URBAN TRANSPORTATION IN MUMBAI
Who do over 1000 leading companies across the world trust for their IT needs?

Tata Consultancy Services.

- Asia's largest software and services company
- Among the top 25 IT Consulting companies in the world - Consultants News, June 2002
- Revenues of $880 million in 2001-02
- 12,800 consultants covered by SEI CMM
- Level 5 maturity - the largest in the world
- Clients include 6 of the U.S. Fortune Top 10
- Over 25 Offshore Development Centres
- Over 100 branches worldwide

TCS. Beyond the obvious.™
www.tcs.com
CONTENTS

From the Editor's Desk .................................................. 3

INTERVIEW
Musings on Transportation and Infrastructure
Needs of Mumbai ......................................................... 4

FOCUS
Some Reflections on Transport Problems
in Mumbai ................................................................. 7

Major Modes of Transport in Mumbai : Issues
and Options ............................................................ 21

COVER FEATURE
Urban Transportation in Mumbai - The Need
for an Integrated Hierarchy of Mass
Transportation Systems ............................................. 23

PERSPECTIVES
Developing Metro-Transport : Beyond Finance .... 29
A Self Sustainable Transport System for Mumbai 31
Comprehensive Transport Strategy for Mumbai -
A Summary of the Recommendations ................. 34

INSIGHTS
BEST - Past, Present and Future ......................... 37
Sky Bus : The True Urban Transport Technology
for the New Millennium ............................................. 40

GLOBAL EXPERIENCES
The Curitiba Transport System : An Example
of Universal Design in Developing Countries . . 45
Best Practices in Transport Planning and
Management - Case Study of Singapore .......... 47
Metropolitan Transport Authority (MTA) :
An Example of Successful Networking of
Transport Organisations ......................................... 49

CITY NOTES
Delhi Metro - A Successful Example of Urban
Mass Rapid Transit System in India .................... 50

STATISTICAL GLANCE .................................................. 51

EDITORIAL TEAM
Chief Editor : S.S. Bhandare
Associate Editors : Ramakrishna Nallathiga
Dattatraya Sabale
Kamolika RoyChowdhury
Secretary : Maureen Dias
Printer : Bhachandra Printing Press
Pvt. Ltd.

BOMBAY FIRST
4th Floor, Yashwantrao Chavan Centre
Gen. Jagannath Bhosale Marg,
Nariman Point, Mumbai - 400 021
Tel.: 2281 0070 / 71 Telefax : 2281 0072
E-mail : mumbaifirst@vsnl.net
Website : www.bombayfirst.org

From the Editor's Desk

From dawn to dusk and, indeed, beyond midnight, the
public transport system truly serves the lineline of
Mumbai's socio-economic ethos. The public transport -
numerous trains and buses - everyday carries a
predominant share of the city's commuters to the place
of their work, to the place of their learning, to the place
of their entertainment, to their factories, workshops,
offices, shops and establishments, and where not! While
travelling relentlessly, Mumbaikars carry their dreams
and despondencies, their excitement and exasperations,
their hopes and frustrations.

Who guides them to their destinations of hopes and
opportunities? There are a couple of tens of public
transport authorities and/or regulators; there are hundreds
of experts and technocrats; and there are thousands of
skilled frontline technicians (including drivers) and a
host of support services employees. This framework
somehow muddles through and keeps the lineline of
the public transport operational, day in and day out.

Most foreigners and domestic tourists are awed by
the gigantic magnitude of commuters moving around
short and long distances. Everyday, three out of four
persons living in the city travel by public transport. They
say that commuters in Mumbai during peak working hours
are equivalent to the population of Sydney. How the city
manages to meet the burgeoning demands of transport
remains quite a mystery.

Over the last two decades, the city has been experiencing
a gradual shift in preference towards personal modes of
transport. Witness the proliferation of registrations of
two wheelers and cars. On one hand, it symbolizes the
emergence of rising aspirations of the middle and high-
income households. But on the other hand (and this
undoubtedly is the worrisome aspect), it shows the
limitations of the public transportation system to meet
the ever-growing demands of safe, comfortable and
convenient modes of transport.

Where do we go from here? This issue seeks to provide
views, perceptions and insights of eminent experts on
this vexation question. As our avid readers would realize
that all that has been said here promises to make
wonderful sense, but a common commuter would like to
see what actual comforts he or she will gain, how soon
and at what cost ........

(S. S. Bhandare)
Musings on Transportation and Infrastructure Needs of Mumbai

[In conversation with Dr. T. Chandrashekar, Director (Projects) & Joint Metropolitan Commissioner, MMRDA]

1. At the outset, we take this opportunity to congratulate you on your new assignment with MMRDA. Indeed, it happily coincides with the launch of MUTP, which is expected to bring about significant improvement in Mumbai’s transport infrastructure. Earlier, you have achieved a turn around in Thane and Nagpur, especially their managing of respective civic infrastructure. You may like to share your experiences of these cities and compare with the situation in Mumbai?

Surely, Thane and Nagpur both have presented different set of problems, and these were equally complex in their own ways. The state of civic amenities i.e., water supply, sanitation and transportation, was the major area of concern in these cities. In spite of resource constraints, we could make a notable progress, thanks to systems improvement and resource deployment. However, the magnitude and scale of problems in these cities are different from those in Mumbai. For example, the share of slum population is as high as 50% or more in Mumbai as compared to about 30% in these cities. Moreover, unlike Thane and Nagpur, Mumbai perhaps can proclaim adequacy of financial resources to meet the challenges of overburdened infrastructure. Also, Mumbai’s problems manifest mostly in lack of land or space to expand. In spite of such divergences, the key issues in the development of cities remain the same, namely, inadequate infrastructure, transport and housing, and problems of environmental degradation and slum proliferation.

2. Mumbaikars have been much awaiting the launch of the MUTP, which is the major infrastructure project in Mumbai’s history. Can you outline some of its salient features? As the MUTP work has already begun, can we expect relief in terms of efficient and comfortable travel?

The Mumbai Urban Transport Project (MUTP) is definitely one of the largest transport projects that Mumbai has had so far, and perhaps one of the largest ongoing urban transportation projects in the country. It has three major components: Railways (Rs 8,080 crores), Roadways (Rs 883 crores) and Rehabilitation (Rs 470 crores) of displaced persons. The rehabilitation of about 20,000 families in new tenements is one of the salient features of this project. It also has an allocation of Rs 500 crores for the improvement of physical and social infrastructure. The project also features other components like subways in about 80 junctions, construction of Foot-Over-Bridges (FOBs), Station Area Traffic Improvement Schemes (SATIS) and the acquisition of about 650 new environment friendly buses for BEST. However, MUTP alone cannot completely solve all transport problems of the city; it can only complement incrementally to the existing infrastructure. It is imperative that the deteriorating transport and traffic conditions call for an urgent action towards improvement of transportation infrastructure.

3. In spite of a strong mass transportation base, mainly in the form of railways, Mumbai’s public transportation seems to be plagued by many problems. For example, the trains are over crowded and buses take longer time to travel. On the other hand, the preference for private vehicle (particularly, car and two-wheeler) is becoming stronger day by day. What are the reasons for such a shift in the public preference? Are there any inherent tradeoffs?

Let me state at the outset that public transport, be it railways or BEST buses, carries a predominant share of commuters every day. However, there is a gradual shift towards a personalised mode of transport in recent years and the reason for this trend are not far to seek. First, the public transport system is under severe strain and is not able to cope with the growing demands of citizens for comfortable and convenient commuting. Second, there is a perceptible growth of middle and high-income households, who, for obvious reasons, have a preference for personalised modes of transport, mostly two wheelers and cars.

If, however, the public transport system can expand and become more efficient, safe and comfortable, then there are good prospects for the reversal of the trend away from personalized transport. Given the difficulties in travelling by own vehicles over relatively long distances, such shifts to public transport becomes imperative. Further, it is important to recognise that two wheelers, three wheelers and cars together have less capacity to carry the commuters, but occupy large
road space. In particular, two and three wheelers adversely affect the traffic movement and contribute to substantial share of congestion and pollution problems, both in the city and suburbs. I appreciate the fact that the inadequacy of public transport is not only causing discomfort to the commuters, but also afflict the efficiency and productivity of employees. Hence, I strongly believe that we need to focus on strengthening the public transportation system in Mumbai.

4. The lack of a centralised authority for coordinating the activities of various agencies involved in infrastructure services in general, and transportation in particular, has been considered as one of the major constraints to ameliorate problems of Mumbai. What is your opinion about it? How do you think this problem can be overcome? Do you suggest creation of such an authority to look after the various modes of city transport?

Undoubtedly, the Municipal Corporation of Greater Mumbai (MCGM) is primarily responsible for providing and maintaining most of the civic services and infrastructure, including to some extent the management of public transport, through its Road Department and the BEST. It is evident that the MCGM is currently overburdened in its delivery mechanism of infrastructure services, thanks to its financial constraints in the wake of rising demands of citizens of Mumbai. Hence, other organizations/authorities concerned with Mumbai’s development need to step in to support and supplement some of the city’s growing needs for infrastructure projects. Thus, MMRDA is now proposing to undertake expansion as well as creation of infrastructure services in co-ordination with MCGM and other concerned organizations.

It also needs to be emphasized that apart from MCGM, there are several other organizations dealing with different activities. For example, MSRDC for road projects; MHADA for public housing; SRA for rehabilitating slum dwellers; RTO for registration of vehicles, police department for traffic management; and so on. All these organizations have evolved over the years and hence they must continue to focus on their core operations. It may not be inappropriate to have an exclusive centralized authority to manage such complex variety of tasks; indeed, any such effort would affect the flexibility and response mechanism of such institutions. However, it is imperative to promote a greater degree of co-ordination in the activities of various organizations concerned with the management of the existing and future infrastructure needs of the city.

5. Mumbai also suffers from an overburdened infrastructure, while investments to that effect have not been coming forth. How can we improve the city’s infrastructure? Of late, we have been hearing about MMRDA embarking on MUIP. Can you explain the salient features of the proposed project?

The status of infrastructure in terms of civic services and transport is rapidly declining in Mumbai, but more so in the suburbs. With a view to providing a facelift to the city and improving the situation, Mumbai Urban Infrastructure Project (MUIP) is now being undertaken by the MMRDA. Among its various components, the project will involve improvements in the road network in the suburbs. Pedestrian needs were not considered in the infrastructure projects in the past. The MUIP will not only provide road network improvements that will upgrade footpaths, but also pedestrian crossings in the form of sub-ways.

The project will receive contributions up to 50% of the funds from MMRDA and the remaining from the Government of Maharashtra and local government authorities. It will involve undertaking projects like Mumbai Trans Harbour Link (MTHL) and Mumbai Eastern and Western Sea Links, which will be executed based on the principle of Build-Own-Transfer (BOT). More viable projects will be identified in the process with a focus on public-private partnerships.

In spite of the proposed improvements in the city’s infrastructure under MUIP, there is still lack of a holistic approach in the promotion of infrastructure development of the city. MMRDA prepares sectoral plans for the development of respective infrastructure sectors, which takes care of it to some extent. However, the lack of a long-term vision (or a perspective programme) restricts any proper planning, which, in extreme cases, may even cause major distortions.

6. In this context, we feel that the lack of funding for implementing transport projects has been one of the major constraints to ameliorate transport situation in Mumbai. In particular, large projects like Mumbai Metro, Waterways and Airports have been facing the dearth of funding for their realisation. Can you suggest creation of a dedicated funding mechanism for Mumbai, which may be based on the operational principle of ‘user charges’?

Surely, the concept of dedicated transport fund requires appreciation as well as careful consideration. The fund can be constituted not based on user charges alone, but also with contributions from various other governmental sources e.g., grants from local/state/central governments,
as well as non-governmental sources (like employers' contributions, betterment levy, etc). Nevertheless, to take forward this idea and make it operational on the pattern of financing system say, based on ‘congestion fee’ (as it is currently experimented in London), we need to progress much far in terms of providing better availability and quality public transport.

It is important to note that both London and Singapore have made experiments with ‘congestion tolls’ only after providing an efficient mass transport system which is an attractive alternative to the private mode of transport. Moreover, we need to integrate all major modes of transport so that one can travel with minimum transfers while making a single payment for the total journey made. Indeed, employers, business and industry - all of them will have to contribute to the development of such a system as it will benefit them the most.

7. The criterion of techno-economic feasibility of projects do not account for large social costs and benefits, rendering large public investment in urban transport projects extremely difficult on the grounds of economic viability. How can we modify these conventional assessment methods to ensure inflow of investments in the case of urban transport projects for Mumbai?

I am glad that you have drawn attention to this important point. In fact, several mega infrastructure projects are often judged on financial grounds alone. However, these projects necessarily involve large amount of social benefits, which are not easily and directly measurable e.g., pollution and accident reduction in case of MUTP. Hence, it is imperative that the decision regarding such investments in large infrastructure projects can be taken only on the basis of economic rate of return, but not on the basis of financial rate of return alone. Again, for example, the MUTP has a financial rate of return less than 5% against an economic rate of return as high as 85%.

---

**COMMUTING TO BECOME CONVENIENT AND COMFORTABLE**

MRVC Ltd. is implementing a number of Projects under Mumbai Urban Transport Project aimed at generating 35% extra carrying capacity during morning and evening peak periods to achieve

less crowd in coaches, reduction from 4700 passengers to 3000-3500 passengers per 9 car rake in peak hours.

More Tracks + Longer Trains + Higher Frequency = Better Comfort

**MUMBAI RAILWAY VIKAS CORPORATION**

*The Catalyst of Change*
Some Reflections on Transport Problems in Mumbai

Dr. M. Q. Dalvi

1. Introduction

Mumbai, once reputed for having a good and efficient public transport system, with commuters having a choice of travelling by tram or bus or train, in which he/she could enter or exit without any fear of being pushed in or out by other passengers, is now the extreme opposite. Even those who owned a car were sure that they would reach their destinations on time by driving on roads, which were uncongested. This was the case during the fifties and early sixties. Elderly persons today, who as youngsters lived in Mumbai then, have vivid memories of a city having a well-integrated public transport system, which offered them a choice of travelling by a range of public or intermediate public transport systems, including a horse-driven ‘victoria’.

Those days are now over. It has become very inconvenient, hazardous and time-consuming to travel in Mumbai, no matter what mode of transport one may choose to get to his/her destination. The tram system had been uprooted in the early sixties, a decision that was made rather short-sighted, and the victorias of the colonial era have also disappeared, although in the suburbs, where travelling by taxis is unaffordable by low-income people, the cheapest Intermediate mode of Public Transport (IPT) are rickshaws, which have been introduced to replace victorias without realizing what their impact would be on the city’s air and noise pollution levels.

Despite sharp deterioration in the quality of Mumbai’s public transport, it is comforting to note, that nearly 80% of the total journeys made in the city, i.e., 11.2 mn out of 14 mn journeys per day – are by public transport, mainly by suburban trains and buses. The modal split is divided between trains and buses in the ratio of 58% for trains (6.5 mn journeys) and 38% for buses (4.7 mn journeys), with the average load of travel of 25 km for rail and 7 km for buses. Of the remaining 2.8 mn journeys, about 1.4 mn journeys, or 10% of the total, are made by IPTs (taxi and rickshaws). The rickshaws are used mainly for short trips to and from rail stations in suburban areas. Car users approximately account for 5% journeys, and the remaining 5% journeys are walk trips, particularly in south Mumbai and suburbs.

The modal split, which is so much in favour of public transport, as in Mumbai, is no doubt transport planners’ ‘dream’ split, for if they want to introduce any new mode of public transport, they do not necessarily have to attract passengers from their private cars to the new mode to make it financially viable; they simply have to wait and see the transport demand automatically getting diverted to the new mode until a new equilibrium is established in the transport system, which will equate the marginal cost of transport on the old and the new modes. In the advanced countries, by contrast, where modal split is so heavily in favour of car-use and the attraction of a private car is so great that transport planners find it hard to attract passengers in sufficient numbers to make public transport projects financially viable. Such has been the case, for example, in Washington DC, where its metro system is still being subsidized to meet its operating costs even three decades after its construction. Such a scenario is least likely to arise in the cities of the developing world, where planners have simply to attract travellers from the existing overcrowded public transport systems to make public transport projects financially viable. This will be the case in Mumbai, for example, as and when a rail-based metro system is introduced.

2. Recent Developments on the Supply Side

In Mumbai, the Western and Central Railways, whose suburban network was introduced in 1928 when the city’s population was just around 1 mn, have been the backbone of the city’s transport system and are likely to be so in the years to come. Over the last 55 years since Independence, this system has been progressively expanded and its carrying capacity augmented with investment in a number of value addition projects, so that the suburban trains presently carry as many as 6.5 to 7 mn passengers per day. During the peak period, that is, between 9 and 11 a.m., nearly 1.2 mn passengers travel in
trains with each train carrying 4,500 passengers, as against the designed capacity of 1,750, indicating extreme, sardine-packed conditions of overcrowding and the consequent unbearable discomfort to commuters.

The second principal mode of public transport is the BEST buses. Its fleet of 8,458 buses carries about 4.5 to 5 mn passengers per day with an average load of 7 km. It provides service not only within Greater Mumbai but also up to 20 km beyond its boundary. BEST’s performance used to be the envy of most public and private sector undertakings in India for best part of its existence under municipal ownership. But this is no longer the case. Between 1990-91 and 1999-2000, its Bus Division has incurred a net loss of Rs. 880 crores, whereas its cumulative cash losses for the decade stand at Rs. 341 crores. These losses have been cross-subsidized by its Electricity Division, which provides electricity to the old island city. Some experts have criticized such cross-subsidization on the grounds of economic efficiency as well as equity – economic efficiency because it conceals from the public eye, BEST’s loss-making performance on its bus operation and equity because it entails the poor residents living on the island subsidizing the journeys of long-distance travellers, who live in the suburbs, some of whom might belong to upper income classes. There is, however, no factual evidence to substantiate the equity argument. In fact, if anything, most long-distance commuters on BEST buses might belong to low-income groups, who may not be able to afford costly housing available in south Mumbai. As regards economic efficiency, the performance of BEST buses is better than most urban STUs in the country assessed on the basis of the conventional performance indicators.

Greater Mumbai had, according to the statistics published by the Transport Commissioner’s Office, a stock of 68,679 taxies, and 1,01,829 auto-rickshaws as on 31st March 2002. Taxis are used by people mainly to make short to medium distance journeys. Their use as a journey-to-work mode is rare. The more popular IPT are the auto-rickshaws, which are barred from operating on the island in order to control pollution but permitted to operate in the suburbs. If the estimates made by some experts of the number of journeys made by these IPT modes at 10% of the total journeys in the city is correct, this raises Mumbai’s modal split in favour of public transport to 90% - probably the highest public transport modal split in the world.

There is a good potential for water transport in Mumbai, but the authorities have paid only lip service to this mode. Private operators, who, on their own initiative, operate conventional as well as modern vessels like hovercraft, catamarans, etc. between selected points in Mumbai Harbour on the west and Vashi and Uran, etc., on the east, find it extremely inconvenient and hazardous to pick up or land passengers in the absence of jetties and other navigational facilities. The Government has not yet constructed permanent jetties, despite pleas from the operators to build them to encourage the operation of regular water transport service. To promote the development of water transport systematically, what is needed is a coherent approach on the part of the Government to build a number of jetties or landing facilities as well as navigational aids and approach roads to these facilities and also make an institutional arrangement to provide loans to the operators at reasonable rates of interest to purchase vessels of modern vintage, which are equipped with safety devices to operate during the monsoon period, so that the operation of all the year-round service was possible.

3. Mumbai’s Transport Demand

According to the census count, Greater Mumbai’s population was 5.9 mn in 1971, 8.2 mn in 1981, 9.9 mn in 1991 and 11.9 mn in 2001. This is predicted to reach 14 mn in the year 2016. Employment opportunities were about 15 lakhs in 1971, 22 lakhs in 1981, 24 lakhs in 1991 and are expected to rise to 31 lakhs in 2016. According to Central Road Research Institute (CRRI) data, trip-making rate in Mumbai was 1.14 in 1996 - a high figure for a city in a developing country, where urban trip rates are generally less than unity.

According to the same source, the number of total trips in Greater Mumbai was 7 mn in 1975 and expected to rise to 15 mn in 2001. However, as has been mentioned earlier, the number of total trips was 18.75 mn in 2001, of which 11 mn were by rail and bus transport and 2.75 mn by IPT, cars and walking.

Urban transport demand is a function of population, employment, land use development and the level of per capita incomes. So long as the trip-making rate is less than unity, the most influencing factor is the
growth of urban population. However, income levels become an important determinant as the economic well-being of the people improves, which pushes the trip-making rate above unity. The growth of car ownership also affects the trip-making rate. The fact that Mumbai’s rate is as high as 1.14 means that income levels and other socio-economic factors of Mumbai’s residents significantly influence it. For in a city where the trip-making rate exceeds unity, the number of daily trips are likely to increase proportionately more than the growth of population. It is not surprising, therefore, that the number of daily trips in Greater Mumbai may exceed the 20 mn mark by the year 2020. If this prediction comes true, the volume of daily traffic might not be met even if the capacity of the existing suburban rail and bus systems were trebled and the enlarged metro system discussed later in this article were constructed. Overcrowding is likely to be a key feature of Mumbai’s transport situation, unless demand management measures are introduced to control traffic growth effectively and efficiently.

4. Mumbai Metropolitan Transport Projects

The first systematic effort made for improving the city’s transport system was by the Indian Railways, which despite their contention that the provision of urban transport service was not a part of their function, had set up in 1969 special agencies called Metropolitan Transport Projects (Railways) - MTP(R) - in the four metropolitan cities, including Mumbai - to investigate the potential for building new rail corridors or augmenting the capacity of the existing ones, with resource allocation from the Planning Commission under the Five Year Plans. The MTP(R), after detailed traffic and engineering surveys in the early 1970s, identified two new rail corridors for Mumbai - the sixth and seventh corridors to handle the projected growth of the passenger traffic. These projects were prepared, during the early 1970s and could have led to the beginning of the metro system in Mumbai, provided an unfortunate incident had not occurred. I was working then as a professor of transport economics in the Bombay University’s Department of Economics and had taken keen interest in the progress of MTP(R)’s investigation. In 1978, I joined the Institute of Transport Studies in the University of Leeds. It was then that I was approached by some friends in the British Government’s Overseas Development Administration (ODA) to suggest the name of a British economist to visit Mumbai to look into the city’s transport problems, and to evaluate the projects prepared by MTP(R) for building new rail corridors. I suggested the name of the late Professor Michael Beesley, with whom I had worked at London School of Economics as a transport economist. I knew that he was a very pro-Metro economist, who jointly with Dr C. D. Foster, wrote a famous article, justifying investment in Victoria Line in London. Many opposed investment in Victoria Line, as it was not justifiable financially. However, Beesley and Foster justified it on social grounds using social-cost benefit framework. I had expected that with his broad social approach, Beesley’s assessment would be in favour of Mumbai’s sixth and seventh Corridors. Unfortunately, he found no justification for new rail corridors in Mumbai and, instead, recommended investment in bus transport. Had Beesley’s report to ODA/World Bank favoured new metro rail corridors in 1978, the construction of the metro system would have begun in Mumbai much earlier than it did in Kolkata.

Beesley’s recommendations in support of BEST’s bus system led for the first time to the involvement of the World Bank in Mumbai’s transport system. This involvement took the form of a support to BMRDA’s first transport project called Bombay Urban Transport Project (BUTP-I), whose main objective was the improvement of the city’s bus transport system by procuring 700 new buses for BEST, construction of flyovers, installation of traffic signals, etc. The project commenced in March 1977 and completed in June 1984. The total cost of BUTP-I was Rs. 89 crores, including a World Bank loan of 825 million to BEST for buses and to MCGM for flyovers and installation of traffic signals.

Initially, BUTP-I was only concerned with improvement in bus transport without any involvement in the improvement of the city’s railway system. However, the backbone of Mumbai’s transport system has been its suburban railway services, which have accounted for more than half of its public transport journeys. With the volume of commuter traffic growing in Mumbai by leaps and bounds and the Railways carrying a larger proportion of that traffic, the travelling conditions in the trains obviously deteriorated with overcrowding getting worse day by day. Over the years, the Railway Board, through its metropolitan agency, MTP(R), has no doubt, taken a number of measures to augment the
capacity of the suburban network through funds allocated by the Planning Commission in the Five-Year Plans. But these measures failed drastically to create the quantum of capacity that was required to meet the growth in the commuter demand. Until recently, neither the State Government nor the World Bank have shown any interest in widening the scope of BUTP-I to include projects for investment in augmenting the suburban system’s carrying capacity or improving the quality of service provided by the suburban rail network in Mumbai.

It was against this background that negotiations were carried out by MMRDA to formulate a second transport project for Mumbai, involving both the State Government and the World Bank. This project has for the first time incorporated a series of investment projects to improve travelling conditions on both the suburban railways and roads. This project is commonly referred to as the Mumbai Urban Transport Project (MUTP-II) and in this article I shall refer to it with this acronym in order to distinguish it from its earlier counterpart (BUTP-I), in which the Bank’s interest was focused on the improvement of Mumbai’s bus transport only. The scope of MUTP-II is much wider in that it includes a number of projects designed to improve the city’s suburban rail system in order to reduce overcrowding in trains and also to improve road transport through investment in the acquisition of 500 new buses for BEST and construction of new roads, bridges, pedestrian subways and traffic management schemes to ensure smooth movement of buses and the extension of bus services to new areas.

<table>
<thead>
<tr>
<th>Table 1: Main Components of MUTP - II (Rs. crores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rail Transport Component</td>
</tr>
<tr>
<td>2. Road Transport Component</td>
</tr>
<tr>
<td>3. R and R Component</td>
</tr>
<tr>
<td>4. Taxes, Duties and Front End Fees</td>
</tr>
<tr>
<td>5. Total Project Cost</td>
</tr>
<tr>
<td>6. World Bank Loan</td>
</tr>
</tbody>
</table>

Source: MMRDA & MRVC Leaflets, March 2003

The formulation of this much-hyped project took over 15 years and it was finally approved in November 2002. To implement the rail-related projects, a joint agency has been established between the Central and State Governments, called Mumbai Rail Vikas Corporation (MRVC) with 51% equity participation by the Central Government and 49% by the State Government. The main components and costs of the Plan are shown in Table 1 above.

The allocation of funds to different items of expenditure for rail and road related projects under MUTP-II have also been agreed to as shown in Table 2.

The key implementing agencies and their responsibilities are as follows:

1. **Mumbai Metropolitan Region Development Authority (MMRDA):** Co-ordination and monitoring of the overall project, Implementation of Rehabilitation and Resettlement (R & R) activities for rail and non-rail components, Providing counterpart funds on behalf of the Government of Maharashtra.

2. **Mumbai Rail Vikas Corporation (MRVC):** Implementation of all railway projects, including coordination of activities of CR, WR and Research Development & Standards Organization (RDSO).


4. **Maharashtra State Road Development Corporation (MSRDC):** Construction of JVLR and SCLR.

5. **BEST:** Procurement of Buses.

6. **Mumbai Traffic Police:** Area Traffic Control System.

The projects shown in Table 2 form the first stage of MUTP-II, and are to be completed within five years from the inception of the Project in November 2002, i.e. by the end of 2007. Work on some of the rail projects is already underway at the cost of the Railway Board. This is partly also because of the business-like manner in which MRVC has been implementing its responsibilities. There is no similar organization to execute the projects and responsibilities on the road transport side save MSRDC, whose main focus has, however, been on building flyovers and bridges, rather than urban transport-related projects. MCGM has the necessary machinery to implement urban projects but it is a slow-moving agency.

Table 2 enumerates the rail related projects, including the new lines to be constructed in the first stage of MUTP-II. It is instructive at this stage to point out that the Railways do not distinguish
between rail lines and corridors, but for a layman, this creates some confusion. A rail corridor is a pair of rail lines, which allows a rail service to operate up and down in both directions, whereas a rail line implies one-way service only. Thus, in Mumbai today there are six railway corridors, the seventh corridor presently figures Mumbai’s Metro Project, which was originally defined by the MTP (R) in 1974 and redefined by MMPG in 1997 for the construction of the first underground rail-based Metro Network. The existing six rail corridors operated by the Railways may be enumerated as follows:

**Corridors 1 and 2:** The two slow and fast corridors operated by the Western Railways (WR). Both start at Churchgate and end at Virar.

**Corridors 3 and 4:** The two slow and fast corridors operated by the Central Railways (CR). Both start at CST and end at Kalyan.

**Corridor 5:** It operates mainly on the CR, but at the Rawli junction, it bifurcates into two branches, one leading to Andheri on WR and the other leading to Panvel via Vashi on CR.

**Corridor 6:** It is expected to operate entirely on CR; part of the Corridor from Kurba and Thane is under construction in the first phase of MUPM - II and part from Kurla to CST will be taken up for construction in the second phase.

**The Un-numbered Corridor - Corridor 7 (?):** The Railways have already decided to shortly operate a new service from Thane to Nerul via Kalwa and Vashi, thus providing a much needed service for commuters from Thane to travel to Navi Mumbai locations without having to cross the Thane Creek.

This corridor has not yet been officially numbered, but it is likely to be numbered Corridor 7. If that happens, it is going to create confusion with the proposed Metro Rail Corridor, which has been named the Seventh Corridor, following the name given to it originally by MTP(R).

**Table 2: MUPM Project Components and Costs**

<table>
<thead>
<tr>
<th>Road Transport Component</th>
<th>Rs. Crores</th>
<th>Rail Transport Components</th>
<th>Rs. Crores</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Jogeshwari-Vikhroli Road (JVLR)</td>
<td>168</td>
<td>1. 5th Line on Western Railways between Mahim and Borivali</td>
<td>74</td>
</tr>
<tr>
<td>2. Santacruz-Chembur Link Road (SCLR)</td>
<td>187</td>
<td>2. 5th and 6th lines between Kurba and Thane</td>
<td>229</td>
</tr>
<tr>
<td>3. ROBs at Jogeshwari and Vikroli</td>
<td>171</td>
<td>3. Borivali - Virar additional pairlines, including Virar car shed and Virar-Dahanu Road Track center work</td>
<td>595</td>
</tr>
<tr>
<td>4. Purchase of Buses (500)</td>
<td>113</td>
<td>4. Optimization on WR, CR and Harbour Line</td>
<td>430</td>
</tr>
<tr>
<td>5. Pedestrian Subways and FOBs (30)</td>
<td>73</td>
<td>5. DC/AC Conversion</td>
<td>418</td>
</tr>
<tr>
<td>6. Area Traffic Control</td>
<td>72</td>
<td>6. EMUs (Rakes)</td>
<td>1,549</td>
</tr>
<tr>
<td>7. Station Area Traffic Improvement Schemes (SATIS - 6 stations)</td>
<td>73</td>
<td>7. EMUs maintenance &amp; Stabiling lines and other Track matching</td>
<td>154</td>
</tr>
<tr>
<td>8. Other Traffic Management and Safety Schemes</td>
<td>55</td>
<td>8. Technical Assistance and Studies, etc.</td>
<td>61</td>
</tr>
<tr>
<td>9. Environment – Air quality monitoring</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Equipment (IT related and others)</td>
<td>18</td>
<td>Sub-total</td>
<td>3,510</td>
</tr>
<tr>
<td>11. Technical Assistance, Pre-investment Studies, etc</td>
<td>73</td>
<td>Total Project Cost</td>
<td>4,526</td>
</tr>
</tbody>
</table>

**World Bank Loan**

| Sub-total | 1016 |

*Costs are inclusive of R & R.*
In this context, it is worth mentioning that according to some Railway officials, the Railways are, in fact, presently operating or soon likely to operate as many as 10 Corridors on Mumbai’s suburban network. Hence, in order to avoid confusion with the public, it would be necessary to provide another name to Mumbai’s First Metro Rail Corridor, instead of continuing to call it the Seventh Corridor. It would be advisable if MMRDA, now that it has been taking a leading interest in the development of Mumbai’s metro system, liaise with the Railways and agree upon a fresh nomenclature for the metro rail corridors. My personal view is that the first Metro Corridors should be numbered as M1, M2, M3 and so on – calling the Seventh Corridor as Metro 1 or M1 and the subsequent Metro Corridors as defined by DMRC, in the context of its Study on the expansion of the metro network in Mumbai, as Metro 2 and M3, etc.

The rail-related projects approved for implementation in the first and second phases of MUTP-II are summarized as follows:

- Construction of the 5th Line on the WR between Mahim and Borivali in the first phase.
- Construction of the 6th Line between Kurla and Thane in the present phase; the construction of the Line from Kurla to CST in the next phase.
- Construction of the additional Lines from Borivali and Virar and between Kurla and Thane in the first phase.
- Construction of Bandra-Kurla Link in the second phase.
- Elimination of level crossings: construction of road-over-bridges (ROBs).
- Introduction of new rolling stock with radically improved design.
- Introduction of 12-coach rakes and running them with 8 minutes headway.

Finally, I would like to emphasize that despite all the hard work done for negotiating the inclusion of suburban rail projects in MUTP-II, these projects are not expected to provide a long-term solution for Mumbai’s transport problems. They would no doubt generate some additional capacity on certain selected sections of the suburban network, but the size of commuter traffic demand in Mumbai is so huge that the additional capacity generated by these projects would only touch the surface of the transport problem. For a long-lasting solution of Mumbai’s transport crisis, these projects, however well conceived they may be for easing overcrowding on the suburban network, would soon have to be supplemented by well-grounded schemes for constructing a metro rail network in Mumbai.

5. An Integrated Urban Transport Policy for Mumbai

I have argued earlier that the rail and road projects included in MUTP-II are essentially value additions to the already congested suburban rail and road system in Mumbai. The additional capacities created by these projects will, no doubt, bring some temporary relief to the overcrowded transport systems. What is really required, however, is to deal with Mumbai’s problems on a long-lasting basis, formulating a comprehensive and coherent transport policy for Mumbai, which begins, first of all, with a clear statement of the city’s long-term land use development, and then evolves a transport system in which all the transport modes are allowed to play their part according to their real cost advantage such that the total cost of transport borne by the city is minimized. This would enable the city to play its historic role as India’s most important port – the gateway to India – and also her role as the commercial and financial capital of the country with an integrated transport network that meets the city’s transport demand at the minimum cost to the society.

In this context, some people argue that in order to cope with the city’s transport crisis it would be imperative to control the unbridled growth of the city’s population first. This is no doubt the most important consideration that the city’s planners must bear in mind. But there are others in Mumbai who, in their zeal to control the growth of the city’s population, want to prevent new people from entering the city limits. They maintain that unless serious attempts were made to control the growth of the city’s population by preventing new comers entering the city for employment or business, nothing can meaningfully be done to solve its transport problems. Incidentally, this argument has not cropped up in the transport policy debate for the first time. Two and a half decades ago, it figured in the deliberations of India’s National Transport Policy Committee (1980). One of its members, Dr. P. P. Anti, strongly maintained that placing a ban on the entry of new comers would check the city’s population growth and
consequently the growth of transport demand. Such a ban needs to be imposed even if persons entering the city have a job or a business to go to, unless the capacity of the transport system is increased simultaneously to meet their transport requirements. Dr. Antia wrote a note of dissent on this issue among others. The majority in the Committee argued that any ban on the entry of people would be not only counter-productive but also unconstitutional, as it would tantamount to transgressing their fundamental rights. Besides, in some countries, such as, the erstwhile Soviet Union, where such a ban on the movement of people was imposed, it had to be withdrawn in the face of strong popular opposition. So long as Mumbai provides employment opportunities, people will be attracted to it and no physical force can prevent them from doing so, without infringing on their fundamental rights. What city planners can sensibly do at most to ease the transport problem is to develop a land use pattern that does not concentrate new entrants for living in selected areas of the city. A well-balanced housing development strategy would help in easing the city’s transport problem.

This argument raises a much more general issue of human settlement and cannot be meaningfully settled at the city level. The question boils down to achieving a well-balanced settlement of human population in a given country. If there were to be free entry and exit for people to move and settle wherever they like, one would expect that in the long-term, an equilibrium would be established in the settlement pattern such that everybody’s welfare is maximized at his/her location. One’s chosen location would be a function of the available employment opportunities and transport and housing costs at his/her locations in a given city. No statutory bar can achieve the solution to transport problems and settlement patterns more efficiently and effectively than what would be achieved by economic factors.

Assuming that the settlement patterns are optimal, there is the second issue as to who will determine a city’s optimal transport strategy, especially when there are a plethora of agencies dealing with the city’s transport problems. There is need for a single transport agency in the city for formulating an integrated urban transport policy, in which all modes are given equal opportunities to develop according to their comparative cost advantage, so that the welfare functions of all the residents of the city are maximized, given their individual preferences and the comparative cost advantage of different transport modes.

The need for a single transport agency has been argued so often that there is no point in going through the same argument here. In Mumbai, MMRDA plays a fairly effective coordinating role, at least in the planning process, though operating agencies differ for different transport systems. This is practically no different from what happens in many western countries, e.g. the UK, in which different cities have independent Passenger Transport Authorities (PTAs) for evolving integrated transport policies and programmes for the cities under their jurisdiction. However, unlike MMRDA, PTAs in the UK can not only develop an integrated transport policy for their cities, but also they have power to approach capital markets to raise resources to develop their chosen transport systems according to their own preference functions - a power, which local agencies do not enjoy in India, despite some recent measures adopted for decentralization under the 1993 Constitutional Amendment.

6. Mumbai Metro Project.

Although the case for building a rail-based metro project was rejected by M. E. Beesley in his report to the Overseas Development Administration (ODA) of UK, the need for strengthening the suburban railway system and augmenting its passenger carrying capacity continued to be recognized in the various measures adopted by the State Government to improve the city’s transport. The Mumbai Urban Transport Project (MUTP-II) clearly endorsed the need for augmenting the capacity of the suburban rail system, but its focus has been mainly on improving the capacity of the suburban rail corridors, rather than looking at Mumbai’s transport problems within a comprehensive and integrated framework.

While the State Government and the Railway officials were pondering over the need for constructing additional rail corridors in Mumbai, some experts in Mumbai, particularly those in Tata Consultancy Services (TCS), came to the conclusion in the early 1990s that the only and the most effective and long-term solution to the city’s transport crisis is the construction of an underground rail corridor, as land for construction of surface rail corridors was not available. The experts appreciated that the
construction of an underground rail corridor would be very costly, but the traffic situation in the city had been deteriorating so rapidly that the social cost of not providing it was mounting every day the project was delayed.

TCS, having decided to take a lead in investigating the case for building a metro line in Mumbai, first appointed a senior railway engineer, Mr. R. B. Asgaonkar, to examine the validity of the two rail corridors, the MTP(R) identified in 1974, viz., the sixth and seventh corridors, to ease the city's present-day traffic situation. Mr. Asgaonkar concluded that while the sixth corridor was being constructed in tit bits by the Railways from the Plan funds allocated by the Planning Commission in Five-Year Plans, the seventh corridor remained completely untouched. On the other hand, it was this corridor that had the greatest potential for easing congestion and reducing overcrowding on Mumbai's rail network. The corridor had also become more relevant because of the change in the island's landuse since 1970s, with more jobs created in Nariman Point and Cuff Parade in the south and at Shivsagar and Worli in the west coast areas of the old island city. The existing suburban railways do not serve these areas.

Secondly, since no meaningful initiative was coming forth from the Government to deal with Mumbai's worsening traffic problem, TCS decided to set up a consortium of like-minded institutions and experts called the Mumbai Metro Planning Group (MMPG) to undertake a techno-economic pre-feasibility study to prepare a bankable project for the construction and operation of the Seventh Corridor through participation of the private sector. The Group comprised the following:

1. Tata Consultancy Services, TCS, Mumbai – Lead Agency.
2. Consultancy Engineering Services (India) P. Ltd., Delhi.
3. Autoriders Industries Ltd, Mumbai.
4. Lok Housing and Construction Ltd, Mumbai.
5. Parsons Brinkerhoff Inc. UK in association with Construma Consultancy P. Ltd., Mumbai.
6. Dr. M. Q. Dalvi.

The Group prepared the first draft of the pre-feasibility study by the middle of 1997 and the final draft by December 1997. The study used a first-rate demand-forecasting model by hiring the services of IIT, Mumbai. Its engineering study was carried out by UNITES, a Group of Consultants who were responsible for the construction of Calcutta Metro, with technical inputs from Parsons Brinkerhoff Inc. whose consultants visited India to attend MMPG's meetings as a member of the Group and its financial packaging was done by Dr. Dalvi in collaboration with the Infrastructure Leasing and Financial Services (IL&FS).

The study estimated, on the basis of traffic forecast of about 2 mn journeys per day for the Seventh Corridor at its full capacity utilization, abstract engineering costs of about Rs. 7,500 crores and the financial costs of Rs. 18,000 crores estimated on the basis of the packaging carried out at 18% interest rate in the domestic capital market and 9% on the international market, a Financial Internal Rate of Return (FIRR) of 17 to 18% - more than enough to attract private capital from the domestic market, which in 1997 was having interest rates of about 18% - the highest the Indian Capital Market had ever witnessed since. Even the Libor Rate in the international capital market was then around 9%. The fact that the Seventh Corridor Project was found financially viable in the tight financial conditions that globally prevailed during mid-nineties confirmed that the Project would attract sufficient volume of traffic right from its inception to make it financially viable. Such has been the frustration among the commuters in Mumbai as a result of overcrowding and discomfort experienced while travelling in the trains.

The Seventh Corridor, as proposed by the Indian Railways in their 1974 Study and later by MMPG, is 22 km in length from Colaba (President Hotel) in the south to Kurla in the north, covering Bandra-Kurla complex, with 22 stations and is completely underground at a depth of 25 to 30 metres below mezzanine surface level. The Seventh Corridor planned in the Railways' 1974 Study was to be constructed underground up to Bandra but thereafter on the surface or elevated between Bandra and Kurla. The construction of office buildings and other structures that have come up since then has now ruled out the surface construction of the Metro Corridor. This has unfortunately hiked the construction cost of the Seventh Corridor substantially. It may be noted in passing that the cost of constructing an underground railway is estimated around Rs. 300 to 350 crores per km whereas that of the surface corridor around Rs. 100 to 150 crores per km. The most costly element in
constructing an underground railway is the cost of construction of an underground station. About seven of these stations would have been on the surface if it were possible to construct the Bandra-Kurla line on surface. It is interesting to note in this context that in the MUTP-II, negotiated in November 2002, a provision has been made for the construction of Kurla-Bandra Link on the surface, but its alignment is shown so far south of the Mithi River that it practically bypasses the Bandra-Kurla CBD complex. I wonder whom this Link is expected to serve if there is no land use development in its vicinity. Its primary function is simply expected to transfer passengers from Kurla to Bandra or vice-versa for continuing their journeys north by CR in the eastern suburbs or by WR in the western suburbs. As it duplicates the connectivity provided by the Seventh Corridor between Bandra and Kurla, its construction could be avoided thereby saving scarce capital resources.

Since MMPG’s Seventh Corridor Study was prepared in 1997, TCS decided recently to revise the Study in the light of the recent developments in the domestic and external financial markets and the developments in the railway construction technology. An Expert Committee set up by the State Government to review the Seventh Corridor Study also suggested the following:

- A review of the traffic forecast made in 1997 Report in the context of the major transport projects and land use changes that have occurred since then needs to be undertaken.
- The extension of the metro system in the suburb in the light of the changed land use pattern.
- The determination and prioritization of the alignment of new metro lines in the suburbs.

The review came to the following key conclusions:

- The traffic forecasts of the Seventh Corridor were most objectively and scientifically prepared, using the state-of-the-art traffic forecasting techniques, taking into account all the major transport infrastructure projects that were already underway or planned for in 1997. There is, therefore, no need to check the validity of traffic forecast.
- The MMPG model in making its traffic forecasts had taken into consideration the proposed land use developments that have occurred since 1997, including the growth of housing colonies and the shift of the offices by corporations to the northern suburbs along WR and CR and to Vashi and Panvel areas in Navi Mumbai.
- The alignment of the Seventh Corridor stands valid even today and no modifications were called for.
- In the 1997 Report, it was suggested that the construction would be spread over a period of 7 years – 2 years for the preparation of DPR and 5 years for the construction of the Metro. It is now considered that the preparation of DPR could be completed within one year or even earlier and the construction could commence as soon as DPR commences. This will reduce the gestation lag considerably.
- The engineering costs of the Project have now been estimated at around Rs. 8,500 crores - an increase over the original estimate but which is, less than the inflation rate because of the recent technological developments; and the financial costs a little over Rs. 10,000 crores because of reduction in the interest rates both in the domestic and international capital markets.
- The Metro should be built by adopting Delhi’s financial model, with the same debt-equity ratio of 70:30. The equity should be equally shared between the Central and State Governments.

7. Expansion of Metro to Suburbs

The Expert Group on Mumbai Metro gave considerable thought to the expansion of the metro to the suburbs of Mumbai in the light of the recent developments in the city’s land use and the proposed developments during the next two decades. The Group was of the view that for recommending any new alignment for the expansion of the metro network in the suburbs, it would also be useful to bear in mind the work carried out in the SMART Study on the selection of the metro technology. It has been generally recognized that the construction of the Seventh Corridor is the first but the most essential stage in the provision of the larger rail metro network for Mumbai. Some experts have pointed out that because of the recent shifts of housing and workplace locations to the northern suburbs along WR and CR and across the Thane Creek to Navi Mumbai, the north-south flow of traffic has changed. The new traffic flow exhibits the following characteristics:

- The is no longer unidirectional movement of
traffic flow from north to south in the morning peak and south to north in the evening peak; there is, in fact, a movement in both directions during each peak period, which is useful in that transport capacities are used in both directions, without wasting capacities in the opposite direction, as it used to happen earlier when Mumbai's job locations were exclusively located in the south.

- Nevertheless, there is no clear evidence yet to suggest that the quantum of movement in the southern direction in the morning peak and northern direction in the evening peak has reduced - in fact, overcrowding in trains moving to the south in the morning peak and to the north in the evening peak is the same as before, indicating hardly any change to justify any modification in the alignment of the Seventh Corridor.

- There is, on the other hand, a significant movement of traffic from the suburbs on the WR and CR north of Bandra and Kurla respectively, for which East-West connectivity is urgently required. Similarly, there is an increase in the movement of traffic between old and new Mumbai across the Creek, although the rail link from CST to Panvel is not as overcrowded as the WR and CR commuter trains are on the main land.

Considering the foregoing points, the Expert Group made the following suggestions for the future expansion of the metro system:

1. On the western side, a line connecting Bandra to Charkop via Linking Road, Versova, Lokhandwala Complex, Millat Nagar.

2. On the eastern side, a line connecting the University (Kalina Campus) station - location of this station needs to be moved northwards on the Seventh Corridor to Thane via Domestic Airport, International Airport, Sakinaka, IIT, joining Central Railway at Kanjur Marg station.

3. An East-West Link, from Kurla to Panvel along the existing railway track or from Byculla to Panvel along the proposed Trans Harbour Bridge.

4. A regional link between Panvel and Charkop via Bhiwandi.

The visual inspection indicates that because of land use developments that have occurred in the recent past, the first two alignments may have to be underground as construction of the metro line on the surface or elevated may not be possible for lack of available land. The alignment of the second line may be underground up to Kanjurmarg and surface thereafter along CR up to Thane, where it may join the proposed circular LRT, whose one arm is to be extended to Bhiwandi. In the long run, the metro may have to be extended directly from Thane to Bhiwandi, as it is a budding textile town with a million population.

The State Government, on the recommendation of the Expert Committee, has recently approached the Delhi Metro Rail Corporation (DMRC) for determining the modality for the construction of the Seventh Corridor after reviewing the Study carried out by MMPG under the leadership of TCS and the investigation into the expansion of the metro network into the suburban areas of Mumbai within a time scale of next fifty years or so. The DMRC is also required to prioritize the newly recommended metro corridors for construction, bearing in mind the existing and the planned land use in the Mumbai region. The findings of DMRC Study would indicate what shape Mumbai’s future metro network would assume as and when it is fully built.

8. Planning Commission’s Policy on Metro in the Tenth Plan

In formulating the Tenth Five Year Plan, the Planning Commission has adopted a new policy for the development of rail-based metro projects in cities with 8 million or more population. Every city should formulate a meaningful urban transport plan, incorporating the following measures:

- Aim at ensuring the fullest use of available transport infrastructure through low-cost optimization measures (Transport System Management Techniques).

- Develop, as appropriate as possible, cost-effective road-based, rail-based and water-based forms of public transport systems and inter-modal integration.

- Reduction of emissions from motor vehicles.

- Land-use/transport integration.

- Higher levels of financial support for urban transport projects by both Central and State Governments; exploration of innovative sources of funding.
- Develop suitable institutional mechanism at national, state and local levels for planning, financing, construction and O&M of urban transportation systems.

For cities with 3 million plus population, the Commission has proposed the construction of rail-based metro systems in the Tenth Plan, following the financial model of the Delhi metro project, whereby the capital expenditure would be financed with 30% equity, equally shared between the Central and State Governments and 70% expenditure financed from loans.

If this model were adopted for Mumbai, the construction of the Seventh Corridor would require an equity of Rs. 3,000 crores (30%), and a loan capital of Rs. 7,000 crores (70%), which may be mobilized either from domestic or overseas sources. Among the overseas sources, the most promising source are the Japanese Banks. For example, in April 2002, Mitsui & Co., had approached TCS for provision of necessary Yen credit for the Metro Project from Japanese Banks, which was going to be supported by Japan Bank for International Cooperation (JBIC) at interest rates ranging between 0.75% and 1.8% with a grace period of 10 years. TCS had brought this offer to the attention of the State Government, but the Government allowed the offer to lapse due to the delay in according its approval to the Project.

Dr Patankar and the present author have been approaching successive Chief Ministers (CMs) and Chief Secretaries (CSSs) since 1997 for obtaining the approval of the State Government for the construction of the Metro. It is heartening to note that it is for the first time that the State Government, under the leadership of the preceding CM (Shri Vilasrao Deshmukh) and the then CS (Shri V. Ranganathan) decided to pay serious attention to the proposal of building a rail-based Metro in Mumbai. One is also pleased to mention that the existing State Government is equally interested to pursue the case of Metro Project. For example, as has been observed above, following the recommendations of the Expert Group and the Terms of Reference (TOR) prepared by it, the Government has already approached the DMRC to undertake a techno-economic feasibility study for the entire metro network, including the review of the Seventh Corridor Study.

It may be noted that what the State Government is doing at present, despite its implicit acceptance of the need for the construction of a rail-based metro network for the city, is to commission a study of the Metro Project to DMRC, while what is required is the inclusion of the Metro in the State’s Tenth Five Year Plan, so that it automatically figures on the agenda of the Planning Commission, and would be eligible for resource allocation during the Tenth Plan. To my mind, while a well-prepared techno-economic pre-feasibility study of the entire metro network is a must, the State Government should strike the iron while it is hot by according its approval to the Seventh Corridor project. It would then be possible for the Metropolitan Commissioner, MMRDA to issue an order for undertaking a DPR of the Project, short-circuiting the bureaucratic rigamarole. In my view, the transport situation in Mumbai is so desperate that the less time is spent on completing the bureaucratic procedures, the better would it be for the commuters of Mumbai.

The case for the Metro Project becomes all the more urgent if it is true that the Government is now having second thoughts about the much-hyped Sky Bus Project for connecting Ghatkopar to Andheri and Versova on safety considerations. Transport safety is one of the key objectives of the National Transport Policy almost everywhere, and one must commend the planners in MMRDA that they have rejected a project whose safety credentials are in doubt. This project was expected to cost anywhere around Rs. 500 to 600 crores in capital expenditure. True, an East-West connection is urgently needed in Mumbai. Instead of wasting time and resources on an untried system, the State Government would be well advised to issue global tenders on competitive basis for building one of the conventional LRT systems on a BOT basis. I am sure that the Government would receive numerous offers to its tender along with offers to provide the requisite amount of capital within a BOT framework. This would release the Government’s funds from the Sky Bus Project for investment in the Seventh Corridor. If the Delhi Metro’s financial model were applied to the Seventh Corridor Project, the State Government would have to shell out Rs. 1,500 crores for the Seventh Corridor over a construction period of 5 years or so. During the first year, however, most of the expenditure on the execution of the Project would be for preparing the DPR and other preparatory items. This may not exceed an expenditure of more than Rs. 100 crores. In this expenditure scenario, the State Government’s equity contribution would be only Rs. 15 crores, which, one hopes, the Government can afford to raise, despite its strenuous financial situation.
9. Development of Roads

In Mumbai, not more than about 10 per cent of land space is devoted to roads, which is why its roads have been always congested even before the recent explosion in the car ownership took place. Today, with more than a dozen of the world’s leading car manufacturers pouring new car models on the city’s roads, adding 300 cars per day and as a sequel to the drop in car prices and rise in middle class income, the city’s car traffic is growing by leaps and bounds, making it very strenuous and time-consuming to drive in the city. Two decades ago, it used to take about an hour to reach the domestic airport from Nariman Point during peak hours; now one must allow for at least two hours to reach the domestic terminal during peak period. The Government has shown its eagerness, at least until recently, to please the car owners by building a number of flyovers – their number was initially 50 flyovers (excluding 5 which were already built), before the financial crunch befell the Government. The MSRDC could construct only 36 flyovers with 2 still under construction, leaving the remaining 12 flyovers on the island portion of the city for construction. It is understood that their construction has been held up due to objection from the World Bank on the ground that they benefit only the richer car owners at the cost of investment in public transport projects, which would benefit the lower income groups.

Apart from the flyovers, the most capital-intensive road projects proposed for the benefit of the car users are: (a) Bandra-Worli Sea Link and (b) the Western Freeway Sea Link Project, which starts from the southern tip of the Bandra-Worli Link and proceeds south to join the Priyadarshini at Malabar Hill and then proceeds to Nariman Point by crossing the bay and circulating the Malabar Hill at the Governor’s Residence. Bandra-Worli Link has been estimated to cost about Rs. 800 to 1000 crores, while the entire Western Freeway Link about Rs. 1585 crores at 1999 prices. These estimates are revised from time to time, and one should not be surprised if the final figure for the Western Freeway Sea Link jumps from Rs. 8,500 to Rs. 4,000 crores at current prices. In fact, the Government is so keen on the construction of the Western Freeway Link that it is seeking a BOT deal for it with some foreign investors. It has been argued that apart from their justification on environmental grounds, this Project is expected to bring considerable cost savings to car users, which, in turn, can be captured by the Government or a BOT investor through user taxes. The Government or BOT operator could recover the capital expenditure, so the argument goes, within a decade by charging Rs. 100 per car per trip.

It may be observed that the Western Freeway Sea Link is, in effect, a modified version of the 1962 Wilbur Smith proposal for building the western expressway from Bandra to Nariman Point through a tunnel from Priyadarshini Park to Babulnath Temple and then linking Nariman Point along the Marine Drive. In 1962, this was estimated to cost Rs. 24 crores. The Planning Commission had allocated Rs. 25 crores in the Fourth Plan for constructing the Priyadarshini-Babulnath tunnel. But the State Government spent the money elsewhere.

Ideally, it would be better if the whole Western Freeway Sea Link were constructed in one shot without breaking it into two separate sections, namely, the Bandra-Worli section and the Worli-Nariman Point section. For the construction of the first section on its own is likely to create traffic bottlenecks at Worli, Haji Ali and Pedder Road junctions. This has already led to a proposal for constructing the Pedder Road Flyover, which has been stiffly objected to by the residents around Pedder Road. Since the World Bank has put a ban on the constructions of Flyovers on the main island, the Pedder Road residents would have a peace of mind so long as the World Bank ban stays.

The other important road project, which has been on the anvil of the State Government for some time is the Nhava-Shiva, which along with the connecting roads, is estimated to cost around Rs. 2000 crores. To my understanding, the Tata Group wanted to build this Link and had made some financial provision for it, provided the bridge were named after JRD Tata. The Government once again has shown a serious interest in this project and is looking for a BOT operator for implementing the project. It has also given its approval to naming the bridge after JRD Tata – as ordinary citizens of Mumbai would obviously welcome the naming of this bridge after Mumbai’s most illustrious son.

10. East-West Connectivity

With the linear development of the city along the two railway lines, Mumbai has lacked East-West road connections that would have allowed people to move
from eastern suburbs along CR to western suburbs along WR. The Planning Commission has often pointed out this deficiency in the city’s transport network while according its approval to the State Five Year Plans. The State Government has not, however, looked at this problem in a systematic manner. It is now in the context of preparing projects for MUTP-II that attention has been paid to construct new roads or widen the existing roads to allow the movement of cars, buses and trucks from the Eastern suburbs to the Western suburbs and vice-versa in order to shorten the travel distance. The two most prominent East-West connecting roads included in the Plan are: (a) Jogeshwari – Vikhroli Link Road (JVL) - costing Rs. 168 crores and (b) Santa Cruz – Chembur Link Road (SCLR), costing Rs. 187 crores. These are sizeable investments in improving East-West road connections. Additional East-West link was planned between Mulund and Borivali via Bhandup Complex at Sanjay Gandhi Udyan. This is omitted in BUTP-II. Mumbai needs, however, more such connections not only by roads but also by railways – the railway connections would be part of the expansion of metro network discussed above. There is a proposal to build a new International Airport in Navi Mumbai, which would require a first-class connectivity of roads and metro lines from suburbs along WR and CR to the airport in Navi Mumbai. Such connections are not visualized in the first phase of MUTP-II, but these must be provided for in the second stage of the Plan in order to facilitate the decision on the location of the new airport.

11. Conclusions

Unlike the other metropolitan cities of India, Mumbai was lucky in inheriting a well-developed suburban rail system and an efficiently operated bus system under BEST management. Both systems have been operated with minimum political intervention. Managerial efficiency with a minimum political interference has been the secret behind the successful transport system of Mumbai and the highest modal split in the country in favour of public transport.

However, despite such a successful operational history of its transport system, Mumbai has done very poorly in framing a coherent urban transport policy for its future transport development. How long would the city continue living on its past history of public transport, howsoever glorious it may be? Today, Mumbai’s suburban railway system is operating under severe strain with commuters travelling in unbearable – indeed inhuman - conditions, with couple of passengers either dying or getting injured in rail accidents every day. This situation cannot continue for too long. There is always a danger that the situation might worsen to a point where today’s well-behaved commuters might take the situation in their own hands and start burning the trains, unless a serious attempt is made to prepare a well-thought-out and well-integrated urban transport system for Mumbai. The most crucial element of that system, if it is to provide a long-lasting solution to the city’s transport problem, undoubtedly, is the construction of a rail-based metro system. The TCS, under the leadership of its forward-looking Padma-Bhushan Dr. F. C. Kohli and with the hard-work put in by its Consulting Adviser, Dr P. G. Patankar and the present writer, has done a crystal service to Mumbai’s travelling public by providing a well-conceived, well-formulated and bankable metro project – the Seventh Corridor Project – which, in my view, should be taken up for implementation as part of the Planning Commission’s Tenth Five Year Metro Development Programme, instead of allowing it to go into the dustbin. There can’t be a more serious tragedy in Mumbai’s transport history, if the Project meets with the latter fate!

(The author was formerly member of Planning Commission, Government of India and is presently with TCS, Mumbai)

Saving Lives in Hundreds Every Year on Mumbai Roads

The number of personal injury accidents, reported actually in Mumbai has remained approximately constant (25,000-30,000) over the last 30 years. The number of fatalities, however, has fallen by 50% since 1981 and is currently over 300 per year. As the number of vehicles has more than doubled from early 1980s to mid 1990s, the reduction in accidents per vehicle kilometre is significant. This may be due to introduction of traffic management measures, improved driver education and more strict police enforcement of road and traffic regulations. Lower speeds resulting from increased congestion may also be a factor. However, the annual accident total of 25,000 remains high, and there is a lot of scope for further reduction.

(Source: Comprehensive Transport Plan for Mumbai Metropolitan Region, 1994)
apocalypse now?

It's not as though we have anywhere else to go. She is our only home. If she dies, we die.

Already, we have stripped her of her forests. Polluted her air and water. Blasted a gaping hole in her delicate protective atmosphere.

If we continue to live the way we do now, then by the year 2025, about 75% of her rain forests will be wiped out. Over 50,000 species will be extinct. 40% of her fertile land will be barren. Her rivers and seas will turn toxic. Her weather patterns will spin out of control.

But if enough concerned, aware people act now, there is still hope. And what is called for is not heroic but rather very simple.

Check your equipment and your processes regularly. Recycle waste products. Use technology that's environmentally sustainable. On an even more basic level, don't leave a tap running when you're not using it. Don't leave lights on when there's no one in the room. Write on both sides of a sheet of paper. Check your vehicle regularly. Recycle old plastic bags. Pool your car.

Such simple things, we can all do them. We can all teach our children to do them.

Start today. Because tomorrow, we may not have a planet left to save.
Major Modes of Transport in Mumbai: Issues and Options

Dr. S. Sriram

"Cities in the developing world are growing rapidly; with this rapid growth comes increased congestion. At the same time, public transport is declining in many cities to the detriment of the city economy, its environment, and the welfare of its poorer inhabitants."


The urbanisation process has been quite rapid in India during the last few decades resulting in problems of poverty, unemployment and inadequacy of housing and other infrastructural facilities such as transport, power and water. The scale and intensity of such problems and the inadequacy of resources are the critical issues in efficient management of the infrastructure in the sector.

Coming to the urban transport scene, we could begin by looking at the supply and demand characteristics of urban transport in cities like Mumbai. On the supply side, much of the provision is handled by the suburban rail system and the public transport bus mode. According to the Atkins Study (1994), the share of the two modes in terms of the number of trips is about 88%. Private vehicles account for about 7% and intermediate public transport modes (taxis and autorickshaws) handle the remaining 5% of the trips. On the demand side, movement has been primarily in a north-south direction due to the linear expansion of the city. But the city has been facing major constraints in expanding the network to meet the growing traffic needs.

While the growth in the traffic on the western and central railway corridors has been steady, the growth in the number of train services has been very slow. Despite a number of optimisation programmes that have been undertaken, the capacity has increased only marginally. Though there have been persistent demands in the past to have alternative rapid transit systems, technical groups have favoured additional corridors. Some of these have materialised, for example, the Mankhurd-Vashi line. A major expansion of the network (in terms of the Sixth and Seventh Corridors) has not taken place not only due to financial constraints, but also due to certain spatial features of the Mumbai Region (which hampered both expansion as well as the systems upgradation).

Historically, the suburban services have been provided by the regional divisions of the Indian Railways. The local rail system has always been considered as a losing proposition. This is not true as studies by the author and by the railways themselves reveal. Theoretically, it can be argued that the demand for suburban rail services differs from the demand for freight as well as non-suburban services. Suburban rail services generate localised benefits for local economic activities. Given the distinct localised character of these services, there is need for a distinct network of fixed assets, separate maintenance and a specific menu of services. Even if such a proposition were a losing one (a deliberate decision), losses can be made up from taxes on unpaid accruals resulting from positive externalities from the operation of the system.

Essentially, the issue is one of devising means by which beneficiaries within the service area are required to pay for the maintenance and growth of the system. However, as long as the suburban rail system continues to be an integral part of the national railway system, local needs hardly appear to be important to the Indian Railways. Accordingly, a point that has been highlighted in the past is the need for the state government and the local authority to realise that urban transport is a local issue and it is up to them to find ways and means to resolve the problem, including the methods to mobilise additional resources to finance projects designed to solve the problem.
The recently approved Mumbai Urban Transport Project (MUTP-II) is expected to serve as a basis for some limited expansion of the system in terms of both the public transport systems for example, laying down the fifth and sixth lines on each of them. A major component of this project i.e. the expansion of rail capacity expansion projects under the MUTP aims at relieving congestion on the existing suburban rail system so as to make commuting comfortable and safe. This will be made possible through the provision of extra suburban rail capacity and segregation of suburban traffic from long-distance traffic through the implementation of these projects. An economic evaluation of these projects has revealed that fairly high returns could be expected in the corridor between Santacruz and Borivali and that between Kurla and Thane; the return on lines beyond Borivali is expected to be lower. This evaluation has considered benefits that are expected to accrue to commuters in terms of savings in waiting time, reduction in discomfort, savings in travel time and also marginal savings in operating costs of vehicles of those who would be benefited by reduced congestion.

However, what needs to be noted is that even after the completion of these projects, a rake would be expected to cater to about 3,000 passengers (on an average) which would be much lower than what is being handled today (excess of 4000), but it would still be higher than the carrying capacity of a rake, i.e. around 2,000 passengers. But, from a financial point of view, It was observed that no positive return on investment results from any of the projects. To generate a financial rate of return of 15%, it was found that very steep hike in fares would be required. Hence, it is imperative that the revenue gap that could arise would have to be taken care of by other means.

In the case of bus transport system operated by BEST, nearly 5 mn trips are made daily on an average. The late eighties and early nineties witnessed increasing congestion on the roads, and this together with fleet renewal lagging far behind the increase in ridership, the performance of bus system has been steadily deteriorating in terms of travel time, comfort and regularity. This has, in fact, contributed to a sharp decline in load factors not only on main routes (where they compete with the railways) but even on feeder routes (due to competition from three-wheelers) which has worsened their financial performance. For quite some time now, the transport division has been kept alive through cross-subsidisation by the electricity division which has been charging high tariffs especially to industrial consumers. It does appear that a stage has been reached when such cross subsidy may not be possible any more since high value consumers are either moving out or are not willing to pay more for power. Here again, an evolving revenue gap is envisaged.

Nearly a decade back, the author, in the course of a study for the Ministry of Railways, had put across a case for a Local Transit Authority, which would handle both the major modes. Given the intrinsic inter-dependence between modes, it would be useful to establish such an authority to cater to the diversified transport needs through a harmonised unified system of transport output mix. Such an Authority is more likely to respond to changing local needs and preferences, flexibly and receptively. It could easily devise measure by which beneficiaries within the region are required to pay for the maintenance and growth of the transit system. Further, it need not also be unnecessarily bound by other constraints and limitations arising from national or regional considerations. Evidently, the area under the Authority cannot be coincident with that under the local government. In fact, it should encompass an area with several local bodies pooled together such as the Mumbai Metropolitan Regional Development Authority which includes areas under three municipal corporations, a few municipalities and a few more in the future.

It is in this context that the formation of the - Special Purpose Vehicle - the Mumbai Rail Vikas Corporation - has been a welcome positive step. But there are some inherent limitations on the scope of its functioning. For example, in some quarters this organisation is merely going to be involved in carrying out construction of railway projects; and it will not be invested in operations of the railway system. This does not augur well for the commuter who looks forward to travelling in greater comfort both on rail as well as by bus. Hence, the case for evolving a unified transport authority assumes a much stronger importance.

(The author is D.R.Gadgil Chair Professor of Planning and Development, Gokhale Institute of Politics and Economics, Pune)
Urban Transportation in Mumbai - The Need for an Integrated Hierarchy of Mass Transportation Systems

Mrs. Bina C. Balakrishnan

Mumbai's growth, both in terms of population and vehicles, has been explosive. It is today one of the largest, most crowded and most expensive cities in the world. From the current population of 11.9 mn, it is expected to increase to 14 mn by the year 2011. We have over 8.5 lakh private vehicles registered, with over 250 new registrations taking place every day. The high volume of floating population also keeps the demand for taxis very high. There are about 68,000 taxis operating in Mumbai, and the demand for taxis is especially high during peak hours, when they operate as shared taxis, providing a point to point service from railway stations to commercial areas.

Since 1962, several studies have been made for improving the transportation system in Mumbai. Unfortunately, most of the studies have not adequately recognized the fact that the modal split of commuters in Mumbai has always been over 80% in favour of mass transportation. Most of their recommendations focused only on the road infrastructure, and paid little or no attention to the mass transportation requirements of the city. Scant attention was paid to the requirements of pedestrians although the volume of commuters spilling out of the suburban stations required substantive pavement space, adequately designed at-grade or grade separated crossings, and integration with other forms of road-based and or / mass transportation.

Since most of these recommendations remained on paper, the conditions of congestion on roads worsened, and the very low journey speeds of buses prompted a shift of commuters from buses to trains. The travelling conditions in the trains then became almost sub-human, and this induced those who could afford it, to move on to 2-wheelers or back to cars. This, in turn, increased the congestion of the roadways, and the commuter was trapped in a vicious cycle.

Apart from a very few projects, the bulk of the recommendations of various expert studies have not been implemented, simply because of paucity of funds. At the same time, with vehicular population growing by leaps and bounds, the urgency of the problem sees improvements in the transportation system as commensurate with engineering improvements. In a misguided attempt to improve conditions and relieve congestion, the authorities have resorted to road widening to the extent that they have cut away footpaths even in areas where there is relatively heavy pedestrian traffic. It is rather unfortunate that pedestrians are not treated as an integral part of the transportation planning process. Instead, we continue to plan for improving speeds of the automobile. It must be stressed that very large volumes of commuter traffic also translate into very high pedestrian volume, as each commuter is a pedestrian at least at one end of his journey while moving from his origin to destination. Such pedestrian movement is, therefore, forced to mix and weave with the traffic stream. This, in itself, is a highly dangerous situation, as safety is greatly compromised, but additionally, vehicular speeds are reduced even further. Removal of footpaths is,
therefore, a self-defeating exercise, as it certainly does not help in improving vehicular speeds.

The Complexities:

An objective assessment of the situation will show us that the current problem stems from:

Uncontrolled and indiscriminate use of the private car: We use the car for the smallest of distances, and then proceed to use up the time saved in trying to find a parking space. Except for long distance commuters, inter-district distances in Mumbai are quite small, and given the “right walking environment,” it is quite possible to walk to many of these destinations. Unfortunately, this “right walking environment,” is simply not available anywhere in Mumbai, with the result that people have forgotten how to “think walking”, and therefore, how to walk on footpaths and pavements.

Very heavy parking demand, met by random, disorganized and illegal parking: Almost all parking in Mumbai is on-street parking, and this, along with parking manoeuvres, reduces the width of the roadway to a very large extent. In the absence of usable footpaths, (those that are in place have been encroached upon) pedestrians have to weave between parked vehicles. Vehicles are also double and triple parked, with no consideration for the rest of the road users.

Fixed land mass and right of way constraints: Land values having always been high, the building contours follow the road line, so any expansion is not possible without large-scale acquisition and demolition of buildings. Therefore, any augmentation of roadway capacity can only be at an elevated level. Thus, there is very heavy pedestrian activity accompanied by near total absence of pedestrian facilities, or design for pedestrians in transportation plans.

Breakdown of enforcement and lack of discipline on roads: Many a time, an entire traffic stream ignores a red light, and the succeeding arm loses its right of way, but the policeman on point duty does nothing about it. Very often, the signals are also switched off, and the traffic is controlled manually. This simply aggravates an already bad situation, as some streams are left waiting until another arm empties itself, and this makes waiting inordinately long, besides blocking the junction behind it.

Highly mixed land use and near total absence of service lanes: This results in entry points to buildings being located all along the arterial roads. A high percentage of personal modes, therefore, keep entering and exiting the traffic stream, along the length of almost all arterials. This makes vehicular speeds slower, as the entry and exit operations of vehicles require the entire stream to slow down.

Lack of attention to mass transportation: No attention has been paid to the fact that this city has always had over 80% of its commuters using mass transportation. Considering that the population of the city has also been growing, the absolute figures indicate that this means is staggering with people.

Solutions to Handling Urban Congestion

There are a number of measures that can be taken to relieve/handle urban congestion. These can be broadly categorized into 3 groups:

(a) Supply side solutions

Increase in the supply of transportation facilities - which essentially means increasing the urban transport infrastructure capacity.

Experiences in other parts of the world have shown that increasing the supply of transportation facilities only increases the demand for them – that is the growth of vehicles and the number of vehicle trips made increases, while the problems of congestion remain. The demand for the supply of these facilities increases, and the benefits of increased mobility, therefore, continue to be elusive. Increasing the supply of transportation facilities is therefore no longer seen as a viable option to relieving urban congestion.

(b) Demand Management

By encouraging a more efficient use of the existing transportation facilities, especially of road space in congested central areas, through some form of restraint on the use of motorized personal modes.

There are several methods of demand management—both physical as well as fiscal, but here few of them worth mention include applying space restraining measures like bus priority schemes, street-running rail systems, cycle lanes, wider footpaths and
pedestrian areas or precincts to attempt to curb the demand for road space. These, when well-designed, implemented and managed, and appropriate for their context, can help to achieve a more efficient use of road space, in addition to improving the attractiveness of non-motorised modes and increasing the accessibility to specific locations. The additional benefits of such measures are improvement in environmental quality, enhanced street aesthetics and greater safety of road users.

There is now practical experience of many cities having implemented policies to re-allocate road space successfully. For example, a study carried out for London Transport and the Department of Environment, Transport & the Regions showed that a reduction in road capacity available for private transport could result in a reduction in the demand for travel. Over a 100 cities were studied, all over the world, and the results showed that less than 50% of the reduced traffic reappeared on other roads, so that the net reduction of traffic was about 16% on the affected roads. Reduction in available capacity is achieved not by actually reducing the width of the carriageway, but by allocating a portion of the existing roadway to other users, such as exclusive mass transport lanes, wider pedestrian pathways, bikeways, etc. The study also found that a variety of changes in travel behaviour could be induced as a result of capacity reductions.

There are also other tougher and rather less democratic options such as Area Licensing Schemes, taxes on car ownership and usage, a Motor Vehicle Quota Scheme (practiced in Singapore), Weekend Car Scheme, Electronic Road Pricing, etc., to curb the use of the private automobile. But in India, we may not be very willing to impose, or accept the imposition of restraints on the use of private automobiles. But within the freedom that democracy assures us, we need to examine the licenses that we have given ourselves. Can they be justified in the larger interests of society- of which we are so much a part?

(c) Changes in Land Use

Changing/inducing changes in land use patterns such that economic activities become more dispersed, and the integration between employment, housing and other urban amenities is improved.

In Mumbai, we are currently attempting to increase the supply of transportation facilities, while at the same time, changes have been induced in the travel pattern by introducing changes in the land use pattern. We have managed to change the high tidal flow of commuters, by developing new CBDs in the Bandra- Kurla area and also in Andheri.

But again, experiences in other cities have shown that merely depending on any one of the above aspects to improve urban traffic congestion has not produced the desired results. If the city is to function efficiently and provide an acceptable living and working environment, then urban planning, transport capacity building and traffic demand management, have to be integrated into one strategic package.

What needs to be done?

(i) Shift in the Focus of Planning

The Transportation Planning process, in use today needs to be changed to a human-centric conceptualization of transport with a shift of focus from design for the movement of vehicles to design for the movement of people. Our planning basis- like that all over the world- is a Passenger Car Unit. We count the number of vehicles moving from point to point and design the system to accommodate this. Vehicles other than cars are counted and reduced to equivalent Passenger Car Units. It is only if we are designing a mass transportation system that we count the number of people already moving by mass transportation, from point to point. Rarely is an opinion survey carried out to determine the likely shift of car or 2-wheeler users to mass transportation, given that an efficient system will be put in place. Our vehicle occupancy is about 1.5 persons per vehicle, so that the total number of persons moved per unit of road space is very low.

(ii) Optimal Use of Existing Resources

Given the fact that the major part of Mumbai is an island, we need to accept the fact that there is no space for endless road building, not to mention the use of funds that could be used more effectively elsewhere. An efficient transport system is central to the economic growth of any city, and we need to wake up to this fact. Our priority should be to efficiently meet the demand for the movement of people and not just the efficient movement of cars.
We have an abundance of water as a natural resource, that is not being utilized, and we need to incorporate this into the transportation plans for the city. Studies made on Passenger Water Transportation for the city in the past, found it to be a very viable, cheap and environment friendly supplement to the transport requirements of the city.

With regard to the road network, we have four fairly strong North-South Corridors, whose capacity is being grossly under-utilized, because of encroachments, parking, and a few points of congestion along their length. The roads of Mumbai have developed organically over time, and, therefore, there are a few weak links and missing connectors, especially in the East-West direction and in the suburbs- where growth has tended to be along the railway tracks. A few of these are being taken care of by the MUTC. While the rest will have to be put in place. Most of the footpaths have been taken over by encroachments- both legal and illegal- and very often this activity spills over onto the carriageway. There is heavy parking demand along almost all arterials, and the kerb-side lane is lost in meeting this demand. Poor driving behaviour and driving habits further erode the roadway capacity.

The railways are already the lifeline of the city’s transportation system, carrying many times their capacity throughout the day. This service needs to be supported by complementary mass transportation services on the road and on water, so as to relieve the tremendous burden that they carry.

(iii) Integrated Mass Transportation System

We need to carry out an entirely new study targeted towards providing a network of mass transportation services in the city. This study should target the optimal use of all available resources—rail based, water based and road based. The emphasis should be on designing a mass transportation system on each of the above resources, and integrating them so that it functions as a composite, integrated, Metropolitan Transport Service.

If this is to fall in place properly, we need to

- Integrate land use and transportation planning to minimise the need for travel;
- Develop a comprehensive road network, while maximising its capacity-utilisation;
- Manage the car population and the demand for road space to alleviate traffic congestion;
- Optimise usage of rail, water and roadway resources already in place; and,
- Provide very good/high quality public transport choices, as an alternative to the car.

Since much of south Mumbai has a mature development, changes in land use patterns can only be made in the suburbs, and is already being done. With commercial areas being developed in the central suburbs, and integrated housing complexes also coming up with the objective of reducing the commute to work, the process is already on set.

If the use of the resources currently available is to be maximized, then we need to put in place the demand management tools mentioned earlier, and reduce the roadway capacity available to cars in order to install an efficient system of road-based mass transportation, running in exclusive bus lanes. If we use the technique of re-allocating the existing road space, giving preference to pedestrians and mass transportation, then we can induce the change in driver behaviour pattern, with resultant reduction in travel demand that was experienced in the other parts of the world.

At the same time, pedestrianisation of certain areas, and improvement of pedestrian facilities and the pedestrian environment will take care of a large number of short trips that today use the private car or taxi. Well designed, well planned and well maintained pedestrian precincts can translate a large number of vehicular trips to walk trips, thereby reducing the demand for road space. As mentioned earlier, inter-district distances in Mumbai are not very large, and given the right walking environment, a large number of short trips, which today use the taxi, can be changed to walk trips.

The railways are already in the process of upgrading their services, but this will not be enough. We need to ensure that comfort and safety are also an assured part of the services provided, in addition to greater frequency and efficiency. Towards this, the coaches may have to be redesigned/re-engineered for more comfort, and air-conditioned coaches may need to be introduced, in order to wean away the upper middle class from their cars. This perhaps is already in the process, as part of the MUTC. But this will
have to become standard rather than an exception, if mass transportation were to become the mode of choice. There is a sort of “class definition” that is associated with the use of mass transportation in Mumbai, and this will need to be removed. This can only happen if the image of the mass transportation service as “Crowded and uncomfortable” and “Not quite my class” is changed.

Mumbai is probably the only island city that does not have passenger water transportation. Passenger Water Transportation (PWT) is an environment-friendly mode that is also much cheaper than road or rail transport, if speed is not of essence, especially in terms of infrastructure requirement. The island of Mumbai is wedge-shaped, pointing downwards, and the main corridor of movement will continue to be in the North-South direction for a long time. The linear form of the island can again be used to advantage, to run PWT services in the North-South direction, supplementing the rail services. PWT can also run across the harbour to the mainland, reducing the load on the railways as well as the commuting time of passengers. Currently, the trip is made through a circuitous rail route to South Mumbai.

The mass transportation systems so designed should have a hierarchical structure, preferably with three levels, with low vehicle-capacity, high frequency feeder services operating at the lowest level, and interfacing with an intermediate level of mass transportation service. The lowest level of the mass transportation system should provide a short haul feeder service from origins/destinations to the next level of mass transportation at collection points, from where an intermediate level of mass transportation will provide the connection to the main corridors of travel. These first level feeder services could be provided by either share taxis or low capacity mini buses, but would essentially have to be road-based services. The intermediate level of mass transportation i.e. level 2, need not be only bus transportation; it could as well be street running rail systems, such as the LRT, mono-rail or the Skybus Metro. The main long distance service should be provided by the suburban rail services and passenger water transport along the coast.

With the use of exclusive bus lanes, it will also be possible to operate High Capacity Bus Systems along the four main North-South arterial roads, further supplementing the other two main services—i.e. rail and water transport. Mumbai is a linear city, and the north-south axis will always be the main corridor of transportation. Further auxiliary services, if required, can be provided by some other form of rail-based mass transportation. The east-west movement is not currently provided by the existing rail services, and here we need to design both feeder services as well as main line services.

Over 87% of the commuters in Mumbai rely on public transport modes. It is therefore imperative that infrastructure planning and investments in public transport systems provide a comfortable and convenient option to city residents that can compete with the comforts provided by a private car. The idea that all public transport is inconvenient and crowded needs to be changed. The advantages of the private modes of transport in

---

**Schematic Layout Integrated Hierarchy of Mass Transportation Systems**

---
terms of levels of comfort, origin to destination movement, absence of transfer time losses etc., need to be countered by lower stress levels, better operating characteristics and improved mobility of the mass transportation systems being offered, in addition to vast benefits to the environment.

(ii) Interfaces between modes

The interfaces between the various modes, where a transfer is affected from one mode or level to another, would essentially be the points of weakness in such a system. The efficiency of the system would hinge on the efficiency of these transfers. These Intermodal Transfer Points need to be carefully designed, both for efficiency of transfers as well as levels of passenger comfort. Information about the arrivals and departures of the various modes should be prominently displayed, and the timings of the modes interfacing at the point should be so synchronized that waiting times are minimized. Additional passenger facilities and services also need to be provided at such points, like well-designed waiting areas, snack bars, wash rooms, communication facilities, ample circulation area, etc. These comforts and conveniences at Transfer Hubs should be the norm rather than the exception.

The mass transportation vehicles should be designed for ease and speed of boarding and alighting, and optimal travelling comfort. Ticketing should be designed such that repeated purchases of tickets on change of modes is eliminated - in other words, a single ticket purchased at the start of the journey should be valid for the various changes of modes required for the duration of the journey. Various ticketing options are available, and these need to be studied and specially designed to meet the needs of the Mumbai commuter.

Mass Transportation Options

The mass transportation options currently available to Mumbai are:

- High Capacity Bus Systems - The bus transportation systems can use available space on arterial roads of cities with dedicated bus ways. These systems utilize modern technologies for optimising flow, passenger movement, ticketing and bus scheduling, etc. The efficiency of the system and high capacity of passengers transported depends on the system as whole and not necessarily on the size of buses, though, when necessary, articulated buses could be used with ease.

  - Light Rail Transit - Mumbai has had a study done for operating LRT on two routes, as recently as 2000.
  - Heavy Metro - It has been recommended to be run along the 7th corridor. Heavy Metro is an underground train service with a high passenger handling capacity.
  - Sky-Bus - It is on offer from the Konkan Railway Corporation, which is an elevated system with the fully air-conditioned cars suspended from the tracks and the frequency of service of 1 minute. Stations will be located at a distance of 1 km, and special access has also been designed for the disabled.
  - Water Transport - using high-speed high capacity vessels, along the East and West Coast, and also transharbour. Land for landing stages has been identified at various places along the West Coast, and operations may start in a couple of years.

Conclusion

In conclusion, it can be said that given our present transport scenario, our environmental concerns and financial constraints, it is imperative that we make dramatic changes in our travel behaviour. We tend to dismiss suggestions on demand management using road space reallocation as wishful thinking, and presume that the public will reject them. However, if these schemes are well designed and are supported by strong reasons of policy and the public is kept well informed of these measures, then they need not be rejected on the assumption that they will aggravate congestion. The key to successful implementation of such schemes is information and education of the public as to the genesis of the problem, the need for such measures, and the benefits that would accrue to them on their successful implementation.

(The author is Consultant, Transport Planning & Management and Convener of the Transport Committee, Bombay First)
Developing Metro-Transport: Beyond Finance

M. K. Datar

Commuters in Mumbai may have heaved a sigh of relief when it was announced a few months back that the Mumbai Urban Transport Project (MUTP) would get World Bank funding to the tune of $542 mn. The World Bank funding may help in timely completion of the project, but the lack of adequate finance is a constraint that keeps transport system in many metros in the current unsatisfactory state. This World Bank funding for MUTP, Rs. 2600 crore approximately is not sizeable not only in relation to incremental bank credit in a year, but even in relation to car loan portfolio of banks (currently at Rs. 18,000 crore). In fact, considering the estimated 25% to 30% growth in this portfolio, incremental car loans in a year could be enough to finance one MUTP!

The project has three main components - two of which deal with capacity expansion of railways and roads, respectively, while the third is to relocate about 20,000 families staying close to the railway tracks. This only highlights the socio-economic factors that affect the state of urban transport. It is, thus, not availability of financial resources as such, but its distribution between private transport and public transport that could explain the paucity of funds from public transport.

Problems in developing and maintaining urban transport systems are quite similar all over the world. Firstly, facilities of public transport are inadequate in relation to growing demands for them due to urbanisation and concentration. The trains and buses are overcrowded; existing road or track capacities become a constraint on introducing new trains or expanding the fleet of buses. More often than not the institutions, generally owned by state or local governments, offering these services are not in the pink of their health and therefore are unable to reinvest non-existent surpluses or mobilise debt funds to augment the capacities which is very much essential to reduce overcrowding and make the journey more safe. Their inability to raise debt funds is linked to their weak financial health, which is largely due to their inability to charge appropriate prices; obligation to offer adequate/ extensive coverage and low operating efficiency due to road congestion.

Road congestion, vehicle emission and road accidents are mainly due to increased number of private vehicles. Despite being perceived as an apparent constraint, private vehicle financing has been made possible on account of aggressive methods of financing pursued by various institutions. Finance does not seem to be a constraint for intermediate public transport via autorickshaws or taxis either. Thus, both these segments of transport being fuel intensive, contribute to congestion and pollution. Moreover, the old vehicles are adding to safety hazards due to fuel inefficiency and poor maintenance.

In addition, space as a constraint is often not given its due importance. Space constraint would necessitate resorting to capital-intensive options like bridge and flyover construction to expand the capacity of the existing road or rail network. Such construction would increase the cost of projects and thus the need for external finance.

On the other hand, the public transport is not growing due to the government’s inability to increase public investment, it not being attractive enough for private finance. While larger macro economic issues (budget deficits, rigidity in operating environment in public sector units) have an important bearing on the current state of urban transport in cities like Mumbai, it is argued here that unless private transport is made to bear the full share of the social cost it inflicts, it would be difficult to create a conducive environment to improve the working of public transport in urban areas.

The Finance Minister, while presenting the Union Budget 2008, had stressed on the need for public-private partnership to operate and finance infrastructure projects. This is true of urban infrastructure as well. But, the initiative to public-private partnership in this area appears to be with the public sector. By rearranging the incentives that encourages use of private vehicles, one can create disincentives for using old vehicles and increase public investment. The first would go a long way in reducing road congestion and pollution, and also improve the working of public transport to some extent.
Among the incentives given for personal ownership of vehicles are allowances given to employees by public and private sector organisations. In addition to soft loans to purchase two or four wheeler vehicles, monthly allowances for vehicle maintenance (purchase of petrol, repairs etc.) and drivers’ salary are also provided. While these are part of the employee compensation, these are structured as such because of differential tax treatment of many of these allowances. Over time, tax authorities too have minimized such incentives. As many perks have been brought into the tax fold, employers have been given the option to pay perquisites taxes on behalf of employees, it should be easier to end all incentives offered for ownership and use of personal vehicles without any adverse impact on overall compensation offered to employees.

Similarly, aligning tax depreciation rates on passenger vehicles with their useful operating life would discourage the present practice to avail of full depreciation benefits and transfer the vehicle to executives at a depreciated value.

In the past, local governments used to levy annual vehicle tax on all vehicles in use. However, a few years back, it was decided to levy instead of annual payment a one-time tax, which was collected at the time of vehicle purchase. As a result, no tax is charged on an annual basis on vehicles in use. Such a tax would discourage use of old vehicles. Such a measure would take old and inefficient vehicles off the roads, which would ease road congestion and reduce vehicle pollution. It is necessary to think about reintroduction of annual tax at least in large towns. It should be possible to devise a mechanism by which tax collection could be easier. It would also provide a recurring income to local authorities to maintain the roads.

There are other measures like parking charges and entry fees, which discourage the use of vehicles in particular areas. Recently, civic authorities in London announced that parking fees would be 5 GBP in the central business district of the city. The charge, considered to be quite stiff even by UK standards, is expected to help reduce congestion. Entry fee linked to the extent of occupancy (more the passengers less the charge) would also help reduce congestion and encourage intensive use.

All these measures discussed above would help reducing road congestion and pollution levels. The former would help some improvements in public transport system. While the micro factors such as budget deficits and working of PSUs need to be addressed to ensure adequate funds for public transport in metropolitan cities like Mumbai, the micro factors discussed here would also help ease the situation.

(The author is the General Manager, Industrial Development Bank of India. The views expressed are personal and not necessarily of the organization the author is associated with.)

---

Any Takers for Building Urban Transport System in India?

According to various reports prepared in the 1990s for urban transport systems in India, the urban bus is likely to play the most important role in Indian cities, mainly due to its costs of available different technologies. Among rail-based systems, the light rail transport is expected to become the most popular for its costs and capacity (30,000-35,000 per hour per direction). An elevated LRT system is half as expensive as a metro rail system. Whereas a metro rail system could cost almost 8 times that of a conventional rail system.

The best opportunities for building urban transport system in Indian cities, will, therefore, lie in developing urban bus and LRT systems, with the entire range of services associated with the planning and execution of such projects. International expertise would be required in general consultancy services, in the design and floating of tender packages and even in legal services associated with project structuring, like BOT or BOOT. No Indian company currently possesses the technology to execute an LRT project or for the manufacture of rolling stock for such systems. Rolling stock of underground metros will also continue to be imported since they are not manufactured in India. There will also be the need for the supply of signalling and telecommunication equipment for rail based projects, particularly where it is expected that high frequency train service will be required.

Construction services in most instances are available in India, except in the case of bore-tunneling for underground railway system, where both equipment and expertise are likely to be imported. Indian companies are experienced in executing a metro system using the cut and cover system. There are opportunities for overseas companies to set up joint ventures in India for the projects in Rupee terms.

(Source: Various consultancy reports published in 1990s.)
A Self Sustainable Transport System for Mumbai

Arun Mokashi

A self sustaining transport system is every city’s dream. At times, a global hunt is undertaken for seeking solutions, without realising that some world class initiatives, taken locally, exist in our own courtyard. These initiatives are often ignored. This paper highlights the need for a self sustaining transport system for Mumbai, and identifies excellent management skills demonstrated by Mumbai’s three sample projects. The paper emphasizes that these pockets of excellence, when repeated in ongoing and forthcoming transport projects, can help develop a self-sustaining transport system in Mumbai.

Introduction

The three projects, which made distinct marks in the planning and construction of transport projects in Mumbai, have enabled the transport sector to take substantial leaps forward. These projects are: (i) Bombay Urban Transport Project (BUTP) (1978-84); (ii) City Flyover Project (1998-2002) and (iii) Preparation for Mumbai Urban Transport Project (MUTP) (1998-2002). MUTP was launched in 2002. The investments made in these projects appeared rather huge (BUTP - Rs. 40 crore, City Flyovers - Rs. 1100 crore and MUTP Rs. 4500 crore) compared to what Mumbai was accustomed to spending for upgrading its transport infrastructure. However, all three projects provided path-breaking direction for assessing Mumbai’s long overdue transport needs. Of the three projects, BUTP and MUTP were funded by the World Bank, and the Flyover Project was funded through State Government supported bonds. The history of these projects has made the Mumbaikars introspective. Mumbaikars want answers to two key questions, namely, (i) Why should Mumbai need financial support either from international or State Government agencies to save itself from reduced mobility? (ii) Is funding the only constraint in upgrading Mumbai’s transport system? The questions are not very tough to respond to. Indeed, the three key explanations relating to project priority, funding and institutional co-ordination emanate entirely from the past projects. These are crucial requisites for making Mumbai’s transport system self sustainable.

Low Prioritization of Transport Requirements

The common experience of most Indian cities is that allocation of resources for urban transport gets a lower priority in the face of the compelling needs for housing, health, employment and environmental projects. Mumbai transport system needs high priority attention and adequate resources. Transport problems should be perceived in the wider context. If metropolitan cities like Mumbai are engines of growth, urban transport is the wheel of that engine.

Mumbai’s transport needs are well documented. Detailed reporting on transport began in Mumbai in the early sixties. The list of significant studies and reports includes, Wilbur Smith Plan (1968), Traffic System Management Plan (1980), Bombay Trans Harbour Link (1983), Comprehensive Road Development Plan (1983), High Level Committee (1987), Comprehensive Transport Plan for Mumbai Metropolitan Region-MMR (1994), Mumbai Metro (1997) and several others till 2002. Some recommendations made in these were implemented and in a few cases they have been earmarked for action. But, in general, the planners and administrators were required to keep transport under low priority.

Several other examples can be cited to indicate relatively low priority for transport. However, the three projects (BUTP, City Flyovers and MUTP) raised the profile of the urban transport sector and made the sector’s financial and institutional problems a priority on the agenda of political and bureaucratic decision-makers. The implementing agencies also felt that these projects provided substantial incentive for implementing reforms. For example, the City Flyovers Project was supported fully by the State Government agencies by raising Rs. 1600 crores through income tax free infrastructure bonds. It also prioritised reforms in contract management, regulatory provisions and use of modern construction equipment.
Funding Constraints

Recent figures for improving urban transport, (estimated in 1998 at Rs. 3 trillion or US$ 63 billion) in Indian cities are frightening, making financial sufficiency a distant reality. Financial crisis and dwindling resources of Local and State Governments mean that Urban Transport authorities have to fend for themselves. In this background, it is futile to await Government funding for this purpose, as amounts involved are quite large.

The possibility of a Dedicated Fund to improve Mumbai's transport system is currently being discussed. Current Indian and international practices also suggest that an Autonomous Fund should be created with participation from all stakeholders, including transport users, employers, vehicle manufacturers and spare part dealers. This fund income should come from surcharge on fuel, toll, employers' tax and property development. Stakeholders would be ready to pay surcharge, as they would benefit from the improved transport system. The dedicated fund amount would contribute as additional resources, and supplement the ongoing Government funding. Considering the rapid deterioration of Mumbai's traffic conditions, it is time to evaluate this initiative.

There is a pressing need to initiate transport projects in Mumbai. Since these projects required high investments, they were kept in abeyance, awaiting financial sanctions. For example, the ten key representative projects, which are estimated to cost over Rs. 20,000 crores, include: Mumbai Trans Harbour Link, Mumbai Underground Metro, Bandra - Kurla Rail Link, Shivaji Terminus to Churchgate Underground Rail Link, Light Rail Transit, Skybus, Worli to Nariman Point Sea Link, Western Relief Road, Anil Panjabipole Link and Water Passenger Terminals. In addition, the expenditure for repairs and maintenance of city roads and bridges, and augmentation of bus fleet is estimated at over Rs. 1200 crores per year. In order to attain sustainability in the city's transport system, it is imperative that the fund contributed by Mumbaikars be exclusively spent for implementing and maintaining such capital-intensive projects. There is no doubt, that this list will get longer in future.

This concept is not very novel for Mumbaikars, who have willingly contributed towards construction of the Mankhurd-Belapur rail line by paying surcharge through rail fare. Similarly, almost the entire project cost of MUTP, amounting to Rs. 4500 crore, will be recovered through surcharge paid by rail and road users over a period of 20 years.

Institutional Fragmentation

In the absence of proper co-ordination or clear-cut assignment of responsibilities, multiple governmental agencies and institutions in the transport sector have been operating without direction, leading to ineffectiveness. In practice, many agencies pursued totally independent paths, each developing fresh projects and taking different policy initiatives, as needs were perceived and new agencies were formed. Since the mandates of each of these agencies were loosely defined, their roles have become increasingly diffused. Moreover, Mumbai's administration continues to face great difficulties in effecting change, because of insufficient institutional co-ordination, lack of adequate staff, and enforcement problems. These factors have a direct bearing on large sized projects.

In Mumbai, the following 17 organisations play important roles towards efficient transport planning and management:


**State Government:** (6) Mumbai Metropolitan Region Development Authority (MMRDA), (7) City Industrial Development Corporation (CIDCO), (8) Public Works Department (PWD), (9) Maharashtra State Road Development Corporation (MSRDC), (10) Maharashtra State Transport Corporation (MSRTC), (11) Traffic Police, (12) Transport Commissionerate, and (13) Department of Inland Water Transport.

**Central Government:** (14) Central Railways, (15) Western Railways, (16) Mumbai Port Trust, and (17) Indian Airlines.

The most outstanding example from MUTP is the attempt to set up a multi-tier coordination committee (including Local, State, Central Government agencies) to plan and execute the project. This assumes distinct importance at a time, when almost all attempts for over three decades have virtually failed in setting up a Unified Metropolitan Transport
Authority (UMTA) in Indian cities. An authority like UMTA would have been ideal for taking up projects, which require contribution from multi-level agencies. The consensus on the urgency and willingness to fund project execution is becoming increasingly complex. MUTP has boldly overcome such adversities and has become a showcase for introducing institutional sustainability in the city’s transport sector.

Lessons from Own Success Stories

Before looking for answers elsewhere, Mumbai should look at heartening actions initiated in its own courtyard. Other metropolitan cities should emulate these actions to accomplish sustainability in their transport sector. In addition to the initiatives for transport sector prioritisation, funding and institutional co-ordination, following are some additional outstanding features of the three transport projects discussed in this paper, which are worth duplicating:

- **Deployment of Management Processes**: Both BUTP and MUTP deployed management processes for preparing follow-up projects. For example, financial and environmental evaluation techniques were used for prioritising project economics.
- **Indication of Performance**: A good indicator of performance was the successful implementation of flyovers with fewer disbursement lags, improved project and financial reporting, more timely procurement, and effective contract administration.
- **Transfer of Technology and Dissemination of Skills**: While working on BUTP and MUTP, transport agencies transferred skills to staff directly involved in project preparation and execution. Consultants and contractors in particular, appointed for various projects, felt that the objective of transferring skills was achieved.
- **Level of Outsourcing**: In all three projects, the participating agencies employed private sector consultants and contractors to handle a large share of their ongoing workload.
- **Growth in Professional Staff Network**: The successful completion of the three projects has resulted in considerable growth of a network of professional staff members, who regularly interact to share best practices.
- **Cost Effectiveness**: The three projects proved to be cost-effective at an aggregate level. For example, the construction of certain city flyovers was completed before schedule. In the case of World Bank funded investments, benefits due to improved planning and procurement, and management systems developed by respective agencies in Mumbai, will accrue in future.

This appraisal of the three projects has shown that there are pockets of excellence in managing Mumbai’s transport sector. This high level of performance in transport planning and management will enable Mumbai to accomplish sustainability in this sector.

*(The author is Consulting Adviser, Tata Consultancy Services, Mumbai and the Chairman of the Transport Committee, Bombay First)*

---

**Travel Habits of Urban Poor in Mumbai**

The surveys carried out from time to time reveal the characteristics of the urban poor and their daily travel in Mumbai. In 1976, over 3 mn. people lived in slums of the Mumbai Metropolitan Region (MMR). Nearly 42% of population lived in slums in the suburbs, which included Dharavi, the largest slum in Asia. Over 16% lived in slums in the island city.

The 1978 Household Survey carried out by the Central Road Research Institute (CRRI) categorized the households into five classes based on their monthly income. The lowest category of households earning less than Rs. 300 per month, termed as urban poor, formed 8.3% of the 30,000 households surveyed in the study. Their modes of travel revealed that nearly 35% of urban poor walk for their daily journeys, over 36% use train and 24% bus for their travel.

The multi-purpose household survey conducted in the MMR in 1990 studied the profile of pavement dwellers, who belonged to the urban poor category. The average monthly household income was Rs. 335, well below the poverty line and with average household size of 1.7. The family expenditure pattern showed that about 70% of income was spent on food items and the savings constituted around 6%. Hardly any amount was spent on travel, although the average trip rate per household observed was 0.92. Most travelled to places close to home. About 86% of the trips were connected to work. Majority of modes of transport for travelling to work were by train (26%) and by bus (29%). Nearly 59% resorted to walking, except when travelling for reasons other than work.

**Comments**

Apparently, there has been a declining trend of urban poor using the public transport as a mode of travel over this period. However, we do not have any surveys conducted subsequently reflecting their current travel habits. Given the massive increase in slum population and expanding city limits, there is reason to believe that there has been a reversal in this trend and a larger proportion of the urban poor are now taking to public transport - trains and buses.

*(Source: Bombay Profile for the Strategic Options Study for Public Transport Improvements in Large Cities, UNCHS, 1991)*
Comprehensive Transport Strategy for Mumbai - A Summary of the Recommendations

Ramakrishna Nallathiga

Way back in 1994, W. S. Atkins Report observed that "Bombay has become the worst example of restraint through congestion." The city has indeed been, slowly strangling itself because of the unrestrained use of personalized modes of transport, over-crowding of public transport and its inability to respond to the challenges of ever-increasing traffic. Essentially the city's transport problem has several dimensions: (a) paucity of funds, (b) lack of road space for traffic movement, (c) lack of scope for road widening of the arterial street system, (d) lack of proper integration of the various modes of transport and (e) continuing growth of population.

In the light of persistent and vexatious transport problems, Bombay First commissioned an expert consultant Mrs. Bina Balakrishnan sometime in 2000 to prepare a 'Comprehensive Transport Strategy (CTS) Document for Mumbai'. While commissioning this study, it sought a change in the perspective, hitherto taken by transportation planners, by viewing the situation as a management problem, rather than an engineering problem. The study carefully examined all major transport studies undertaken since 1962, and submitted the CTS document detailing out a strategy for improving the city transport and a phased implementation plan for achieving it. The purpose of this article is to summarize its major findings.

Objectives of the Study

While the broad objective of this study was to achieve maximum results in the shortest possible time, with minimum investment, it strategically focused on:

- Curbing the use of private modes of transport by using some form of restraint.
- Upgrading and augmenting two existing forms of mass transportation
- Introducing third form of mass transportation, namely, Passenger Water Transport

The study stressed that the best approach in resolving the transportation problems of Mumbai lies in "Demand and Traffic Management before Engineering, and Essential Integration of all Mass Transportation Modes".

Major Findings

Given the complexities of the city's transport problem, the study has pointed out that the key solution lies in the demand management of private transport accompanied by an augmentation of public transport as well as development of alternative modes of transport. It has also addressed the financing mechanism, while outlining the organizational structure for implementation. The key summary points are as follows:

- First, emphasis on discouraging the use of private vehicles through either policy restraint or fiscal restraint and encouraging the use of mass transportation, especially during peak hours. Illustratively, the proposed restraints include: (i) streamlining road-based mass transportation (ii) imposing curbs on entry to and parking in CBD (Island City) (iii) restrictions on traffic manoeuvrings and truck operations (iv) removing hindrances to traffic movement and (v) traffic engineering measures.
- Second, several improvement measures are proposed under road and rail based transport to enhance the potential of existing North-South transportation corridor and provide East-West linkages.
- Third, since the inter-modal transfer points are critical points causing congestion, it identified the need for their designing such that the delays are reduced to the minimum, and passenger transfers take place efficiently, as far as possible within the terminal area itself. This implies the need for integration of all mass transportation modes and intermediate public transport modes such as shared taxis and contract carriages.
- Fourth, it identified that introducing a third form of mass transportation - Passenger Water Transport (PWT) - will ease the pressure on land based transport. Mumbai is blessed with an abundance of this natural resource that can provide cheap and environment-friendly transport, and it is time the city exploited this to its advantage.
Fifth, the need for integration of all these mass transportation modes so that they function as an Integrated Metropolitan Transport System, complementing and supporting each other, rather than running in competition. This integration can be provided by the road based bus services, which can provide the short-haul feeder services from the terminals of rail and water to the final destinations in the CBD and residential areas, thereby also providing the East-West connectivity.

Last, it proposed upgradation of N. M. Joshi Marg/ Senapati Bapat Marg to an arterial road for developing an additional transport corridor. This will provide the following travel corridors in the North-South direction: (i) 4 corridors of road transport (ii) 5 corridors of rail transport (iii) 2 corridors of water transport and (iv) one Trans-Harbour PWT route.

The study recommended a phased implementation of various measures:

- **Phase-I**: focuses mainly on Demand and Traffic Management measures, with only essential engineering inputs, which by and large are met by the MUTP components. It could be implemented over a 5 year period.
- **Phase-II**: contains measures for further streamlining of Integrated Metropolitan Transport System. This phase could have a time period of 10 years.
- **Phase-III**: carries capital-intensive long-term road proposals. This phase could be implemented in over 10 years.

Among these three phases, Phase-I is more important for it contains several measures for implementation. It has also been stated that if the proposals selected for implementation in the first phase could become sources of revenue, then the funds generated could contribute towards implementation of more capital-intensive, long-term proposals of Phase-II.

**Funding of Transportation Projects**

In order to carry out these improvements in the transportation system, the following funding mechanism has been outlined:

- First, revenue generation through parking charges. For this purpose, all parking is to be brought under the control of the Parking Authority, which can be vested with the powers of imposing and collecting parking penalties;
- Second, income from the Cordon Pricing Scheme (if implemented) and License Fees;
- Third, re-imposition of the Wheel Tax in a revised form, which was abolished by the Government;
- Fourth, imposition of a ‘Payroll Tax’.

**A word about ‘Payroll Tax’**

The logic for this tax is that the peak demands for transport are created almost entirely by the journey to work, and the intensity of this demand in a major urban area arises from the concentration of employment in and around the CBD. In several countries, major fixed capital investment in urban public transport systems is underwritten by the revenue generated from a payroll tax levied on all employers employing more than a minimum number of staff (generally more than 9).

**Organizational Structure**

As recommended by W.S. Atkins, the study has proposed a reorganization of the Traffic Department within the Municipal Corporation. This will include departments of Highway Planning, Traffic Planning, Parking Control, Traffic Signals and Traffic Data and Survey. It is proposed that each department should have well qualified engineers, planners and economists. This is already being included in the World Bank aided MUTP as the formation of a Traffic Management Unit (TMU) within the MCGM. The formation of the TMU to a large extent can do away with the problems so far associated with the plethora of organizations handling the city’s transport.

**Likely Impact**

The basic rationale of various recommendations is to curtail the indiscriminate use of automobiles, while ensuring public transport accessibility to larger section of the population. Evidently, greater level of comfort is expected from mass transportation systems (rail, road and water transport) thanks to their increased frequency and expansion of the suburban services. A substantial shift from private cars and taxis to mass transportation can also be expected, in view of the restraints planned to be imposed on the modal choice. The increase in the
number of lines will also create a network for the suburban services, which at present experience delays due to long distance trains operations. In substance, the recommendations are expected to have the following impacts:

**Rail Transportation:**
- Better travelling conditions, and therefore, less stresses and strains;
- Shorter trip length due to better East-West connectivity, and inter-services transfers;
- More trips shifted to rail because of higher levels of comfort with more first class, and possibly air-conditioned coaches;
- Improved accessibility to the extended suburbs because of better services to the northern suburbs;
- Higher speeds due to the removal of encroachments along the tracks; and
- Lower incidence of accidents.

**Road Transportation:**
- Lesser congestion because of lower volumes of cars on the streets;
- Higher ratio of people transported to number of vehicles;
- Higher speeds and better driving conditions because of less volumes of private cars;
- Shorter journey times and lower periods of stress;
- Lower levels of pollution because of (a) more number of CNG vehicles (buses) (b) less volume of cars on the streets (c) higher speeds and, therefore, less number of stop-start sequences,
- Better inter-modal transfers and, therefore, the absence of congestion due to pedestrians on the streets; and
- Greater safety because of efficient segregation of pedestrians and vehicular traffic.

**Maintenance of Systems:**
The Cordon Pricing/ Area Licensing Scheme and the parking charges are expected to generate substantial revenues, which can be used for the periodic maintenance of the road network, including road signs, markings, signals, and roadside furniture, etc., all contributing to a much more efficient system than we have today.

**Land Use:**
It is expected that the imposition of some form of fiscal restraint on the use of private vehicles and taxis in the island city, together with steep parking charges and the payroll tax, will result in a shift of job opportunities to the northern suburbs, bringing in the much needed relief in the form of decentralization of jobs. Moreover, once these fiscal measures are in place, the provision of the Mumbai Trans Harbour Link will accelerate the shift of commercial areas to Navi Mumbai, and also help in further development of the residential areas on the main land.

**Conclusions**
In summing up, the CTS document has provided significant insights into Mumbai’s transport problems and offered very useful solutions. Quite apart from comprehensive examination of past studies, it has reflected upon the strategic objectives to be met through various measures prescribed in a phased implementation plan.

Phase-I dealing mainly with road and rail improvements is already partially reflected in the various components under MUTP. The recent World Bank approval of $ 542 mn assistance for the project has facilitated the initiation of MUTP. Likewise, Phase-III is also reflected in the MSRTC proposal for the development of Freeways under the Western Sea Link project.

However, the traffic conditions will continue to be a more challenging task. This is because of the road conditions and lack of traffic management. Indeed, how to improve the productivity of roads shall form one of the focus areas of improving the city’s transport. Similarly, improving the local traffic in a neighbourhood area or zone can also be replicated throughout the city. Area traffic improvement is now mooted by the city transport authorities worldwide, which may find some flavour in the ongoing MUTP project.

<table>
<thead>
<tr>
<th>Congestion Charges in London</th>
</tr>
</thead>
<tbody>
<tr>
<td>The City of London had introduced a congestion charge of £5 a day for driving in central London between 7 am and 6:30 pm on February 17 with a view to reduce road traffic. As a result of it, there has been a doubling of average speeds in the central area and a reduction in the traffic. According to Derek Turner, the chief of the city's street management department, the road traffic has been reduced by 30% and the delays cut by 30% respectively. It has also been accompanied by a 13% increase in bus passengers. Despite the apprehensions expressed by the businesses, the net impact of the changes on the business has been more or less neutral. With the citizens and businesses expressing their support, and the compliance increasing due to high penalties and successful vehicle monitoring, the experiment of congestion charges appears to become successful in London.</td>
</tr>
</tbody>
</table>
BEST: Past, Present and Future

Shri S.S. Kshatriya

The role of transportation in the development of any area or sector in the process of economic development is very critical. The development of any city, village or even small area depends on the development of its industry, trade, etc., which, in turn, is directly related to the strength of its transportation system. The present trend in population movement and settlements clearly indicates the faster pace of urbanization. Indeed, urbanisation is faster in developing countries, and Mumbai is a classic example of it.

Bus transport in urban areas has been and will continue to remain the principal mode of commuting due to its advantages with respect to capital cost, congestion, environmental issues and, above all, fuel consumption. At this juncture, before going into specific details, I wish to set out briefly the historic perspective and discuss a few issues pertaining to the Brihan-Mumbai Electric Supply & Transport (BEST) Undertaking.

The Bombay Tramway Co. Ltd., was incorporated in the year 1873, when the first horse-drawn carriages were introduced. These carriages were later replaced by Electric Tramways and the Bombay Electric Supply and Tramway Co. Ltd, was set up in 1907. Petrol buses were introduced in July, 1926. Until March 1964, tramcars and buses operated together. The tramcars have since been withdrawn from service.

With a very humble beginning of a few carriages, tramcars and buses catering to a few hundred commuters, today the Undertaking proudly owns a fleet of 3,380 buses catering to 4.5 million commuters daily. The Company was made part of the Municipality on 7th August, 1947, and continues to provide the city of Mumbai with two most essential services of bus transport and electric supply. BEST operates its bus services not only in the entire jurisdiction of the Municipal Corporation of Mumbai, but also in its neighboring townships of Thane, Navi Mumbai and Mira-Bhayander. Electricity is distributed in the island city upto Sion and Mahim.

The path on which the Undertaking has been traversing has had a fair share of ups and downs. BEST has taken a lot of efforts in overcoming the hurdles that have come its way. However, it may not always be possible for BEST to overcome all obstacles, as there are many extraneous factors that influence its operations. These factors can be combated only with a concerted effort of the commuters, citizens, law enforcing authorities, NGO's, etc. Let us now look at some of the issues that are a cog in the wheels of progress of public transport in this city.

1. Uni-directional travel pattern:

The peninsular topography of Mumbai itself is one major inherent problem. This problem has been further compounded by the fact that the growth of population has been accommodated in the suburbs but the commercial activity is concentrated in the island city. This to a very large extent causes unidirectional travel pattern. Such travel patterns cost heavy to all transport operators, be it BEST, Railways or even Intermediate Public Transport modes like taxis and autorickshaws.

2. Growth in the number of Vehicles:

The number of vehicles, which was around 5 lakhs in the year 1993 has almost doubled today. It is estimated that by the end of the first decade of the next century, private registered vehicles would be around 15 lakhs. One of the major factors that has contributed to this rise in personalized vehicles is the liberalization wave sweeping the country and the easy availability of finance. However, this economic liberalization has brought along several evils, which if not tackled in time may assume serious proportions.

3. Available Road Space:

During the last decade, vehicular population in the
city has grown quite alarmingly. As against this, there has been no increase worth mention in the available road space. This has led to congestion and perennial traffic blockades. Efforts made in recent times, such as the construction of flyovers, have eased the congestion problem, but only to some extent.

4. Deteriorating mobility standards:

The congestion on the roads is so bad that the average speed of our buses is merely 14 kmph. It is not possible for us to operate at full potential. The slow speed of our buses has ultimately led to longer journey time for commuters. Even if we manage to increase the speed by, say, 10%, this would have a considerable improvement on the passenger clearance as the journey time would get reduced. Besides, operating efficiency will improve as we can manage the present operation with lesser fleet.

Our Future Plans

Inspite of all the above hurdles, it has been our constant endeavour to provide quality service to the citizens of this great city. It is with this concern that we:-

- realized the importance of a clean environment and were the first to introduce environment friendly CNG buses;
- introduced upgraded air-conditioned services with a view to contribute towards reducing the vehicular congestion;
- constantly streamlined our maintenance procedures and upgraded our equipments and systems;
- try to be more passenger friendly by constantly interacting with the commuters for identifying their needs and fine tuning our operational network suitably.
- use technological developments for the comfort of commuters and convenience of operating staff.

The following reflect various ongoing and forthcoming initiatives being planned:

I. Smart Card Scheme:

On an experimental basis, the Undertaking had introduced Automatic Fare Collection System through Contactless Smart Cards on 75 buses as a Pilot Project in October 1998. With the success of the Pilot Project, the Undertaking has now decided to introduce the scheme on all the routes on the five Western Suburban Depots of Goregaon, Oshiwara, Malwani, Poisar and Goraip.

This system would not only ease and facilitate the process of purchasing ticket, but also be of immense help in fare collection for the conductor.

II. Exclusive Bus Lanes for BEST buses:

With a view to facilitate faster movement of our buses so as to ultimately benefit the passengers, we intend to ask for dedicated bus lanes in the city so as to encourage public transport. The stretches where vehicular density, bus density and passenger movement are on the higher side would gain from this priority. We have taken up this issue with MMRDA, which is the nodal agency for MUTP-II, and are hopeful about making a headway on this front.

III. Quick Services:

We are presently carrying out an experiment by operating route no.415 between Andheri (East) and SEEPZ as a Quick Service. The buses on this route do not halt between Andheri (East) and Chakala. The passengers get the convenience of faster travel. The initial response/reaction to this project has been positive and we have plans to extend this scheme to other routes/stretches.

IV. Hail and Board Scheme:

We have introduced 'Hail and Board Scheme' on short distance routes wherein a commuter can Board at any place along the itinerary. We have plans to extend this scheme to more routes. This would benefit commuters at large but particularly, school children, ladies and senior citizens.

V. Passenger Friendly Buses:

Under the MUTP-II, BEST would procure around 600 passenger friendly buses. Of these buses, we shall procure some low floor, rear-engine buses on experimental basis, which would enable smooth alighting/boarding. These buses would also be
technologically superior. All new buses of BEST shall comply by EURO-II standards.

VI. Passenger Information Systems:

We are working out plans for improving upon our Passenger Information Systems. The Undertaking values the time of its commuters and hence we are finding ways and means for indicating Expected Time of Arrival / Departure at the starting / terminating point, and also at the intermediate bus stops. Further we are also working on a proposal for developing a passenger information system in the bus for the commuting passengers.

VII. Vehicle Tracking & Bus Monitoring System:

With a view to having better control on bus operation and to ensure punctuality of services, we are planning to introduce the Global Positioning System (GPS) on our buses. This system would also be used for Passenger Information.

VIII. Pay and Park:

We have decided to start Pay & Park Schemes at some of our depots / bus stations. This will not only reduce the unauthorized parking by the roadside, but also act as a changeover for using buses by the scooterists, motorcyclists and other vehicle owners on similar lines as is being done at the railway stations.

BEST understands its responsibility of delivering efficient passenger service to Mumbai citizens by virtue of it being the Monopoly Stage Carriage Operator. It has always strived to deliver the BEST by introducing new, innovative schemes and ideas. However, these need to be complemented by several other measures.

Some of the measures that would help in solving today’s complex problems to a certain extent are:

1. Not allowing private vehicles in the CBD area during the peak period: Private vehicles could be permitted only upto a particular point where large scale parking arrangements could be made, and from these points, the people would be carried to the CBD area only by public transport.

buses. The BEST Undertaking is ready to accept the challenge of providing services in this manner with an ideal fleet mix.

2. A concerted effort in dispersing the commercial activities concentrated in the CBD area. This is already happening; some of the major markets have already been shifted to the satellite city of Navi Mumbai. Major corporate bodies have also shifted their offices towards the central and the suburban parts of the city. What is now required is the speeding up of the process.

3. Area Licensing Schemes.

4. Formation of a Unified Metropolitan Transport Authority to co-ordinate the activities of different agencies related to city transport.

5. Introducing separate Bus Lanes for promoting the cause of public transport.


7. Removal of encroachments and roadside parking for facilitating free flow of vehicular traffic creating exclusive “Hawking Zones” and “Pedestrian Plazas” as an alternative.

8. Utilisation of lesser-frequented roads for the movement of private vehicles or introduction of one way flow of traffic on certain roads during peak hours.


10. Adherence of vehicles to Pollution Control Norms.


12. Incentives to public transport such as tax reliefs, soft loans, subsidies, etc.

It is now time to take bold decisions and implement them with will in the right perspective. It is essential to adopt measures to propagate public transport and discourage the growing use of private vehicles by means of implementation measures mentioned above. Traffic management schemes would help in solving to a great extent the problems faced today. These schemes will also require creating public support and strict enforcement.

(The author is the General Manager of BEST undertaking)
Sky Bus: The True Urban Transport Technology for the New Millennium!

B. Rajaram

The most precious asset in growing urban areas is land. Its allocation to residential and commercial purposes puts heavy pressures on availability of land for public use like parks and open spaces as well as critical roadways. As a result, hardly 6% to a maximum of 18% of land in cities forms roadways. The roadways once laid almost remain constant and indeed may be effectively reduced by uncontrolled encroachments. With the physical constraint on road area in the wake of increasing population, the intensity of loads on the roads increase.

As more and more people from different habitats try to converge on to the central business district, the road has little or no capacity to handle traffic, leading to congestion. Roads take one exactly to the point where one wants to go. But the capacity is limited in terms of passengers per hour that can be handled. Even if one considers only buses, both the need to maintain the braking distances between two buses and the space maintained between them affects the speed, and also limits the lane capacity that can be achieved. When mass transit, that too at higher speed, is required, only rail based systems can handle such situations.

An ideal urban transport system

Heavy concentrations of residential units coupled with required movement to work places, or to market places, demand transportation of people. Roads are expected to cater for the same. But, roads have a limitation—once the development is completed, the area available remains constant. Old cities in particular, throw up the problems of mismatch between designed capacity and the increasing pressure of populations.

Let us examine the various modes of transport that the population uses in a city and their capacities and limitations to evolve requirements of urban transport solution in a holistic manner. Currently the available solutions are either elevated railway or underground railway, if mass transportation is required.

Elevated railway technically cannot reach truly congested central busy locations where mass transport is needed. It is also too invasive and may lead to dislocation of some portions of habitat as well as introduces noise pollution.

Underground railway is less invasive on surface but still poses technically challenging risks of fires and evacuations. It also has to address concerns for foundations of heritage buildings.

However, modes suffer from derailment and capsizing killing commuters. Further, if road vehicles are involved, in inter-modal transfers, they become weak link in the chain of transport between walking and railway.

Surface railway is impossible to lay in an existing city. But even to lay the same in a new development, one should keep in mind what happens 50 years after laying the same. We have a living example of our own suburban system. The city remains divided by the corridor and it is an eternal noise polluter in the heart of the city day in and day out. Sudden disgorging of heavy loads of commuters at stations create needless congestion on the roads, reducing the quality of life. Almost close to 2000 persons die annually—because of trespassing or falling from trains.
in our present system- whatever be the excuse and justification for accepting the same. Besides vulnerable to minor vandalism by urchins, it results in grievous injuries like loss of sight for the commuters. Again this mode cannot follow roads, so the weak link of road vehicles has to be brought in for inter-modal transfers.

It is important to note that derailments, collisions and capsizing concerns remain with loss of life for all the above mentioned three systems.

The infrastructure created for urban transport is hardly being utilized up to 20 to 40% of its capacity because of the uni-directional as well as inevitable peaks during limited hours in a day. It has no other use and just idles.

An ideal solution is the one which:

a. follows the existing roads- but does not take road space- and be as flexible as a bus;

b. has rail based mass transit capacity, same as existing rail metro;

c. does not divide city while providing integration along its alignment;

d. is derailment and collision proof- with no capsizing of coaches- so that there can never be loss of life;

e. is free from vandalism;

f. is noise free and pollution-free;

g. is non-invasive -requiring the least amount of scarce land space- and not coming in the way of development.

Sky Bus Metro: An Alternative

Sky Bus technology offered by Konkan Railway Corporation meets the above requirements, and helps us re-define the thinking and planning for urban transport. It is an eco-friendly MASS urban transport which can revolutionise urban life! Following are the technical characteristics:

The fixed structure at 8 m height above road level provides the support and guidance for powered bogies which can run at 100 kmph, with the coach shells suspended below, carry passengers in air conditioned comfort, can follow existing road routes, while existing traffic on roads continue. It is aesthetically pleasing and there is no concern of claustrophobic feeling for road users.

Aesthetic and eco-friendly, the Sky Bus can never derail, capsize or collide- by design as well as by construction, hence is safer than the existing rail-based system. At the cost of Rs 45 crore per km or US$10mn/km in India, the system is noise-free and pollution-free with 18,000 pphpd, scalable to 72,000 pphpd as required. With no signalling and having no points and crossings, it is a unique mass transit system that can be put up within two years in any crowded & congested city. In addition to moving people, the Sky Bus system can carry standard 20ft containers, boosting its capacity utilization to double that of other existing systems.

Since it operates along existing roadways and within municipal limits, Sky Bus metro falls under tramway category, under Art 366(20) of the Constitution of India, hence excluded from Indian Railways Act.

The main components of the sky bus systems are described below:

(a) Sky way

(i) The sky way consists of a concrete box structure 8m x 2m carried over a series of piers at a height of 8 m above the existing road level

(ii) It has the pile foundations middle of road way for support in the formal 1 m dia columns approximately 8 m high, and at a spacing of 15m all along the roadway

(iii) It has two heavy 52/60 kg/m rails fixed with appropriate fastenings within the concrete box support at standard gauge that guide the sky bogie. There are no points & crossings.

(b) Sky Bogie

- Standard two axle bogies can be used in
metros for speeds of 100 kmph (but can have higher speeds, if required up to 160 kmph).

- Linear induction motor technology is incorporated with 4th rail driving, which is above the bogie or 3 phase AC motors with regenerative power capability can be used.
- Third rail is used for current collection
- Braking-bogie mounted
- Regenerative
- Disc brakes and emergency mechanical brakes

(c) **Design loads:**

Max axle load 12 tonnes
- Weight of
  - bogie-2 axle motor: 5 t
  - tare weight of coach: 6.5 t
  - weight of equipment: 3 t
- Each bogie can take a passenger loaded 9 t, and total load of 24 t which is inclusive of axle load: 12 t

(c) **Sky Coaches**

- These are double walled light shells with large wide windows are suspended from the sky bogies
- Controlled banking on curves is possible and even 100m radius curves can be handled.
- The coaches are air conditioned and fixed with automatic doors.
- They have audio visual information to assist the passengers.
- They also have special 4m wide sliding doors for quick entry and exit of passengers.

- Each pair of the coaches carries 800 persons and service every one minute or 30 seconds is possible.

(d) **Sky station description**

- Unlike conventional mass transit systems, Sky Bus needs smaller stations.
- Service is available at every 30 seconds or 1 minute, which means virtually no waiting time for passengers.
- Totally automated without drivers or guards and access control is also electronic by prepaid cards being swiped in.
- Stations act only as access facility, and not as passenger holding area.

**Traverser system**

The traverser is the system which automatically shifts the sky bus units for balancing the loads/changing routes as well as shift units to depot lines etc.

Proven technologies and a very simple solution by merely re-engineering the components constitute Sky Bus. The new technological solution, in terms of Sky Bus Metro, is based on the concept of Sky Wheels presented in 1989 at World Congress for Railway Research. The technologies used are:

- Well proven rail guided bogie system commonly used for normal railway system.
- Linear Induction Motor Technology or 3 phase AC asynchronous electrical motive units- well proven and widely adopted abroad as well as in India.
- Light weight coaches called `Sky buses’ which are suspended from bogies and travel below rail guides, the physics of which can be engineered.
very easily – shells of coaches and suspension links well proven.

- Pre-fabricated latest construction technologies, which save time and money resulting in easy execution of the project in busy urban areas without disturbing the existing traffic pattern. These structural engineering methods are well proven and do not have any project execution risk attached.

- Information technology tools for economic communications and control.

Advantages

- In this new technology of 'Sky Wheels', almost no land acquisition will be required, except for providing for right of way on existing roadways.

- Only at terminal points, minimum amount of land of the order of 2000 to 4000 sqm of area will be required – that too at places away from the urban centre.

- Neither demolition of structures nor gardens will be destroyed.

- Vandalism not vulnerable to or persons throwing stones as the track is inaccessible.

- Fastest evacuation possible in case of fire as compared to underground metros.

- If at all derailments, cannot fall down coach keeps hanging. Hence no capsizing takes place as compared to railways and underground metros.

- No deaths due to trespassing/falling off trains; in normal metros like Mumbai, daily 2 to 3 deaths occur on the system with total casualties reaching almost 2,000 per year.

- Sky Bus follows existing busy roads and reaches the very heart of the city, thus, decongesting the roads. This is not possible in case of normal railway.

- Capital cost is lowest - almost 50% of elevated systems and 25% of underground metro for same performance standards.

- Maintenance free tracks, no signals, points and crossings to maintain make the running cost lowest.

- No interference with normal road traffic and does not require road over /under bridges.

- Since the system involves guide ways in the sky, it does not fall into an exact definition of Railway.

- The number of agencies involved in clearing and executing the project will be minimum and only one authority at state level will be created for implementing the project.

| Railway bogie running over steel rails | Proven century old technology | We daily travel!
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Suspension links holding the coach below bogie</td>
<td>Century old suspender designs working safely</td>
<td>In Mono rail-systems &amp; rubber tyred sky systems</td>
</tr>
<tr>
<td>Moving block/control</td>
<td>Proven micro-processor based systems</td>
<td>In underground metros/surface railways</td>
</tr>
<tr>
<td>Traverser</td>
<td>Standard mechanical handling</td>
<td>Existing in EOT cranes-workshops</td>
</tr>
<tr>
<td>Concrete box/columns</td>
<td>Standard prestressed concrete</td>
<td>All current structures we use today</td>
</tr>
</tbody>
</table>
Investments and returns for Sky Bus Metro:
(The costs are worked out for a typical 10 km double line route)

<table>
<thead>
<tr>
<th>Capital</th>
<th>Depreciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed structure US$ m 116</td>
<td>2 m for structure</td>
</tr>
<tr>
<td>Rolling stock for pphpd</td>
<td>add for rolling stock</td>
</tr>
<tr>
<td>A</td>
<td>25000</td>
</tr>
<tr>
<td>B</td>
<td>50000</td>
</tr>
<tr>
<td>C</td>
<td>75000</td>
</tr>
</tbody>
</table>

Operation & maintenance

<table>
<thead>
<tr>
<th>Rolling stock</th>
<th>Fixed structure</th>
<th>Energy</th>
<th>Staff costs</th>
<th>Million $</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 5.0%</td>
<td>3</td>
<td>11</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td>B 6</td>
<td>8</td>
<td>22</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>C 8</td>
<td>8</td>
<td>33</td>
<td>7</td>
<td>51</td>
</tr>
</tbody>
</table>

- It can be built on roads with Fly over, which cannot be an impediment.
- From the day financial closure is achieved, the Project can be completed and commissioned within 100 weeks i.e. about 24 months.
- Aesthetically pleasing with no noise pollution.
- Insulated against floods, rains and obstruction on track.

This is the only metro system which can handle standard containers to move goods/services in a city – thus eliminating the need for trucks to enter city limits. So for a charge of 2.5 to 5 cents per km or about 5 cents per mile, it is possible to provide air-conditioned travel with waiting time for service at interval of less than 1 minute. A service at 100 miles per hour can be provided, if 10 miles between halts is provided. Then a distance of 50 miles will be covered in 30 minutes at a ticket charge of $2.50.

However a survey for local area costs is required to firm up the local civil engineering costs. The system, in addition to moving people, can carry containerized cargo, thus, during off-peak period also the asset is utilized. The capital cost is hardly half that of the conventional elevated railway, and only a quarter that of underground metro; but the asset gets utilized upto 70% of the capacity as compared to normal 30 to 40% in the dedicated urban systems. The system provides a holistic solution to a city.

Minimum fares for different capacity utilization

(Cents per km)

<table>
<thead>
<tr>
<th>PPHPD</th>
<th>20%</th>
<th>25%</th>
<th>30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,000</td>
<td>5.1</td>
<td>4.1</td>
<td>3.4</td>
</tr>
<tr>
<td>50,000</td>
<td>3.9</td>
<td>3.1</td>
<td>2.6</td>
</tr>
<tr>
<td>75,000</td>
<td>3.5</td>
<td>2.8</td>
<td>2.3</td>
</tr>
</tbody>
</table>

(give 10% return on capital after providing for depreciation and O&M.)

Conclusion:
Sky Bus System not only redefines the urban mass transport for cities, but also provides for efficient automated container delivery system point to point, following existing roads and brings down the cost of service while improving quality. With land being at premium, even for intra-city high speed 200 kmph system, Sky Bus provides an excellent alternative for mass transport as it is being derailment free and safer than existing rail-based systems.

(The author is the Director, Konkan Railway Corporation Ltd. India and pioneer of Sky bus technology system and holds several patents to his credit)
The Curitiba Transport System: An Example of Universal Design in Developing Countries

Introduction
Curitiba in Brazil was like any other city in a developing country in the early sixties grappling with the various problems of rapid growth and development in the face of a rather erratic and unreliable transport system. But the situation transformed dramatically when the city government, in a bid to address the challenges of growth, adopted a strategy, which from henceforth would continue the growth process without compromising the quality of life of its citizens. The results are for all to see. The sustainable transportation system that has evolved in the city since the last three to four decades has become a model for both developed and developing countries alike.

Strategy and Guiding Principles
A Master Plan was formulated in the 1960s, which laid down certain guidelines to restructure the city's urban expansion process to cope with rapid urbanization in the city. Thus, Curitiba adopted an Integrated Transport Network making it the most accessible transport system in Brazil. The objective of this strategy: to accommodate an ever-increasing number of inhabitants into a static, physical space without deteriorating the quality of services provided. This system has also been well equipped to provide better services to disabled travellers.

Some of the guiding principles that helped metamorphose Curitiba's transport system are as follows:

- Effective urban transportation can be developed only by integrating activities that contribute to urban growth.
- The priority of quality transportation is on an effective system rather than insisting on a particular mode of transport.
- Convenience, travel time, flexibility and cost are the key features of a user-oriented transportation system.
- Land use controls and the transportation system should complement each other and promote easy interchange of people between their different activities.
- A sustainable transportation system is a partnership between the government, the private sector and the citizens.

Salient Features of the Transportation System

- Curitiba adopted an integrated planning approach such that both the transportation system and land use planning complemented each other. The government viewed land use, road network and transportation planning as key developmental tools for a coordinated growth of the city. The existing streets were used with very minor physical modifications.
- Planners did not import the technology but implemented locally developed innovative technologies and adapted it to the Curitiban system.
- Unlike many Latin American cities no attempt was made to alter the existing system of transportation. Curitiba's transportation plan did not involve major structural changes; neither did it call for highways and dismantling of neighbourhoods.
- The main mode of transport in Curitiba was buses. Instead of replacing it with more capital-intensive projects like subways or rail-based systems, the city improvised its existing bus system and developed a surface-based bus system, which was affordable from the point of view of cost also.
- A better transportation system would not only help addressing the problems of urbanization but also help in planning the development and growth process of the city.
- The basis of the transportation system was in the nature of a public-private partnership, the interests of both private and public parties had to be kept in mind while implementing the plan. While private firms provide buses, drivers, maintenance and capital, it is the city-owned corporation that provides Curitiba with route planning, roads, terminals, scheduling and enforcement of standards. It also collects fares, provides public accounting and distributes revenues on the basis of negotiated contracts. The city corporation acts as an agent for the...
community’s interest in effective transportation. Interestingly, the corporation is technically a mixed capital, municipal parasatal, i.e., a publicly administered, and privately funded entity.

Cost Aspect

The users of this bus service pay only a single fare. This “social fare” implies that shorter trips pay for the longer trips, thereby, reaching low-income people in the suburbs. The entire system is wholly financed by these fares without any subsidies; as a result, it avoids any increment in fare. Urbanizacao de Curitiba, a public-private company, runs all aspects of the system. Interestingly, the buses themselves are owned and operated by private companies that are paid per kilometer and not per passenger. Maintenance of buses is governed by municipal laws and the bus stations are designed like tube stations, making the system fast and clean.

Benefits of the New System

A good public transportation, undoubtedly plays a fundamental role in preserving the environment. The consequences of adopting such a well-planned transportation system in Curitiba can be enumerated as follows:

- Quality transportation replaced a rather erratic system of transportation. It reduced travel time and increased convenience. Usage of private cars reduced since the mass transportation was very competitive because of its speed, punctuality and regularity.
- Direct “inter-district” connections between corridors allowed passengers to travel directly between points without passing through the city centre.
- Arterial roads containing public transit rights-of-way were complemented by high-density zoning. Today, these arterial roads cover 60 km and are met at termini by bus feeder lines of 800 km length. In total, the Integrated Transportation Network (RIT) between Curitiba and its surrounding areas covers around 900 km in eight municipalities.
- As the system evolved, larger buses were designed and built, including articulated ones in the 1980s with a carrying capacity of 160 people. In the following years, these buses were replaced with buses with an increased carrying capacity of 270 people.

Conclusion:

The transformation of Curitiba’s transportation was not the handiwork of a day’s efforts. Underlying the successful implementation of the goals and objectives of the 1960 Master Plan was a very careful and well-thought plan. The implementation of the Plan took place in a phased manner in small steps. Although it may be not be possible to reproduce what Curitiba has done, surely the city’s experience in transforming the transportation system and using it as a tool for the city’s development can be a lesson for other developing nations. It clearly shows how the transportation system can be made effective even at a relatively low cost by just improvising the existing system.

(Prepared by Kamolika RoyChowdhury)

Transmilenio: Bogota’s Bus Rapid Transit System

In less than three years between January 1998 and December 2000, the municipality of Bogota, Colombia developed and implemented a bus rapid transit system called Transmilenio. The system consisted of exclusive busways on central lanes of major arterial roads, roads for feeder buses, stations, and complementary facilities. Trunk line stations are close facilities with one to three berths varying from 40 m to 180 m in length, located every 500 m on an average. Trunk lines are served by articulated diesel buses with 160 passenger capacity, while integrated feeder lines are served by diesel buses with capacity of 80 passengers each.

To maximize capacity, trunk lines accommodate express services stopping at selected stations only, as well as local services stopping at all stations. This combination allows the system to carry up to 45,000 passengers per hour per direction. Services are operated by private consortia of traditional local transport companies, associated with national and international investors procured under competitively tendered concession contracts on a gross cost basis.

By May 2001, Transmilenio carried 360,000 trips per weekday, without operating subsidies at a ticket cost of US$ 0.86. Productivity was high, with 1,945 passengers per day per bus and 325 km per day per bus. Fatalities from traffic accidents had been eliminated, particulate emissions in the corridors reduced by up to 80 per cent, and user travel time reduced by a third.

Source: South Asia Urban Air Quality Management Briefing Note No.8, The World Bank.
Best Practices in Transport Planning and Management – Case Study of Singapore

Singapore is a small island state measuring about 650 sq km area with a population of 3.9 million. It is one of the densely populated and urbanized countries in the world. Its total road length of about 8,100 km, includes a 150 km long express way. Even though the car occupancy is very high (about 1 car per 10 persons), it is still low as compared to most developed countries. Like many cities in the world, travel demand in Singapore has risen rapidly due to population and economic growth. For example, the number of motorized trips rose from 2.7 million a day in 1981 to about 7 million by 1995, of which peak hour trips during morning and evening constituted a quarter each.

The Singapore policy makers have been serious about integrated urban land use and transportation planning for long time. The fundamental motivation for Singapore was not environmental concerns but in economic prospects, which envisioned being a prominent commercial and trading center by utilizing its unique geographical location. Despite the rapid economic growth, Singapore has been remarkably successful in meeting unprecedented travel demand while controlling congestion and environmental pollution to the acceptable limit. Singapore employs a mixed approach of command-and-control and market-based instruments to manage traffic demand and related environmental problems.

Singapore’s Transport Strategy

Singapore has perhaps the best transport planning and management system in place. An important development was the formation of the Land Transport Authority (LTA) through the strategic merger of four government agencies involved in different aspects of transport planning, development and management in Singapore. These agencies were Roads & Transport Division of the Public Works Department, the Mass Rapid Transit Corporation, the Registry of Vehicles and Land Transport Division in the former Ministry of Communications.

After the creation of LTA, transport planning and management fully came under its purview. The LTA plans, develops, implements and manages transport infrastructure and policies. Further, the provision of public transport services – bus and rail – is regulated by the LTA, even though they are provided by private operators in the form of partnership. The key elements of Singapore’s transport strategy are as follows, which are subsequently elaborated:

- First, Integrated transport and land use planning
- Second, Development of an efficient road network and harness technology to maximize its capacity
- Third, Demand management for road usage
- Fourth, Public transport improvement for providing an attractive transport mode alternative to car

Integrated Transport and Land Use Planning

Singapore has chosen integrating the goals of transportation planning with land use planning. As travel is always made with a purpose, the amount and number of travels can be reduced by means of effective land use and transport planning e.g., by proper location of homes, offices and other uses in relation to the transport systems. As part of this process, concept plans have been prepared and reviewed periodically. The strategies laid under concept plans are then translated into specific planning guidelines as well as local plans.

Road Development

As part of the transport strategy, Singapore has laid preference to comprehensive road network development. From the road length of 1,000 km in 1965, it had expanded the road length to 3,100 km by the end of nineties, through expansion activity. However, it is important to note that Singapore has not achieved roadway development with an objective of more private vehicle use, but more of providing better public transport and of improving access to the remotest areas.

Demand Management of Transport

Singapore has demonstrated how to curb transport demand by means of fiscal instruments like duties and fees as well as quantitative instruments like quota restrictions. Import duties and registration fees for new cars have been laid along with annual road taxes pegged to engine capacity to check the growth of vehicles. The Vehicle Quota System (VQS) was introduced in 1990, under which a person has to bid for a Certificate of Entitlement (COE) before
purchasing a vehicle and the number of which is restricted in each month. These efforts effectively restricted the growth of vehicles. However, an important element of Singapore’s transport demand strategy is Electronic Road Pricing (ERP), which is discussed in the following:

**Electronic Road Pricing**

The high ownership costs achieved through above means are not equitable as it is the usage of vehicles that causes congestion than ownership. Singapore has demonstrated the use of technology that allows road pricing. It allows for internalization of external costs of vehicle use on roads. This system is improvisation of manual road pricing that was prevalent after 1975. Under the manual road pricing system, Area Licensing Scheme (ALS) was implemented to regulate vehicle usage in the city. A restricted zone (RZ) was demarcated around city centre and the vehicle users were to display paper area license to gain entry into it. Enforcement was carried out through manual observations. The road pricing scheme was then extended to express ways.

The Electronic Road Pricing (ERP) was planned, tested and prepared for 10 years and then successfully implemented in 1998. Even though the basic objective of ERP is the same as that of ALS, it is more sophisticated in design and versatile to manage traffic flow. Under the ERP, an In-vehicle Unit (IU) is slotted with a storage value card. The road usage charge is deducted when the vehicle crosses a detection point. Enforcement is done through surveillance cameras that are activated to photograph the violating vehicle. The ERP system is flexible and enables different charges to be levied on different categories of vehicles at different times of the day. Moreover, ERP charges can be adjusted to traffic conditions.

**Public Transport Improvement**

Encouraging public transport has been one of the strategies of transport planning and management in Singapore. The objective was to increase the share of public transport from 63% to 75% by proving a quality public transport that provides competitive services as comparable to that of car. This was implemented through the construction of rail transit as the backbone of such system and complemented by the buses. This integrated rail and bus transport provided seamless journey between any part of the city to the other with a far better service in terms of comfort and pollution.

As a part of the public transport improvement strategy, Singapore has also developed a Mass Rapid Transit (MRT) system, which links the new residential towns outside the city with the employment concentration in the city centre. This MRT network is now 83 km long with 48 stations. Whereas, Light Rapid Transit (LRT) system was developed with an objective of providing link to the public housing town that was not directly served by MRT. The LRT has some definite advantages over MRT in terms of its (a) accessibility, (b) maneouverability, (c) less space consumption, and (d) fast, safe, reliable and comfortable travel. Moreover, the development of hierarchal rail transit system follows the development pattern, which results in development of integrated rapid transit network in Singapore.

**Conclusion**

Singapore serves as an excellent example of urban transport management by including the essential principles of (i) integrated transport and land use planning (ii) transport demand management and (iii) good public transport. The integration of transport agencies in case of LTA presents a good case for Mumbai as well.

*(Prepared by Ramakrishna Nallathigil)*

---

**Share of Various Modes of Transport in Cities across the World in Mid-1990s**

<table>
<thead>
<tr>
<th>City</th>
<th>Amsterdam</th>
<th>Atlanta</th>
<th>Bangkok</th>
<th>Bogota</th>
<th>Cairo</th>
<th>Curitiba</th>
<th>Los Angeles</th>
<th>Mumbai</th>
<th>New York</th>
<th>Singapore</th>
<th>Tokyo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (m)</td>
<td>1.4</td>
<td>2.5</td>
<td>6.5</td>
<td>6.1</td>
<td>9.7</td>
<td>13.1</td>
<td>18.1</td>
<td>12</td>
<td>16.6</td>
<td>3.3</td>
<td>27</td>
</tr>
<tr>
<td>Pvt Transit (%)</td>
<td>40</td>
<td>95</td>
<td>60</td>
<td>9</td>
<td>10</td>
<td>14</td>
<td>87</td>
<td>5</td>
<td>61</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td>Public Transit (%)</td>
<td>25</td>
<td>5</td>
<td>30</td>
<td>75</td>
<td>58</td>
<td>72</td>
<td>6</td>
<td>90</td>
<td>30</td>
<td>56</td>
<td>40</td>
</tr>
<tr>
<td>Walking &amp; others (%)</td>
<td>38</td>
<td>0</td>
<td>10</td>
<td>16</td>
<td>31</td>
<td>18</td>
<td>6</td>
<td>5</td>
<td>9</td>
<td>22</td>
<td>24</td>
</tr>
</tbody>
</table>

Source: ‘Redesigning Cities for People’ in ECO-ECONOMY, Worldwatch Publication (1997)

Note: Mumbai’s public transport share includes that of intermediate public transport.
Metropolitan Transport Authority (MTA) : An Example of Successful Networking of Transport Organizations

The Metropolitan Transport Authority (MTA) takes care of the entire public transportation system of New York city. This is a network comprising of the following agencies: (i) New York City Transit (ii) Long Island Rail Roads (iii) Metro North Rail Road (iv) MTA Bridges and Tunnels

New York City Transit
Structurally, the New York City has been divided into five boroughs and the New York City Transit (NYCT) operates 204 local and 81 express bus routes. These 285 routes cover a total length of 1,871 miles. In terms of volumes, the buses run 24 hours a day, seven days a week and the bus operators make more than 45,550 trips daily. The system’s 4,373 buses carry about 2.2 million people daily. During peak hours, about 3,654 buses are in operation, picking up passengers at more than 14,000 bus stops.

It is important to note that all the New York City transit buses are air conditioned and are either new or remanufactured or overhauled. In addition, every bus is accessible to people in wheelchairs, either through rear door lifts or through low floors that enable wheelchair travellers to enter at street level. This makes NYCT system as one of the largest accessible fleet in the world.

Use of New Technology in Buses:
- In 1999, NYC Transit began a pilot project using Continuously Regenerating Technology (CRT) for lowering diesel emissions. In this project, the first 50 buses received CRT particulate filters. These buses use ultra low sulphur fuel and undergo half-yearly emissions testing.
- At present, NYC Transit has five electric hybrid buses that are equipped with electric motors and small diesel engines. Plans are now being made to have 150 such buses next year.
- Currently, NYC Transit has 88 buses using Compressed Natural Gas (CNG) which is a cleaner fuel. They are expected to have another 150 in service next year.

The Long Island Rail Road
The Long Island Rail Road (LIRR) holds the distinction of being the busiest railroad in North America. Currently, the LIRR carries on an average 290,000 passengers each weekday on 785 daily trains. The LIRR system comprises of 9 branches, stretching from the eastern tip of Montauk, Long Island to the refurbished penn station in the heart of Manhattan approximately 120 miles away.

Poised to serve its customers, Long Island, and the region into the 21st Century, the LIRR has benefited from over $4.6 billion in investment, spanning almost two decades to provide improvements. The LIRR owns 1060 rail cars and 701 miles of track. While employing 6000 people, it serves Nassau, Suffolk, Queens, Brooklyn and Manhattan.

MTA Metro - North Rail Road
Founded in 1983, MTA Metro-North Railroad is the second largest commuter line in the United States, providing services to more than 2,400,000 persons each weekday. Metro North has assumed since then control of Conrail commuter operations in New York and Connecticut. Metro-North traces its antecedents back to the New York & Harlem Railroad, which began in 1832 as a horse-car line in lower Manhattan. Metro - North, currently has a fleet of more than 950 cars and engines, 384 route miles and 775 miles of track. It has 119 stations distributed in seven counties in New York.

MTA Bridges and Tunnels
This is the largest among the nation’s bridge and tunnel toll authorities in terms of traffic volumes; MTA Bridges and Tunnels serve more than a million people daily in the New York metropolitan area. As a constituent agency of Metropolitan Transportation Authority (MTA), its dual role is to operate seven bridges and two tunnels and to provide surplus toll revenues to help support public transit.

By the 1960s, the city was becoming choked by automobile congestion and pollution, and the need to restore long neglected subway, bus and commuter rail system became apparent. Accordingly, in 1968, the Triborough Bridge and Tunnel Authority was made part of the MTA. Its surplus revenues, previously used to finance new projects for the automobile, were redirected to public transportation. Since that time bridge and tunnel toll have contributed more than $5.6 billion to subsidize fares and underwrite capital improvements for New York City Transit, the long Island Rail Road, and the Metro-North Railroad. Total toll revenues, more than $750 million annually, and Bridges and Tunnel’s Five-Year Capital Programme will keep its facilities among the best in the region. Over 750,000 vehicles use these facilities each day.

(Prepared by Dattatraya Sabale)
Delhi Metro - A Successful Example of Urban Mass Rapid Transit System in India

Transport situation in most of the Indian metropolitan cities is rapidly deteriorating, thanks to the influx of population and the increasing needs of transportation. The congestion on roads and the accompanying vehicular pollution are also rising to an alarming level. Although the levels of realization are different, the city authorities are waking up. There is a realization of the urgency to cope with the situation by the way of providing mass rapid transport to cater to the transportation needs of citizens. Delhi has already begun to demonstrate how a strong political will, visionary leadership and committed working can make a difference to metropolitan transport.

The recent launch of metro services in India's capital city is an important milestone in the history of urban transportation. The Delhi Metro project has several technological features to its credit:

- First, Delhi Metro Rail Corporation, under the leadership of Mr. Sreedharan, was created to plan and implement the project in a record time span (the Phase I has been completed in 7 years as compared to 25 years taken by Kolkata);
- Second, the project has elevated, underground and at-grade rail tracks with about 51 stations. The total project cost has been estimated at about Rs 8,000 crores that has been proposed to be implemented in two stages at the first instance, and extended to two more stages for further expansion;
- Third, the rail network under the project has been proposed to be laid in four lines and measures about 62 km in the first two phases, but expandable to 241 km later. This is almost four times that of the network laid in Kolkata. It has also been proposed to make use of about 240 coaches that will be imported from Korea/Japan at the cost of Rs 1 crore per piece;
- Fourth, a proposal for integrating the rail transport with bus transport is on its way with about 200 shuttle buses moving the people to and fro railway stations. This will also allow the seamless journey of passengers without any need for separate tickets for bus and train services;

- Last, apart from the above, proposals for hiring the station area for fast food service centres and food plazas are also included as part of the comprehensive station area development strategy.

Like any other large public infrastructure project, Delhi Metro initially faced the problem of obtaining finances for project development and the viability of financing it through service charges. However, the Japanese soft loan at the rate of a meagre 1.8% payable in 30 years (with a 10 year moratorium), accounting for 56% of the total project cost, made it possible to raise finances in a comfortable manner. More importantly, Mr. Sreedharan, Managing Director of DMRC expressed his confidence that the entire loan can be serviced through service or user charges from the passenger travels made.

With expected 2.2 mn passengers travelling every day, it is estimated that a revenue of Rs 12 lakh can be raised from commuters, which is sufficient to meet almost 90% of the project cost. The remaining amount is also proposed to be met through selling space for advertising and food plazas/service centres. Even though, the NCAER survey has placed the estimates of passenger trips between 1.6 and 1.7 million, on account of less likely shift of lower income groups to relatively expensive metro, it has expressed its confidence that this will be sufficient to recover the project cost, albeit with lower rate of return.

However, the external benefits to the society arising from this project can be substantial due to the reduction in costs of pollution and accidents as well as fuel wastage costs. These benefits will definitely justify such large investments.

Taking the lead from Delhi, we believe that, concerned authorities, expectedly the MMRDA, are seriously evaluating the prospect for creating metro for Mumbai to provide for the growing transport needs, particularly to those not being covered by the current mass transport system.

(Compiled by Ramakrishna Nallathiga)
## Metro-wise Vehicular Population

<table>
<thead>
<tr>
<th>Urban Agglomerations</th>
<th>Population</th>
<th>Vehicles Regd. end - March 1998 (Numbers)</th>
<th>Vehicles per 1000 people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mumbai</td>
<td>16,368,084</td>
<td>859,734</td>
<td>860</td>
</tr>
<tr>
<td>Bangalore</td>
<td>5,686,844</td>
<td>1,129,836</td>
<td>1180</td>
</tr>
<tr>
<td>Chennai</td>
<td>6,424,624</td>
<td>975,009</td>
<td>975</td>
</tr>
<tr>
<td>Delhi</td>
<td>12,791,458</td>
<td>3,038,045</td>
<td>3033</td>
</tr>
<tr>
<td>Kolkata</td>
<td>13,216,546</td>
<td>664,046</td>
<td>664</td>
</tr>
<tr>
<td>Hyderabad</td>
<td>5,583,640</td>
<td>887,367</td>
<td>887</td>
</tr>
</tbody>
</table>

Notes: (i) Population figures relate to the respective urban agglomerations; (ii) Mumbai's registered vehicle population is 1,069,499 as of end March 2003.


## Share of Road Space in Select Indian Cities

![Share of Road Space in Select Indian Cities](chart)

## Vehicle Density in Major Metros of India

![Vehicle Density in Major Metros of India](chart)

---

**BOMBAY FIRST**

**Vision Statement**

Bombay First will help to improve the economic and social infrastructure of the city to make it globally competitive and improve the quality of life of its citizens.

**Mission**

Bombay First is an initiative to make the city a better place to live, work and invest in. It aims to serve the city with the best that private business can offer. It will help achieve this by addressing the problems of today and the opportunities of tomorrow, through partnerships with government, business and civil society.
Five years is a blink of an eye in the life of an institution.
It is, however, sufficient time to build the foundation of a lasting edifice.

IDFC had a difficult mission. A mission to lead private capital to an area where it had rarely been permitted to go in post-independent India: infrastructure.

In the nineteenth century, most infrastructure was privately financed - the Suez Canal, Railways and Electricity. However, over time the commanding heights became the exclusive preserve of the public sector in most parts of the world. It was only after 1987 that Britain led the way by dismantling its public sector, making way for the privatisation of infrastructure. Other nations were to follow. It was, and really is, back to the future.

With a capital of Rs. 1,000 crore and subordinated debt of Rs. 650 crore, IDFC was one of the largest capitalised companies ever in India. Today our balance sheet size is over Rs. 3,500 crore with 97 projects and gross approvals and disbursements of Rs. 11,429 crore and Rs. 3,909 crore respectively.

IDFC, in the short span of five years, has developed a completely new paradigm for infrastructure financing. Encouraging the public sector to invest its resources in a manner that leverages private investments. In turn, this enables the private sector to do what it does best - provide services at least cost, benefiting ultimately, the citizen.

Amortisation financing of roads, acquisition financing in telecom, commercialisation of container berths in ports, partnerships with State Governments, creation of road funds, new decentralised infrastructure initiatives such as rural power distribution and connectivity, new structures for mandis and haathis in the agricultural sector, orienting power sector reform towards distribution, operationalisation of SEZs, are all components of the new paradigm. Not to mention the new areas to which IDFC is now directing its attention: tourism, health and education.

IDFC's activities go beyond infrastructure. It is about how we redefine India's future.