignore or insufficiently take into account these negative externalities while making their travel decisions. These negative externalities are not captured in the transactions of the market for transport services either. Experiments elsewhere show that

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the standard way of solving congestion in the long run, by increasing road capacity via investment in the road infrastructure, seems to induce ever-increasing demand for travel.

When road capacity is relatively fixed, the economic efficient solution is to price the use of roads differentially by setting road tolls/congestion tolls, which reflect the scarce value of road services. Road space is indeed one of the few examples of a good or service, which market forces have left relatively untouched. Since the market fails to promote a social optimum, it is relevant to inquire how these externalities can be mitigated through policy initiatives such as implementation of social marginal cost pricing of road transport and promotion of one mode of road transport at the expense of another. Under ideal circumstances the suggested economic solution to the externality problem is to charge users of all transport modes and services for the marginal social costs, including all external costs, they inflict on society. This induces users to take account of all social costs in making their decisions. Implementation of this first best principle requires full knowledge of all social marginal costs and it has to correctly reflect all the interactions between different transport markets. Moreover, the basic principle has to be adjusted in second-best situations where for technical or political reasons correct pricing of all transport services at their social marginal cost is not feasible. An examination of the practicability and efficiency of social marginal cost pricing in urban road transport has

thus become an important area of policy research.

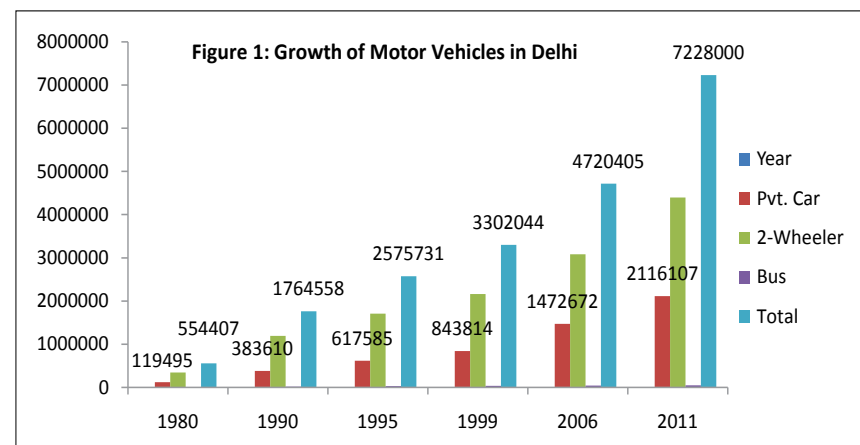
The present paper builds a case for road pricing based on social marginal cost pricing for correcting identified market failures so as to make urban roads congestion-free and smooth for all road users.

2.0 URBAN TRANSPORT SCENARIO IN DELHI

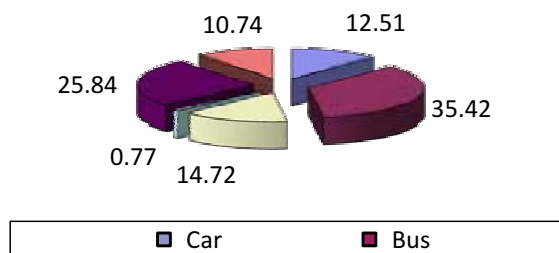
In India, as in other developing countries, urbanization is most evident in the country's metropolitan areas. It is expected that the population of Delhi will grow from 16.75 million in 2011 to 23 million in 2021. Delhi's population has increased eighteen times in a span of last six decades in comparison to the national average of 3.5. The total area of Delhi is 1486 sq. km. with an urban area of about 500 sq. km (RITES, 2005). Delhi has been experiencing a consistently high rate of growth of motor vehicles during the last few decades as is evident from Figure 1.

Over the period 1980 to 2011 the total number of vehicles has multiplied thirteen times. The compound annual growth rate of vehicles in Delhi is about 9 per cent. On an average about 1000 new vehicles are added in Delhi every day, most of them private (Figure-1). Given the rapid pace of urbanization, it is expected that motor vehicles would grow even faster.

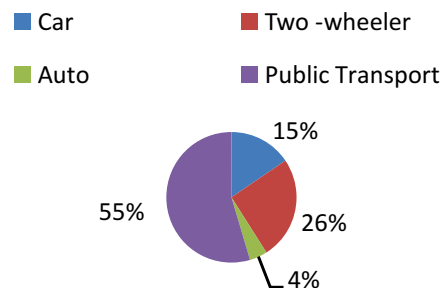
Unlike most Indian cities, the traffic in Delhi comprise predominantly of motorized vehicles. The share of motorised trips is over 63 per cent of the total daily trips. The road space is shared by at least seven different types of vehicles, each with different static and dynamic characteristics. The proportion of fast moving vehicles- especially light & fast vehicles- has increased dramatically over the years. As per a study (TRIPP-IITD, 2000), the share of private car transport in total trips is approximately 12.51 per cent (fig-2) whereas the share of public transport (bus) is 35.42 per cent. The



Source: Delhi Statistical Yearbook; Transport Authority, Delhi & MoRT&H, GoI

Figure-2: Modal Share in Delhi (2000)

Source: TRIPP-IITD, 2000.

Fig - 3: Modal Split in Delhi(2007)

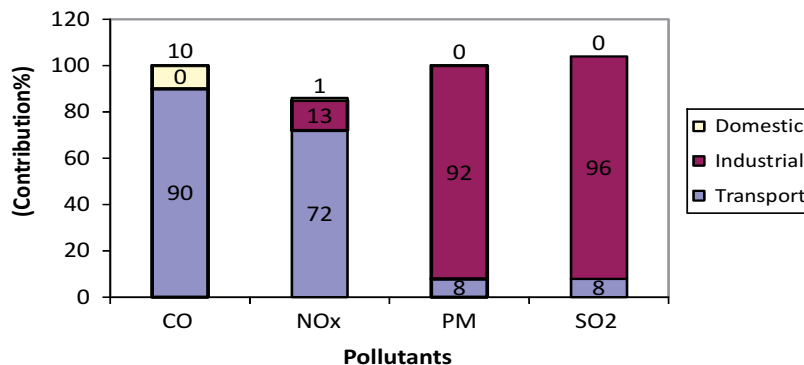
Source: RITES, 2010.

remaining 52.07 per cent are shared by motorised 2-wheelers (14.72 per cent), auto-rickshaws (0.77 per cent), bicycles (25.84 per cent) and walk trips (10.74 per cent).

The dominance of personalised modes of transport has been a characteristic feature of this growth. As can be seen from figures 1 & 2, the share of registered buses in total number of motor vehicles, which cater to about 35.42 per cent of the total passenger travel demand, has been a mere 1 per cent. Even the share of Intermediate Public Transport (IPT) like autos & taxis, as a percentage of the total motor vehicles, has gone down from 4.3 per cent in 1985 to 3.3 per cent in 2004. Average speed of a car in peak hours is reduced to less than 24 kmph, while the same for bus transport to 21 kmph. On average, per capita trip rate per day in Delhi Urban Agglomeration is 0.7816 without walk trips and 1.139 with walk trips. The average trip length of all motorised vehicles has also increased over the years adding to the congestion on the roads.

As per a Study by RITES in 2010, the modal split among the motorised average daily trips of 11670629 in 2007 was as follows: public transport 54.6 per cent; two-wheelers 25.5 per cent; car 15.5 per cent; and auto 4.4 per cent (fig-3). RITES projects that the share of car would increase to 17.1 per cent by 2021 whereas the share of public transport would increase to 59.7 per cent by 2010. This reiterates the fact that if appropriate steps are not taken now, urban mobility would pose a greater challenge in years to come.

The rapid urbanisation in Delhi, together with industry and transport, has resulted in an equally rapid increase in urban air pollution. Major motorized modes of transport like buses, cars, auto rickshaws, trucks and scooter/ motorcycles are major contributors of air pollution. The use of poor quality fuel (e.g. coal with high sulphur content and leaded gasoline till recently), inefficient methods of energy production and use, poor condition of automobiles and roads, and traffic congestion are major causes of increasing airborne

Figure - 4 Contribution of Various Sectors to Air Pollution

Source: Govt. of India (2003), Auto Fuel Policy Report.

emissions of sulphur dioxide (SO_2), oxides of nitrogen (NO_x), carbon dioxide (CO_2), suspended particulate matter (SPM), lead (Pb), carbon monoxide (CO) and ozone.

In a city like Delhi, even after many years of efforts to reduce pollution from motor vehicles, road transport is responsible for 60 per cent of the total urban air pollution (Govt. of India, 2003). Figure-4 shows that road transport alone is responsible for 90 per cent of carbon monoxide (CO) and 72 per cent of total NO_x emission. CO_2 contributes the maximum, i.e. 62 per cent of the total pollution which is due to vehicular emissions.

The increasing vehicle population on Delhi roads has also raised the noise levels in Delhi which vary from 54 dB(A) to 84.6 dB(A). In addition to causing ill health effects, noise from roads leads to reductions in property values. Road accidents are also on rise in Delhi despite growth in traffic management. The deaths on Delhi road have increased from about 500 in early 1970s to over 2000 in 1990s and to 2325 in 2009 as per Delhi Traffic Police data. The main victims are the pedestrians whose share among the deaths on Delhi roads is 50 per cent, although their share in total traffic flow is only 10.74 per cent.

3.0 A CASE FOR ROAD PRICING

The negative effects of urban transport in terms of congestion, air pollution, noise, accidents, etc., call for an efficient and optimal road

pricing is needed in India, particularly in metropolitan cities like Delhi where the problem is severe. Optimal road tolls would be good for firms, for people, and for the environment. The money raised could be spent in useful ways – such as improving public transport, reducing other taxes etc.

The argument for optimal road pricing is simple. Imagine what would happen if Kendriya Bhandars and Shopping Malls give away their products for free or nearly free. During long periods of the day, there would be enormous queues outside Kendriya Bhandars and Shopping Malls. People would have to get up early and allocate time in their diaries just to be able to reach the malls to grab these goods. It would be no use building wider front doors to these Kendriya Bhandars or Shopping Malls (the let's-build-more-roads approach), or having special approaches that only certain kinds of people could use (the bus-lane approach). As soon as the queue starts to shorten, other consumers would notice and come to the new wide-entrance Kendriya Bhandars or Shopping Malls. Dealing with the queues would be a difficult proposition for the Mall's management. The Kendriya Bhandars or Shopping Malls would be better advised to put appropriate prices on their goods so that persons who are able to pay for the goods can only enter the outlets. This hypothetical situation is an illustration of various regulatory and economic principles of urban

transport management and it works well.

Queues happen when a demand-and-supply mechanism fails. Economists know that using the pricing system to ration things is the most sensible and effective way. It is especially necessary on roads because drivers do not bear in mind, when they make a journey, that their presence on the road creates an 'externality' for others. The affect of traffic congestion, especially on highly skilled workers, has not been suitably realized. Probably more than half of all skilled workforces in Delhi spend more than 3 hours a day traveling to and fro from work, on a normal working day. The hours spent on road increases considerably if it happens to be a rainy day or if there is a breakdown of vehicle on the road, which is very common in Delhi. This is a waste of people's productivity, it wrecks marriages, and increases road rage and stress-related illnesses. Optimal road pricing is a widely acclaimed tool which can make our roads run freely and smoothly again.

Although exact calculations are subject to any number of quantifications and uncertainties, it is quite clear that motor vehicles in Delhi almost certainly impose very large social costs, most of which drivers do not shoulder. In a study, Sen (2007) demonstrated that the current pricing system in Delhi is inefficient and different transport services are grossly under-priced. As per his study, the generalised price including the marginal social

cost for driving a small petrol car driven alone during peak hours on Delhi road was estimated to be Rs. 14.30 per kilometer, where as the actual price being paid was Rs. 6.70 per kilometer. The pricing is inefficient because of mainly two key reasons directly related to the transport sector: First, the resource cost of parking is not charged to the drivers, which results in inefficiently and high demand for transport; and second, transport pricing is below social costs, including marginal external costs that accrue to the society.

There is, therefore, a strong case for optimal pricing of urban road transport based on the principles of Marginal Social Cost. It is fair that those who enjoy the benefits of motor vehicle should pay for the costs of that use directly. It is expected that optimal urban transport pricing measures would generate three important impacts: (a) Impacts on the transport system itself, assessed in terms of transport service performance (accessibility, speed, reliability, safety, modal split, congestion, efficiency); (b) Impacts on environment and health, assessed through the monitoring of air quality, noise levels, accidents for which transport is responsible; (c) Impacts on the economy and society as a whole, which can be estimated through the assessment of the welfare effects of pricing policies.

4.0 MISLEADING OBJECTIONS TO ROAD PRICING

There are various misleading objec-

tions to optimal road pricing some of which are as under:

1. The most common claim is that optimal road tolls would increase cost of travel of general public as well as firms, by making them pay extra charges. This is not true. Optimal road tolls would be good for firms, for people, and for the environment. Optimal urban road pricing is likely to increase prices for car use in congested urban conditions which would encourage the car users not to bring their cars on the road and look for alternative transport such as public transport. Public transport will become more competitive. As a result of optimal pricing less time will be wasted in congestion, there will be fewer accidents and the quality of the environment will improve making the transport system more efficient and the society better-off. Road pricing would also make life cheaper for firms in India. Tolls would be set at the right level to make traffic flow freely – and not higher. A road toll of Rs 50, say, would be negligible for a firm's truck carrying Rs.10 million worth of goods. But it would be a lot of money to a person heading off to a leisure centre for squash before work or a parent who does not want their child to take the bus to school because it is raining, so that road toll would make such persons avoid car use and take them out of the truck's way. A truck journey time that is cut by 10 minutes would easily be worth the toll. Thus, road pricing would cut companies' costs and make the Indian economy work more efficiently. It may also be desirable and efficient on environmental grounds, as it would encourage firms to send freight by rail rather than road. It would be a simple matter for a government to set tolls on trucks at a different level, then those on cars.
2. Another major criticism is that road pricing would hurt the poor. This is unfounded. The poor does not drive a car. The purpose of road pricing would be to take money from the rich. Those on high salaries would be happy to pay a few rupees more to be able to get to their work at 9 am without having to rise at the crack of dawn. Sensible road tolls would be designed to be high at peak times. Those earning good wages would travel then and pay for the privilege. Those on low incomes would take alternative transport like bus, metro and/or travel at other times of the day when the tolls are low or even zero. Charging people to use their cars will create extra revenue for the government which can be utilized for creating better transport infrastructure and more efficient public transport system.
3. Another misleading criticism is that most road users are against congestion charging. One of the reasons for this is that opinion polls are usually run by organisations trying to get people to say so. Another reason is that people do not realise, when answering opinion polls, that road tolls would clear the roads.

After an experimental week of road tolls, we think people would be delighted and never wish to go back to the jams of toll-free roads. This is what is happening on the toll roads such as D-N-D Flyover connecting Noida and Delhi.

5.0 IMPLEMENTABILITY OF ROAD PRICING

There is considerable debate in the literature on the issue of implementability of optimal road pricing. There is no single best mechanism for charging all the now-hidden costs of driving to users of motor vehicles. Ideally, the price should be based on “polluter pays” principle and should be paid as close to the place and time, where the cost is incurred, as possible. But in practice, it is not always technically or economically feasible. Studies around the world find that optimal transport pricing can be implemented. The concept of marginal cost pricing can be translated into concrete pricing or taxation measure using existing technology. Simple “second best” approaches, such as cordon tolls and peak/off-peak price differentiation, can often achieve almost as much as the theoretically optimal solutions. Different countries have adopted different methods of tackling road congestion. Some of the widely followed methods are the following:

- 1) Electronic road pricing (ERP) schemes, cordon tolls or toll booths (e.g. Singapore, Spain, Japan);
 - 2) Restricted access at certain times or on certain days to different coloured/numbered cars (e.g. Athens, Mexico City);
 - 3) Meter parking in residential areas near Central Business Districts (CBD);
 - 4) Closing roads to cars at certain busy hours of the day ;
 - 5) Toll bridges and flyovers (e.g. Delhi-Noida-Delhi flyover).
- The command and control schemes that involve directly banning drivers infringe personal freedom, and are less desirable and less effective than road pricing. One of the most comprehensive and preferred schemes involves ERP, where variable tariffs more accurately reflect the marginal external costs of a trip. Electronic Road Pricing (ERP) in Singapore has increased charges and lowered ownership taxes -- hence controlling congestion without raising the total costs to road users. Traffic in Singapore moves at an average of 60kph even at peak times. Road tolls in Singapore have been a success. Queues do not build up. People who need to travel urgently, pay a premium for the convenience, rather than waiting. The London Congestion Toll system is also working well in the peak hours
- In some of the countries like Spain, France, Belgium, Italy, Japan and some US states, the toll revenue is used to finance new motorways, and users pay for roads through license fees, fuel tax and a weight-distance charge for heavy goods vehicles. Other ERP systems have been installed in Barcelona, Lisbon, Dallas, Oklahoma and Florida. Oslo has had a system in place since 1990

using electronic tags and a cordon of electronic beacons around the central business district, which deduct credit from the tags each time you pass through them.

6.0 CONCLUSIONS

Despite increasing awareness of the growing costs associated to excessive congestion, pollution and despite increasing popularity of road pricing principles, examples of its actual implementation in transport have been very slow. In India, in particular, Marginal cost pricing of urban transport is absent and widely considered a radical and controversial policy. Even the National Urban Transport Policy (NUTP)- 2006 of the Government of India is silent on this important issue of urban transport. In order to have sustainable urban mobility, optimal road pricing based on marginal social cost pricing has to be considered and be made acceptable to all stakeholders. People need to be convinced about the effectiveness of the measures, use of revenues and anonymity of the road pricing mechanism. By making pricing part of a package of policy measures, by offering alternatives to car use and by using the revenues in the most profitable way for the local context, be it in transport or in other sectors, efficient pricing can be made acceptable to policy makers and citizens and other stakeholders. A “clever and intelligent” marketing strategy and sound consultation process is crucial for the success of the road pricing in Indian cities.

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CAR FREE ZONE - FAZILKA, INDIA

Key Information

- In 2006, Graduates Welfare Association Fazilka (GWAFA) organized Car free street for a week
- Entry for cars banned between 10:00 am to 7:00 pm for central area
- Beneficial impact of car free zone
 - 10,000 visitors/day in market areas
 - 23% reduction in accidents in central area
 - 3% reduction in air pollution
 - 25% increase in local sales
 - 12% increase in visitors to area
 - Improved community social life



Fazilka is a small city in Punjab, India located near India Pakistan border. Like most small cities in India, Fazilka has many narrow streets in the old market areas and excessive growth of motor vehicles in the recent years has lead to increasing traffic congestion. In the year 2009, municipal committee decided to convert market area into car free zone. The main market area around clock tower was declared as car free zone. The entry of cars between are 10:00 am to 7:00 pm is banned. Only two wheelers and cycle rickshaws are allowed during this period. Placement of traffic calming device and permanent barriers at few locations was the key to success.

In 2006, a group of people from Graduates Welfare Association Fazilka (GWAFA) organized Fazilka heritage festival for one week. As a part of the festival, they converted 300 m long street (Sandhu Ashram road) into pedestrian street. The success of this event led to other opportunities and GWAFA conducted an experiment in central zone as car free zone. In later phase, Shashtri chowk road (800m long)and Wool bazaar road (400 m long) were converted into car free zone. This program improved the air quality, law and order, traffic related issues, and provided healthy social life. (Kumar, Planning and Design for Pedestrian Safety, 2009)

The successful implementation car free zone has been beneficial in many ways, not only by decongesting the market. The local market traders near clock tower are now happy with the ban of cars and the trading in the shop has increased by 25% since the ban.

77% of people accept that pedestrian streets in Fazilka have brought the community back to the street culture. The pedestrian street will promote walking trips from various residential zones of the city to market areas and 64% people accept that pedestrian streets has improved the air quality in Fazilka. Pollution level in central area is reduced by 3%. (Asija, Pedestrianisation need of the hour: a case study of fazilka town, 2009)

Fazilka is a historical town and is likely to have potential for tourism development. Following the successful implementation of the project, 70% people agree that car free zone will help to enhance tourism potential for the city. Car free zone has led to reduced accidents and has increased pedestrian safety during day and night time. A large majority (91%) of people have indicated that they would like to see such improvements in pedestrian safety throughout the city along with allowing for slow moving traffic.

Source: Environmental Planning Collaborative, 'Sustainable Urban Transport : Principles & Guidelines for Indian Cities (Draft Report)', 2013.

METRO RAIL IN INDIAN CITIES: FEASIBILITY AND IMPACTS

GEETAM TIWARI
RAHUL GOEL

With billions of dollars to be spent on the metro rail projects in different cities of India, it is imperative to understand the need and effectiveness of metro systems as a means of public transportation in Indian context.

During last one decade, metro systems have occupied centre stage in the context of urban transportation solutions. Though Kolkata metro is the first underground rail project implemented in India, the fillip to investments in metro projects in India was given by implementation of Delhi metro which currently has nearly 200 km of operational network. However, the willingness among policy makers and government for implementing metro systems is not backed by strong evidence that shows the effectiveness of metro systems to fulfill urban transportation needs in Indian cities. With Delhi metro as a fully developed operational system, there is an opportunity to learn various lessons which can guide policy making as well as planning with regards to metro systems in the future. This paper is based on results of an on-board survey of metro commuters in Delhi and data from annual reports of Delhi Metro Rail Corporation in order to understand profile of metro users as well as cost and revenue patterns of the system.

1.0 INTRODUCTION

Metro rails are rail-based, mass rapid transit systems which operate on exclusive right-of-way separated from all modes of transport in an urban area. Most often, the right-of-way is either underground or elevated above street level. The capital cost of construction ranges between 20-30 times that of the bus based system, depending on whether the metro systems are underground or elevated.

There has been a growing interest among policy makers about the benefits of rail-based systems in India to address the mobility needs

of increasing population of the cities. While evaluating different mass transit options for Indian cities, metro systems are often being given preference due to the belief that a road-based bus system cannot cater to the capacity requirement as much as metro systems. In addition to this, metro rails are perceived to have higher levels of comfort, speed and efficiency as compared to bus systems.

Promoters of metro systems claim the benefits of reduced congestion due to shift of road-based motorized mode users to a metro system. This modal shift is claimed to result in reduced air pollution and road accidents. However, the experience of a metro system in the low and middle income countries around the world shows otherwise (Mohan, 2008). The available space on the road gets filled up with motorized vehicles due to induced demand and the modal shift to metro eventually does not result in reduced congestion or air pollution.

Due to limited coverage of city by rail based systems as opposed to road-based bus system, a metro commuter spends significant amount of time during access (from origin to metro station) and egress (metro station to destination). Due to this additional travel time, even though the average main-haul (in-vehicle) speed in metro is about 30 km/h, the average door-to-

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door travel speed for a short trip on metro system gets reduced as compared to a road based system. Hence, metro systems have been found to be most favorable in terms of saving time if the trips are 10 km or long. Due to the polycentric nature of Indian cities with multiple business districts, majority of trip lengths remain below 5 km. For instance, examination of the trip length distribution of Delhi and Mumbai (Tiwari and Jain, 2011) reveals that in spite of greater metropolitan areas of these cities, 20 percent of trips are longer than 10 km.

Flyvbjerg et al. (2002, 2005) have found that often, mega projects involving large capital investments have been justified around the world based on exaggeration of benefits and underestimation of costs. Their study of more than 210 transportation infrastructure projects worldwide demonstrates that cost underestimation and exaggeration of benefits (both by an average factor of two) are common, especially for rail projects.

India has currently four operational metro rails, namely Kolkata metro in West Bengal, Delhi Metro and Delhi Airport Express Link in National Capital Region (NCR) of Delhi, and Bangalore Metro in Karnataka. Similar rail projects are being planned and/or are under construction in Ahmedabad in Gujarat, Bhopal and Indore in Madhya Pradesh, Chandigarh,

Ludhiana in Punjab, Jaipur in Rajasthan, Kochi in Kerala, Pune and Mumbai in Maharashtra and Hyderabad in Andhra Pradesh.

The Planning Commission proposal for the 12th Five Year Plan for urban transport has recommended that all Indian cities with population in excess of 2 million should start planning rail transit projects in old Cities and cities with population in excess of 3 Million should start constructing metro rails. An estimated investment for the development of Metro rails in Indian cities is US\$ 26.1 billion¹ (Planning Commission, 2011).

With billions of dollars to be spent on the metro rail projects in different cities of India, it is imper-

ative to understand the need and effectiveness of metro systems as a means of public transportation in Indian context. Since the metro systems are capital intensive projects, financial sustainability of these systems is also an important issue to be explored.

2.0 FUNDING OF METRO SYSTEMS

Most metro systems in India have been financed through debt-equity mechanism. While equity is shared equally among state and union government, debt is raised through loans from agencies such as Japan International Cooperative Bank (JICA), formerly known as Japan Bank for International Coopera-

Table 1 : Financing Pattern of Metro Projects in India

Metro Project	Union Government (%)	State Govt. (%)	JICA (%)	Others* (%)	Total (\$ Billion)
Delhi Metro Phases I&II	18	18	53	11	5.9
Kolkata	100	0	0	0	0.4
Kolkata East-West Corridor	24	30	46	0	0.9
Bangalore	15	15	45	25	1.6
Chennai	20	20	59	1	2.96
Public-Private Partnerships (PPP)					
Delhi Airport Express Link	19	19	0	62	0.8
Mumbai Phase-1	9	22	28	41	5.1
Hyderabad	9	0	0	91	3.3
Gurgaon	0	0	0	100	0.22

Subordinate debt by state/central government, equity by private partners in case of PPP, grants, property development etc.

tion (JBIC). In some cases, state or union government also share debt in the form of subordinate loans. This method of financing has been used by metro systems in Delhi, Kolkata (East-west corridor), Bangalore and Chennai. The other

mechanism, known as public-private partnership (PPP), has also been used by metro system in Delhi Airport Express link, Mumbai, Hyderabad and Gurgaon. In this, private entities contribute to some or most of the finance.

¹ 1USD = INR 40

3.0 TAX EXEMPTIONS

In addition to debt and equity, state and central governments provide financial support to metro projects in the form of tax and other exemptions. The exemptions are provided in various forms during various stages- financing, infrastructure development as well as operations. Following are the different exemptions granted to Delhi metro (CAG, 2008)-

1. Interest free subordinate loans from Government of India (GOI), Government of National Capital Territory of Delhi (GNCTD), Haryana Urban Development Authority (HUDA) and NOIDA for supporting the cost of land required for the project.
2. The long-term debt required for the project was raised by the GOI through a loan agreement executed with the JICA at concessional rate of interest and transferred to the company.
3. Immunity from exchange rate fluctuation-fluctuation risk for the period of repayment of foreign loan was to be shared between the Government of India (GOI) and the Government of National Capital Territory Delhi (GNCTD), equally.
4. Exemption from property tax and electricity tax.
5. Exemption from import duty, excise duty, sales tax and works contract tax.
6. No dividend to be paid on Government equity till the JBIC/JICA loan is fully repaid.

Subsidies for rail-based infrastructure and similar capital intensive

projects are often justified as a support system for financing such projects. Without subsidies and other support systems from government, such projects are not feasible to construct and operate. In terms of operations, subsidies are required so as to keep fare prices low. The high cost of operation cannot wholly be recovered from passengers as high ticket prices will deter passengers from its usage, thus defeating the purpose of a public transport system.

The experience with first two phases of Delhi metro system shows that even with ~190 km of the system, ridership reached only up to a quarter of the forecast. Consequently, its modal share is also less than 5 per cent. Since cost of metro projects reach billions of dollars, and they hardly seem to reach a double digit in the modal share of the city, it raises an important question of their cost-effectiveness. It is important to evaluate their cost effectiveness vis-à-vis other road-based public transportation options. Bus-based rapid-transit

systems having implemented successfully in many cities around the world have shown that they are as efficient as a metro system. These are also the least capital intensive mass transit options available in the world. In many metropolitan cities in India, including Delhi, buses have the major share of public transportation. With lack of support from government similar to what is given to metro systems, their quality of infrastructure as well as operations is hampered. Thus the current regime of subsidy seems to be biased towards the magnitude of capital required for construction of a system, rather than its benefits.

4.0 REVENUE AND COST STREAMS

Delhi Metro Rail Corporation (DMRC) has the following sources of revenue:

- *Traffic Operations:* It consists of income from train operation, feeder bus earnings, rental income of space for kiosks,

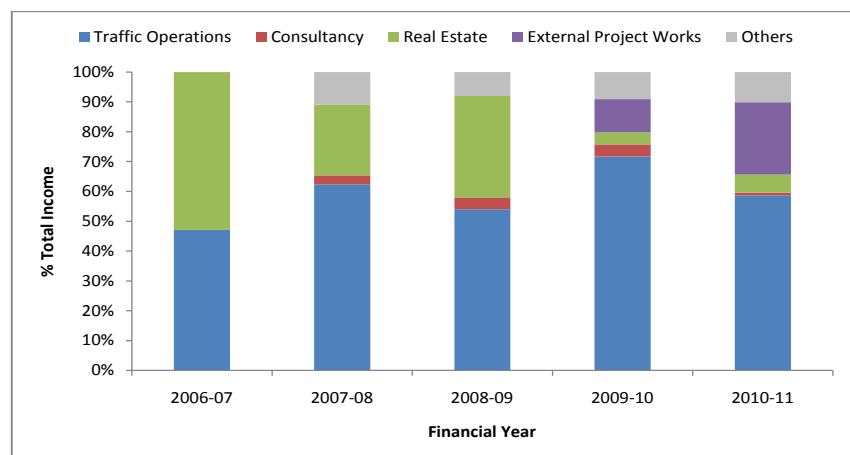


Figure 1 Revenue Sources of Delhi Metro and their percent contribution to Total Income

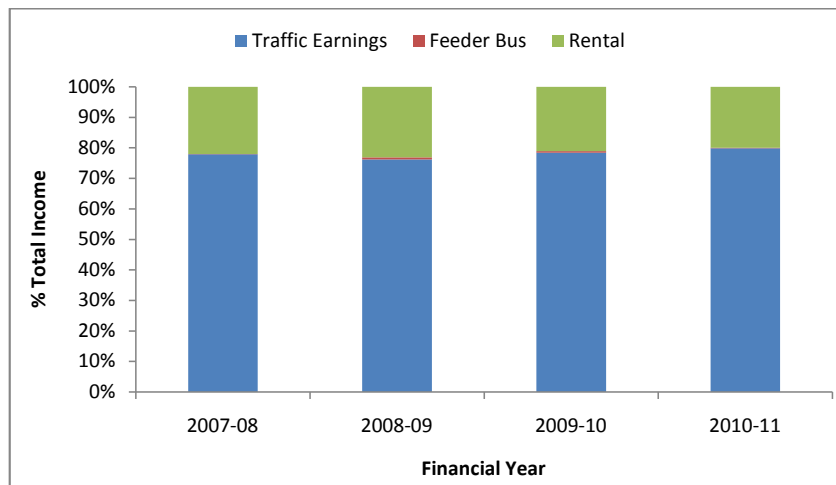


Figure 2 Traffic operations revenue sources and their percent contribution

parking, shops, restaurant, malls, advertisements, sale of tender forms and sale of carbon credit

- **Consultancy:** Consists of income from consultancy services to other metro systems in India as well as abroad
- **Real Estate:** It consists of sales of land and lease income
- **External Project Works:** It is income from works carried out in other metro projects
- **Others:** It consists of government grants, income from sale of carbon credits, sale of tender documents, etc.

Figure 1 shows different sources of revenue and their respective share in the total revenue from financial year (FY) 2006-07 to 2010-11 (DMRC, 2008, 2009, 2010, 2011). The share of real estate income in the years from 2006 to 2009 is comparatively higher because of the upfront income that is received when vacant land is given for commercial exploitation (Business

Standard, 2008). During this time, the percentage income from traffic operations varied from as low as less than half (41 per cent) to two-third (63 per cent) of the total income. From 2009 onwards, it is the revenue income from real estate which comes every year and therefore is comparatively lower.

In 2010-11 again, the percentage income from traffic operation is reduced due to higher contribution by revenue from external projects works taken up by Delhi Metro.

In figure 2, revenue under traffic operations has been further classi-

fied into traffic earnings (from fare collection), feeder bus earnings and rental earnings. The rental revenue is earned from space for kiosks, parking, shops, restaurant, malls, advertisements, sale of tender forms and sale of carbon credit. The percentage contribution of traffic earnings and rentals remain almost constant over the four years from 2007 through 2011. In order to calculate the percentage contribution of fare-box revenue of Delhi metro to the total income, the rental portion was removed from traffic operations. This reduced the proportion of traffic operations in the total income to 47 per cent (2010-11), 56 per cent (2009-10), 42 per cent (2008-09) and 49 per cent (2007-08) from 58 per cent, 71 per cent, 54 per cent and 63 per cent respectively. The analysis reiterates the fact that income from fare-box contributes to less than half of the total revenue of Delhi metro operations.

5.0 FORECAST AND ACTUAL RIDERSHIP

Delhi Metro's average daily ridership increased from 82,179 in December 2002 to almost 1.4 million passengers in March 2011 (DMRC, 2011).

Table 2: Projected and actual ridership of Delhi Metro in Phase I corridors (UNFCCC, 2011)

Year	Passengers per day*		Actual as % of projected
	Actual	Projected	
2006	500,000	2,500,000	20%
2007	620,000	2,800,000	23%
2008	770,000	3,000,000	25%
2009	900,000	3,400,000	26%

*rounded-off numbers

The ridership of Delhi Metro has been much lower than its estimated numbers. Table 2 shows the actual as well as projected ridership of Delhi Metro for four years of operation. It can be seen that the actual ridership remained at most one-fourth of the projected figures.

Given the trend of low ridership, Delhi metro has revised its projected ridership many times since the completion of Phase-I. The original feasibility study for developing a metro system for Delhi, projected a daily ridership of 3.1 million passengers by 2005 which was later reduced to a projected demand of 2.18 million passengers per day on the first three corridors (65.8 km) when completed in December 2005. This figure was further reduced to 1.5 million in 2005 (Mohan, 2008). The latest revision came in 2011 (DMRC, 2011), according to which DMRC targets to achieve average ridership of 2 million passengers per day by the end of 2011 for a 190 km long network. It should be noted that the revised ridership of 190 km of network is less than the projected ridership of 65 km of network in 2006. The inaccuracy in the estimation of projected figures for ridership has been accepted by DMRC which is clearly indicated by the following statement from audit report of Phase-I of Delhi Metro by

Comptroller and Auditor General of India (CAG) office -“The fact that transport modeling for ridership was not carried out accurately by RITES, was accepted by the company (DMRC) as well as the Ministry of Urban Development (MoUD) before the Empowered Group of Secretaries in 2005” (CAG, 2008).

In order to estimate the usage of Delhi metro per unit length of the network, Table 3 shows the number of passengers per km of metro network based on the actual ridership. It gives an average of ~10,500 passengers per km. Also, the revised projection of ridership of 2 million passengers per day for 190 km of network gives 10,500 passengers per km. It is clear that ridership of metro system stabilizes around 10,500 passengers per km. Using this figure, an estimate of the ridership for the future network can also be made.

It is imperative to learn lessons from the large variance of projected and actual ridership of Delhi Metro. With more than US\$ 70 billion to be spent in the next 20 years on metro rails in major cities of India (HPEC, 2011), there is an urgent need to revise the existing travel demand models in order to project metro ridership closer to the realistic value.

Forecast of ridership for metro systems (or any transportation

project) has a very crucial role to play in order to evaluate their success or even the need to have such a system. Ridership numbers are used to estimate the benefits that a metro system provides. Benefits are further quantified in terms of travel time savings, pollution reduction, and other benefits often claimed during metro planning- need for less number of buses, reduction in number of road accidents, etc. The monetary value of these benefits is then used in the calculations for cost-benefit ratio. An overestimation of these benefits by a factor of four (considering ridership one-fourth of the forecast, as in case of Delhi metro), is very likely to give a wrong impression of the benefits of a metro system.

It is understood that forecast using travel demand models have limitation in their accuracy. However, an analysis of detailed project reports (DPRs) of several metro systems reveals that travel demand models completely ignore the access-egress stages of a metro trip. This underestimates the “disutility” or inconvenience of a metro trip. These models are bound to give unrealistic ridership forecast and overestimation of benefits attributed to metro.

6.0 TRAVEL CHARACTERISTICS OF DELHI METRO USERS

An on-board survey of ~1100 metro commuters was carried out in the year 2011. This section outlines the major findings from the survey:

1. More than half of the respondents used non-motorized modes (walk-44 per cent, cycle

Table 3: Passengers per kilometer ridership of Delhi Metro

Year	Network Length (Km)	Passengers per km per day
2007	65	9,550
2008	68	11,300
2009	76	11,600
2010	156	9,900
Average		~10,500

-1 per cent and cycle-rickshaw- 9.6 per cent) for access and egress. Para-transit modes (cycle-rickshaw and auto-rickshaws) have a combined share of almost one-third (31 per cent) of the access-egress trips; almost three times that of buses (11 per cent). Usage of private motorized modes- motorised two-wheelers (MTWs) and cars- for access-egress also differs significantly. While MTWs have been used for less than 4 per cent, cars were used for 9.4 per cent of the access-egress trips.

2. Forty-five per cent of respondents mentioned owning no vehicles. MTWs and cars were owned by almost equal number of respondents (~25 per cent each) and less than 5 per cent owned both MTWs and cars.
3. The average trip length is 20.3 ± 0.5 km. More than 80 per cent respondents have trip lengths longer than 10 km.
4. As an indicator of mode-shift, survey respondents were asked to mention the alternative mode for their current trip. Less than 2 per cent respondents mentioned non-motorized modes (walk, cycle and cycle-rickshaw) while more than half of them (52.5 per cent) mentioned bus. One-eighth mentioned auto rickshaws and 15 per cent & 25 per cent mentioned MTWs and cars, respectively.
5. During the survey of metro commuters in Delhi, up to 18 per cent of the survey respondents mentioned that they would not make

their current trip if metro was not available. This indicated that up to 18 per cent of the metro trips may be induced. Any transportation system which reduces the travel time for a long distance trip compared to the existing modes is bound to attract induced trips. This is also called “rebound effect”. Metro systems being operated on exclusive right-of-way, have much higher in-vehicle speed compared to any other road based system. For short trips (less than 10 km), the gain in overall average trip speed is not significant, it is however significant for long trips. While induced trips contribute to ridership of metro systems, they contribute little towards benefit of provision of a public transportation system. There are simply more trips produced and not the previous trips by motorised modes shifting to public transportation where the major benefit of public transportation lies.

7.0 SIGNIFICANCE OF ACCESS-EGRESS TRIP OR THE “LAST-MILE” CONNECTIVITY

Access-egress of public transportation trip may seem very insignificant in terms of the distance covered in these two stages compared to the total distance of the trip. However, these stages contribute to most of the inconvenience in a public transportation trip. This is because these stages often involve physical effort (walking, crossing the road,

waiting), transfer (from road-based mode to a metro).

The survey of metro commuters revealed that average trip length of metro commuters is 20 km. This is in complete contrast with the trip length distribution of all the trips in Delhi. There are only 20 per cent of all the trips in the city which are more than 10 km long. In order to augment the coverage of metro systems, a lot of focus is kept on developing a feeder bus service. However, international studies as well as analysis of the Delhi metro survey data indicate that using a bus or any other motorised mode to access metro station is likely only when a commuter has to travel long distances. Conversely, commuters are more likely to use public transit for short trip lengths when it can be accessed by walking. These results have an important implication on the ridership of metro systems. Experience with Delhi metro has shown the gross overestimation of ridership forecast. Therefore, providing feeder services does increase the coverage of metro systems, but it comes with a reduced likelihood of people using it. Therefore, the key to improve the coverage of metro systems is to have safe, well-connected and shorter pedestrian and cycling infrastructure.

8.0 IMPACTS OF A METRO SYSTEM

As compared to road-based systems, metro systems have high requirement of space for station area. In case of property development

around stations, area requirement far exceeds station area. Since metro line alignments as well as its stations are most often underground or elevated, magnitude of energy requirement for the construction of such systems is also much more than the road based bus system. In addition, metro stations as well as passenger coaches are air-conditioned. Due to these reasons, construction and operation of metro systems have many implications on urban population, energy requirement and emission produced.

8.1 Electricity consumption and Emissions based on Life Cycle Assessment of Delhi Metro

Delhi metro consumes electricity for traction (running of trains) as well as for non-traction purposes (air-conditioning of underground stations, lighting of stations, lifts, and escalators, etc). An analysis of cost stream of Delhi metro shows that electricity contributes 25-30 per cent of the total operating cost. For evaluating such a system, it becomes essential to estimate the emissions attributed to the operation of this system. According to a 2007 estimate, electricity generation in India contributes ~38 per cent of CO₂ eq. emissions (MOEF, 2010). This is because production of electricity in India (up to ~70 per cent) is mainly through coal-based thermal power plants. Since coal in India has higher fly-ash content (30-40 per cent), fly-ash residue and pollutants settle on soil contaminating areas and are especially harmful to agricultural activities. In addition, combustion

of coal releases emissions of sulphur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs), and various traces of metal like mercury, into the air through stacks that can disperse this pollution over large areas. Therefore, electricity based metro systems may have less direct emissions within the city but contributes to carbon emissions at power plants during generation of electricity used for its operations.

A recent Master's thesis (Kumar, 2012) at Civil Engineering Department, IIT Delhi carried out the life cycle assessment of CNG buses and Metro in Delhi. Life cycle assessment of Metro and CNG based bus system reveals that considering only the operational aspect of transportation systems gives an incomplete picture of the overall cost. For instance, life cycle energy consumption per passenger km travelled is 90-120 per cent higher than vehicle operational phase for Delhi metro. Life cycle greenhouse gas emissions per passenger km travelled are 93-123 per cent higher than vehicle operation. The increase in energy and greenhouse gas (GHG) emission is primarily due to infrastructure construction, infrastructure operation and maintenance, vehicle manufacturing and vehicle maintenance. Thus, GHG emission of Delhi metro is 1.5 times higher than the CNG run bus system in Delhi.

8.2 Displacement of Households

According to the Environment

Impact Assessment report of Phase I of Delhi metro, the project needed 348.45 hectare of land and needed to relocate ~2500 jhuggies (Hazards Centre, 2006).

Several households from different slum settlements were relocated to a designated resettlement colony called Holambikalan, located at the north-west periphery of Delhi. A thesis carried out at TRIPP, IIT Delhi investigated the impact of dislocation of households to their travel needs. A survey of 2000 households in the resettlement colony was carried out in 2004 (Anand, 2007). The survey assimilated impacts on the relocated household in terms of their socio-economic profile as well as accessibility. The following impacts were found in the survey:

- The bus route availability and frequency of buses reduced after relocation. For 66 per cent of the households, income reduced after their relocation.
- On an average, household income reduced from Rs 3145 (78.6 US\$¹) to Rs. 2514 (62.85 US\$).
- 99 per cent of the households did not have need of using para-transit modes for access before relocation, but all households use these modes to travel after relocation
- The daily travel distance after relocation increased from an average of 4.4 Km to 15.4 Km resulting an increase in travel time as well as cost.

8.3 Fatalities during Construction

From the information obtained using Right to Information (RTI) Act, 2005 in December 2007, there were 60 fatal accidents during construction of Delhi Metro from year 2000 through 2007. Also, there were 26 major non-fatal accidents during the same period. According to another source (Civil Society, 2009) which obtained information of accidents during metro construction using RTI from police records, puts the total deaths to 261 and a total number of injuries to 481 by 2009.

8.4 Real Estate

Income from real estate development has a significant share in the operational revenue of metro systems. Delhi Metro project has generated as much as half of the total operational revenue from real estate development during its initial years of operation.

The implementation of metro at different locations in Delhi has led to an increase in the real estate prices of the areas adjacent to the metro line. According to studies done in 2007-2008 (Swamy, 2008), for residential area, on an average land value within 500 m of metro line increased by 11 per cent and for commercial areas, on an average land value within 500 m of metro line increased by 18 per cent. Also, land value changes are more consistent and higher after the operation of metro as compared to the construction and planning stage and the

property value has been increasing at a rate of 2- 4 per cent every year.

9.0 MAJOR POLICY IMPLICATIONS

- 1) Due to high capital requirement of metro projects, government support is required in the form of equity shares, grants and various tax exemptions. With increasing number of million plus cities in India it needs to be evaluated whether state governments can sustain such financial burdens to run metro systems in many of its cities.
- 2) A major part of revenue of metro systems comes from sources other than fare-box revenue. This has a significant implication on the self-sustainability of metro systems. This leads to dependence of metro systems on real-estate development which often occurs at the cost of displacement of poor households.
- 3) Emissions and electricity consumption based on life cycle assessment of metro system is higher than CNG run bus system.
- 4) Travel demand models used in the planning and ridership forecast of metro systems need to account for access-egress stages of a metro trip. An underestimation of inconvenience during those stages may lead to highly overestimated ridership of metro systems.
- 5) Use of motorised modes to access a metro system is not very effective. The study in Delhi shows that passengers are likely to use these modes only for long trips. However, most trips in Indian cities are short (less than 10 km) in length. Thus increasing coverage of metro using feeder buses cater only to a very small proportion of trips. Use of motorised modes to access metro stations, also adds to the out-of-pocket expense as well as travel time thus further discouraging use of these modes. In addition, use of these modes to access metro stations adds vehicular emissions.
- 6) The key to improve coverage of metro systems is to have safe infrastructure for non-motorised modes- walking and cycling. While these modes have zero emissions, their use also adds no out-of-pocket cost in the travel.
- 7) Due to design and coverage limitations of metro systems, their use is most likely to occur for long distance trips. This leaves out a major (up to ~80 per cent) proportion of the trips in the cities to be catered to by road-based systems. Thus presence of metro systems have minimal effect on ridership/demand of bus systems.
- 8) Metro stations lead to an intense flow of pedestrians and other access modes around station area. Design of metro systems should include redesigning the nearby road network for providing safe dispersal of metro commuters.

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CORRIGENDUM

The article 'Affordable Housing: A commercial or Institutional Challenge?' Published in HUDCO-HSMI's April, 2013 edition of Shelter was co-authored by Miss Swati Sharma, who was a student of Master's in Urban Planning, School of Planning and Architecture, New Delhi at the time of publishing of the Article.

URBAN MOBILITY: OPTIONS FOR SUSTAINABILITY

RAJIV SHARMA

Integration of various modes becomes a pre-requisite to achieve sustainable urban mobility. Lack of integration increases waiting time and may result in exponential growth in the number of car and motorised two-wheeler users.



The contribution of cities in national economy is moving up from two third and is likely to be around 70 per cent by 2030. This would mean more migration to urban areas and particularly to cities. Unless, properly planned and developed, cities would tend to grow in an organic form, which may not be efficient from economic perspective. This article looks into the challenges in meeting the travel needs of the growing cities. It would argue how sustainable transportation principles, if applied to these cities can mitigate risks associated with urban mobility. The article suggests that cities need to follow people-centric and not transport-centric principles of urban development. It recommends that managing transport demand is the key to success for urban mobility. This way issues like road user safety, pollution and parking can be easily addressed.

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1.0 BACKGROUND

Urban transport plays an important role towards growth of city economy.

The economic performance of cities depends on efficient movement of goods, services and inhabitants, which can be achieved through an effective, efficient and integrated transportation system. City also needs transportation for regular supply of essential services like water, milk, vegetables, grains and other commodities and also to discharge the waste generated from various city functions. The transportation demand for these services is much higher as compared to that of inhabitants. However, this paper is restricted to intracity mobility needs of the city inhabitants only.

Urban mobility is important to bring efficiency in city productivity. A study on operational efficiencies of freight transportation by roads has

estimated that India loses approximately Rs. 60,000 crore a year due to congestion (including fuel wastage), slow speed of freight vehicles and waiting time at toll plazas and checking points. It is said that vehicles crawl at an average speed of less than 20 kmph on some key corridors such as Mumbai-Chennai, Delhi-Chennai and Delhi-Guwahati, while the speed is only 21.35 kmph on Delhi-Mumbai stretch.

The condition of urban transport is also suffering from many similar problems. Cities are unable to function efficiently for two reasons. First, productivity of a city gets affected for lack of timely supply of goods and services and second, congestion within cities also results in loss of man-hours and thus productivity. The present policies for intracity transport tends to be biased towards private motorised vehicles. As a result, the use of desirable modes; walk, bicycle and public transport is decreasing and the use of undesirable modes i.e. car and motorized two-wheeler is increasing. This situation is characterised by congestion, pollution, increase in consumption of fossil fuel, unsafe streets and social disintegration. As per CSE (2009), during 1970-2005, the number of motor vehicles registered increased 50 times. While, the road network grew less than three-fold, accidents increased four-fold. An MORTH (Ministry of Road Transport and Highways) committee on 'Road Safety and Traffic Management' (February, 2007) also estimated about 50 per cent increase in road accidents over a 10 year period (2005-15). Lack of footpaths,

cycle tracks and unchecked speeds are some of the reasons to blame. Thus, there is an urgent need to reverse the present trend.

Two recent reports, one each by McKinsey Global Institute and the 'High Powered Expert Committee' commissioned by Ministry of Urban Development, Government of India (MoUD, 2011) have projected that Mass rapid transit services and roads (the main infrastructure for urban transport) together require nearly 50 per cent of the total projected investment for various urban services (including housing) in cities. This amounts to nearly Rs one lakh crore per year for the next 20 years. The estimate of the working group on urban transport shows that this investment can be reduced by nearly 30 per cent by pro-actively promoting sustainable practices.

2.0 AN APPROACH TOWARDS SUSTAINABLE URBAN MOBILITY

An assessment of the results achieved from present policies needs to be assimilated, so that corrections, if any may be applied for improvements. It is seen that urban mobility is getting shifted in favour of motorised private vehicles,

whether car or two-wheelers. These modes are resource demanding and also has negative externalities to the society in terms of use of fossil fuel, road safety and congestion. A (MOUD,2008) 'Study on Traffic and Transportation Policies and Strategies in Urban Areas in India' has reported that the share of personal modes especially of two wheelers has gone up at 12 per cent per annum in the past two decades, while the share of public transport has generally declined. The study further reiterates that road congestion, increase in trip length due to urban sprawl, increase in purchase power of people and inadequate facilities for cycling have contributed to reducing cycling to less than 11 per cent of the modal share in 2007, which is down from nearly 30 per cent in 1994.

The figures in Table-1, indicate a decrease in the share of public transport in 2007 as compared to 1994, in the cities of various sizes.

There needs to be a much greater focus on planning for movement of goods overall, since it is almost universally recognized that transport of goods is important and will grow with economic growth. The subject

Table 1: Public Transport share comparison 1994 to 2007

City Category	City Population (Range in lakhs)	WSA , 2007 (%)	RITES , 1994 (%)
1	< 5.0	0.0 – 15.6	– 22.7
2	5-10.0	0.0 – 22.5	22.7 – 29.1
3	10.9 – 20.0	– 50.8	28.1 – 5.6
4	20.0 – 40.0	– 22.2	35.6 – 45.8
5	40.0 – 80.0	32.1	45.8 – 59.7
6	Above 80.0	35.2 – 54.0	59.7 – 78.7

Source; MOUD study 2008

Table 2: Sustainability Index of various modes

Sr. No.	Most Prevalent Modes	Sustainability Index
1.	Walk/Bicycle	9-10
2.	Cycle rickshaw/ Hand Rickshaw	8.5-9
3.	E-rickshaw/Segway/velocab	8-8.5
4.	Bus	7.5-8.5
5.	Light Rail Transit/Tram	5-6
6.	Metro	3.5-4.5
7.	Personal Car	1-3

needs to be studied in depth to evolve planning norms that permit goods movement without affecting passenger movement.

At Regional level, government plans to develop corridors connecting important cities with industrial and business relation. The first such effort was made in 2001, with the launch of North-South corridor, East-West corridor and Golden Quadrilateral (connecting Delhi, Mumbai, Chennai and Kolkata) that aimed to improve National Highways to a four/six lane express highways. The Delhi-Mumbai Industrial Corridor is a recent effort that goes beyond road widening/ improving and promotes transport based economic development. This corridor is designed to overcome problems of congestion and delays by creating a world class infrastructure such as high-speed transportation (rail, road) network, ports with state-of-the-art cargo handling equipment, modern airports, special economic regions/ industrial areas, logistic parks/trans-shipment hubs, knowledge parks focused on feeding industrial needs, complementary infrastructure such as townships/ real estate, and other urban infra-

structure along with enabling policy framework. The Government of India has announced other corridors on this line, they are Bengaluru-Chennai Industrial Corridor, Bengaluru-Mumbai Industrial Corridor and Amritsar-Delhi-Kolkata Corridor. These corridors are likely to increase economic growth in the country through fast inter-city transport system.

The approach towards safe and sustainable urban transport needs to prepare a strategy, which gives importance to a mode as per its sustainability index. This index can be calculated based on parameters such as pollution (both during manufacturing and use of a mode), space requirement (for parking and traveling), carrying capacity, speed, safety,

ease of using, flexibility, cost, etc.

A sketchy estimate of these factors would classify major transportation modes, as in Table-2 below. Higher number means more sustainability and hence high in priority:

Urban transport needs to take this into account while detailing out transport plan for a city or region. However, the above modes have limitations on their capacities and distance that can be traversed by them. Not all modes can be used for regular work trips, particularly when the city size and consequently trip length exceeds 5 kms. In such cases, the above mentioned modes can be used in combination, provided the city is able to integrate them.

Integration of various modes becomes a pre-requisite to achieve sustainable urban mobility. Lack of integration increases waiting time and may result in exponential growth in the number of car and Motorised Two-Wheeler (MTW) users. In a research done by Prof. Geetam Tiwari (Tiwari, G, 2007) desirable modal share for various city sizes has been worked out (Table-3). This study suggests that the share

Table 3: Desirable modal shares for Indian Cities (as a % of total trips)

City size in lakhs	5-1	1-5	5-10	10-20	20-50	>50
Walk	30	30	30	30	25	25
Cycle	25	20	15	12	10	10
Rickshaw	12	10	8	6	1	1
3-wheel ScooterRickshaw	8	3	5	3	3	1
Public Transport	12	15	15	20	33	38
Cars	1	1	2	4	8	10
Motorised 2-wheelers	12	21	25	25	20	15

Source: Tiwari, G (2007).

of Public Transport on an average should be aimed at 50 per cent of motorised trips and 35 per cent of total trips should use non-motorised transport, including walk. This will bring equity in sharing of road space between all categories of users.

3.0 GROWTH SCENARIOS AND SUSTAINABLE URBAN TRANSPORTATION

The MOUD (2012) has conducted a study with a representative sample of 87 cities (all State capital cities and towns with population above 0.5 million). Out of these, 30 representative cities were selected for detailed study. Data was collected through primary and secondary surveys for the 30 sample cities to understand the existing urban transport scene. The Business As Usual (BAU) scenario, projected from 2007 to 2030 shows as follows:

- The per capita trip rate for all modes including NMT is estimated to increase from 0.8-1.5 to 1-2 for cities of various sizes
- The future public transport (PT) share will decrease from 5-46% to 2-26%
- Expected average journey speeds on major corridors in future for various city categories will fall from 26-17 kmph to 8-6 kmph
- The daily trips in the 87 urban centers are anticipated to double from 2,286 to 4,819 lakhs

The Energy and Resources Institute (TERI), a Delhi-based non-governmental organization (NGO), has forecast that India's commercial energy demand and emissions will

increase by more than seven times under business as usual scenario (if nothing is done to curb the emissions) from the existing levels by 2031/32.

Such a situation cannot be sustainable. Therefore, drastic measures are needed to address this issue, before it gets too late. The problem of urban transport needs to be addressed at two fronts- demand management of urban mobility and supply enhancement of public and private transport modes. In both these cases, the quality and quantity aspect of urban transportation needs to be strengthened, to address the existing deficit in these areas.

4.0 DEMAND MANAGEMENT OF URBAN MOBILITY

To make urban transport sustainable, a holistic view of travel needs and demand is needed, so that precise decisions on its implementation is taken. Demand management is being pursued as one of the important milestones towards inclusive and sustainable city planning. Some of the approaches in this regard, are discussed in this section.

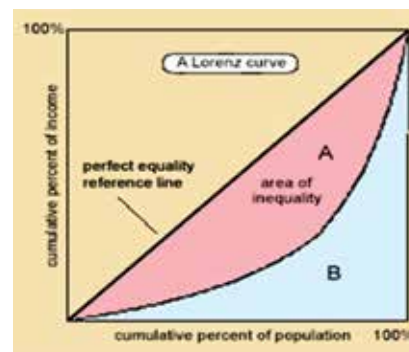


Fig 1: Lorenz curve

4.1 Integrating landuse and transport planning

The basic discussion on transport planning, relates to 'urban form', which is the physical arrangement of residences, workplaces etc. Theoretically, need for transportation arises due to spatial distribution of population and jobs. It is often characterised by the imbalance between the two in a particular zone. Lorentz curve (1905) is often used by transport economists to present the amount of concentration or dispersion of population or jobs in a particular zone. If the population distribution is perfectly even, that is, if in a specific zone if income (or jobs) and population is equal, then the curve plotted will be a diagonal line, indicating no demand for transport service to reach the workplace. If the population and income (or job) distribution is not even, then a curve below the diagonal will emerge. The proportion of the area marked 'A', will mark the change from a perfectly even distribution, thus indicating the need for transportation. (Fig. 1)

Many attempts have been made by planners to address this issue, and three most effective strategies that have emerged over the years are, polycentric development, redensification of existing areas and mixed landuse planning. Each of these strategies has been able to demonstrate varied results.

Polycentric development has been able to encourage people to live close to their workplace. Employment becomes the prime mover for deconcentration of City centre by planning self sufficient nodes. Ideally

these nodes should have access to all facilities and services at a distance that can be accessed by walk or using Non Motorised Transport (NMT), but it is not so very often. The kind of decentralisation possible in reality is by inducing employment in decentralised clusters outside central area. This appears to be an effective strategy than the wide scattering of jobs all around the city, as it encourages greater use of transportation systems. As experienced in many cities, relocation of industries or development of new industrial estates should be combined with housing for all categories of employees. However, commercial activities have often proved difficult to relocate but should be convinced to move with the housing. Furthermore, it should be noted that people select both home and job locations for many reasons besides minimising travel to work. Other factors affecting selection are location of commercial activities, school, relatives in the vicinity, peer group, etc. Thus, long distance commuting behavior is not always successfully solved by decentralisation of employment.

Development or redensification of old areas at higher densities would have substantial benefits for reducing urban transport problems. Higher densities could reduce total movements required by the population and make public transport more convenient and feasible, leading to lower energy consumption, decreased air pollution and reduced congestion. Other related benefits include lower costs of building infrastructure networks (eg utility lines)

high density housing, energy saving in housing and urban transport and sense of security. Compact, well designed employment centres, usually clustered around regional shopping malls and mass transit terminals appears a feasible option. One fine example of landuse controls is depicted in Curitiba in Southern Brazil. Despite having a private vehicular population of 500,000 in a city of 1.6 million, Curitiba does not suffer from traffic congestion. Another example is Singapore, which permits high density housing clusters near suburban public transport terminals or stops, as per the new town planning norm.

The mixed landuse has its advantages and disadvantages but it is more known for its disadvantages rather than advantages. These measures, however, need strict enforcement, as per regulation. India has been able to demonstrate the positive contribution of mixed landuse in reducing urban transport needs. But, if an area designated gains momentum and translates itself to a city-level hierarchy, it starts attracting people from all over the city thus encountering problems of transport as well as inconvenience to the local residents. Of the cities in Asia, Hong Kong has a city plan, called 'Metroplan', which utilises a systematic approach to transport planning, linked to a strategic land-use plan. For example, one of the plan's objective is to achieve a balanced distribution of jobs relative to population concentration, locational preferences of enterprises and ease of travel. In case of Singapore, one of its strategies has been to reduce

commuter traffic to and from the city center by developing integrated industrial, commercial and housing facilities at its biggest industrial estate in Jurong, some 20 kms from the Central Business District (CBD).

4.2 Enhancing the use of Information Technology (IT)

The revolution of IT has been seen in all spheres of life. It is presumed that use of Information and Communication Technology (ICT) is likely to reduce the demand for travel and consequently negative externalities caused by transportation. City functions, particularly related to banking, shopping, preparations for travel, etc gets substantially reduced as a consequence to e-shopping, e-booking and e-banking etc. The emergence of e-governance as an option for reaching out to people, essentially results in lowering down the cost of transportation or the number of visits to the CBD.

Use of IT is also reshaping inter-industry relationship through advanced communication and quick response. The society is now gradually becoming a e-society, using upcoming technologies as a means of communication. In this emerging e-society, digital technologies manifest through the Internet, mobile and wireless networks, make possible just-in-time production, telecommuting, and outsourcing as the foundation for communication related to personal or official purpose. The emerging connectivity has been utilised by many employers to promote concepts like- 'work from home' through virtual office. Video conference facilities have also con-

tributed to conduct many meetings online without physically visiting a office or meeting venue.

The IT age cities are changing their characteristics and becoming compact, transit-oriented, mixed landuse and intensely wired in all aspects. However, there is no direct evidence if IT has really contributed towards reduction in transport demand. The theory of urban settlement predicts reduction of travel demand due to virtual office and e-governance but to what extent these predictions are able to have an impact on trip generation, is unknown.

4.3 Planning Smart Cities

The term 'Smart growth' is used in North America and it call for organizing development in cities, towns, and villages that are compact, walkable, mixed-use, and transit-friendly and contain a diverse range of housing. In Europe, similar concepts are described as 'Compact City' or 'urban intensification'. Smart growth values long-range, regional considerations of sustainability over a short-term focus. Its goals are to achieve a unique sense of community and place; expand the range of transportation, employment, and housing choices; equitably distribute the costs and benefits of development; preserve and enhance natural and cultural resources; and promote public health. The Delhi-Mumbai Industrial Corridor plans to develop 7 new towns in Phase-I and more in Phase-II on its corridor, on the principles of 'Smart City'.

Some of the fundamental gains for

the benefits of residents and the communities are increasing family income and wealth, improving access to quality education, fostering livable, safe and healthy places, stimulating economic activity (both locally and regionally), and developing, preserving and investing in physical resources. The common features of a Smart Growth are:

1. Compact Neighborhoods within walking distance, reduces urban sprawl and consequent transport demand. Such a tactic includes adopting redevelopment strategies and zoning policies that channel housing and job growth into urban centers and neighborhood business districts, to create compact, walkable, and bike- and transit-friendly hubs. It promotes creation of jobs in the neighbourhood, mixed-use development, inclusive planning, affordable housing, parks & open areas in the vicinity, education and health facilities and commercial activities within the neighborhood.
2. Transit Oriented Development (TOD) is referred to locating high density residential or a mixed land-use, close to a transit node, so that people visiting these facilities do not have to take another mode of transport. The demand for transport is highly reduced in such cases, as people either walk or travel by NMT to the place of work or residence, from the transport nodes. Accessibility of these areas is increased since after coming out from highly efficient public transport commuters can either walk or use NMT, without any waiting

time. To make TOD successful, efficient and high capacity transport services is a pre-requisite, as in the case of Curitiba, Brazil. TOD also reduces the demand for commercial parking.

3. Designing for Pedestrian and NMT facilities will make Eco-friendly modes popular and reduce energy use in transportation. Large number of NMT users in a community can reduce emissions, save money on fuel and maintenance, and make the community healthy.

In addition, Smart Growth model also advocates preserving open space and critical habitat, reusing land, and protecting water sources and air quality. Developing areas around existing settlement decreases the socio-economic segregation, allowing society to function more equitably and gives an opportunity to generate a tax base for housing, educational, health and employment generation programs.

4.4 Adopting Economic Instruments for traffic management

Economic instruments are designed on the principle of 'willingness to pay'. The user has a choice of either using a public transport or other forms of non-privatised modes or pay for using his own car. Economic instruments appreciate ones willingness to pay for the services one uses, so that choices are not restricted but open at a price.

Two types of economic instruments are available for management of urban transport demand. Direct

instruments affects road user directly and collects a price for using a facility, examples are area licensing, road pricing, etc. This type of instrument is very popular after engaging private sector in road construction projects. The concessionaire is given the right to collect tax for a specific period, so that the investment made on the construction of a facility is adequately recovered along with a suitable profit. Area licensing requires that a permit is purchased to take a vehicle to a designated city area during peak hours. In road pricing, user is often charged for the length or duration of the facility used by him. The price may vary during peak and non-peak hours and during weekdays and weekends. This instrument is used to mitigate congestion in CBD during peak hours.

Indirect instruments are collected indirectly from users like vehicle ownership fee, parking fee, fuel cess, user charges etc. These instruments discourage ownership of private vehicle by imposing taxes on vehicle ownership, its maintenance and operation. Other more innovative methods to curtail ownership of private vehicle include, imposition of a limit on one car per household, as practised in Bermuda, or the requirement of a dedicated residential parking space for every car, as in Japan.

Market based instruments have the advantage of maximising individual choice but suffer from the disadvantage of favouring high income households over poor. These instruments are therefore, classified as anti-poor and inequitable.

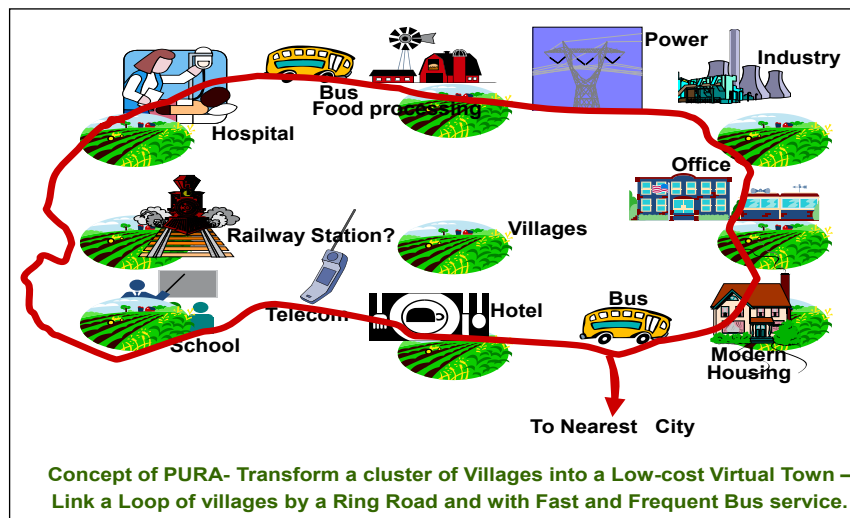
4.5 The PURA Growth Model

The disparity in development indicators like civic services, education, healthcare, employment opportunities, etc in rural areas results in the migration of rural population to urban areas. Providing Urban Amenities in Rural Areas (PURA) model recommends providing good amenities, at par with urban areas, to rural population by connecting them, physically and otherwise. This will prevent, if not reverse the trend of rural-urban migration and consequently demand for urban transport. Rural areas are unable to achieve access to urban markets and facilities for two reasons- one is they are individually small community to achieve economies of scale; and second individual community do not justify high order of transport infrastructure to achieve physical connectivity. To overcome this difficulty, a loop of villages can be linked together by a ring road and high quality transport. The transport connectivity will

create those connected villages into a virtual town providing a market to support a variety of services, which single village would not have been able to support individually. The hinterland will be protected to provide access to the produce from farms and would also act as sink to digest the waste generated in the community.

The, set-up of PURA involves:

- selecting a ring of villages;
- connecting the villages on a ring by establishing high quality transport and telecommunication system;
- encouraging reputed specialists to locate school, hospitals and other social services around the ring; and
- marketing this with serviced space to attract industry and commerce; and
- connecting the loop with broadband internet services.



Source: Kalam, Abdul APJ Dr. (2005).

Fig 2: The PURA Model

In order to attract both entrepreneurs and employees, PURA offers the following four types of connectivity:

1. **Physical connectivity-** This would provide connectivity to the cluster of villages through ring road and round the clock service of efficient public transport for moving people and goods from villages to villages and villages to schools, health centres, fuelling stations, farming areas, warehouses, agro-industry and other commercial establishments.
2. **Electronic connectivity-** This connectivity would introduce tele-education for farmers and villagers through village internet kiosks, public call offices, tele-medicine, e-market, e-governance, e-commerce and so on.
3. **Knowledge connectivity-** It will transform the rural areas with connectivity in education, healthcare, vocational training, satellite application for crops, water and forest management, environmental protection and cooperative product marketing.
4. **Economic connectivity-** The above three connectivity will bring forth economic connectivity through small-scale industries, agro & food processing, warehouse, micro-power plants, renewable energy and village markets.

PURA proposes that 10-15 rural communities having a population of 10,000-15,000 each, if connected together with high order transport system will make them one large community of around 2,00,000

population which can have high order of education, health, industry, commerce and other such facilities. Thus, PURA integrates the markets of all villages on the ring, to create a town-sized market, large enough to support a wide range of urban amenities. It has been estimated that out of 6 lakh villages in the country, 50,000 PURA complexes would emerge.

4.6 Traffic Calming and Road User Safety

Urban roads are being planned to move vehicles and not people. As a result, other vulnerable road users, particularly using NMT, are at great risk. According to government estimate, about 30 per cent of the

urban inhabitants across the country commute daily by walk. If we add the figures of those who walk to take a bus or metro, the figure would be quite high. But, still the facilities supporting pedestrian and NMT transport are inadequate and often do not match with the requirements.

As a result, 1,40,000 persons were killed in road accidents in the country in the year 2012. As per estimates of MoRTH, 2012, the total number of road accidents that occurred in rural areas was more than that in urban areas, the former accounting for 54.3 per cent (2,66,450) and the latter accounting for 45.7 per cent (2,23,933). One reason behind this figure could be the slowdown in urban areas, due to traffic conges-

Table 4: Road related deaths and Injury Accidents in Selected Countries in 2009

S. No.	Country	Deaths per 100,000 population	Injury per 100,000 population
1.	Australia	6.81	6.15
2.	Brazil	3.81	31.48
3.	Canada	6.55	371.08
4.	China	5.09	17.90
5.	Denmark	5.48	75.49
6.	France	6.82	115.49
7.	Germany	5.07	379.59
8.	India	10.83	36.58
9.	Indonesia	8.69	27.38
10.	Japan	4.52	577.52
11.	Korea, Republic of	11.98	475.91
12.	Qatar	17.49 (2007)	NA
13.	Russian Federation	18.39	143.53
14.	South Africa	27.92	304.15 (2007)
15.	United Kingdom	3.59	265.21
16.	United States of America	11.01	504.16

Note: Injury accidents refer to road accident resulting in at least one injury or death.

Source: MoRTH, 2012.

tion. Delhi reported 6937 accidents and 1866 deaths in 2012. Analysing the extent of accident severity (road accident related deaths per 100 accidents), Mumbai ranked best with a figure of 2.0, while Amritsar was the highest with a figure of 62.5. Table 4 gives a cross-country comparison of road accident related deaths and injury accidents per lakh persons as per World Road Statistics (WRS), 2011.

An analysis on the persons killed in road accidents reveals that roads are unsafe for two wheeler (20 per cent) and pedestrians (8.7 per cent). Large number of deaths and injuries to people riding trucks, tempos, Multi-axle Vehicles and tractor indicate the need to strengthen public transport. The analysis suggests that cities should recognise pedestrians and NMT as transport modes and create an environment to promote them. During 1970-2005, while the number of motor vehicles increased 50 times, the increase in the facilities for pedestrian and NMT

facilities has seen very insignificant increase. The immediate need is to recognise the role of NMT in sustainable transport, and to curb the use of inefficient motorised vehicles. Traffic calming has been successfully adopted by many cities to promote NMT.

Traffic calming measures are aimed to give priority to NMT users over motorised vehicle users.

The neighborhoods have to be planned with NMT as highest priority. Other modes of transport may be allowed upto a certain distance beyond which private vehicle owners should be encouraged to walk. This will ensure safety to the residents and pedestrians. Some of the guiding principles of Traffic calming and NMT oriented development could be summarised as below:

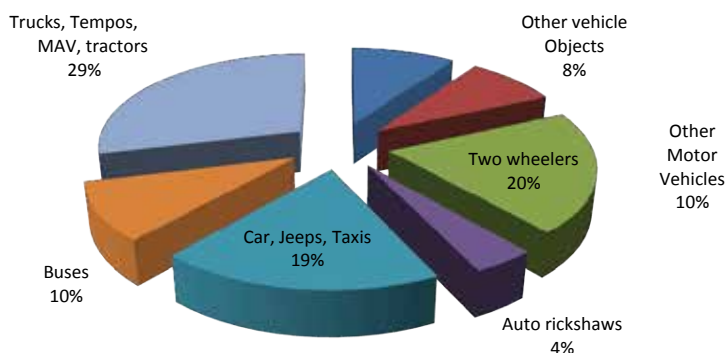
- improve pedestrian facility with lots of greenery and street furniture;
- provide segregated cycle track



along busy roads, with separate traffic crossings;

- Streets should be designed with blind turns and narrow lanes in residential areas so that driving speed cannot go beyond 40kmph;
- central areas should be pedestrianised with access by public transport facility and park and ride facility;
- Declare first Sunday of every month as car-free day;
- develop pedestrian friendly neighbourhood design with cul-de-sac to discourage through traffic and promote walking and bicycle use;
- provide pedestrian refuge islands at road crossings;
- roads should be narrowed at pedestrian crossings for better visibility of pedestrians and slowing down of motor vehicles;
- all pedestrian facilities should be barrier-free, with access to visually and hearing impaired;
- Provide bicycle parking at major commercial streets and transport nodes;
- The walkways and NMT lanes should be slightly raised at motorized crossings in a way that it acts as speed breakers for cars;

Fig 3: Persons killed in Road Accidents by type of motor vehicle, 2012 (% share)



Source: MoRTH, 2012.

- organise bicycle riding competitions once every month;
- roundabouts should be proposed at intersections instead of traffic lights;
- space for hawkers to be earmarked at major bus stations and other transport nodes etc.

Segregation of the slow and fast moving transport modes would not only reduce fatal accidents involving NMT users but will also provide motorised vehicles an unobstructed driveway.

5.0 SUPPLY ENHANCEMENT OF PUBLIC AND PRIVATE TRANSPORT

A shift from personal vehicles to other mass transit and non-motorized modes is necessary to reduce energy demand from cities. MOUD (2012) suggests that share of public transport on the average should be aimed at 60 per cent of motorized trips and 35 per cent of total trips including walk. Buses are the main component of public transport even when rail transit is provided. By promoting modern intelligent transport system enabled buses, both capital and revenue is placed on a firm footing because a very large number of small and medium size cities will not need rail transit.

Metro Rail Transit system (MRTS) is high cost and high capacity option that is being in operation in Delhi, Kolkata, Bengaluru, etc. Many other cities are likely to start the commercial operation of MRTS soon. Bus Rapid Transit System (BRTS), Light Rail Transit system (LRT), Mono Rail etc. are some

other options which have more flexibility in operation, that matches with the growth pattern of Indian cities. BRT is working successfully in Ahmedabad, Indore, Rajkot and Visakhapatnam and is in planning stage in many other cities. LRT or High Speed Tram has advantage of pollution free ride and can operate on the RoW equally shared by other transport modes. Buses in mixed traffic are the cheapest option but do not have priority driving and thus cannot compete with personal modes.

Choice of a public transport option varies from city to city and would depend on the city size, number of trips generated, average length of trips, per capita income & expenditure, density, availability of land, and aspiration of citizens etc. Design factors such as, system capacity, ease of operation, flexibility in operation, Right of Way and existing landuse along the proposed corridor to induce ridership are also studied during planning stage. Other features like speed, cost, safety, eco-friendliness, energy and land conservation, aesthetics and local technology, maturity for maintenance, etc. of the system are also be given due consideration for finalizing technology option. A final decision would however, depend upon local conditions, including availability of land.

Public transport network cannot be planned in isolation of the peripheral services needed to make it fully functional. A developed Public Transport (PT) station needs to have an interchange or dispersal facility with all associated infrastructure such as parking, road and rail based

modes of transport, Intermediate Public Transport, and interchange for suburban rail and/or road based transport. Improved accessibility of stations/stops for the last mile connectivity is a vital feature of public transport planning. Planning should be flexible and permit entry of new technology at a later date.

However, the following elements are essential to make public transport successful:

- ***Intermediary Public Transport (IPT)***

IPTs are playing a very important role in meeting the travel demand of urban population. They operate on fixed charge basis, shared basis or on the fare as prescribed by the regulatory authority. IPTs are very effective in providing access to congested neighbourhoods, owing to their size and capacity.

- ***Integrated multi-modal transport facility***

A system by itself cannot meet the transport needs of entire city. Since the travel pattern and intensity varies in different areas of a city, the transport system should have inbuilt flexibility to cater to this demand. To be able to provide door-to-door service, vehicle of different capacities need to be integrated, to optimise the capacity of the main transport network. A mix of IPT, small buses, regular buses, metro system could make an ideal mix. But the challenge is to achieve physical integration, network integration, fare integration, time-table integration, institu-



NMT Infrastructure in a neighborhood

tional integration and operational integration of these modes.

- ***Integration of city-level public transport with regional transport***

With the advent of public transport, the influence area of cities are increasing and going beyond their territorial boundaries. This calls for regional connectivity, which is often catered to by suburban railways. The urban transport system should be geared to integrate with suburban commuting system, so that commuter is assured of seamless travel without much waiting.

- ***Parking***

Parking space for private vehicles, IPT and interchanging public transport should be planned at the transport nodes. Parking in the influence zone of public transport encourages shift of people from personal mode of transport to public

transport. Parking is an essential component of public transport infrastructure and it should be prioritised and subsidised. However, parking charges should be fixed so as to discourage long term parking, thus encouraging maximum utilisation of the facility.

- ***Station and station area planning***

Station area has to accommodate large number of commuters every day. It is, therefore, important that station area is planned meticulously for improved accessibility and to provide commuters with connectivity for onward journey. Station should have footpath and parking for quick dispersal of commuters in the vicinity of station. It should also have area for pick-up and drop of passengers by IPT, feeder services and personal vehicles. Station area is also being planned

as commercial centres to take advantage of the footfalls, emerging from public transport.

6.0 CONCLUSIONS

The Indian cities are jostling for options to tackle the bustling growth of private vehicles. Streets are getting choked with motorised vehicles and citizens are gasping for fresh air. Planners are overworked to facelift cities- from the seize of wheeled monsters to a new paradigm of an equitable and sustainable transport system. The infringement of emerging technologies has resulted in reincarnation of the theories and principles of transport planning. The giant leap in information and communication technology has resulted in new patterns of working and leisure. The overlay and consolidation of technology on urban development has resulted in complex patterns that has made the prediction of trip generation even more difficult. In the transition economy, the data on changing living conditions and its consequence on transport planning is often not available to planners, to validate their planning models.

In spite of these challenges, planners do believe that improved and responsive urban planning and a modal shift to public transport is necessary to guide the growth of cities in a manner that it is not hostile to the environment. Extensive facilities for public transport and non-motorised modes in urban areas would discourage the use of private motor vehicles and make cities inclusive and sustainable.

Million plus cities have a significant sharing in energy consumption and CO₂ emission from the transport sector and if they can save on energy consumption and CO₂ emission, by adopting the strategies suggested in this paper it would be a role model for other towns in the country. They can plan to meet their growing transport demands on a low carbon path.

The Policy documents on urban transport and Master Plan have a clear vision. They unanimously agree that to solve the problem of urban mobility a city should be designed as people friendly city and not motor friendly city. But, ultimately the journey from policy to enforcement has to be short.

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a Dipak K Dash, The Times of India, May 31, 2012.

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c Wilbur Smith Associates Pvt. Ltd.

d Rail India Technical and Economic Services Ltd.

e A thorough study needs to be carried out to achieve an exact scientific value.

f Kalam, Abdul APJ Dr (2005) MoRTH, 2012.

List of existing Regulations for Protecting the Rights of Pedestrians

1. The Indian Penal Code (1860) sections 279, 304, and 336/37/38 protects the public, which includes pedestrians, against rash driving and negligence by motorists.
2. The Motor Vehicles Act (1988), sections 7-38 talks about penalizing the motorists exceeding speed limits and license regulation etc, indirectly protecting vulnerable road users. Furthermore section 138 clause (h & i) empowers the state government to prevent motor vehicles from using the pavements for driving or parking.
3. The Rules of the Road Regulation (1989) has three rules mentioning pedestrians or their right of way which are:
 - the duty of the driver to slow down when approaching a pedestrian crossing (Rule 8)
 - that no driver can park a motor vehicle near a traffic light or on a pedestrian crossing or a footpath (Rule 15)
 - that motor vehicles are not allowed to drive on the footpaths or cycle lane except with permission from the police officer on duty (Rule 11)
4. The Municipal Corporation Acts also protect public roads and streets by terming all obstructions illegal unless they are made with the prior permission of the collector. They are entitled to ascertain the footpath width based on width of the public roads.
5. Under the Persons with Disabilities (equal opportunities, protection of rights and full participation) Act (1995), the government must provide for auditory signals, engraving on the zebra crossings, slopes in pavements for easy access of wheel chair, and warning signals at appropriate places.

(Source: www.transparentchennai.com)



SUSTAINABLE URBAN MOBILITY: LEARNING BY DOING

A.K. JAIN

It is estimated that 3-wheeler vans, pickups, manual *thelas* and *rehri*, etc. cater to about 60 per cent of goods movement in Delhi. As compared to small truck, the autos and rickshaws are substantially cheaper, which by multiple trips deliver as much as a 5-ton truck in a day

The ultimate purpose of academics and research is to convert learning into practice so as to transform and make a difference in the lives of people. This paper presents some of the experiences of the author with respect to devising alternative transport systems like Delhi Metro Rail, Delhi Bus Rapid Transit and suggests some key measures in the pursuit of efficient, sustainable and safer urban mobility.

1.0 INTRODUCTION

Delhi is one of the fastest growing cities in India, and more so in terms of motorization. Vehicles are growing three times of its population growth rate. Traffic and transport has been a contentious and most discussed issue. Besides perennial jams, congestion and accidents, it engages several independent agencies and departments working on aspects like- (a) modes of mobility, (b) transport infrastructure, (c) service and sustainability and (d) transport management & governance (traffic regulation/control, planning, design, finance, implementation/ enforcement).

The city has been witnessing large variations in mobility between different income groups and considerable diversity comprising walking, cycling, rickshaws, buses, railways, chartered transport, private automobiles, intermediate public transport, informal transport, goods vehicles, intermediate para-transit, taxi, three wheeler auto-rickshaws, battery operated e-rickshaws, etc. Transport infrastructure, i.e. roads, parking,

sidewalks and paths are often congested, crowded, encroached upon and in poor condition leading to high number of casualties, especially of pedestrians, cyclists, women, children, disabled and elderly.

Inefficiency, unreliability and low comfort levels of public transit have been persisting. Due to increasing traffic and trip lengths, consumption of fossil fuel is also increasing thus resulting in high emissions and air-pollution. With several compartmentalized organizations, there are serious gaps in planning, implementation and enforcement of traffic related initiatives.

The economic liberalization and prosperity has seen a boom in the number of cars and two-wheelers. As a fall out of motorization, there is a spurt in development of sub-urban cities and transformation of agricultural land to non-agricultural uses. Several new urban centres have emerged within 50 kms radius of Delhi, which include Gurgaon, Manesar, Kondli, Sonapat, NOIDA, Greater NOIDA, Ghaziabad, Faridabad, etc.

The sub-urban growth and commuting have led to intractable carbon emissions. In Delhi, 90 per cent of private vehicles carry 31 per cent of vehicular trips and are responsible for 90 per cent of emissions. Some attempts have been made to control vehicular pollution loads, such as Supreme Court

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mandated switch over of commercial vehicles to clean fuel i.e. CNG, adoption of Bharat Stage II and Bharat Stage III emission norms and engine improvements. The emission control efforts continue to lose its relevance due to increasing volume of private vehicles, congestion on roads, increasing trip lengths (vehicle kilometres travelled), lack of travel demand management and synergy between land use and transport.

Although the problems (also the solutions) of urban transport are well known, the challenge lies in its implementation, which is closely linked with social, economic, physical (land uses and transport infrastructure), environmental, political, administrative and financial systems. As traffic and transport touches everyone in daily life, it is worth sharing few experiences on the implementation of some of the new modes of transportation in Delhi.

2.0 DELHI METRO

The idea of rail based city public transit system for Delhi was mooted in the 1970s by the government planners (TCPO and DDA). It was partly implemented as Ring Railway during the Asian Games organised in 1982, operated by Indian Railways. However, it failed miserably mainly due to its disconnect with major work centres, lack of feeder service, uneconomic fares and low frequency of services.

The concept of rail based transit system got a legal back-up in August 1990, when the Master Plan for

Delhi-2001, prepared by the Delhi Development Authority (DDA), was approved and notified by the Central Government. Initially, many experts, academics and media were opposed to the idea due to certain apprehensions such as expensive and financially unviable, failure of Ring Railway, resources and space constraints, etc. However, it was realised that without a rail based system, the city would be choked and doomed, not only physically, but also socially, economically and culturally. Without metro, Delhi would become one of the most polluted cities of the world, which it was fast becoming. The metro would provide the commuters a comfortable, efficient and fast mode of travel at a price comparable to bus, one fifth of auto fare and one tenth of the taxi fare. The other benefits of Delhi metro would be property development, which would mean that commuters would only pay 15 to 20 percent of actual expenditure or would have a subsidy of 80 to 85 per cent on each ticket, help in saving huge amount of money in term of workers' time value, reduced emissions, reduced consumption of imported & subsidized petrol and diesel, and growth in the city's economy. Given its significant potential role in changing the urban mobility landscape of Delhi. Finally, Delhi metro was sanctioned by the Union Cabinet in September 1996. The work on Delhi Metro commenced in April 1998, after the setting up of the Delhi Metro Rail Corporation Ltd. (DMRC), the implementing agency for the project. The Metro Rail Transit System (MRTS) network for the entire city has been identified

in four phases, which comprise of underground, elevated and surface corridors aggregating to approximately 415 km and is expected to carry 3-4 million passengers daily, with an average trip length of 15 km by 2021 in phases, as mentioned below:

- Phase one of the network (65 km) is in operation since 2002.
- Phase two (2006-11) covering a length of 121 km is also in operation.
- Phase three (2011-16) will cover 120 km, and is under implementation,
- Phase four (2016-21) will cover 108.8 km length, which is to be completed by the year 2021.

The metro connectivity has also been extended to the suburban towns- Noida, Ghaziabad, Gurgaon and Faridabad. About 60 per cent of Delhi's urban areas will be within 15-minute walking distance from the MRTS stations, after its full development. At present about 15 per cent of urban area of Delhi is directly served by the metro. Due to development of economic activities along the Metro Corridors and optimization of connectivity provided by it, the ridership on the Metro has been growing rapidly, reaching to staggering 2.40 million passengers per day. Vehicular trips are progressively shifting from road-based transport to MRTS, particularly, the longer trip lengths (greater than 10 km). About one-fifth of the capital costs of Delhi Metro project have been met by the Central and State Governments each, JBIC and other subordinate soft loans contributed

about half of the capital cost and the balance funds are generated from fare box collection and from internal resources of the DMRC through property development. To keep a check on harassment of women commuters, Delhi metro has

reserved a coach for women passengers, besides installing CCTV and deploying women marshals.

3.0 BUS RAPID TRANSIT

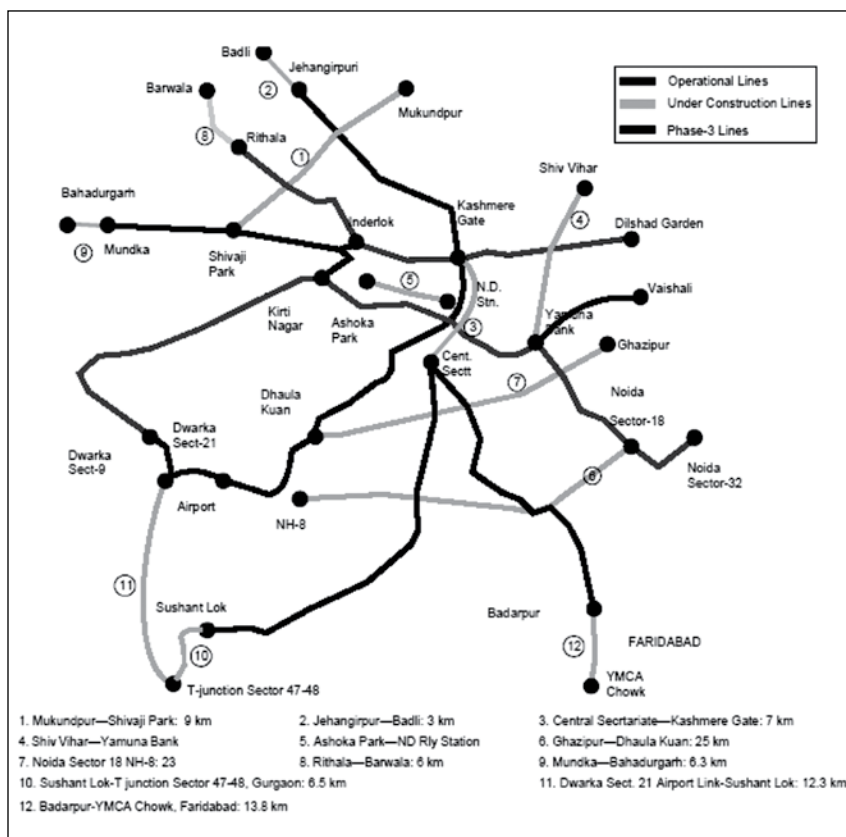
The buses in Delhi carry an estimated 60 per cent of the motorized

commuting trips, emit 4 per cent of Green House Gas (GHG), occupy 6 to 8 per cent of road space and are only about one per cent (70,000) of the total motorized vehicles (75,00,000). In comparison, cars and two-wheelers represent 90 per cent of the motorized vehicles, emit 90 per cent of GHG, carry about one-third of commuters and occupy two-third of road space. The private vehicles are also responsible for most of the accidents involving mostly the pedestrians or cyclists. The idea of dedicated Bus Corridor was first mooted in 1989 with the realization that a separate bus corridor would double the speed of buses, increase efficiency and carrying capacity, without investing in purchase of more buses. Based on the extensive work by IIT Delhi on Bus Rapid Transit System (BRTS), the Delhi Government and DDA approved BRTS during 2003-04. A detailed plan for 5.8 kms pilot project was prepared by the IIT Delhi and this plan was taken up for implementation in 2004.

The BRT pilot corridor from Ambedkar Nagar to Moolchand junction has been in operation since 2006. BRT has been designed with many innovative features. It is disabled and wheelchair friendly with ramps at stations & level entry, tactile flooring for visually impaired and low floor buses. The corridor has special street lighting for the safety and security of pedestrians. A dedicated bicycle lane has been built for the cyclists. The bus stops provide user information (fixed signs, maps, variable message signs), pedestrian crossings, integrated fare collection

Delhi Metro vis-a vis Global Systems

City	Year of Opening	Track Length (km) 2013	No. of Stations	Daily ridership (in millions)
London	1890	402	270	2.74
Paris	1900	199	368	6.00
New York	1904	368	468	4.27
Moscow	1935	292	177	9.00
Delhi	2002	200	140	2.25 to 2.50



Delhi Metro Network

Source: Delhi Metro Rail Corporation

systems, protection systems and communication elements. Delhi Government plans to build 26 BRT corridors in Delhi, covering a total length of 310 km by 2020. However, the project has run into difficulties and received bad press reporting, due to squeezed right of way for private vehicles, and partly due to faulty selection of pilot corridor. The area around the pilot corridor is inhabited largely by car owners and does not have an escape route within three kilometers. As a result, the Government of Delhi has put on hold the further development of BRT in spite of positive feedback from the surveys. A survey by Centre of Science and Environment and Indian Youth Climate Network (2008) recorded that 83 per cent of all commuters supported the BRT. A subsequent survey in December 2008 by the students of the Indian Institute of Technology, Delhi, has reinforced these findings by showing that 85 per cent of bus commuters felt that the BRT has been successful, 88 percent found it quicker and 90 per cent supported its implementation in other places. Studies undertaken by IIT Delhi (TRIPP, 2008) and Washington based expert group EMBARQ (2009) show that bus speeds have improved by 50 per cent on BRT corridor.

The BRT system is also being implemented in some other cities of India under Jawaharlal Nehru National Urban Renewal Mission (JNNURM). BRT is popular in cities such as- Ahmedabad, Bhopal, Indore, Jaipur, Pune, Rajkot, Surat and Visakhapatnam, as compared to Delhi. The ICTSL (Indore City

Transport Services Ltd.) structured a PPP model for urban bus services in Indore. The investment in the urban bus transport system was shared between ICTSL, private operators and service providers. The investment in common infrastructure like retrofitting of roads for BRT, bus stops and office space was contributed by the ICTSL, while the investment in the rolling stock was made by the private bus operators. The ICTSL identified the BRT routes for PPP operations for tenure of five years against payment of a fixed monthly premium to the ICTSL, and bearing the operation and other maintenance costs by the bus operators. Entire fare box collections, 60 per cent of the revenue from sale of advertising rights and 80 per cent of the revenue from sale of monthly passes go to the operator. The ICTSL linked the BRT with the provision of supporting services like advertising, GIS (geographical information system), PIS (passenger information system) and feeder services.

The BRTS in Ahmedabad, known as 'Janmarg', is based on the idea of equitable sharing of road space. An exclusive bus lane of 7.5 mts width has been provided together with sidewalks along the BRT network with tree cover and passenger services. A 2.1 mts wide parking area is provided along the mixed traffic lanes. Certain locations on 'Janmarg' corridors, with large volumes of people and traffic, are provided with subways and FOBs with elevators for disabled, wheel chair users and elderly. The mixed traffic lanes have been elevated to provide at-grade

pedestrian crossing. Interchange stations are designed for integrating different modes of travel. As per the surveys conducted by the CEPT, there has been a shift in 21 per cent of trips from private transport and 70 per cent trips from city bus service (AMTS) to Ahmedabad BRT. The project financing is shared by the Government of India, Government of Gujarat and Ahmedabad Municipal Corporation, broadly in the ratio of 35:15:50.

4.0 INFORMAL AND INTERMEDIATE GOODS TRANSPORT

During the XIX Commonwealth Games (October 2010) in Delhi the movement of trucks was almost banned for three weeks and the people were wondering whether they will get their daily supplies of fresh fruits, vegetables, milk, bread, newspaper, laundry, grocery, soft drinks, water, etc. In spite of no trucks, the supplies were more or less normal. Credit goes to informal goods transport, which regularly delivered bulk of the daily supplies of fruits and vegetables (3600 mt) and many other items of daily consumption.

In spite of being informal and unorganized, it is estimated that 3-wheeler vans, pickups, manual *thelas* and *rehri*, etc. cater to about 60 per cent of goods movement in Delhi. As compared to small truck, the autos and rickshaws are substantially cheaper, which by multiple trips deliver as much as a 5-ton truck in a day. Courier services, perishables, such as milk, vegetables, fruits, groceries and other short-

haul deliveries are increasingly being made by auto-rickshaw, van or tricycle. They are able to reach in narrow lanes and congested areas where public authorities do not allow trucks/public carriers during day time and also during frequent VVIP visits, processions, ceremonies, etc.

The informal carriers and goods services have developed their own indigenous logistics. They often work on the principle of relay race and area-wide trip chains which link various transport nodes-railway stations, bus terminals, truck terminals, wholesale markets of grains, fruits and vegetables, milk production centres with the retail markets, street vendors and consumers. The dabbawala, lunch delivery system in Mumbai is a classical example of informal logistics. In Mumbai more than 200,000 lunches get moved every day by an estimated 4,500 to 5,000 dabbawalas, with a nominal fee and with utmost punctuality. Although the service remains essentially low-tech, with the barefoot delivery men as the prime movers, the dabbawalas (tiffin carrier) system is gradually becoming hi-tech and have started booking orders through SMS and on-line. The system depicts precise teamwork, time management and indigenous logistics. A simple colour coding system doubles as an ID system for the destination and recipient. Dabbawala's carry a wooden crate for the tiffins on their cycle, sometimes on their head and sometimes in local trains. The objective is delivery in time and at the right place which is achieved by a combination of

transport modes-cycle, barefoot, wheel barrow, head loading, push cart and train.

Informal transport services bridge the void left by formal public transport operators for transport and goods movement. It provides employment to thousands of unskilled young men, estimated at about 15 percent of total employment in transport sector. However, the intermediate or informal transport sector is riddled with numerous challenges, like lack of parking space, right of way, harassment by transport officials, poor vehicle safety & fitness standards, lack of insurance, etc. Although competitive and affordable, low fares force the operator using sub-standard fuels, polluting engines and preclude service improvements. The transportation officials often fail to appreciate the importance of informal transport. This mindset, together with the pressures from customers and automobile industry, add to the marginalization of informal transport. There is absence of any kind of normative policy framework for informal motorized transport services. Delhi had about 60,000 transport related shops and repair facility, of which one-third are illegal or informal. Keeping in view the service rendered by informal shops and workshops, Delhi Master Plan-2021 mandates a reservation of 10 per cent space in planned commercial and transport centres for the service and repair shops and for informal sector.

5.0 NON-INVASIVE TRANSPORT APPROACH

The Master Plan for Delhi-2021

advocates a comprehensive strategy comprising preventive, structural and non-invasive transport solutions and approaches. For a synergy between land use and public transport system, it mandates restructuring the city by Transit Oriented Development. Higher density, FAR and mixed land use envisage a compact and smart growth. It mandates an integrated multi-modal public transit system, including Rapid Railway extending to NCR, together with corridor development. Simultaneously, transport infrastructure, roads, dedicated two wheelers, cycle and pedestrian tracks are to be constructed. E-governance is an effective tool to conserve transport and reduce the need to travel. It is proposed to adopt zero defect standards for roads, services and their maintenance. Sub-terranean space is to be explored for roads, metro, parking, etc. There is a need to improve the drainage, mandatory use of porous paving and swales for rainwater harvesting on all foot paths and parking areas. Master Plan for Delhi-2021 also suggests to link registration of new vehicles with parking space availability and adopting other travel demand management measures.

6.0 ESTABLISHMENT OF A UNIFIED METROPOLITAN TRANSPORT PLATFORM

Urban transport is a complex, inter-disciplinary subject involving about 30 Central, State and Local Government agencies in Delhi, besides many other semi-public, corporate and private entities. As a result, there is a fragmented and ad-hoc approach to address

problems pertaining to urban transport management. The National Urban Transport Policy (2006) suggests that for transport planning, development and implementation the state governments should create a unified traffic and transport authority for metro-cities. This needs a new enactment and a new set-up. Meanwhile, an Unified Traffic and Transport Infrastructure (Planning and Engineering) Centre (UTTIPEC) has been constituted for Delhi vide Gazette Notification dated 31st July, 2008 (amended on 7th August 2009) under the existing Delhi Development Act, 1957.

It aims to enhance mobility, reduce congestion and promote traffic safety by better coordination among various agencies and by adopting standard transport planning practices, capacity building, enforcement measures, road safety audit, traffic engineering practices, developing traffic culture and avoiding transport planning pitfalls. The aims and objectives of Unified Traffic and Transport Infrastructure (Planning and Engineering) Centre are as follows:

- To study and coordinate the norms and standards for planning and engineering practices in traffic and transportation
- Implementation of NUTP 2006 and MPD-2021
- To prepare Traffic Road Safety Guidelines
- To coordinate the engineering and infrastructure aspects of sustainable public transport system
- To evolve a parking policy and parking solutions
- To make an inventory of corri-

dor-wise traffic and transport problems, traffic management strategies and enforcement guidelines.

- To act as a repository for sharing traffic and transportation plans/ database/ information/ digitization and web site information
- Developing protocol and designs for signage, street furniture, lighting, signals, hoardings, trees, roadside landscape, zebra crossings, pedestrian passage, commuter facilities, etc.
- Evaluation-public participation-feedback
- To take up other related activities, including co-ordination, capacity building and training

The Chairman of the UTTIPEC is the Lt. Governor/Chairman DDA, and it has members from all the departments concerned with urban transport, viz. GNCTD, MOUD, TCPO, CRRI, DIMTS, MCD, PWD, NDMC, Northern Railways, DMRC, Traffic Police, Indian Roads Congress (IRC), Institute of Road Traffic Education, etc.

Since its establishment in 2008, the UTTIPEC has undertaken the planning, coordination and scrutiny of various transport projects like, roads, flyovers, parking projects, underpasses, pedestrian facilities, cycle network, BRT, MRTS, etc. It has prepared norms, guidelines and manuals based on hand books and best practices in traffic and transportation planning and engineering for uniform adoption in NCT Delhi. The UTTIPEC has also worked out Transit Oriented Development guidelines and pilots based

on Transit Oriented Development (TOD). UTTIPEC has coordinated the planning and integrated development of Metropolitan Passenger Terminal (MPT), Inter-State Bus Terminals, Metro and Railway stations by involving the planning agency, consultants, concerned urban local bodies, railways and the DMRC. Rather than earlier practice of road alignment, it has adopted the practice of urban corridor planning, together with corridor specific land use and development controls, facilities and infrastructure services. The concept of Facility Corridors along major roads has been incorporated in MPD-2021, so as to relate transport with land use and to promote compact, smart and mixed use development.

7.0 SAFETY OF PEDESTRIANS AS A NATIONAL MISSION

Recently several Jain monks, pilgrims and Kanwaris were killed by vehicular traffic unmindful of the pedestrians on the road. Some concerned citizens and organisations approached me for working out an actionable plan for safety of pedestrians. Accordingly, the following guidelines and proposals were worked out after discussion with concerned organisations, key officials, NGOs, etc. These were submitted to the Central and State Governments for consideration and implementation.

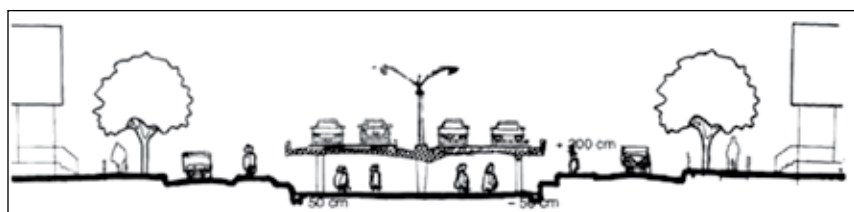
As Foot-over Bridges (FOB) and subways are hardly used by the pedestrians, it is necessary to provide wide and safer pedestrians corridors at grade while the motorised vehicles move up and

down. The walkways also need to cater to wheelchair users that require avoidance of steps and provision of curb ramps. This may be possible by raising the carriage ways of the road by about 2 to 3 meters, so that pedestrians keep moving freely at the ground level without mingling with vehicular traffic. Such facility should be provided on all major roads, national and state highways, in front of village abadi, cattle grazing fields,

required on the railway lines for safe passage of pedestrians and animals.

Corridor Plans for Pedestrians and NMTs (particularly cycles) should be developed, covering the following:

1. Plan for pedestrian zone and road safety
 - i) Identifying accident prone points, pedestrian movement, volumes and areas



transport nodes (Railway Stations, Metro Stations, Bus Terminals, etc.), and also forests and wildlife areas. The walking zone should be barrier free and designed as per the specifications.

- ii) Prepare area wise/corridor wise pedestrian and road safety plans with dedicated footpaths, NMTs and cycle lanes



Safe corridors for cyclists, cattle, pedestrians and wheelchair users

A 10 to 15 m wide pedestrian underpass may be created by raising the vehicular carriageway by 2 to 2.4 m and dipping the pedestrian passage by 0.5 to 1.0 m. It shall be provided at regular intervals on all NH, SH, Arterial roads where there is sizable volume of pedestrians, non-motorised transports (NMTs), cattles/wildlife. Similar provision is

- iii) Underpasses at grade for pedestrians and cattle at regular intervals
2. Engineering and implementation
 - i) Road management plan, repair, drainage and work zone management
 - ii) Speed breakers
 - iii) Maintenance to aim zero defect roads

- iv) Road markings, zebra lines

- v) Provide railings and crash barriers, signage, orientation points and guide maps

3. Traffic regulation/control and audit

- i) ITS, Intelligent signals, alarm and communication system, unified CCTV command platform to be installed

- ii) Streamline drivers licensing procedures, training and behavior

- iii) Check overloading of goods vehicles and joy rides

- iv) No free U turn, No blind corners, keep right of way and crossings free from parking, bus stops, kiosks, taxi stands, encroachments, etc.

- v) Online complaints and redressal system to be in place

- vi) Inter-state/city and inter-departmental coordination,

4. Help in emergency

Helpline, surveillance, first aid, trauma centres, ambulance service, integrated/common complaint centre should be designed.

5. Institutional capacity building, public participation and support

- i) Organisational resources, financial strengthening and capacity building

- ii) Promote active safety campaigns by participation of public, road users/citizens

- iii) Monitoring and accountability framework

- iv) Revising Motor Vehicle Acts and other legal framework
- v) Pedestrians' right to safe mobility be deemed as a human right

The most important suggestion is to take-up road safety as a mission, with a well structured action plan. The 'National Road Safety Mission' should be under the Prime Minister and 'State Road Safety Missions'

should be under the Chief Minister of each State.

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DIAL-A-CYCLE RICKSHAW SERVICE- FAZILKA, INDIA



Key Information

- Node to Node Connectivity
- Sustainable Technology
- Affordable and Comfortable
- Key design features:
 - Reduce carriageway for motorized Vehicles
 - None call centers serve an average of 1500 Households. Total ECOCAB available in Fazilka - 500
 - Daily passenger ridership – 10,000 passengers per day
- ECOCAB won the National Award for Excellence in NMT Initiative from the MoUD in 2011

Cycle rickshaws are a traditional and an eco-friendly mode of transport in India. They continue to play a role as para-transit and non-motorized mode of transport in Indian cities. The world's first dial-a-rickshaw service, ECOCAB, was initiated in Fazilka, Punjab in 2008 by Graduates Welfare Association Fazilka, an NGO dedicated to education, employment, environment and energy.

The key to ECOCAB concept has been the improvement of the existing rickshaw design. The cycle rickshaws are ergonomically designed and the service is offered at a very affordable price. The new rickshaws are lightweight, low-floor and carry extra luggage and have better advertisement space.

The second key innovation in the ECOCAB concept is its operations based on advanced IT infrastructure. Fazilka is divided in nine different zone of one kilometer by one kilometer grid. Individual grid has its own zone code. Further the city is being served via nine ECOCAB call centers from where the user can dial for rickshaw at doorstep. The users just have to dial ECOCAB number in which the last three digits are zone code. Each traction man carries mobile phone for direct calling facility and its android application is available in the market.

Currently in Fazilka, more than 500 ECOCAB are available and

ridership is 10000 passengers per day. The service is usually available between 9:00 a.m. and 6:00 p.m. The scheme functions very similar to the dial-a-cab service and all rickshaw pullers, also known as traction men, have been provided with cell phones.

According to estimates, nearly 60 lakh (6 million) people travel on cycle rickshaws in Punjab every day. The ECOCAB scheme has been instrumental in employment generation, becoming a source of livelihood for about 3 lakh (300,000) families and reducing use of fossil fuels. The availability of ECOCAB save 1500 liters of fuel on daily basis and reduce the amount of air pollutant in the air. The project helped increase the latent demand for cycle rickshaws and has contributed towards improved well-being of rickshaw pullers and their families. With the success of the scheme and its national- level recognition, several other cities, including Delhi and Jaipur are considering implementing a similar dial-a-rickshaw system.

In 2011, Fazilka ECOCAB won the National Award for Excellence in Non- Motor Transport from the Ministry of Urban Development, Government of India. A similar practice has been adopted for auto-rickshaws in several other cities. The concept was successful, and it has now been taken to 21 other cities in the state of Punjab.

Source: Environmental Planning Collaborative, 'Sustainable Urban Transport : Principles & Guidelines for Indian Cities (Draft Report), 2013.

ECO-MOBILITY: A STRATEGY FOR SUSTAINABLE URBAN TRANSPORT

KULWANT SINGH

Eco-mobility is a paradigm shift towards promoting and integrating walking, cycling, wheeling, passenging and car-sharing, bringing the focus back from automobile-centered development to human needs and liveable cities. While Eco-mobility focuses on the mobility of people, Eco-logistics focuses on the transportation of goods and freight in an environmentally sound and efficient way.

This paper is based on the discussions that took place in the second Eco-mobility 2013 Congress in the city of Suwon, Republic of Korea during September 1-4, 2013. The purpose of this paper is to provide guiding thoughts, principles, examples and starting points for concrete improvements in urban planning & development, be it for existing municipalities or new towns, towards the greening of mobility in the cities worldwide.

In the fast urbanising world there is an increased need for mobility. However, the result of this is that the city streets are getting choked. Street space in a city is most valuable asset that needs to be optimally distributed and used. The judicious use of the street, the public space, mainly being a political issue, requires a strong political will.

1.0 INTRODUCTION

Historically, urban settlements have been the cradles of civilisation and culture environments in which a multitude of intellectual, economic and social activities have flourished. For these many pursuits to thrive in the cities of the developing countries of the 21st century, we need settlements that work efficiently, are sustainable and provide access to work, services and security to all its citizens, along with the social and cultural space needed for full human development and expression.

Urban mobility is one of the key aspects to achieve sustainable,

liveable, efficient and healthy cities. Eco-mobility focuses on sustainable and safe alternative systems of urban transport.

Today there is a growing traffic congestion in urban areas that is not only leading to increased fuel consumption but also loss of productive time. Eco-mobility does offer alternative solutions with multiple benefits in the form of clean air, recreation for the community at large and making people healthier. This needs a change in the urban paradigm, so that cities can be put on the right track. Cities need to become green in substance and not just in colour. Eco-mobility provides a solution to reduce high emission of greenhouse gases.

Cities need to reinforce the linkage between spatial attributes and transport demand. Decreasing the demand for mobility through urban planning solutions is the key. Many cities are in the pursuit to make urban mobility an integral part of urban planning, in order to create a “city of short distances”. In this regard innovations such as intelligent transportation systems integrated with intermodal interchange offers a solution that connect mass transit system to cycle networks and pedestrian areas.

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¹ The Eco-mobility World Festival 2013 was held in Suwon, South Korea, throughout the month of September, 2013. The Festival showcases an ecomobile urban lifestyle in one neighbourhood of Suwon City, which has become car-free for a whole month. The festival aimed at identifying solutions to deal with the ever increasing demand for mobility in the wake of fast urbanisation. The Festival was jointly implemented by the City of Suwon and ICLEI - Local Governments for Sustainability under the leadership of Mayor Yeom and Creative Director Konrad Otto-Zimmermann, and presented to the world by ICLEI and UN-HABITAT, <http://www.Ecomobilityfestival.org>

The way people and goods are moved in and between urban areas determine how our cities look and function. Cities in most countries prioritize fast private automobile traffic, destroying urban fabrics and lives. Modern mobility concepts are bringing change into urban transportation outlook, making it a key component for safe, clean, liveable and economically sound city development.

Eco-mobility means travelling through integrated, socially inclusive and environment friendly transport options, including and integrating walking, cycling, wheeling, passenging and car-sharing. Eco-mobility includes integrating different transportation means, encouraging inter-modal transfer in city-wide tariff systems, creating new organizational models, fostering new technologies & public-private partnerships, raising awareness and communicating about modern mobility behaviour, enabling the movement within and between urban areas and providing affordable & accessible transport for disadvantaged, such as children, women, elderly people and physically challenged.

Eco-mobility allows citizens to select the most appropriate, sustainable and economically reasonable mode of mobility by implementing the transport subsidiarity principle: Walking - cycling - wheeling - passenging - car-sharing and establishes a priority order for urban planning and mobility. The subsidiarity principle is thus translated into "Transport subsidiarity" and guides local government decision making.

Eco-mobility is a paradigm shift towards promoting and integrating walking, cycling, wheeling, passenging and car-sharing, bringing the focus back from automobile-centered development to human needs and liveable cities. While Eco-mobility focuses on the mobility of people, Eco Logistics focuses on the transportation of goods and freight in an environmentally sound and efficient way.

Eco-mobility is a uniting term. Other terms such as Sustainable Urban Transportation or Green Urban Transportation express similar goals and values. The given cultural context determines which term is used by municipal decision makers. Eco-mobility will serve as common concept, also to enrich mutual learning across regions and for setting and accomplishing global goals.

2.0 PLANNING FOR ECO-MOBILITY - WHAT SHOULD CITIES DO?

Local planners and decision makers need to take immediate leadership in transforming their cities for the future, by making them resilient, resource efficient, low-carbon and liveable. The crux of this transformation is transport system, built on the principles of Eco-mobility. Equally important is municipal action promoting legal and financial frameworks supported by higher governmental authorities. To win the hearts and minds of citizens and businesses in favour of Eco-mobility, public authorities and private sectors must provide the right motivation, incentives and support. Planning for

Eco-mobility depends on a number of elements, some of which are already in place in few cities. What is needed is local and regional strategy that combines diverse actions and establish an overall mobility concept. In addition, national strategy needs to provide supportive framework and condition to favour Eco-mobility.

2.1 A new paradigm of urban planning and development

- Modern urban development that offers mobility for all and takes into consideration a majority of the population: women, children, elderly people with no driving license and car, and people with limited mobility.
- City and transport development, which fosters micro-qualities rather than investment in macro-projects.
- Planning towns and neighbourhoods around Eco-mobility, not around the car (Eco-mobility-Oriented Development - EOD, which goes beyond Transit Oriented Development - TOD).
- Public space for people, not for cars.
- Planning for tomorrow's society with a higher proportion of elderly people.
- Planning for sufficient density and zoning for mixed uses to minimize the need for transport.
- Countering the trend toward bigger, stronger and faster motor vehicles by providing incentives for a transition to smaller, slower, shared-used vehicles (the 3 Ds: downsizing, down speeding, down-numbering).

- Adopting new comprehensive definition of public transport, innovative vehicles and business models to ensure dispersion of public transport (for example on-call buses, night-cabs).
- New concepts for carrying goods and freight (e.g. Car Go Tram) (Zurich/ Swiss; Dresden/ Germany; Vienna/ Austria).
- Eco-mobility should become the backbone of urban transport.
- Encouraging independence from cars.

2.2 New priorities for urban transport planning

- Translating the new paradigm in municipal traffic planning. Anchoring the subsidiarity principle within transport planning with the priorities of walking - cycling - wheeling - light and small e-vehicles - passengering - car-sharing.
- Reducing traffic speed in general and avoiding excessive traffic speed.
- Revitalizing traffic areas for multiple public and private functions, traffic calming
- Considering the impact of all modes of transport in terms of traffic reduction, shared space and coexistence.
- Starting and continuing pilot projects (e.g. the Eco-mobility World Festival Suwon), to initiate public debates, promote new technologies and organizational forms.
- Limiting access to inner cities for private cars (London/UK; Milan/ Italy; Singapore).

- Reducing parking supply, limiting wayside and sidewalk parking.

2.3 Safe lanes for Eco-mobile traffic

- Redesigning and/or reclassifying roads as Eco-mobility lanes with three segments:
 - one lane for pedestrians and other slow and sensitive users;
 - one lane for faster non-motorized vehicles;
 - one lane for faster public transport (buses, trams and cabs) and light-electrical vehicles.
- Introducing a general speed limit of 30 km/hour in the entire city, except on arterials (Freiburg/ Germany).
- Introducing shared-space zones with a speed limit of 30 km/hour or less.
- Expanding pedestrian areas.
- Reclassifying main roads: one lane for rapid buses, trams and fast non-motorized or light e-vehicles (Curitiba/ Brazil; Suwon/ South Korea; BRT systems).
- Strictly separating slow Eco-mobility (pedestrians, children, elderly, users of wheelchairs and walkers) and fast Eco-mobility (bicycles, electric wheelchairs, mobility scooters, Segways, small light electric vehicles etc.).

2.4 Facilities and infrastructure for Eco-mobility

- Establishing "Eco-mobility stations" including weather-proof and safe parking of small vehicles

(e.g. bicycles, scooters, Segways, walking frames, carts, trailers for children, etc.) and light electrical vehicles.

- Designating public spaces as pitches for bike-sharing, car-sharing, wheelchair rental services, etc.
- Using car-sharing services instead of maintaining motorized vehicle fleet.
- Promoting public charging and battery exchange stations for pedelecs and electric cars, supplied by renewable energy.

2.5 Elements of public and shared transport systems

- Providing bike-sharing systems with facilities at bus and tram stations (Changwon/ South Korea; Paris/ France).
- Promoting rental stations for wheelchairs, mobility scooters, walking frames, carts etc. at train stations, (suburban) parking spaces, neighbourhood and strategic places of interest.
- Fostering local neighbourhood buses (micro buses).
- Implementing velocab services, including cycle rickshaws or trishaws.
- Building up cab-services with light electrical vehicles.
- Installing (Rapid) bus and municipal tram systems with priority lanes and attractive stations (Bogota/ Columbia).
- Embedding cable cars, cog-railways, hoists, conveyor belts, escalators, solar ferries and water-driven cable ferries and

lifts (Medellin / Colombia, Stuttgart / Germany, Lisbon / Portugal).

2.6 Inter-modality: Smooth transition between transport modes

- Establishing transport connection hubs where various non-motorized and public transport systems meet.
- Guaranteeing short distances between stations and synchronized timetables to minimize transfer times.
- Introducing an Eco-mobility card with integration and combination of tariff systems and tickets for public transport with shared-use vehicles and rental vehicles (Bremen / Germany; Changwon / South Korea).
- Building up facilities and infrastructure for an easy transition between different modes of transport, e.g. bicycle / bus, mobility scooter / subway, parking lots. (Bremen / Germany; New York / USA).
- Inventing and using new information and communication systems for Eco-mobility to interact and coordinate between different modes of transport and with the users: Linking-transport, timetables, bus-/taxi-services, bike- and car-sharing services, electronic ticket, etc.

2.7 Legal Framework, supportive instruments and incentives

While municipalities can decide and experiment on their own, they also require the following enabling conditions from national and provincial

governments, to promote Eco-mobility:

- Modifying standards for roads (e.g. dedication to specific vehicle types, dimensions of roadways and parking spaces for non-motorized and new small electric vehicles).
- Abolishing eco-mobile obstructive standards.
- Adapting building standards to ensure accessibility for mobility disabled, non-motorized and new small electric vehicles.
- Implementing technical standards for compatibility of non-motorized and small electric vehicles.

2.8 Private users, service providers and local economy

Municipalities provide infrastructure, public services, incentives, inspiration, and their moderation capability. Citizens, service providers and local business are encouraged to take advantage of these, develop approaches further, realize their opportunities, and demand new mobility systems. Therefore, everyone can participate in the development of a low-carbon, resilient, safe and sustainable urban planning process. Municipalities need to encourage the early participation of citizens and businesses; and create incentives and compensation systems for private actors. Citizens and stakeholders should become acquainted with alternative non-motorized and new small electric vehicles. They also need to take initiative to become part of local experiments and innovations, even if they come with changes

as well as accept reconstruction and temporary partial solutions. Further, the local economy should identify opportunities rather than rejecting changes, e.g. pedestrian zones; develop new business models that create jobs; foster new forms of cooperation instead of competition, e.g. between public transport companies and pick up innovations and integrate these into existing services and businesses, rather than resisting them.

2.9 Transportation needs - a new benchmark for planning and investments

- Measuring service levels and performance of urban mobility, as a basis for priority setting for future infrastructure development.
- Thinking of new systems for traffic statistics and measuring of success that takes all modes of transport into account (e.g. modal split).
- Focusing on human needs rather than distances (e.g. routes and trips, not only km).
- Using indicators e.g. allocation of resources for Eco-mobility, parking provision, public transport coverage, road safety etc. as means to measure transport performance.

2.10 Transparency of subsidies and financing

- Funding Eco-mobility through reallocation - shifting money from infrastructure for cars to Eco-mobility.
- Taking into account all direct and indirect costs for cost-benefit analysis of transport projects.

Direct costs include infrastructure investments, maintenance of roads, parking spaces, import of oil indirect costs include impacts of emissions, air pollution, health damage, building damage, accidents, and decline in value of property.

3.0 BENEFITS OF ECO-MOBILITY

Eco-mobility bears many benefits and can thus come with a variety of pro-arguments, e.g.:

- New forms of mobility enhance the quality of life, even for those who have been dependent on cars.
- Mobility becomes safe and reliable for those who do not own a car.
- Severe accidents and possible accidents caused by inadequate planning (e.g. when mixing fast and slow moving modes) can be avoided.
- Citizens can save time and money
- Children and young people are able to move around the city independently.
- Elderly people can easily and safely participate in daily life affairs.
- Access to high quality urban mobility does not depend on income-level.
- Energy and exhaustible resources are saved.
- Air quality in cities is improved.
- Noise pollution in the cities is reduced.
- Movement through muscle-power promotes the health and fitness of the population.
- Real estate values can increase in quiet and accessible neighbourhoods.

- The local economy gets additional business ideas and markets.
- New jobs and professions are created.
- Sustainable tourism is supported.
- Transport costs are minimized.

4.0 MOBILITY AND CITY CHANGER CAMPAIGN OF UN-HABITAT

How we transform our cities to become better places to live and how we involve citizens in this process, are goals fully aligned with UN-Habitat's approach to sustainable urban development. In this regard UN-Habitat has initiated a City Changer Campaign which aims at raising awareness about the themes that impact our cities and how citizens can contribute to

improve urban spaces, with their actions and initiatives. The "I'm a City Changer" campaign around the world encourages a new social conduct on Mobility suggesting:

- Leave your car at home and ride a bike or take public transport
- Promote car pooling among your friends as an alternative means of mobility

The Eco-mobility festival, of which UN-Habitat was a partner, has similarly made an endeavour to promote green mobility for sustainable development and encouraging new "City Changers".

² UN-Habitat is partnering with national and local governments and promoting a new urban agenda for better and sustainable urban planning and design with optimal density and diversity so as to decrease the demand for mobility.

Forthcoming Event

AIHDA NETWORKING EVENT IN WORLD URBAN FORUM (WUF), 2014

The Seventh session of the World Urban Forum will be held in Medellin, Colombia from 5 to 11 April 2014. Theme of WUF-7 is 'Equity in Development – Cities for Life'. This Session will bring together some of the most committed – City Changers from the South and from the North. It will be a platform to create new networks and partnerships and strengthen existing ones, with a meaningful impact on equity and development. Participants will gain new awareness about the role that cities, countries, international agencies and development partners can play in advancing an equity agenda, sharing knowledge and best practices.

The All India Housing Development Association (AIHDA), like previous WUFs, will take a delegation of officials from housing and urban development agencies in India to participate in the WUF-7 and also organise a Networking Event on one of the sub-themes of the Forum. Networking Events at the World Urban Forum provide a platform for governments, civil society organizations, private sector, community representatives, international and national organizations, academia, and other United Nations entities to discuss specific topics of relevance and interest within the theme of the Forum.

The Networking Event format provides an opportunity to build knowledge, strengthen partnerships and networks through sharing ideas and identifying best practices in an effort to advance sustainable urban development in cities and towns around the globe. As the world advances fast to an urban future, Networking Events organized by hundreds of partners from all parts of the world provide a window through which the prospects of dealing with challenges of humanity's living conditions may be better understood and addressed. Please visit www.unhabitat.org for more information.

For details on AIHDA Networking event, please contact aihda.org@gmail.com

PARKING IN MILLION PLUS CITIES

**J.B. KSHIRSAGAR,
PAWAN KUMAR**

Out of 8760 hours in a year, the average steering time of a car is 400 hours. It means that a car is parked for about 90 to 95 per cent of the time and hence space for parking becomes important.

Due to huge growth of car population, the issue of parking has assumed increased attention. This paper advocates the need for appropriate parking interventions including policies for on-site and off-site parking. The Urban Local Bodies should enact regulations for control of vehicle parking.

1.0 INTRODUCTION

A parking space is designated for parking of the vehicles in a particular location which may be depots, multi-level parking garage, parking lot, on-street & off-street parking, etc. Generally, space allocated for parking at a particular location is regulated through time (duration) and fee paid to use the space. Parking space for public transport is provided and managed by the Authority concerned but the parking of personal transport, particularly car, has multi-dimensional issues. Many attempts are made to manage parking by the Urban Local Authorities but it does not cope with demand. A study conducted by the Central Road Research Institute states that out of 8760 hours in a year, the average steering time of a car is 400 hours. It means that a car is parked for about 90 to 95 per cent of the time and hence space for parking becomes important.

If a car is used, then each car requires two /three parking spaces in a day. First, a parking space at residence; second, space at office; and third, space during non-work trips. In this context, it is a challeng-

ing task to provide parking space for the same car at different locations in a day. Further, every car user / owner expects that the space should be provided either free of cost or at a very nominal fee irrespective of high land cost in cities. Therefore, parking issues are not only related to space requirement but it is totally based on economic principles related to land cost, operation cost, maintenance cost, management cost, hourly parking fees, loss & gain of the service providers, etc.

2.0 PARKING ISSUES

A car is a commodity and therefore it is purchased by an individual which further defines his ownership for same. In this context, two schools of thoughts prevail:

- i. If it is owned by the individual, then it is the responsibility of individual to have the parking space before purchasing a car. The freedom of purchasing a car should not put burden on local authorities to supply land for parking at different locations without adequate remuneration.
- ii. If parking space is not available, the owner may be asked to pay for the same.

Unfortunately, the car owners transfer both the responsibilities to the city authorities stating that parking is an infrastructure provision that needs to be provided by the Government either free or at

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minimal cost. Such approach does not hold good to make any base for sustainable parking solutions.

The economy of urban areas boosts up income and the purchasing power of the residents. In residential areas, the increase in absolute number of cars as well as number of cars per household makes condition worse. Recently, there was an amendment in the Master Plan of Delhi 2021 (MPD 2021) through a notification to increase the housing stock in Delhi for which there was provision to double the permissible built up areas with maximum height of 15 mt. in plots of all sizes upto 750 sq.mt. with provisions of stilt parking. The aim of stilt parking is to make roads, in the residential areas, free from parked cars by putting car unto the plots. But in reality, stilt parking areas are either not sufficient to meet the parking demand of all residents or are used for other purposes. This mis-management of on-the-plot parking has resulted in the spillover of cars to open spaces, thus eating away the areas meant for circulation thereby, creating congestion on internal as well as external roads. The worst affected are vulnerable road users such as pedestrians, bicyclists, cycle rickshaws, etc. In this context, parking is slowly becoming an important issue which is directly related to management of parking areas and enforcement of rules and regulations for the same in residential areas.

There is a close relation between parking space and park (open space). Due to scarcity of land, there is more pressure to use park as a parking space illegally. It is well known fact

that park, playground, etc are lung spaces for the city but in spite of that, individuals have a tendency to grab the open space for parking of personalized vehicles. In fact, parking problems are increasing and people are adopting demand centric policies to increase the supply of parking space, by using open space as parking space.

In Group Housing Societies, the Resident Welfare Associations have failed to manage the parking in their own premises and often use reserved green/open space as parking space illegally. As a matter of fact, no parking problem can be solved without the co-operation and active participation of the communities themselves.

Now-a-days, the demand for subsidized parking has become a political agenda. In the context of inclusive growth, subsidized parking for car owners cannot be justified. Generally, it is assumed that car owners, who park on the roads, are economically more sound than those who do not have a car. A car is generally allotted 23 sq mt or 1 Equivalent Car Space (ECS) for parking whereas the houses for urban poor have a carpet area between 18-25 sq mt, which is slightly more than 1 ECS. Thus, the car owners, which are in minority, use majority of road space (urban space). In this case, persons having both car and parking space can be treated as high income group and therefore subsidized parking cannot be justified on both social and economic grounds.

The Master Plan of Delhi 2021 (MPD 2021) prescribes parking norms for various land-use zones. As per

MPD 2021, parking norms varies for different land use zones. The parking norm is- 1.8 ECS/100 sq mt floor area for Government buildings; 2 ECS/100 sq mt floor areas for residential areas; 3 ECS/100 sq mt floor area for Commercial area, etc. In this context, the relation between ECS and floor areas has no significance as demand of parking area is totally independent of floor area but fully dependent on income, social status and affordability of each household. Similarly, in the most cases, to make parking economically viable, it is either subsidized or cross-subsidized. The MPD 2021 allows 25 per cent of the parking areas to be used as commercial complexes to cross-subsidize the cost of parking areas. On one hand, it reduces the availability of parking area but on the other, it induces more parking demand due to commercial areas/activities. Such approach needs to be relooked to achieve a balance between demand and supply of the parking areas.

3.0 PARKING INTERVENTION

In general, the parking interventions at city level can be discussed at four levels:

3.1 Restriction in On-Street Parking

To reduce the demand for parking, it is important to reduce the number of cars. Therefore, it is necessary to reduce car ownership on the lines of Singapore and Shanghai where obtaining parking permit is a must to own a car. Similarly, Beijing has a lottery system of auctioning car permits annually. Such decisions and their enforcements are important to reduce the demand of car parking.

Recently, the State Bank of India has come up with a policy decision to provide car loan only to those who have a monthly income of more than Rs 50,000 per month. Such ceiling may reduce the tendency to purchase the cars and hence reduction in demand for parking space. In Bengaluru, employees of most of the Information Technology (IT) companies use Volvo buses for going to office instead of their cars. Further, the Bangalore Metropolitan Transport Corporation observes the 4th of every month as a “Bus Day” in order to promote use of public transport and discourage the use of personalized vehicles. In addition, the Government is taking many initiatives such as increasing parking charges, promoting car-pooling, etc. to reduce demand for car parking at the city level.

The restriction of on-street car parking needs strict enforcement. On-street car parking reduces carrying capacity of roads, resulting in congestion and delays. Therefore, each city has to frame rules and regulations to mitigate unorganised parking menace. To make enforcement effective, it is important to give legal power to local authority to impose fines, wheel clamping, towing, etc. and the amount should be spent for creating better parking facilities. It is desirable that the role of real estate developers, private sector companies and other players is recognized and they are roped in for improving transport related problems in the city. Further, it is also important that legal responsibility of the car owner is defined and specific fee may be imposed to discourage

on-street parking. Local authority may also charge a lump-sum fee, at the time of purchasing the vehicle, in lieu of parking in public places. Such enforcements i.e. placing the legal responsibility to the vehicle owner in places like Singapore and Japan are seen as effective tools. As a policy decision, on-street parking should be made costlier than off-street parking and charges should be levied on hourly basis in each and every part of the city, so that people stop parking on roads.

3.2 Off-Street Parking Facilities

In most cases, off-street parking facilities such as multi-level parking in CBD/commercial areas is sustainable but the same has failed in residential/educational areas. In residential areas, private operated multi-level parking facilities should be provided at minimum charge worked out on hourly basis. However, such areas should be clearly demarcated in zonal plans/layout plans. Such projects may be taken-up in PPP mode to develop and manage parking areas in residential pockets. The Government may be convinced to give tax incentives to private developers to develop off-street parking. If the residential areas have fewer parking spaces, the private operators may share parking lots at negotiated price to accommodate more vehicles.

3.3 Parking Fee

Parking fee is a multi-objective approach which aims to manage both supply and demand. The main objective of a fee is to reduce car usage and reduce parking time. Generally, the prices should vary

and should be linked to demand. It should be higher for specific time slot and for locations with higher parking demand. Similarly, unbundled parking (i.e. parking spaces are sold/rented separately) concept should be promoted so that households without car, can get income by selling/ renting their parking space. In Singapore, public housing estates have unbundled residential parking for this purpose. However, the success of such concept depends on strict enforcement.

3.4 Planning Initiatives

The Central Govt. flagship programme “Jawaharlal Nehru National Urban Renewal Mission” (JnNURM) advocates the formulation of parking policy as one of the reforms in urban transport at the city level. Parking should be regulated to favour higher priority uses of the space and encourage efficiency in the public transport. Therefore, the availability of parking space should increase public transport ridership along the transit corridor and recover both land and management costs of the parking areas.

To reduce the need of car travelling and parking, coherent and integrated urban development concept has been advocated. The compact city with mixed land uses/urban functions which may support maximum urban mobility with minimum length and therefore number of necessary trips needs to be planned. In other words, Transit Oriented Development (TOD) may be promoted as a concept to make cities free from cars. In fact, TOD is a concept that aims at integrating high

trip generating land uses with transit system in a city and its periphery. It seeks to reduce personalized modes, congestion on roads, air pollution, etc. by promoting public transport and its ridership, which improves livability and quality of life in a city. In urban planning context, TOD is as a mixed land-use comprising of residential cum commercial areas, having maximum access to public transport and often incorporates features to encourage transit ridership. Parking policies in relation to TOD is pre-requisite to make it success. Land near transit station is costly and limited. Hence, clear policy framework is needed to distribute usage of land for purpose like parking or development, keeping in mind the land value and return on

investment. It is also important to assess empirical relation between parking cost and affordable housing cost.

4.0 CONCLUSIONS

Car parking is although a city level issue but it may be taken up at employer level also. The employer may device certain rules and regulations to pay incentive to those who are not using car to come to work. Such initiatives may promote reduction in car trips. In Bellevue, USA, there is commuter trip reduction ordinance and it is made compulsory for the employers. Under this ordinance, if more than 100 full time employees come to a single worksite between 6-9AM, they have to participate in trip

reduction program. This program yielded a significant decrease in car use. Such ideas can be implemented in both private and public sectors through proper awareness among the employees.

Further, the Mizoram Regulations and Control of Vehicle Parking is one of the best examples which may be followed by other urban local bodies. In this regulation, there is a provision to obtain a certificate from the Transport Department that buyer has a garage for parking the vehicles intended to purchase. In fact, all the Urban Local Bodies should enact such regulations and reduce the demand for valuable road space for car parking.

Course Announcement

FORTHCOMING HSMI/HUDCO TRAINING PROGRAMMES FOR URBAN LOCAL BODIES

Sl. No.	Date	Name of the Course	Zones/States covered.
1	21-23 Oct. 2013	Designing Shelter needs for urban homeless By Ms. Sangeeta Manav, Sr. Coordinator	West: Maharastra, Rajasthan, Madhya Pradesh, Gujrat, Goa, Dadar Nagar Haveli, Daman & Diu
2	28-30 Oct. 2013	Better Services Better Cities By Mr. Manoj Mathur/ Rajiv Sharma, Fellow	South: Tamil Nadu, Kerala, Karnataka, Puducherry, Andhra Pradesh, A & N Islands North East: Arunachal Pradesh, Assam, Manipur, Mizoram, Meghalaya, Nagaland and Tripura.
3	11-13 Nov. 2013	Municipal Finance By Mr. Atul Shrivastav, Associate Fellow	East: West Bengal, Chattisgarh, Bihar, Jharkhand, Orissa, Sikkim North East: Arunachal Pradesh, Assam, Manipur, Mizoram, Meghalaya, Nagaland and Tripura.
4	26-28 Nov. 2013	City without Poverty By Mr. S.K. Gupta, Sr. Fellow	East: West Bengal, Chattisgarh, Bihar, Jharkhand, Orissa, Sikkim
5	04-06 Dec. 2013	Project Financing and Monitoring (including Govt. Action Plan Scheme) By Mr. Alok Joshi, Fellow	North: Uttarakhand, Uttar Pradesh, Delhi, Haryana, Himachal, Chandigarh, Punjab, J&K
6	10-12 Dec. 2013	Sustainable Solutions for Solid Waste Management By Ms. Nila Pandian, Sr. Coordinator	South: Tamil Nadu, Kerala, Karnataka, Puducherry, Andhra Pradesh, A & N Islands
7	18-20 Dec. 2013	Formulation, Implementation, Operation and Maintenance of water supply and sewerage schemes By Dr. A.P. Tiwari, Fellow	East: West Bengal, Chattisgarh, Bihar, Jharkhand, Orissa, Sikkim
8	6-8 Jan, 2014	Project Financing and Monitoring (including Govt. Action Plan Scheme) By Mr. Surendra Kumar, Fellow	West: Maharastra, Rajasthan, Madhya Pradesh, Gujrat, Goa, Dadar Nagar Haveli, Daman & Diu

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PUBLIC TRANSPORT IN THE CONTEXT OF URBAN MOBILITY IN INDIA

BHARGAB MAITRA
SHUBHAJIT SADHUKHAN

In urban India, public transport services are mostly availed by captive riders who do not possess private vehicles. There are opportunities to attract or encourage choice riders, who own private vehicles, to use public transportation system in order to reduce the vehicular traffic on urban roads.

India is experiencing rapid urbanization along with accelerating growth of private vehicles. The growing imbalance between demand and supply of urban transport is aggravating traffic congestion which has become a major hurdle in the context of urban mobility. Public transportation system has assumed paramount importance in the context of urban mobility. In the recent years, several initiatives have been taken up in India for improving the public transportation system. In this paper, these initiatives are reviewed and the major issues and research needs are highlighted.

1.0 INTRODUCTION

India is the second highest populated country in the world with a population of more than 1.21 billion (MoHA, 2011). The country is going through rapid urbanization. The share of urban population has escalated from 28 per cent to 31 per cent during 2001-2011 and is expected to be 54

per cent by the year 2025 (MoHA, 2011). Rapid urbanization has instigated momentous increase in travel demand and made urban transportation a major concern. The country is also experiencing rapid growth of private vehicle population and these private vehicles are concentrated largely around urban areas. The total number of registered vehicles has been amplified from 55 million to 115 million during 2001-2009 (MoRTH, 2011). The average annual growth rate of registered vehicle population was recorded as 9.7 per cent during 2001-2011 (MoRTH, 2011). The growth of different vehicle categories over the last few decades indicate a substantial shift in the modal share towards private vehicles.



Fig-1: Traffic congestion on urban roads

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Most of the Indian cities and towns are not planned as per the town planning principles and norms. The land allocation for roads is generally inadequate. For example, percentage of land allocated for roads in Kolkata, Delhi, Mumbai and Chennai is 5.45 per cent, 11.25 per cent, 9.5 per cent and 11.13 per cent respectively (IIR, 2009) which is inadequate compared to 15 to 18 per cent for metro cities in plain areas as recommended by Urban Development Plans Formulation and Implementation (ITPI, 1996). Besides, roadside activities and encroachment (such as hawking activities, temporary food stalls, etc.) are also very common in urban areas. Therefore, augmentation of transport infrastructure by means of widening of existing roads or development of new roads gets restricted. This imbalance between the demand and the supply of transport is seriously affecting the urban mobility. Traffic congestion has aggravated and reached beyond acceptable limits and the pollution due to emissions from vehicles is also increasing at an alarming rate (Fig. 1). Higher usage of public transport is considered as an effective instrument for reducing vehicular volumes in urban India and thereby alleviating traffic congestion as well as vehicular emissions (Maitra and Sadhukhan, 2013).

The public transportation system includes both rail and road based systems. Suburban rail system plays a vital role in some of the metro cities such as Mumbai, Kolkata, Delhi and Chennai. Metro rail services are operational in Kolkata, Delhi and Bangalore. Several other

Indian cities are now opting for metro rail system. However, the bus system will continue to remain as the predominant public transportation system in majority of Indian cities due to reasons such as lower capital cost, flexibility, door-to-door service, wider network coverage and other inherent reasons. Therefore, a special emphasis is necessary on improvement of bus system in urban India. The present document reviews various issues and initiatives in the area of public transportation system in urban India and identifies the research needs in Indian context.

2.0 URBAN PUBLIC TRANSPORTATION SYSTEM IN INDIA: KEY CONCERNS

It is necessary to improve public transport usage in order to bring down traffic congestion and improve the mobility in urban areas. In urban India, public transport services are mostly availed by captive riders who do not possess private vehicles.

There are opportunities to attract or encourage choice riders, who own private vehicles, to use public transportation system in order to reduce the vehicular traffic on urban roads. However, there are several key concerns related to the present public transportation system in urban India (Maitra and Sadhukhan, 2013).

- **Overcrowding:** The public transportation system is generally overcrowded (Fig. 2) during peak hours which causes discomfort to commuters and makes it a less attractive alternative to choice riders (Maitra and Ghosh, 2008).
- **Poor Quality of Buses:** The quality of buses in most of the Indian cities is very poor in terms of their aesthetics and convenience. Besides, the noise level is high, the step heights are inconvenient and the appearance is not attractive. In general, it is assumed that 'soft factor' such as 'quality of bus' is not so import-



Fig-2: Overcrowding in Public Transport

ant in India. The research findings, of course, indicate that trip makers consider 'quality of bus' as an important attribute even in urban India (Maitra et al., 2013).

- **Inadequate Traffic Information:** Presently, real time traffic information for buses is not available in most of Indian cities. On-board travel information is also a missing component in the context of bus service in urban areas. The choice riders, however, consider availability of traffic information as an important factor in the context of bus travel (Maitra et al., 2013; Phanikumar and Maitra, 2006).
- **Lack of Reliability and Public Transport Priority:** Public transport services are often not reliable and there has been no attempt to improve the reliability of services. Although, no information is available with regard to the importance of reliability in the context of bus service in India, in-vehicle time is found to be an important factor to urban commuters (Maitra et al., 2013; Phanikumar and Maitra, 2006).
- **Lack of Security:** Adequate prominence is not given to on-board security in public transport, especially for buses. Incidents such as pick-pocketing, eve-teasing, theft, etc. make the bus system less attractive to commuters.
- **Low Fare:** Public transport fare is a socio-political issue. Considering the low affordability of the urban poor, it is reasonable to keep the fare as low as possible. However, in most cities, the low

fare has been maintained in lieu of low quality of service. In the absence of a clear segmentation of urban bus services (Maitra et al., 2013) and innovative funding mechanism, the low fare itself has become a major bottleneck for improving the bus service in urban India.

3.0 UPGRADING URBAN PUBLIC TRANSPORTATION SYSTEM: RECENT INITIATIVES

In recent years, several initiatives have been taken by the Government of India, State Governments and other public sectors in order to improve public transportation system in urban India (Maitra and Sadhukhan, 2013). Some of these initiatives are given below:

- **National Urban Transport Policy (NUTP):** National Urban Transport Policy was initiated by the Government of India in the year 2006 to emphasize the need of greater use of public transport and non-motorized modes in urban areas by offering central financial assistance for such projects (MoUD, 2006).
- **Jawaharlal Nehru National Urban Renewal Mission (JnNURM):** In 2005, Ministry of Urban Development, Government of India initiated the Jawaharlal Nehru National Urban Renewal Mission (JnNURM) programme in order to improve the quality of life and urban infrastructures (MoUD, 2011). The JnNURM bus project was aimed to provide better public transportation in Indian cities and reduce the vehicular loading on urban roads.

- **Bus Rapid Transit System (BRTS):** Acknowledging the relevance of the bus transportation system in urban areas, several Indian cities such as Ahmedabad, Delhi, Jaipur, Rajkot, and Pune have implemented Bus Rapid Transit Systems (BRTS) which is a high-quality customer oriented transit system. Several other cities such as Bhopal, Indore, Visakhapatnam, Surat, etc. are also opting for BRTS in order to provide a seamless travel and boost the share of public transport.
- **Mass Rapid Transit System (MRTS):** Recognizing the need of urban travel, several cities such as Kolkata, Delhi and Bengaluru have successfully implemented metro rail as eco-friendly mass rapid transit system (MRTS). Other metro cities such as Mumbai, Hyderabad, Kochi, and Chennai are also on way to have metro facility in few years from now.

4.0 EMERGING RESEARCH NEEDS

India has realized the need for upgrading public transportation system as a tool for improving the mobility in urban areas. Even if the Ministry of Urban Development and various state governments initiated the process of upgrading public transportation systems in urban areas, there are several emerging issues and gaps which need to be addressed through research (Maitra and Sadhukhan, 2013).

- **Selection of Optimal Public-Transport System:** At present various forms of public transport such as Bus, BRTS, Metro rail, etc. being planned in many Indian cities. There is no scientific procedure for selecting the optimal public transport mode(s) for a city. Factors affecting selection of optimal public transport mode choice include size of the city, geometry of road network, population, available urban infrastructure, land use, socio-economic characteristics of users, fixed variable cost of alternative public transportation system, etc. Hence, it is essential to conduct field research for selection of optimal public transport mode(s) in various sized cities.
- **Travel Demand Estimation considering Travel Behavior:** Travel demand forecasting is a major factor for governing the economic and financial viability of urban transportation projects. In most cases, travel demand forecasting does not consider the travel behavior of commuters. It is necessary to consider commuters' behavior towards various 'hard' and 'soft' factors of public transportation services and include these factors in travel demand model.
- **Public Transport Priority:** Practically, no attempt has been made to incorporate bus priority techniques in urban India so as to reduce the journey time of buses and making bus transport an attractive option to car or taxi for

intra-city travel. Therefore, there is a dire need to develop warrants or guidelines for application of different public transport priority techniques in India.

- **Bus Characteristics and Service Attributes:** The type of buses (including dimensions, seat capacity, seat orientation, step height, etc.) vary widely in urban India. The service characteristics are also found to vary widely in different routes. It is necessary to develop a methodology for optimizing the benefits to commuters through appropriate selection of bus characteristics and service attributes, giving due consideration to the operational viability.
- **Intelligent Transportation System(ITS) Application:** Intelligent Transportation System (ITS) application such as on-board travel information, real time bus arrival information, etc. are important factors of bus service which are likely to influence the modal choice behavior of choice riders. It is necessary to identify the priority domains for the application of ITS in public transportation and develop an application framework for the same.
- **Planning of appropriate Feeder System:** Feeder service say, (auto, trekker, rickshaw, etc.) has a big role to play in the context of high capacity public transport system such as metro-rail, suburban rail, etc. In India, there are deficiencies associated with planning and management of feeder system. Optimal planning and opera-

tional framework for feeder service is another key area for research.

- **Planning of Transfer Facilities:** There are lacunas associated with transfer facilities around bus stops, rail stations and metro stations in urban India. The role of transfer facilities is extremely relevant in the context of pedestrian safety and convenience. Therefore, it is important to identify relevant factors of transfer facilities, investigate their role on public transport ridership and prepare guidelines for the development of transfer facilities around bus stops, rail stations and metro stations.

5.0 CONCLUSIONS

The urban mobility has become a major concern in India. Public transportation system is considered as an effective demand management instrument in Indian context. An increased use of public transportation system can not only reduce traffic congestion but also improve the quality of urban life. In the recent years, Government of India and various State Governments have taken up several initiatives (or projects) for upgrading the public transportation system in urban India. However, further research is needed to address issues and gaps for enhancing the effectiveness of public transportation system in urban India and addressing issues related to urban mobility, traffic congestion, vehicular emissions, etc.

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ECO MOBILITY WORLD FESTIVAL 2013*

Suwon takes the stage as the World's first Ecomobile City

The world's first EcoMobility Festival was held during September 1–30, 2013 at Suwon, a city 30 km from Seoul, South Korea. The objective of this festival was to prove that a truly ecomobile city – one where citizens can move freely, safely and sustainably – can exist.

On this occasion, 4,300 residents of this city swapped some 1,500 cars for ecomobile vehicles, and adopted an ecomobile lifestyle for the entire month. Haenggung-dong, one of the most crowded neighborhoods in Suwon, was designated as a car-free zone, where various cultural and arts performance took place.

This unique undertaking was backed by a €9 million euro (13 billion KRW) public investment to regenerate the inner city of Suwon. It is part of Mayor Yeom Tae-young's program to transform the neighborhood into one that prioritizes sustainability and accessibility – particularly for low-income residents whose access to employment and services was impaired.

Around 5,000 international visitors, led by influential Mayors, policy makers, CEOs and concerned citizens visited the festival and enjoyed the ride in the human-powered and electric vehicles from around 39 manufacturers from eight countries including



the United States, Germany, Taiwan and South Korea.

The newest lineup of ecomobile vehicles demonstrated here were: Yikebike, the smallest foldable bike; Trimobile, a tricycle that can carry three people at a time but only requires one to pedal; Nordic Cab's multipurpose bike trailer made out of eco-friendly aluminum and hardened plastic; Gobax, a customized ambulance bike; Egretta, a bike that consolidates both sophistication and practicability; MoVi, a safe and robust light electric vehicle, and many more.

Alongside month-long exhibitions and vehicle test tracks, visitors and residents participated in concerts, movie festivals, singing contests using pedal-powered karaoke, art fairs, street tours, conferences and workshops – all celebrating the ecomobile lifestyle.

“With this Festival, we strive to deliver the message that an ecomobile city is possible. We aim to lead and inspire other cities around the world to follow suit,” Mayor Yeom Tae-young added.

**ICLEI – Local Governments for Sustainability, the world's leading network of cities for sustainability organised the Festival together with the City of Suwon and UN-Habitat.*

Source: www.ecomobilityfestival.com

ATAL SARIGE: AN EFFECTIVE MODEL FOR PUBLIC TRANSPORT FOR THE URBAN POOR IN BANGALORE ?

SRIKANTH SHASTRY
AMIT BHATT

The service operates uniquely designed buses; the seats in the bus are all along the sides and corners with a large aisle space where passengers (vegetable vendors, construction workers etc.) can store their belongings.

A public transport system needs to address the travel demand of all sections of the society. Urban poor in most cities face problem in using public transport because it is either expensive or stops far from their residence or does not provide them point-to-point service. A new initiative of Bangalore Metropolitan Transport Corporation has been able to address all these issues in providing an exclusive service to the poor, called Atal Sarige.

1.0 INTRODUCTION

The NUTP (National Urban Transport Policy) announced by the Government of India in 2006, was formulated to promote sustainability of transport services in Indian cities. One of the visions of the NUTP is to recognize that people occupy centre stage in our cities and all plans would be for their common benefit and well-being[1]. With the urban poor constituting a major portion of the population, it is essential that their interests are included during the planning process. Walking and public transport are the two main modes of transport for the urban poor [CSTEP data]. With increasing traffic volumes and poor pedestrian facilities, walking is becoming increasingly risky. Allied with increasing travel distances, access to livelihood is a cause of concern to the urban poor. This makes the need for inclusive public transport planning more pressing. As per NUTP, the travel for the urban poor must be subsidized and the subsidy must be borne by other

sections of the society. To achieve this mandate, Bangalore Metropolitan Transport Corporation (BMTCL), the public transport operator in Bangalore operates an exclusive service for the poor called *Atal Sarige*.

Atal Sarige was introduced to provide fast, reliable and direct connections to the urban poor to their work destinations. The service operates uniquely designed buses. The seats in the bus are all along the sides and corners with a large aisle space where passengers (vegetable vendors, construction workers etc.) can store their belongings. The buses also have a unique colour. The service charges 50 per cent of the ordinary fares. For mobility of urban poor, although fare subsidy is important but other factors like access to transport, buses at regular intervals and at the required time etc are equally important. A World Bank report has defined 'adequate' public transport in terms of four components: affordability, accessibility, acceptability, and availability [2]. In this paper we analyze the adequacy of the *Atal Sarige* bus service.

2.0 SETTING THE CONTEXT

The population in Bangalore is growing at a rapid rate. Between 2001 and 2011 the population growth rate was 45.68 per cent [3]. The population of slum dwellers also seems to be growing at a rapid

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Figure 1: Atalsarige bus interior

rate and the provisional figures of Census of India 2011 indicate that about 30-40 per cent of the population in Bangalore are slum dwellers, as compared to 23 per cent in 2001 [4]. According to a Government of Karnataka report on urban development in Karnataka, the monthly per capita expenditure of slum dwellers in Karnataka is much lower than in other comparable cities (10th in India) [5]. The reason for this is that while the employment opportunities in the informal sector have grown in urban regions, it has not been accompanied by growth in

the housing stock for this section of the society. Due to this reason, their access to health, sanitation, employment and education facilities is poor. Public transport can play a key role in increasing their accessibility to new layouts in distant areas with better civic facilities and social infrastructure.

According to a survey conducted by a Bangalore based think tank, CSTEP (Center for Science, Technology and Policy), 70 per cent of the slum dwellers travel for less than 30 minutes to work [6]. The two major modes of travel to work for the slum dwellers are walk and public transport (52 per cent and 33 per cent respectively) [6]. A 30 minute travel would approximately be equivalent of 8 km¹. An 8 km. travel by Public Transport (PT) in Bangalore² would cost Rs 11/-. According to the CTTS, the per capita trip rate for Bangalore is 0.924 [7]. The average household size in the slums is around 5 persons [6]. Using these numbers the average total travel cost per household³ works out to be between Rs. 1200-1500. According to a survey conducted by The Energy Research Institute (TERI), the average household income varied between Rs. 2000-4000 [8]. Another study (of slums around JC Road in Bangalore) found that 62 per cent of the households in those slums depended wholly or partially on incomes ranging from Rs 1386

¹ According to the CTTS, the average speed of buses in Bangalore is 17.5 kmph.

² BMTC: 8 km is approximately 4 stages (2 km is one stage) and the fare (ordinary service) for 4 stages is Rs.11.

³ Travel expenditure/month/household = number of persons in household x travel cost/trip x trips/day*number of days. We have used Per capita trip rate as the indicator for trips/day and the number of days varies between 24 and 30 days (working days). The numbers here are a rough estimation.



Figure 2: Uniquely branded service

to Rs 3374 [9]. Using either of these income ranges, it is clear that a large portion of the income will be spent on travel. According to Armstrong-Wright [10], for equity, not more than 10 per cent of the population should spend more than 15 per cent of their income on travel. If this is used as a standard for comparison, the existing situation in Bangalore is not equitable.

3.0 ATAL SARIGE: AN ADEQUATE PUBLIC TRANSPORT?

To assess the effectiveness of *Atal Sarige*, a methodology developed by the World Bank [2] was used by Embarq. The authors identified four steps in developing a comprehensive index for adequate transport:

- Defining adequate transport and its attributes
- Determining attributes that are most valued by low-income groups
- Selecting and describing indicators that represent each attribute
- Determining the weights for each indicator

In this study, authors used different components of adequacy to qualitatively analyze the service.

3.1 What is adequate transport?

According to the World Bank report on public transport and urban poverty[2], adequate transport is referred to transport which is affordable, accessible, available and acceptable.

- Affordability refers to whether a user can pay for the travel journey or not. Affordability is closely related to the fares on the

Table 1: Concerns of respondents in slums

Concerns	%
Bus stop is not nearby	49%
Ticket price	31%
Buses are not on time/need more buses/large waiting time	12%
Crowded buses	3%
Pick pocketing	2%
Service hours	1%
Difficulty boarding/alighting	1%

service and can be determined by the percentage of income spent on transport.

- Accessibility refers to the ease with which people can use public transport. The indicators for accessibility include the distance to the bus stop, information about services at the bus stop, accessibility for the physically disadvantaged etc.
- Availability refers to the service offered; the service hours and route possibilities. The indicators for availability can include waiting time at bus stop, avail-

ability of night and weekend services, service hours etc.

- Acceptability refers to the quality of service. Some indicators include behavior of drivers, age and condition of bus fleet, security, comfort etc.

3.2 What do the poor value the most?

In 2010, the CSTEP conducted a survey to understand the relationship between mobility, shelter and livelihoods and explore the relationship between slums and the broader city around them in economic and

Table 2: Indicators for concerns of the poor

Category	Concern	Indicator
Affordability	Ticket price is too high	Ratio of total monthly expenditure on transport to total monthly household income
Accessibility	Bus stop is not nearby	Number of slums within a 400m walking radius from the bus network Walking distance to bus stop
	Difficulty boarding/alighting	Rating of service based on physical accessibility
Availability	Buses are not on time	Schedule adherence
	Need more buses	Frequency
	Long waiting time	Headway
	Service hours	Total service hours of the service per 24 hours
Acceptability	Crowded buses	Capacity of buses
	Pick pocketing/Harassment	Security

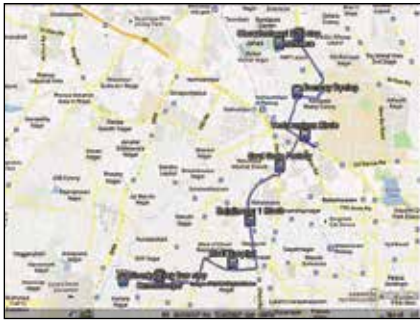


Figure 3: AS-8



Figure 4: AS-14

spatial terms. The survey covered 1080 households in a spread of 36 slums. A part of the survey had collected information about the travel behaviour of slum dwellers. The respondents were asked to give their concerns about public transport. Table 1 summarizes the main concerns of the respondents.

The walking time to a bus stop is clearly the most significant concern among the respondents. For the daily wage earners, getting to their work on time is crucial and being late could mean that someone else is hired and they lose their job for that

day. Having to walk 2 km to take a bus is obviously not desirable.

The second most reported concern is the ticket fare. As discussed in the introductory section, the fare consumes a large portion of the household income.

The waiting time at bus stops is the next most reported concern. Long waiting time can be caused by delay due to congestion etc. or due to insufficient number of buses on a route (scheduled waiting times are sometimes large). Improving the reliability as well of regularity of bus services can benefit the urban poor.



Figure 5: Map showing 400m buffer zones around AS-8 and the slums which fall within this zone

Finally respondents raised concerns regarding comfort, security, physical accessibility, etc. These concerns are not often revealed because of the importance assigned to other concerns which are bus stop location and fare.

3.3 Indicators for each attribute

Table 2 lists the indicators chosen in this study related to the concerns of the slum dwellers expressed in the survey analyzed. The indicators have also been arranged according to the four components of adequate transport, as defined in the World Bank Report on Public Transport and Urban Poverty[2].

4.0 EVALUATION

In order to get a better sense of the adequacy of *Atal Sarige*, we conducted a qualitative survey on board the *Atal Sarige* buses in April-May 2012. In addition to capturing the mobility patterns/issues of the travelers we also wanted to capture some socio-economic information. We selected two routes (AS-8 and AS-14) for conducting these surveys.

AS-8 runs from Choudeshwari bus station in Mattikere to Shankar Nag bus stand [Figure 3]. The bus passes through Basaveshwarnagar, which is a residential pocket, and also through Yeshwantapur market. Basaveshwarnagar has a large concentration of slums⁴ which are within 400 meters of the bus line [Figure 5]. In spite of many slums being close to this bus line, the bus does not seem to be a

⁴ Slum locations were mapped by the authors on Google Maps using information from Karnataka Slum Clearance Board (KSCB) and Bruhat Bangalore MahanagaraPalike (BBMP)



Figure 6: Map showing 400m zone around AS-14 and BBMP slums in this zone

large attractor for these people. The reason could be that the bus does not connect them to their work destinations.

AS-14 runs from Banashankari bus station to Thalगतपुरा [Figure-4]. From Jaraganahalli until Thalगतपुरा there are many factories and small scale industries. This service caters to workers who are employed in these industries. In addition maid servants, construction workers, street vendors also frequent this service. Thalगतपुरा bus stop is also a switching point for people residing in the villages near kagalipura as BMTC has very little coverage beyond Thalगतपुरा; most villagers ride on this bus for this reason.

Some of the findings from the qualitative survey are discussed in this section.

4.1 Affordability

The people interviewed in our qualitative survey can be broadly classified into three income groups based on monthly household income: those earning less than Rs. 10,000, Rs. 10,000-20,000 and greater than Rs. 20,000. Majority of the respondents were in the first two income bands. The average percentage of income spent on transport was around 14 per cent. For those earning below Rs. 10000, this increased to 20 per cent and rose further for an income of less than Rs. 4,000. There is clearly a divide between the spending of different income groups. People belonging to a higher income group seem to be able to afford passes⁵ and thus reduce their transport expenditure; whereas people in the lowest income group seem to travel

by buying tickets every day. Even with the cheaper tickets on the *Atal Sarige*, they seem to be spending a large portion of their income on conveyance.

4.2 Accessibility

Most of the people surveyed live within 10 minutes (500m) walk from a bus stop and almost all of them walk to the bus stop. According to the CSTEP data, around 49 per cent of the respondents mentioned that there is no bus stop near their home. This seems to contradict with the data we collected from the *Atal Sarige* buses. This can be explained either by self selection (people who access the service are a biased sample of the broader population) or from the network design of the BMTC. The BMTC operates mainly destination based services and every transfer would require the passenger to buy a new ticket. Combined with poor schedule integration, this could force people to walk to the bus from where they can get a direct route rather than get to the nearest bus stop. This seems to tie in with the reasons people mentioned for using the *Atal Sarige* bus to many of the passengers this was the only direct route between their origin and destination and a more important reason than the reduced fare.

When queried about the buses, people mentioned a couple of issues with accessibility including the steps being too high, the buses starting to move while passengers still on the steps to get in, etc. This is especially an issue for older passengers or those carrying baggage (such as students).

⁵ BMTC has multiple pass options: The day pass for ordinary services is Rs. 45 and for A/C services is Rs. 90. If the passenger owns a travel card (costs Rs. 25 for 5 years), the passenger can avail a Rs. 5 discount on these passes. The monthly pass for black board buses (city buses) is Rs. 550 and for suburban buses (and city buses) it is Rs. 725. The monthly pass for city/suburban A/c services Rs. 1450 and Rs 1500 for normal A/C services and Airport service. There are discounts for senior citizens and students.

4.3 Acceptability

Pick-pocketing seems to be the main issue raised by the male travelers whereas a couple of female travelers mentioned about harassment from drivers and conductors. In terms of capacity, it was not an issue as most

passengers could find a seat easily on the lines surveyed. This could be only in the case of *Atal Sarige* which was also mentioned by some of the passengers as the reason for choosing this service. When we travelled on this service we found that the load

did not exceed 60 persons. Safety was not mentioned as an issue by any passenger. In addition, people also mentioned that the buses do not stop at all bus stops, when it is full.

4.4 Availability

Most of the people surveyed were satisfied with the schedule adherence of the buses. They were a little critical of the service hours though. Low frequencies during the afternoon hours, no buses in the late evenings (after 8.00 PM) and on weekends were some of the concerns raised by commuters. One of the passengers mentioned that the bus does not run when the crew is on leave or during their weekly off. This was confirmed by the driver who mentioned that the bus runs only when he is on duty and no one else is assigned the service in his absence. There are only two buses on each of the routes, and hence very limited options for the passengers. However, it is still possible to achieve headway of 30 minutes with 2 buses, but this was not being achieved at present. For route 8, the headway varies between 35 minutes and 60 minutes whereas for route 14, it varies between 30 minutes and 55 minutes (Table 3 and Table 4). We can also see from the table that the two routes have service hours between 7 AM and 8 PM only.

Table 3: Schedule table, AS-8

Hours	Departure from CJP		Frequency (#/hour)	Headway (min)		Departure from SNB		Frequency (#/hour)	Headway (min)	
7-8	7:25		1					0		
8-9	8:10	8:40	2	45	30	8:00	8:45	2		45
9-10	9:25		1	45		9:20		1	35	
10-11	10:00		1	35		10:05		1	45	
11-12	11:10	11:50	2	50	40	11:10	11:50	2	65	40
12-13	12:30		1	40		12:30		1	40	
13-14	13:10	13:50	2	40	40	13:10	13:50	2	40	40
14-15	14:30		1	40		14:30		1	40	
15-16	15:10	15:50	2	40	40	15:10	15:50	2	40	40
16-17	16:55		1	65		16:55		1	65	
17-18	17:35		1	40		17:35		1	40	
18-19	18:15		1	40		18:15	18:55	2	40	40

Table 4: Schedule table, AS-14

Hours	Departure from BSK		Frequency (#/hour)	Headway (min)		Departure from TGP		Frequency (#/hour)	Headway (min)	
7-8	07:30		1					0		
8-9	08:00	08:30	2	30	30	08:00	08:30	2		30
9-10	09:00	09:30	2	30	30	09:00	09:30	2	30	30
10-11	10:00	10:55	2	30	55	10:25	10:55	2	55	30
11-12	11:25	11:55	2	30	30	11:25	11:55	2	30	30
12-13	12:25	12:55	2	30	30	12:25	12:55	2	30	30
13-14	13:25	13:55	2	30	30	13:25	13:55	2	30	30
14-15	14:25	14:55	2	30	30	14:25	14:55	2	30	30
15-16	15:25	15:55	2	30	30	15:25	15:55	2	30	30
16-17	16:25		1	30		16:50		1	55	
17-18	17:20	17:50	2	55	30	17:20	17:50	2	30	30
18-19	18:20	18:50	2	30	30	18:20	18:50	2	30	30
19-20						19:20		1	30	

5.0 DISCUSSION

Based on the surveys, secondary information and other information provided by the BMTC, we have summarized some of the issues facing the *Atal Sarige* in this section.

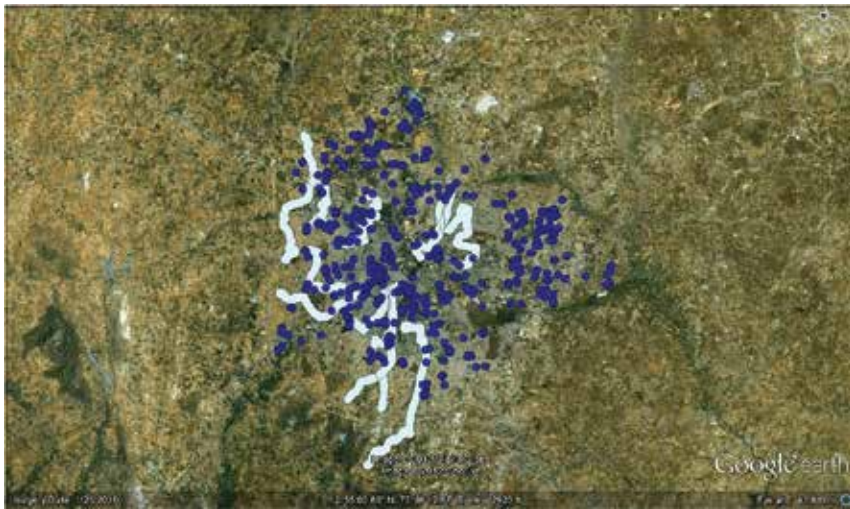


Figure 7: Map showing 400m buffer zones around the Atal Sarige routes and also the BBMP slum locations



Figure 8: Map showing the Atal Sarige routes and the ring roads in Bangalore (Inner, Outer, Peripheral)

5.1 Can all the urban poor access the Atal Sarige?

In order to answer this question, we digitized the BBMP slums in Bangalore Urban region. This list is not complete and does not include the BDA slums, railroad slums or other newer slums. Even with this

smaller list (500 slums) we see that not all of the slums are within 400 meters of the *Atal Sarige* network; in fact only 77 of the 500 are within this zone [Figure-7]. The different routes are also not interconnected [Figure-8]. A person who lives near one of the *Atal Sarige* routes can

only access destinations along that particular route. To go to a different part of the city, that person would need to use the regular service. The service also has some temporal issues, the buses usually operate between 7AM and 8 PM only (with some exceptions).

The key issue with the service is small number of routes and few buses in service. Increasing the coverage (acquiring and operating more buses) might be a difficult proposition for the operator without support from the state. One solution to address this issue can be to relax the retirement age of buses, which operate on this service. The operator can use older buses on this route and acquire buses for other profitable routes. The cost can also be brought down by engaging private operators to provide services on this route.

5.2 How do you determine the subsidy required for the service?

It is quite clear that the *Atal Sarige* would require some form of subsidy since it is not a profitable service. Subsidy can be provided in two ways – subsidy to the passenger in fares or subsidy to the operator to run these non-profitable routes. In the case of providing subsidies to the passengers, the issuing agency (Slum board etc.) can buy passes and distribute the same to the concessionees. The disadvantage of this method is the difficulty in administering these concessions and also the potential of abuse. Another method is to reduce the operating costs. These subsidies

to the operator could be in the form of grants to acquire buses, tax concessions, etc.

In order to determine the subsidy required for either of these methods, it is necessary to continuously monitor and report the cost and revenues on these routes separately. Currently, the balance sheet reports the costs and revenues for all the services operated by the BMTC. A more segmented information for individual services and information about the number of passengers on these *Atal Sarige* routes can be useful to determine the type of subsidy required.

5.3 What are the operational issues with the service?

There are some operational issues with the service, which can be immediately addressed. The scheduling of buses can be improved to reduce the schedule headway on these routes. As an example, the schedule headway for AS-14 varies between 30-55 minutes. This route currently has 2 buses running on it. The travel time on this route has been calculated as 25 minutes (by BMTC). Using these numbers it is possible to get two buses in each direction per hour. This makes the service regular and is easier for people to plan their trips.

The second operational issue is with respect to crew scheduling. As it has been discussed in a previous section, the crew on the *Atal Sarige* buses is fixed and on the day of exigency, no one else is assigned

these routes. This creates problems to regular users of this service (as was mentioned in our qualitative survey). Ensuring that the bus adheres to its schedule, without any cancellation, can improve the reliability of the service.

6.0 CONCLUSIONS

Atal Sarige was introduced as a service for the poor on the recommendation of the Transport Minister of Karnataka in 2009. While the service is a good start, there is scope for improvement. The operator must receive support from the state to retain efficiency in operation and benefit more number of urban poor in future. Making the operator bear the entire cost of operation is not a good solution, since it targets the disadvantaged section of the society. The service also has some small operational issues in terms of timetable and crew scheduling which can be fixed quite easily.

In conclusion, the service is a good start, but in its present state it is not enough to provide mobility to the urban poor.

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KSCB, <http://ksdb.kar.nic.in/slums>

HUDCO'S CONTRIBUTION TO TRANSPORT SECTOR



Housing and Urban Development Corporation Ltd. (HUDCO) is a premier techno financing company, set-up in 1970, by government of India to accelerate the pace of housing and urban development in the country. HUDCO lays considerable importance on the housing needs of the poor and provides innovative financing models in utility infrastructure sector.

Till August 31, 2013 HUDCO has sanctioned 16,536 projects worth Rs. 4,94,520 crore in which HUDCO's loan commitment is Rs. 1,30,632 crore, out of which Rs. 87,908 crore, has already been released. HUDCO's assistance has so far facilitated in taking up of about 1.55 crore residential units, over 7.2 lakh developed plots, 66.87 lakh sanitation units, 1706 urban infrastructure projects and 665 Building Centres.

HUDCO has been in forefront in initiating Green Field Projects in Urban Transport Sector Viz., Fleet Augmentation of Road Transport Corporation, Construction of Integrated Bus Stand Complex, Construction and widening of Roads, Multi Level Parking, Development of New Airport, Expansion of Airport, Air Cargo Complex, Railway Station Developments, Port development etc. HUDCO has so far sanctioned 270 projects with a loan commitment of Rs 21,691 crores. Some of the transport projects, supported by HUDCO, are as follows:

Fleet Augmentation: Kerala State Road Transportation Corporation (KSRTC) had accumulated loss of more than Rs 200 crore and the existing old fleet of vehicles require higher O&M expenditure. After a series of discussion with KSRTC, a project proposal was structured to finance acquiring of 1000 new buses thus reducing O & M cost and consequently improve moral of staff and public at large. As per the plan, Rs 1000/bus/day would

be escrowed into HUDCO's account on daily basis. This helped the agency not only to repay the loan within 5 years but also improved the image of KSRTC to a great extent.

Airport Projects: The first Green Field Airport, initiated outside the ambit of Airport Authority of India, by Cochin International Airport Limited was funded by HUDCO. This is considered as one of the least cost Airport in the world. Acquisition of more than 1400 acres of Land, construction of 3.7 km runway, 20,000 sq. mts of terminal complex, ATC tower. etc were completed successfully with the project cost Rs. 254 Cr. This has triggered the New Airport Construction projects in the country.

The expansion of runway and redevelopment of Calicut Airport was funded based on the collection of a User Charge from customers at the rate of Rs 500 per ticket for servicing interest on HUDCO Loan, whereas the principal amount was paid by Airport Authority of India.

An Air Cargo Complex at Thiruvananthapuram Airport was also funded to cater to the need of increased Cargo Traffic.

Port : First port in the private sector at Pipava was funded by HUDCO on consortium basis.

METRO: HUDCO has been actively partnering building modern METRO projects across the country viz., at Bangalore, Jaipur and actively considering at other locations also.

Apart from the above, HUDCO has financed number of Road projects, Bridges, Flyovers, underpasses, Ring roads, Integrated Bus Stand Complex, Truck Terminals, Parking Complex etc all over the country.

Please visit www.hudco.org for more information.



RENDEZVOUS ON WHEELS: TAXIS FOR WOMEN BY WOMEN IN THE CITY OF DELHI

SANGEETA MAUNAV

Preparing and placing women drivers as chauffeurs and commercial drivers will quickly alter public perceptions about women's participation in a booming public transportation sector and enable a hitherto invisible community to move from the margins to mainstream economy

Eleven Sakha women drivers, eleven taxis and almost eleven percentage female work participation in Delhi; while seemingly similar, they are not close enough. The social enterprise of women operated taxis by Sakha Consulting is an unambiguously appreciable initiative. But we need more women drivers and women conductors on public transport and most importantly progressive perception towards women, within the home and on the roads.

The 16th of December, 2012, a cold dark night, has enough to be remembered as one big black day in our contemporary diaries, especially for the urbanites in Delhi. Several such black days have been there before and it pains me to say that there could be many in the offing in the least, and much as an immediate inevitability, the Death Punishment for the four gang-rape convicts would air a message to society. Today I have limitations by virtue of intent in this piece of writing, and therefore I shall not get on to share my reflections on the burgeoning urban crime-analytic, I mean the cause dynamics. But in the least, and as a working urban woman, I could claim my rights for safe mobility on city streets.

Geeta has arrived before time. She is a taxi driver from Sakha Consulting Wings Pvt Ltd. I have hired a taxi to drive me around the city. No, Not really! The pettiness of me and my pen, Mr Rajiv Sharma has insisted that I write for this issue of the magazine. The drive begins from Jungpura to destinations not so distinct, or should I say that I had reached my destination anyway. I preferred the front seat. I haven't



quite understood till now as to why a car traveller should necessarily take the back seat when the vehicle is driven by a hired driver. I remember having learnt in school that one who drives a vehicle is a driver. By such learning, we and our family members, our relatives, friends, peers, superiors and subordinates, all are drivers once in a while. Geeta feels the same way, and I listen her speak after having provoked a conversation. She smilingly reminisces the big hue and cry from all quarters, from those significant to the insignificant-others of society, from family to distant relatives who have never possibly come close enough with a helping hand. Driving was a lowly job and of-course a vocation that only men-folk could be adept at, that's what everyone warned her off, she muses aloud as she drives away. Geeta was determined. She has worked with JAGORI, an NGO in Delhi, working on women's rights.

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I could distinctly decipher the aura of empowerment that graces her demeanour. Her resolve linked her to Azad Foundation, an NGO working its way towards women's livelihoods with dignity and 'Sakha' is its first initiative in social enterprise. This enabled her to be where she is. She has undergone training not only in driving but also in route identification & map reading, car maintenance, personal grooming, self-defence and women's rights. We have reached Khanna market. She slows down to a still and I alight. I never felt like a celebrity before.



A pleasure drive with Sunita in Durg, Chhattisgarh.

A wife who has taught her husband to drive; a mother of three; an anganwadi worker, Sunita is a private taxi driver in the city of Durg, Chhattisgarh, the only woman driver in the State. Supported by the SJSRY program of Ministry of Housing & Urban Poverty Alleviation, Government of India, Sunita has undergone training in car driving, purchased a car vide a bank loan and is running this private taxi ie an individual micro-enterprise. She ferries passengers all day long and people including the District Collector can vouch that her veil does-not shift. Breaking the poverty lines, Sunita now dreams of opening a Driving school for women of Durg.

Women feel safer in her car and men have an opportunity for paradigm shift.

Many eyes towards my side! Let me sheepishly share, I felt inflated within. But alas, I soon realised. It was not for me. The eyes oscillated between Geeta and the Sakha prints on the car that read – 'Cabs for women by women.' I leave her for a while to pick up the south -Indian snacks and savouries for Amma, it's her daughter's baby shower ceremony tomorrow. I return in almost half an hour's time. Geeta is quick to help me load the big bags on the back seat. I tell her, we must have to proceed to R.K.Puram for more. We move along. I am too excited to know the challenges that she and her colleagues face as commercial drivers, driving women at odd hours in the night on Delhi streets. She recalls an incident of her driver colleague, whose car tyres got punctured in the middle of the night and that too around Gaziabad. A few meters away stood a bunch of truck drivers, their attention obviously turning her way. In the first instance, she felt somewhat nervous. She called up Geeta who was also on duty that night. Geeta advised her to be careful but confident, not express fear and moved towards them to seek help. I intervened. I was told that the Sakha women drivers were skilled in puncture fixing, then why did she have to seek the truck drivers' help. Quick came Geeta's reply – It would take less time for the men, and her friend would not have to be outside her car for long. She had even advised her to get back into her car and lock herself inside leaving only her side of the window a little ajar, while the truck drivers fixed the tyre. Geeta's friend did as guided and left the place safe. Though the drivers had helped her, they never missed mischievously asking her for a drive..... that too in the dead of the night.

Geeta adds that it feels quite uncomfortable at times our society has to go a long way before women could feel safe outside their homes. But we must remember that fear begets trouble and carefulness prepare us towards security. I am impressed. I know what she says, for this is what this city has made me feel. Carefully through the traffic, she reaches me to R K Puram. I alight leaving her to find a place to park. On my return, I was not too surprised to hear that the traffic police cross checked her license and threatened her to pay a fine for having parked the taxi at a non-parking zone. On having questioned the police on the absence of a No-Parking sign board, 'Ok, I am leaving you simply because you are a woman' was the policeman's reply. Geeta and I could see many cars parked around on the same plot and on the same side. I was reminded of a small work at South Extension and we moved further. It was almost 6:30 p.m. The sun had ceased to show its light. I finished my work in around 20 minutes and as we were on our way out from the parking at the entrance to the main road, a young man was kind enough to accede to my request for a picture of this rendezvous. I was so engrossed, in the conversation with her that I almost lost sight of my purpose and I had almost forgotten to click some pictures for memory and learning.

Geeta is 21 years of age now and manages to earn about Rs. 10,000/-a month including her overtime. She is the only source of her family's income- a family that has been always be Jewelled with vulnerabilities of kinds, like inadequate income addiction and abuse. Needless to say, what this money means to her. A professional taxi driver not withstanding, Geeta is pursuing her

graduation from Delhi University's distance learning program and aspires to become a lawyer and work on women's rights. She has worked as a chauffeur for a year before she could be placed as a commercial driver. Meanwhile, Geeta has applied for the post of a bus driver in DTC (Delhi Transport Corporation) while I can't even fearlessly walk my way on Delhi streets. I wish her well. It's time for all of us to think. A taxi operated, driven and used only by women sounds more than safe to me. I have been feeling comfortable all along the drive, did not really have to be conscious about the way I sat. During long hours of journey, sometimes we doze off to dreams, our hung heads shifting positions and our mouth often wide open. A sudden mirror view of the male driver's gaze often leaves us with a sense of fear and disgust. The hush realities of the female species needs so much comfort in long drives and who else could be a better companion for a single woman traveller than a woman on the steering wheel. Geeta recalls her one year tenure as a chauffeur when she drove a physically challenged young lady to college every-day. Challenges not with standing, Geeta's eight hours' company had aided in the healing of this young lady. The story was touching, and I shall be with you on this some other time.

Though Sakha cabs do not ply men, one male companion with a lady passenger is permissible. I find that the rule has been violated. The Sakha drivers drive Aamir Khan around the city of Delhi when he is here. I remind Geeta of the rule and she smilingly adds 'Unki to baat alag haye' meaning thereby that it's a different thing when it's he. Moving

beyond, I wonder if I can afford a taxi for my routine mobility. Can the thousands of women who take to the city's streets afford a taxi even on a single day? Geeta is aware that there has to be more taxis and more women commercial drivers on our roads, and just not taxis, women driven buses and women conductors. I may even add that if we move from paddling to e-rickshaws, more women could take up rickshaw riding as a dignified livelihood. When Geeta had gone to DTC to apply for the driver's post, she was told that this was the first time a woman has applied. She is confident that there would be a day when a big queue would await the DTC counter. Today buses continue to be the most popular means of transportation for intra-city travel in Delhi, catering to about 60 per cent of the total commuting requirements. Delhi has one of the highest traffic densities in India. I am sure our educated women, mundanely deliberating on sustainable development, will take to women driven buses thus contributing to reduction in traffic congestion.

This evening, I have learnt something on women taxi drivers, their contribution to safe urban mobility for women and much more. Geeta made me feel safe, answered urgent calls and only through head phones. She is clear that accidents are more often than not, the result of irresponsible driving. She adds, women by nature are more responsible, so why would they not be so on roads. We reach. She does the billing, garage to garage, Rs. 600/- for half a day and Rs. 50/- for any additional km. She stops. Switches on the light, picks her billing book, calculates on a calculator, hands the bill. I pay my fare. The journey is not over. Amma is at the

car door to unload the bags. Geeta greets her with a smile and helps her unload. We shake hands and part our ways for the day. Relationships may be transient, but bonds, always eternal. I must return to my desk and write. Development intervention has to be holistic, and for this, people, processes and products need to be converged. What could be a better way to ensure safe urban mobility for women than by augmenting a fleet of women drivers from economically vulnerable families for public transport! Else, all that executors of poverty alleviation programs end up with, is 'tailoring' or 'beautician' courses for poor urban women, oblivious of economies of scale and market needs. I feel frustrated to find how executors of poverty alleviation meet their targets. I wish to talk on targets and development, but not today. Not just a means of livelihood, the historical perception of women as the weaker sex and hence vulnerable to physical force, I am sure will fade at a pace as the number of women commercial drivers begin to rise. I am eager to hope that in the days to come, black days like the 16th of December, 2012, will fade from our contemporary diaries too. Azad Foundation believes that 'preparing and placing women drivers as chauffeurs and commercial drivers will quickly alter public perceptions about women's participation in a booming public transportation sector and enable a hitherto invisible community to move from the margins to mainstream economy'. And I would like to add, that I, as a working urban woman will move safer on city streets.

My Gratitude to Geeta for having unfolded her story and Mr. Rajiv Sharma for having pushed me into penning down this piece.

TEN FACTS ON GLOBAL ROAD SAFETY



1 Every year, there are 1.24 million road traffic deaths worldwide

Young adults aged between 15 and 44 years account for 59% of global road traffic deaths.



2 92% of road traffic deaths occur in low- and middle-income countries

These countries have only 53% of the world's total registered vehicles.



3 Vulnerable road users account for half of all road traffic deaths globally

Pedestrians, cyclists and riders of motorized two-wheelers and their passengers are collectively known as "vulnerable road users". The proportion of road

traffic deaths vulnerable road users is greater in low-income countries than in high-income countries.



4 Controlling speed reduces road traffic injuries

Only 59 countries, covering 39% of the world's population (2.67 billion people), have implemented an urban speed limit of 50 km/h or less and allow local authorities to reduce these

limits. A 5% cut in average speed can reduce the number of fatal crashes by as much as 30%.



5 Drinking alcohol and driving increases the risk of a crash

Above a blood-alcohol concentration (BAC) of 0.05 g/dl, the risk of road traffic crash increases dramatically. 89 countries, covering 66% of the world's population (4.55 billion people), have

a comprehensive drink-driving law enforcing the WHO-recommended blood alcohol concentration limit of 0.05 g/dl or less.

Source: World Health Organisation, 2013.



6 Wearing a good-quality helmet can reduce the risk of death from a road crash by 40%

Wearing a good-quality helmet can also reduce the risk of severe injury by over 70%. 90 countries, representing 77% of the world's

population, have a comprehensive helmet law covering all riders, all roads and all engine types, and apply a helmet standard.



7 Wearing a seat-belt reduces the risk of death among front-seat passengers by 40–65%

Wearing a seat-belt can also reduce deaths among rear-seat car occupants by 25–75%. 111 countries, representing 69%

of the world's population, have comprehensive seat-belt laws covering all occupants in a car.



8 Infant seats, child seats and booster seats can reduce child deaths by 54–80% in the event of a crash

More than half of all countries have implemented a law on child-restraint use in cars.



9 Prompt, good-quality pre-hospital care can save the lives of many people injured in road traffic crashes

111 countries have a universal national access emergency number, but only 59 countries have ambulance services available

to transport over 75% of injured patients to hospital.



10 Since 2007, 88 countries have reduced the number of road traffic deaths

This suggests that progress can be made if there is sufficient political commitment. However, in 87 countries the number of road traffic deaths has increased, while

at the global level the number of deaths has remained stable. The pace of legislative change and enforcement need to be hastened and more attention should be paid to vulnerable road users to reduce the number of road traffic deaths.

BUS RAPID TRANSIT: PARADIGM SHIFT IN INDIAN URBAN MASS TRANSPORT SYSTEM

VIJAY ANADKAT
AMIT BHATT

Bus rapid transit (BRT, BRTS) is a bus-based mass transit system with specialized services and infrastructure designed to increase the quality and performance of the system and remove the typical causes of bus delay.



Cities in the developing world are in search of sustainable solutions to their accessibility and mobility related problems. An analysis of existing public transport facilities shows that most of the cities do not have even an organized city bus service. Where ever the city bus-service exists, the quality is not good enough to motivate commuters to use public transport instead of their personal modes. In the city's chosen multi-modal transport option, Bus Transit, both in its basic and rapid form, forms the core of the chosen strategy. Indian cities are choosing Bus Rapid Transit System (BRTS) as a sustainable solution to its growing urban transport demand. This paper describes the status of BRT in India and their success stories.

(Key words: BRTS, Urban Mass Transport, NUTP, JnNURM, Janmarg, i-bus)

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1.0 INTRODUCTION

In India, the pace of urbanization and the rapid growth of the urban economy has put the spotlight on urban sector. For urban areas to be

able to support the required level of economic activity, they must provide for easy, sustainable flow of goods and people. However, such flow of goods and people has been facing severe problems of congestion, pollution and accidents coupled with lack of coordination amongst various agencies. Unless these problems are remedied, poor mobility can become a major hurdle to economic growth and cause deterioration in the quality of life.

An analysis of existing public transport facilities show that most of the cities do not even have an organized city bus service. Where ever the city bus-service exists, the quality is not good enough to motivate commuters to use public

transport instead of their personalised modes. A ray of hope in this dark patch is that, cities are developing world class bus service in form of Bus Rapid Transit System. This has emerged as a new trend in public transport system.

2.0 CONCEPT AND ELEMENTS

Bus Rapid Transit takes its name from rail rapid transit, which describes a high-capacity urban public-transit system with its own right-of-way, multiple-car vehicles at short headways, and longer stop spacing than traditional street cars and buses. Bus Rapid Transit (BRT, BRTS) is a bus-based mass transit system with specialized services and infrastructure designed to increase the quality and performance of the system and remove the typical causes of bus delay. BRT aims to combine the capacity and speed of a light rail or metro system with the flexibility, cost and simplicity of a bus system. BRT, however, uses buses on a wide variety of rights-of-way, including mixed traffic, dedicated lanes on surface streets, and bus-ways completely separated from traffic. The expression 'BRT' is mainly used in America and China; in India, it is called 'BRTS' (the additional 'S' stands for system); in Europe and Australia, it is often called a 'bus way', while elsewhere, it may be called a quality bus.

The BRT buses operate, for a significant part of their journey, within a fully dedicated right of way (bus way), in order to avoid traffic congestion. In addition, to be considered a BRT, the system will have most of the following elements:

- *Bus way alignment:* Centre/Side of roadway or bus-only corridor keeps buses away from the busy kerb-side, used by cars and trucks for parking, standing and turning.
- *Off-board fare collection:* Fare payment at the station, instead of on board the bus, eliminates the delay caused by passengers waiting to pay on board.
- *Intersection treatment:* Prohibiting turns for traffic across the bus lane reduces delays to the buses significantly. In addition, Bus priority will often be provided at signalized intersections to reduce delays by extending the green phase or reducing the red phase in the required direction compared to the normal sequence. However, prohibiting turns is the most important measure for moving buses through intersections — more important than even signal priority.
- *Platform-level boarding:* Station platform at level with bus ensures quick and easy boarding, making it fully accessible for wheelchairs, passengers with disability, and baby strollers with minimal delays.
- *High frequency all day service:* A BRT network with comprehensive coverage can serve a diverse market (all income ranges) by moving large number of people between locations quickly and reliably throughout the day, while maintaining a comfortable riding experience. These characteristics are essential for satisfying the demands of a diverse market for offering high-frequency service without heavy subsidy.
- *High capacity vehicles:* High capacity vehicles, such articulated buses may be used, which are typically fitted with multiple doors for fast entry and exit. Vehicles used on Trans Milenio System in Bogota, Colombia can carry up to 270 people.
- *Quality stations:* BRT systems typically feature significant investment in enclosed stations which may include attractive sliding glass doors, staffed ticket booths, information booths, etc. The stations often have facility for level boarding, using either low-floor buses or higher level boarding platforms. The multiple doors of vehicle makes passenger boarding fast and also enhance accessibility to disabled passengers. Validation of ticket upon entry to the 'station' rather than boarding the bus, in a manner similar to that of a subway system is also common, particularly at busy stations.
- *Prominent brand or identity:* A unique and distinctive identity contributes to its attractiveness as an alternative public transport option e.g. Janmarg, I-bus, My-bus, Sitilink, Rajpath, Viva, Max, Trans Milenio, Metropolitan etc. Attractive logos and names often mark the fleet and stations look distinct.
- *Safe & Reliable:* Statistics indicate that globally 1.3 million people die in road accidents every year – and India leads the world in the number of reported traffic fatal-

ities, with 140,000 lives lost in road accidents annually. A BRT project, if done right, can significantly reduce road accidents because BRT system necessitates changes in road design and road infrastructure, thereby creating refuge islands and shorter pedestrian crossings, thus contributing to passenger safety. EMBARQ study for road design and guidelines for the bus system, which address mobility and accessibility on bus corridors from the viewpoint of road user safety finds BRT as one of the safest mode. It is also universally accepted that BRTs are a cost-effective and environmentally sustainable form of public transport and can also be used to address road safety issues in urban areas.

3.0 EVOLUTION OF BRTS GLOBALLY

Approximately 158 cities worldwide have implemented BRT systems or priority bus corridors, serving nearly 27 million passengers daily. There is growing interest and demand for BRT as cities seek low-cost, sustain-

able urban transportation solutions. As the number of BRT systems in the world increases, current, accurate and complete information about existing and planned systems becomes increasingly important but difficult to collect.

In 1972, Jaime Lerner, then Mayor of Curitiba had a brilliant idea to transform the face of his city. Lerner was an architect and urban planner by training and when he ascended to power he brought the tools of a designer to the mayor's office. Then, Curitiba was a small but rapidly expanding city in the south of Brazil and his aim was to develop a plan for the city that could accommodate growth without the sprawl and congestion, that were beginning to plague other cities in Brazil.

He planned an above-ground subway system that would use buses instead of rail. Up to this point buses were used in ways that most of us are familiar with; they ran in the same lanes as other traffic, picked up passengers at designated stops, and charged passengers a fare once that had boarded.

Bus Rapid Transit has been so instrumental in Curitiba's fight against congestion and sprawl, that the Chairman of Habitat-II, the United Nations Second Conference on Human Settlements, called it "the most innovative cities in the world." Naturally, other cities began to take note of this system. Under the leadership of Mayor Enrique Penalosa, Bogota, Colombia followed Curitiba's footsteps in developing Transmilenio, a Bus Rapid Transit System with 7 corridors, which has become the pride and joy of the city. Quito, Ecuador has also adopted BRT of Curitiba to create an advance public transport system.

4.0 STATUS OF INDIAN BRTS

BRTS has generated immense support of the central and state Governments in India. Government of India has approved a comprehensive National Urban Transport Policy (2006) which focuses on returning the roads to the people which have been colonized by the vehicles, with the strongest recommendation of development of mass transport system. It is supported by State and Central Government financial assistance to the cities under Jawaharlal Nehru Urban Renewal Mission (JnNURM). This has created a new path for developing world class bus based mass transport system in the form of Bus Rapid Transit System. This paper attempts to document the status of Indian BRT and showcase best practices amongst them.

4.1 JnNURM sanctioned BRTS: (State-wise in alphabet order)

Followings are BRT projects sanction by the MoUD under JnNURM.

Table 1: Evolution of BRT world wide

Location	System	Year of start	Peak passengers per hour per direction	Passengers per day	Length (km)
Bogotá	Trans Milenio	2000	43,000	19,80,000	106
Guangzhou	Guangzhou BRTS	2010	29,900	8,00,000	22
Curitiba, Brazil	Rede Integrada de Transporte	1974	11,000	5,80,000	81
Belo Horizonte, São Paulo	BH Trans	2012	35,000	13,08,000	24
Istanbul	Metrobus (Istanbul)	2007	30,000	800,000	52
Jakarta	Trans Jakarta	2004	3400	350,000	NA
Brisbane	South-East Bus way	2009	6500	242000	NA

(Source: brtdata.org, July 2013)

4.1.1 Andhra Pradesh: Vijaywada BRTS

Under BRTS phase-1, total length of corridor approved is 15.5 km. The corridor route plan follows a ring structure and starts at Police Control Room to Railway Station to CK Reddy Road to Satyanarayana-puram to Machavaram down to Ramavarappadu Ring to Benz Circle to M.G. Road to IGMC Stadium to State Guest House to Police Control Room. Out of the total 15.5 km of road, only 3.5 km has dedicated corridor for BRTS operations. The construction of the road is complete. The project is sanctioned under JnNURM with sanctioned project cost of Rs.152.64 crore in the year 2007.

4.1.2 Andhra Pradesh: Vishakhapatnam BRTS

Two corridors with 38.5 kms length were identified for BRTS by the APSRTC and GVMC. The two corridors connect Pendurthi to Dwarkanagar on two different routes. The portions of corridors that are under implementation are Pendurthi to Railway Station (20 km) and Pendurthi to Maddilapalem (18.5km). The first corridor of BRTS is complete and buses are in operation for last six months. The project amounting to Rs. 452.93 crore was approved for the city by the Ministry of Urban Development, Government of India, under JnNURM.

4.1.3 Gujarat: Ahmedabad BRTS

Ahmedabad BRTS has emerged as a successful BRTS in India, enhancing city mobility opportunities. It is branded and known as

'Janmarg'. Currently, Janmarg BRTS is operating 63 km of BRTS corridor. Another 27 km is under implementation and the first stage is expected to be operational in 2013. 'Janmarg' has been acclaimed internationally and is acknowledged as the first 'complete' BRTS in India. Total project cost of two phases amounts to Rs. 981.45 crore and has been funded by the Ministry of Urban Development, Government of India, under JnNURM. The third phase of BRTS proposes further extension of corridors by another 27 kms. This proposal has been submitted has to the Ministry of Urban Development, Government of India, for financial assistance under JnNURM.

4.1.4 Gujarat: Rajkot BRTS

Rajkot BRTS project is planned for 63 kms. In the first phase, 29 km long stretch on 150 feet (45 m) wide Ring Road, known as blue corridor is sanctioned and is under construction. A pilot project stretch of the BRT corridor of about 10.7 km is commissioned and has been opened for public in October 2012. Two more corridors are proposed in Phase-2. The sanctioned amount of the pilot corridor is Rs.110 crore and has been funded by Ministry of Urban Development, Government of India, under JnNURM. It is branded and known as Rajpath bus service.

4.1.5 Gujarat: Surat BRTS

There are nine identified BRTS corridors in Surat and in Phase-I, 2 of these corridors, with a length of 29.7 km, have been sanctioned by Ministry of Urban Development, Government of India, under

JnNURM. The BRTS project for Surat was approved in 2008 at a cost of Rs. 495 crore. Surat Municipal Corporation has planned Phase-II of BRTS with a length of 42 kms and Phase-III having a length of 30 kms. Phase-III has been submitted to the Ministry of Urban Development, Government of India, for financial assistance under JnNURM. It is branded as Sitilink and first corridor is likely to be operated from October 2013.

4.1.6 Madhya Pradesh: Bhopal BRTS

Four BRT corridors have been identified in Bhopal under Phase-1 with a total length of 44 kms. The first phase of Bus Rapid Transport System (BRTS), costing Rs. 247.12 crore, was approved by Ministry of Urban Development, Government of India, on 10th November 2006 under JnNURM. It has a total length of 24 km, which is the longest (23.95 km length) single stretch of BRT corridor in the country. It is branded as My-bus and trial operations are on-going for the last two months. Commercial use of some stretches is likely to start soon.

4.1.7 Madhya Pradesh: Indore BRTS

Total seven corridors are planned with total length of 106 kms under JnNURM. Out of which, 11.5 km of BRTS from Niranjapur to Rajeev Gandhi square of Corridor-1 is in operation since last four months. It is branded and known as iBus. The i-Bus BRTS is planned as an Open System and has express service of buses, which has reduced the travel time for the commuters. For the

pilot project corridor of 11.5 km., the total sanctioned amount is Rs. 98.5 crore.

4.1.8 Maharashtra: Pune BRTS

Pune is among the first JnNURM cities for which a BRTS project was approved. Pune BRTS provides an interesting case study as well as a learning experience for other BRT corridors in the country. Pune Municipal Corporation conceptualized the BRTS Project in the year 2006. Pune BRTS was planned as an Open System with stretches that were free from any segregated BRT lanes. This was done so that the non-BRT buses are also able to use the BRT lane. Initially the total length of BRTS network in Pune was 118 km of which 19 km of additional links and 99.38 km of BRTS network was approved. Later on the network has been revised to 68.80 km, which was approved under JnNURM in 3 phases. Bus Rapid Transport System, costing Rs. 1013.97 crore, was originally approved on 5th March 2007 and it was revised later in August 2008.

4.1.9 Maharashtra : Pimpri Chinchwad BRTS

As a first phase, PCMC proposes to take up the implementation of 8 BRTS under JnNURM. Out of which, 4 BRTS corridors, totalling 47.30 kms., have been approved in the first phase at the sanctioned cost of Rs. 426.04 crore under JnNURM.

4.1.10 Rajasthan : Jaipur BRTS

Jaipur Development Authority (JDA) is the nodal agency for planning and implementation BRTS in Jaipur. As per the Master Plan of BRTS total 138 km of corridor length has been identified for the system. The project

is proposed to be taken up in three phases. In first phase, a corridor length of 46.7 km has been selected on priority basis which connects North-South and East-West ends of the city and fulfills major transport needs of the city. The estimated cost towards the development of road infrastructure for the first phase of BRTS in Jaipur was Rs 479.6 crore and was approved by MoUD in July 2007. First phase of about 7.1 km is in operation since October 2010. Due to various revisions and with the advent of Metro in Jaipur, the cost of the project is revised to Rs. 679.5 crore and the revised proposal is submitted to the Ministry of Urban Development, Government of India.

4.1.11 West Bengal: Kolkata BRTS

Kolkata Bus Rapid Transit System (BRTS) is a new rapid transit project taken up by Kolkata Metropolitan Development Authority (KMDA). The BRTS project from Ultadanga to Garia along E-M Bypass in Kolkata was approved in October 2010. In phase 1, the route will cover 15.5 km running along the E M Bypass to Garia. The BRTS will connect the East-West Metro and will pass through eastern by-pass via Ultadanga. The Phase-II of BRTS is from Airport to Ultadanga and phase-III will extend beyond Garia, which are suppose to be taken in future after completion of phase-I. Kolkata BRTS was approved by the Ministry of Urban Development, Government of India, in March 2010, with a sanction cost of Rs.252.92 crore.

4.2 Sanctioned BRTS other than JnNURM

Following BRTS projects have been

developed by cities from their own fund, state support or external assistance. These are non-JnNURM projects.

4.2.1 Raipur BRTS

Naya Raipur Development Authority (NRDA) has signed the participation agreement with the MoUDGoI in February 2009 for implementation of BRTS project under GEF-UNDP-World Bank assisted Sustainable Urban Transport Program of GoI. Master Plan for the city with three corridors of total length of 80 kms is planned. Out of this, under GEF project the first phase of about 21 kms covering the central spine of the new city and the expressway link with Raipur via NH-6 has been sanctioned.

4.2.2 Hubli-Dharwad BRTS

For twin cities of Karnataka separated by about 20 km, BRT system has been funded under Sustainable Urban Transport Project (SUTP). The total length of BRT corridor is planned for the cities is 22.25 kms. Special Purpose Vehicle has been formed for implementation of the project and operations are to be managed by the state transport department. The DPR is already sanctioned and work has been started.

4.2.3 Delhi BRTS

The 14.5 km long corridor from Ambedkar Nagar to Delhi Gate runs along a right of way, varying from 28 meters to 51.5 meters wide. Buses use a bus lane planned in the middle of the road which is 3.3 meters wide with general purpose motor vehicle lanes to each side with a width of 6.75 meters to each side. Buses run at the same level as normal traffic

and share the same traffic signals. Currently it operates on a length of 14.5 km with dedicated bus lanes in the centre of road and carries around 120000 passengers per day. DPR for new corridors are being made to extend the reach of BRT.

4.3 Indian BRT projects at planning stage

Looking to the success of various projects following cities have also planned for BRTS. The status of their BRT varies from Pre-feasibility to Detailed Project Report stage.

1. Mumbai BRTS
2. Bangalore BRTS
3. Vadodara BRTS
4. Lucknow BRTS
5. Chennai BRTS
6. Guwahati BRTS
7. Coimbatore BRTS
8. Hyderabad BRTS
9. Madurai BRTS
10. Nagpur BRTS

5.0 SUCCESS STORIES OF INDIAN BRTS

Indian BRT completes about seven years and almost seven cities, viz., Delhi, Ahmedabad, Jaipur, Rajkot, Indore, Bhopal and Vishakhapatnam, have started the bus operation on BRT track in different forms. Other five are an advance stage to start bus operation. Amongst all these seven cities, Ahmedabad and Indore have shown excellent results. Therefore, it is worthwhile to narrate their success story.

5.1 Ahmedabad's Janmarg'

Ahmedabad city has a well-de-

veloped road network. The street network in Ahmedabad, evolved historically, may be classified as a ring-radial form. There are about 20 well-defined radials; 12 in the west and 8 in the east. Ahmedabad Municipal Corporation manages a road network of 1272 kms, of which 93 per cent are surfaced roads. Available information indicates that the speed on major roads range from 14 to 24 kms per hour. In the walled city, the speed is much less, about 10 kms per hour. It was after the year 2000, the bus patronage levels in the Ahmedabad Municipal Transport Service (AMTS) started to decline drastically, due to insufficient bus fleet and stiff competition from intermediate modes of transport, plying on the same routes as the buses. The intermediate modes for public transport such as the shared auto rickshaws known as "Chakdas" have proved to be a stiff competitor for the AMTS buses. They ply on the same routes as AMTS at compar-

ative fares. The fleet size of AMTS came down from 886 buses in 2001 to 540 in 2005.

The first serious attempt to resolve urban transport problems was made in 1983, wherein the techno economic feasibility of developing a mass rapid transit system for the city of Ahmedabad was examined. After a large field based data gathering, analysis and forecasts for ten and twenty years, Rail India Techno Economic Services (RITES), a public sector consulting company, recommended establishment of a rail based transit solution. After twenty years, neither the traffic intensity on any corridor reached anywhere close to the forecast nor did the proposal for a transit system progress any further. In the early nineties, the State agency, Gujarat Industrial Investment Corporation (GIIC) signed an MOU to develop a rapid transit system in Ahmedabad. However, due to lack of agreement



Ahmedabad BRTS near Zansi ki Rani (Photo by CoE CEPT University)

between the private sector and the government with regard to terms of operation, the proposal did not go very far. By the time the city population had crossed 3 Million and the vehicular boom continued. The Gujarat Infrastructure Development Board (GIDB) through international competitive bidding commissioned a comprehensive study (GIDB-1998-2002) to formulate a broad strategy for solving urban transport problem of the city. Based on elaborate field surveys (over 11000 households) and modelling, proposals for LRT and BRT emerged as a potential mass transit system for Ahmedabad. Another study recommended introduction of a regional railway system to solve the urban transport problem. While these studies were being made, the bus transport service in the city deteriorated and it's the share came down to an insignificant level. Need for focused effort for resurrecting bus got priority, which got translated into a BRTS study. The outcome of these exercises formed the basis for a comprehensive and integrated transport sector strategy to transform the city towards sustainability.

Some of the important features, which contributed to the success of Ahmedabad BRTS-Janmarg, are highlighted below:

- Janmarg is the first full BRTS system in India to operate as a closed system. 'Networks and not corridors' and 'connect busy places and avoid busy roads' have been basic principles for selecting 90 kms long network. The network connects central city with traffic generators such as

transit terminals, markets, industries and institutions.

- It uses Integrated Transit Management System (ITMS). ITMS includes transit signal management, smart card integration, passenger information system and Geographic Information System (GIS) on the buses.
- Dedicated right of way for the buses and stations with level boarding saves travel time for the buses and make the system more competitive with the auto travel. BRTS streets are complete streets with dedicated bus lanes, cycle tracks, pedestrian facilities, separate lanes for personalised vehicles and optimum parking. It enhances quality of life for all citizens. For people with disability, access to BRTS stations is now easier with ramps, level boarding and better buses. Trial run of BRTS was conducted over three month period. The major objec-

tive of trial runs was to allow the passengers to understand the system and its applications.

- The organization is lean and manages the operations through a set of PPP arrangements.
- Currently, Janmarg BRTS is operating 63 kms of BRTS corridor. Another 25 kms of corridor is under implementation which is expected to be operational in stages beginning 2013. The system carries 1.4 lakh passengers daily through a fleet of 128 buses.

Continuous monitoring and up-dation of route, frequency and travel demand and adoption and modification of latest technology and management by professionals, under the Special Purpose Vehicle 'Janmarg', are key elements of success of Ahmedabad BRTS.

5.2 The i-bus of Indore

The Indore Bus Rapid Transit System



Indore BRTS ibus ride by children (Photo by Embarq India)

(BRTS) or Ahilya Path is the bus rapid transit system for the city of Indore, Madhya Pradesh, being operated by Atal Indore City Transport Services Ltd (AICTSL). Atal Indore City Transport Services Ltd (AICTSL) is a joint venture between Indore Development Authority and Indore Municipal Corporation, set up to operate and manage the public transport system in the city. Indore BRTS or Ahilya Path became operational on 10th May 2013. The implementation of Indore BRTS project started in 2007 under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM). The financial partners of this project were Governments of India, Government of the State of Madhya Pradesh and the World Bank. The UK-based Serco got the operation and maintenance contract of the BRT from AICTSL. The Company will operate and maintain the fleet of the 50 low-floor and air conditioned buses. It will also manage the operations, control centre and a depot for the corridor. Under the Sustainable Urban Transport Project (SUTP), the Global Environment Facility will fund the setting up of the GPS-enabled Intelligent Transport System (ITS) on the BRTS.

It is also full BRTS and has similar features of Ahmedabad BRTS. Additionally, the key factors for success of i-bus BRTS are summarised below:

- For those cities hoping to learn from Indore's experience with BRT, one of the most important lessons is the necessity for open and honest communication. Recently, i-bus has been at the

centre of public debate and even faced opposition in court. The primary reason was the delay in completion of the project, which took nearly six years to complete. This delay was exacerbated by poor communication and little transparency, leading to media backlash and public discontent. The city of Indore has completely reversed this in the last six months. Officials of Atal Indore City Transport Services Limited (AICTSL) have actively engaged themselves with the public and the media, ensuring that all updates and details of the project are communicated effectively. The result is a more open forum between the media, government, and citizens and a drastic increase in public buy-in for the project. Even the most thorough and well-executed plans encounter some degree of public resistance. For that reason, it is essential to inform and engage the public from the very beginning. Ideally, they will have a stake in the future of the project and own the changes to their community. At the very least, they will have access to the facts.

- Management by professional with the external support of Emabarq India and the World Bank
- Use of GPS/ GIS to monitor the bus operation
- High quality buses and partnership with private agency for

operation and maintenance

The astounding growth in public acceptance and ridership is a testimony to the changing attitudes of Indore's citizens. Within a period of 10 weeks, ridership has increased 10 fold, from 2,500 to 25,000 passengers per day. Where earlier passengers would have had to wait up to 20 minutes for buses to arrive, now one can expect a bus every 7-8 minutes. All of this has happened with just 14 buses. When the fleet size reaches 50, as is planned, riders will only have to wait 2-3 minutes during peak hours. For these reasons, iBus is not only a positive change for the citizens of Indore, it is also a landmark in public transport systems throughout India.

6.0 SUMMING UP

Cities in the developing world are in search of sustainable solutions to their accessibility and mobility related problems. Indian cities are discussing about the suitability of public transport system. They found BRT as a successful option due to features like faster implementation, lesser capital investment and suitability for average trip length of Indian cities. More than 14 cities have adopted the system and 11 are at planning stage. Evaluation of all these systems shows that each BRT has some innovative idea and Indian fragrance, which led it to a successful story. Though, the pace of BRT was initially slow, but now it is being developed with strong, firm and steady way across the country.

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Book Review

DILLINAMA-THE CITIES OF DELHI BY A.K. JAIN

Synergy Books India, New Delhi, 2013, p. 310, Price Rs. 995/-

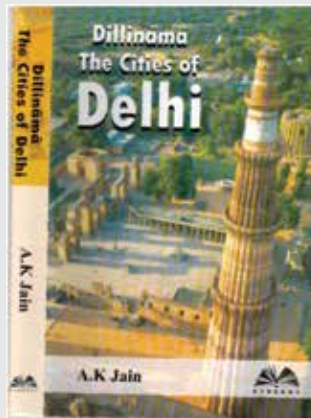
Delhi is not a single city, but has many cities within it. A.K. Jain in his book 'Dillinama-The Cities of Delhi' weaves the fabric of historic cities, which have risen and fallen here. These cities present pictures of contrasts and contradictions, of triumph and tragedy and chaos and order. All these add up in making Delhi a unique and throbbing city.

The historic cities of Delhi are the stamps of cultural diversity and its evolution. Mehrauli, Lalkot, Khilji's Siri, Tughlakabad, Jahanpanah and Ferozabad, are the reminders of Delhi's embattled past. These are the tales of terror and valour. The construction of cities at the site of Purana Qila-Dinpanah by Emperor Humayun and Dilli by Shershah Suri are the expressions of thrift and nimbleness of the rulers. Shahjahan's Shahjahanabad is a living reminiscent of the past and expresses the climax of the Mughal art of city building. Immensely rich in cultural heritage, Shahjahanabad with its palaces, mosques, bazaars, gilded domes, havelis, katras and a maze of lanes and bye-lanes had been one of the most beautiful cities of the Orient Emperor. Shahjahan expressed his love for Delhi by inscribing the following in the Diwan-i-khas at Red Fort:

"If there be paradise on the earth,
it is here,
it is here,
it is here".

MirzaGalib in the same fervor wrote: "if the world is the body, Delhi is its soul"

The Colonial British rule gave a new turn to the cultural and physical form of Delhi. From development of 'colonies' by the East India Co. and subsequently by the British Raj, Delhi was



resurrected as the capital of India. This was the beginning of a new chapter in the evolution of Delhi. It culminated in the building of the Imperial Delhi, which continues to be the seat of the national government and the focus of power and politics. Imperial Delhi was conceived as an "Anglo-Indian Rome", a subtle blend of India and the West. New Delhi celebrated the century of its founding in December 2011. In 1911 when Imperial Delhi was founded Delhi had a population of 2.30 lakh which grew ten times, i.e. 2.3 million in 1961 and would be 100 times, i.e. 23 million in 2021. The massive growth of Delhi has severely impacted its heritage, culture, morphology and ecology. Today it is a magnificent paradox of

hybrid urbanism- chaos and order, triumph and tragedy. Both in literal and metaphorical sense, Delhi is a city of contradictions-rich and poor, exclusion and inclusion and of problems and potentials. It is a portfolio of huge population, polluted river, numerous illegal colonies, villages and slums, and also the charming Lutyens' Delhi, the Shahjahanabad, ridge, large parks, wide roads and avenues. According to A.K. Jain, the heritage of Delhi is its soul which gives the city a unique identity. It should be sensitively protected and conserved. The future of Delhi lies in the conservation of its unique heritage, culture, bio-diversity and ecology.

The book "Dillinama-The Cities of Delhi" is an exciting journey of discovery. It provokes a fascinating and complex area of enquiry. The text is simple and flowing with many illustrations, which make the book absorbing and interesting.

Book reviewed by: Dr. Akshaya Kumar Sen (akshaya_sen@yahoo.co.in), Assistant General Manager (Economics), HUDCO, New Delhi.

INNOVATION IN HUDCO

Housing & Urban Development Corporation Ltd (HUDCO) has been continuously reviewing its business strategies to fulfill its mission of promoting sustainable habitat development and eradication of housing shortage in the country. To achieve a quantum jump in housing and urban infrastructure operations in both rural and urban India, five stretch goals, namely 'Mission Five Ones' have been formulated by HUDCO in October 2012. Mission Five Ones are envisioned to deliver:

1. One lakh crore cumulative release in 2 years
2. One thousand crore Profit after Tax in 2 years
3. One million housing units to be sanctioned every year
4. One hundred Urban Local Bodies to be supported every year
5. One per cent reduction in gross NPA every year

Subsequently, HUDCO has set-up an Innovation Cell. Dr. P. Jayapal, Senior Executive Director is in-charge of Innovation Cell and Mr. Rahul Mane is the Nodal Innovation Officer. The team is supported by Mr. Rajiv Sharma, Dr. Akshaya Sen and Dr. Vivek at corporate office. Each Department and Regional Offices have also nominated Innovation Officers to share ideas and to explore ways and means of achieving the stretch goals. Mr. Sanjay Bhargava, who has had success with 'big ideas' in three different financial services in three different countries, is the pro-bono coach for this team.

In the HUDCO intra-net facility for in-house communication, a box on Innovative suggestions has been created. All the employees of HUDCO can post their ideas in this box. The ideas are regularly monitored and feedback goes back to the person, with regard to the status of the idea posted, by the head of the concerned department.

So far, Innovation Cell has been able to achieve the following milestones:

1. Innovation has been made in revival of old products such as HUDCO Niwas bulk loan; and loan to ULBs, Housing Finance Companies, Police Housing Corporations, State Road Transport Corporations (for fleet augmentation and other related infrastructure), etc.
2. A new 'Accelerated Rural Housing Programme' has been formulated for State Governments/ public agencies with three kind of loan products, viz, fully grant scheme, grant-cum-loan scheme and fully loan scheme for the purpose of providing affordable housing to the rural poor. Rajasthan is availing loan for rural housing under this programme.
3. A new scheme "Rent to Own" has been introduced for the employees of State Public Agency, police personnel through State Police Housing Corporations and Employees of Transport Corporation, through State Road Transport Undertakings. In this scheme, the agency would avail loan from HUDCO on behalf of its employee. It can build the houses or purchase the houses in bulk and give them on 'rent-cum-ownership' basis to its employees. An employee would become the 'owner' of the house, as and when the full cost of the house is paid to the Employer. The House Rent Allowance (HRA) alongwith certain additional amount, as consented by the employee, is deducted from the salary that would

be used by the agency to repay the Equated Monthly Installment (EMI) requirement to HUDCO.

4. Hudco Nav Nagar Yojana (HuNNY) is a product developed to incentivise the State Housing Boards, Development Authorities or Urban Local Bodies to take up a comprehensive township project that would address the demand of affordable housing, particularly for EWS, LIG and MIG categories in small and medium towns. HUDCO will provide technical and financial support for developing potential sites, as planned urban extension, to meet the requirements of the ever growing population.

In this programme, HUDCO's assistance will be available for (a) advisory service on conceptualization and feasibility of the proposed development; (b) consultancy assistance on fee basis, for architectural and engineering designs; and (c) providing funds required for development of sites and services as well as housing, including land acquisition.

5. HUDCO is contributing Rs.25 crore in India Inclusive Innovation Fund (IIIF) of National Innovation Council (NIC) in order to promote IT enabled innovations in the area of "Housing and Habitat". NIC has also agreed for inclusion of "Housing and Habitat" as one of the sectors, earmarked for innovation.

6. HUDCO has joined hands with SEWA through an equity investment of Rs 1 crore (10 per cent) in the proposed new housing finance company. This company will ensure financial inclusion of poor and self-employed women in slums and informal settlements.

7. The Delhi-Mumbai Industrial Corridor is going to develop world class transport infrastructure, smart cities and high quality support facilities for movement of goods between the two cities. HUDCO has subscribed Rs. 19.90 crore (19.90 per cent) equity capital in Delhi-Mumbai Industrial Corridor Development Corporation Limited.

8. The Infrastructure Debt Fund (IDF) has been created by India Infrastructure Finance Company Limited (IIFCL) for long-term financing of viable infrastructure projects in the country. HUDCO has subscribed upto Rs 50 crore towards IDF of IIFCL.

9. A framework to support ULBs for accelerated development of small and medium sized towns has been prepared under Adarsh Nagar Yojana. This scheme looks into innovative ways of city transformation by unlocking its potentials and suggesting measures for physical and socio-economic development.

10. Innovation Cell is in the process of formulating a new product-"Senior Citizen Housing", which will have all required amenities for the comfort living of Senior Citizens. Under this scheme, on the basis of monthly fixed charges and security deposit, a well furnished apartment is provided to senior citizens with all daily need facilities such as dining, medical support, internet, DTH, laundry services, security, yoga centre, club, Gymnasium etc.

Other new products under development are- Housing for Women in Distress and Parking Solutions in urban areas.

For further information please contact Dr. P Jayapal, Senior Executive Director (Operations), HUDCO, New Delhi.

MOBILITY REFLECTIONS IN URBAN RETROSPECT: MY E-RICKSHAW RIDE

SANGEETA MAUNAV

E-Rickshaw may not be banned, but could be definitely regulated. If people like Manoj or those better-off than him become owners of e-rickshaws costing Rs. 1,00,000/- , should the poor cycle rickshaw pullers of Delhi Streets or for that matter rickshaw pullers of any other city stand to benefit ?

The sounds of 'E' reverberate along almost every step of my urban footing. I cannot exist without an Email, an E-governance and an Environment friendly product or process. Now it's an E-rickshaw ride for me. As if the big labels are any scarce, my logical restlessness wants to add a yet another 'E'. And this is 'Equity', for I believe that if this comes into being, the other 'Es' would rest in peace. Whether in stillness or in mobility, on rustic roads or urban streets, we need equity.



Manoj, his e-rickshaw and my ride

I am awaiting an auto rickshaw to return home from work. Dusk is at its dawn. Peeping through the bushes of the road divider outside my office on Lodhi Road, is a vehicle that strays my this wait. It is not yet a very oft-seen fleeting object of senses in a plush street of New Delhi that escapes attention. I have never seen it ever before at this location. Such a vehicle as this is too distant for an intimate learning. My sensory perceptions are increasingly getting habituated to innovations and their nomenclatures in the area of City Rebuilding, I can ill-afford to escape this anyway, a labourer in urban

development sector that I am. After all, this a motorised battery-operated rickshaw, 'E-rick', sponsored by cellular services provider Vodafone Essar, launched to promote eco-friendly transportation in the city ahead of the Commonwealth Games. I manage to whisk pass the traffic. I am glad, incidentally the camera hangs across my feeble shoulder.

I reach him, am ready to pay any price, for I need to know more. 'Is this what you call an E-Rickshaw'? I enquire from the driver. I learn that it is. We set off without a bargain, and we chat along, Manoj that's the driver and I. He says that at present this electrical battery operated rickshaw costs around Rs. 1,00,000/- and he owns it. He has bought it from a local manufacturer based at Paharganj.

Manoj is a school bus driver. He finishes work at 4:00 p.m and then takes to this e-rickshaw driving for 4 hours a day, an additional source of livelihood. It gives him a sense of ownership too. The ride feels comfortable, while a cycle rickshaw, with its sloping seat, gives my aging spine often a painful ride, and as I continue my queries I hip hop from one side to the other of the two seating areas, just to hear him better. There is a sense of joy, it's new to me. It doesn't take me more than 10 minutes to reach my destination a distance of around 1.5 kms and at a speed of 20 kmph. He charges me Rs. 40/-. An

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Should you want to know more...

auto rickshaw would not cost me more than Rs. 30/- for this distance that I traverse every day. Manoj allows some pictures to be clicked. I have clicked many, the twin storage spaces, the spare tire hear him better. There is a sense of joy, it's new to me. It doesn't take me more than 10 minutes to reach my destination a distance of around 1.5 kms and at a speed of 20 kmph. He charges me Rs. 40/-. An auto rickshaw would not cost me more than Rs. 30/- for this distance that I traverse every day. Manoj allows some pictures to be clicked. I have clicked many, the twin storage spaces, the spare tire behind, the rickshaw shed and everything my immediate attention could see. It does not embarrass me to withhold my curiosity of all sorts. I very candidly ask him as to how much does he earn a day and I learn it's about Rs. 300/- to Rs. 400/- i.e. for a four hour business. Well, we have got to subtract the cost of charging it every night and he says the electricity consumption works out to almost 6 units a day. Manoj lives in a rental accommodation and pays Rs. 7/- per unit for his household's electrical consumption. This means that he shells out around Rs. 1300/- a month towards the recurring operational cost of the rickshaw.

He is able to park his vehicle just outside his house for luckily there is space. Going by the figures shared by Manoj, and if we were to take them on the upper limit, then Manoj would take 7 years to cover the cost and any other driver who plies his vehicle for around eight or nine hours a day would possibly cover the cost in three and half years. As we further, Manoj shares that he has mobilised personal resources, his savings and some borrowing from friends, to buy this rickshaw. He could not manage a bank loan, and I thank my incorrigible tongue for not lecturing him or his bank on Financial Inclusion and micro enterprise development for poverty alleviation. My pseudo urban elitism has already taken away an entire fertile time of Manoj's. I thank him for his patience and we bid adieu. Who knows I might meet him again some other day outside my office.

Not long before my thoughts could fade, the newspaper headlines dampen my desire of yet another, E-rickshaw ride – 'The state government and the three municipal corporations were on Wednesday directed by the Delhi high court to respond to a Public Interest Litigation (PIL) seeking ban on E-rickshaws on city roads as they are plying without a licence or number plate. But why, I wonder, and I learn that they are powered by more than 250 W, un-registered, unlicensed and unsafe on city streets. And as it stands now, the PIL seeks a ban, and the Government, a regulation. I am not too quick to understand as to why the eco-friendly rickshaw was launched at all. Was it to promote a company, market the innovations

and nomenclatures or for that matter to post an image during the Commonwealth Games? Interestingly, this is also the time when E-rickshaws and Rickshaw banks are being recognised and promoted by the National Government. It's all about Big people, Big ideas, Big innovations, Big challenges and of-course Big funds. While incorrigibly sceptical as I am, yet I am hopeful that all this is for small people, small by the capacity of their resources to subsist in our Big cities. More than 2000 E-rickshaws ply on the streets of Delhi, says Manoj. E-Rickshaw may not be banned, but could be definitely regulated. If people like Manoj or those better-off than him become owners of e-rickshaws costing Rs. 1,00,000/-, should the poor cycle rickshaw pullers of Delhi Streets or for that matter rickshaw pullers of any other city stand to benefit? True, cycle rickshaws are most environment friendly and rickshaw pulling a healthy labour. But are the circumstances amidst which they gruel healthy enough? Are we not to gear towards institutional mechanisms like community based organisations of rickshaw pullers and pro-poor banking models to reach E-rickshaws to paddlers please?

I will await yet another E-rickshaw ride, but this time with Rajan and his likes who I see paddling away from the dawn of day to the dusk of night. Every other day, I cannot but hear big cars endlessly sulking at small rickshaws on city streets; it seems they are obstacles to a faster drive. Every day, I see us pouring resources to make our roads wide. How I wish we drove smaller cars to root our developments deep.

VISION ZERO INITIATIVE- TRAFFIC SAFETY BY SWEDEN

No loss of life is acceptable

The Vision Zero is the Swedish approach to road safety thinking. It can be summarised in one sentence: No loss of life is acceptable. The Vision Zero approach has proven highly successful. It is based on the simple fact that we are human and make mistakes. The road system needs to keep us moving. But it must also be designed to protect us at every turn.

Freedom to move A matter of life and death

Cars are a passion for people all over the world. They are a symbol of freedom and progress. The ability to move is crucial in every aspect of life and certainly the reason why the wheel was invented in the first place. Mobility is also one of the most important drivers of economic growth and prosperity.

Increased traffic : The statistics clearly show that economic growth also leads to increased traffic. What happens when traffic increases is well known: congestion, pollution, climate change and, last but not least, death and serious injury. The statistics make truly painful reading.

Higher death tolls : Every year, more than 1 million people die in traffic-related accidents around the world. Today, road traffic is the 9th biggest cause of death worldwide. By 2030, the rise in vehicle ownership and use will see road traffic become the 5th largest cause of death, claiming more victims globally than AIDS and tuberculosis. For people aged between 15 and 29, road traffic accidents are already the most common way to die.

No more acceptance : We know that road traffic is a deadly and daily threat. Why, then, do we not do more to counter it? There can be no moral justification for the death of one single person. You should be able to move freely - and feel safe at the same time. This is what the Vision Zero Initiative is all about.

The Human Factor People might fail, the road system should not

The Vision Zero starts with a statement: we are human and we make mistakes. Our bodies are subject to biomechanical tolerance limits and simply not designed to travel at high-speed. Yet we do so anyway. An effective road safety system must always take human fallibility into account.

People make mistakes : An individual can feel nervous about standing on a chair to change a light bulb yet see a train coming and hurry to cross the rails. We have a very natural fear of heights, but lack the ability to judge velocity. We're also naturally prone to be distracted and have our attention diverted by music, phone calls, smoking, passengers, insects, or events outside the car. On top of this, we just make silly mistakes. The human factor is always there - 365 days a year.

Unreasonable risks : Considering this, our road systems are allowing drivers to take risks way beyond our capability. They have an unclear responsibility chain that actually blames the victims for crashes and injuries. For example, our road systems allow cars to travel at 200 km/h just a metre or two behind the vehicle in front. They allow cars travelling at 100 km/h to pass a child standing a metre away - in the wet and not knowing if the driver is fit or understands the risks.

Making errors part of the equation : Only by designing the entire transport system to cater for human fallibility can we overcome these risks. Doing so will teach us how to manage kinetic energy in traffic systems and change road and vehicle design - separately and in unison.

In every situation a person might fail - the road system should not. This is the core principle of the Vision Zero.

The Vision Zero Any loss of life in traffic is unacceptable

Transport systems are traditionally designed for maximum capacity and



mobility, not safety. This means road users are held responsible for their own safety. The Vision Zero Initiative takes the opposite approach. We place the main burden for safety on system design because we recognise human weaknesses and low tolerance to mechanical force. Ultimately, no one should die or suffer serious injury in traffic.

From principle to law : The Vision Zero was first conceived in 1994. Like all good ideas, this one travelled fast. Just three years later, Parliament passed a Road Traffic Safety Bill that wrote the Vision Zero into Swedish law. The bill sets an ultimate target of no deaths or serious injuries on Sweden's roads. Sweden has since modelled its road safety reform strategy on the Vision Zero approach.

Involving all of society : The Vision Zero also means putting an emphasis on market options and less on government enforcement and traffic education, because we believe that people really do care about safety. Swedish people now drive more responsibly on the roads and our private sector competes to save lives.

Does the Vision Zero work? The Swedish Experience

The Vision Zero approach to road safety is highly effective. Sweden has one of the world's lowest traffic-related fatality rates - and the statistics clearly show that safety does not compromise mobility. On the contrary, increased mobility actually depends on effective road safety.

More traffic, fewer fatalities : Traffic volume and fatality rates are partly linked to changes in economic growth. But we can clearly see that road deaths have continued to decrease despite a steady rise in traffic.

Huge potential : There are other positive effects. Fatalities involving unprotected pedestrians in Sweden have fallen by almost 50% in the last five years. The number of children killed in traffic accidents has also been cut. In 2008 the first traffic death involving a child did not occur until 22 October that year. And yet, the untapped potential remains huge. In Sweden, we could cut the death toll by a further 90% if we could eliminate technical system failures, failure to wear seat belts, speeding and drink driving - from 5 deaths per 100,000 to 0.5. This is what the Vision Zero is about: looking forward and creating strategies to take safety to new levels.

The Swedish experience can be yours

Every nation of course has its own set of issues to address in road safety. Specific conditions might differ from those in Sweden, but we believe that the will to protect the lives and health of men, women and children is a universal one. The Vision Zero Initiative offers you access to the experience and knowledge of those involved in Swedish road safety. Please see the Solutions or Get started sections for more information.

Source: <http://www.visionzeroinitiative.com>

HSMI INITIATIVES

To strengthen the academic and professional capacities, HSMI has now been restructured into four centres of excellence namely, Centre for Urban Poverty, Slums and Livelihoods (CUP), Centre for Project Development and Management (CPD), Centre for Sustainable Habitat (CSH) and Centre for Affordable Housing (CAH). Some recent initiatives taken by HSMI are:

■ Research and Development

HUDCO is supporting innovative research initiatives in the housing and urban development sector through its collaborative research platform. The research should lead to a tangible project or guidelines for improving a sector specific issue. The research grant is awarded to national level institutions and universities of repute in the country. So far, grant to 26 research proposals have been awarded.

■ Rajiv Gandhi Fellowship

HUDCO has instituted a 'Rajiv Gandhi Fellowship' to encourage students to undertake research in the habitat sector. This fellowship follows the norms of the Ministry of Human Resource Development/University Grants Commission, and is awarded for pursuing M.Phil and Ph.D. programmes at national level premier institutions. The institutions have to sign a MoU with HUDCO for availing this Fellowship for its students.

■ HUDCO Chairs

HUDCO Chairs have been reintroduced in a new format. The HUDCO chairs are functional at 17 institutions in the country and are supported in terms of activities undertaken for improving the sector. The chairs conduct skill development programmes, research & dissemination workshops and documentation.

■ Challenge Fund

The Ministry of Housing and Urban Poverty Alleviation (MoHUPA), Govt. of India has initiated a flagship initiative to establish a Challenge Fund. Jointly proposed under the World Bank supported Capacity Building for Urban Development (CBUD) project and the DFID supported Support to National Policies for Urban Poverty Reduction (SNPUPR) project, the Challenge Fund is intended to promote the implementation and replication of good practices in the area of urban poverty reduction.

The aim of the fund is to support urban local bodies to take up pro-poor development projects within the thematic areas and create a competitive environment amongst the urban local bodies in addressing the challenges of urban poverty alleviation in transparent, cost effective and responsive manner. It is designed to provide urban local bodies the opportunity to innovate and adopt approaches/practices to respond to urban poverty alleviation

challenges. HSMI has been designated as the administrator for operationalization of the Challenge Fund.

■ HUDCO Best Practice Award

This award has been announced by HUDCO to promote innovative initiatives undertaken by urban local bodies. These awards are given under ten categories, viz., urban governance, housing, urban poverty & infrastructure, urban transport, environmental management, energy conservation & green building, sanitation, urban design & regional planning, inner city revitalization & conservation and disaster preparedness, mitigation & rehabilitation. The award is given to 10 selected entries and carries a cash prize as well as a trophy and commendation certificate.

■ Network of India, Brazil and South Africa

IBSA is a trilateral agreement between India, Brazil and South Africa to promote south-south cooperation and exchange on several mutually agreed areas of interest. At the fourth meeting of the trilateral commission of the IBSA dialogue forum in Delhi in July 2007, 'Human Settlement Development' was identified as an area of cooperation between IBSA partners. The Ministry of Housing and Urban Poverty Alleviation (MoHUPA), Government of India, has nominated HSMI, as the anchor institute to provide support to the ministry in carrying out various activities under the network.

Joint Meeting of IBSA Working group on Human Settlements was held on 17-18 May, 2013 at New Delhi. The objective of this meeting was to take stock of progress and to adopt the framework document and strategy of the Working Group as well as to adopt an Operational Work Plan on implementing the strategy. A seminar on "Mobilizing Reflexive Communities for Transformation in Cities" is being organized by the counterpart institute at Sao Paulo, Brazil from 2nd to 4th, December 2013 for IBSA member countries.

■ Capacity Building

HSMI, being the research and training wing of HUDCO, has been imparting training to in-house professionals and national and international professionals in the sector. HSMI has made an impressive contribution in handholding of urban local bodies through capacity building of professionals and functionaries of national level programmes like Swarna Jayanti Shahari Rozgar Yojana (SJSRY), Jawaharlal Nehru National Urban Renewal Mission (JnNURM), Rajiv Awas Yojana (RAY) and HUDCO Project Financing.

For more information on the above, please contact Executive Director(Training), HUDCO/HSMI, New Delhi.



Hudco Nav Nagar Yojana (HuNNY)

**For Development of New Townships
- from Planning to Financing**



The Scheme

- » Hudco's technical and financial support for developing potential sites as planned urban extensions
- » Advisory service on conceptualization and feasibility
- » Consultancy for architectural and engineering designs
- » Long term loan for development of sites and services, housing including land acquisition



Who can Avail

- » Urban Local Bodies
- » Urban Development Authorities
- » Housing Boards
- » Any other Government Corporation or Agency
- » Private Developers for projects approved by the Central/State Governments for subsidy under the Affordable Housing in Partnership Scheme of the Ministry of Housing and Urban Poverty Alleviation



How it Works

- » Agency to identify land for integrated township/ layout/colony development
- » Hudco's initial advisory service on the project feasibility
- » MoU for Consultancy between Hudco and the Agency (Optional)
- » Sanction of Hudco loan upto 90% of the project cost for Government/Public Agencies



HOUSING AND URBAN DEVELOPMENT CORPORATION LIMITED

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