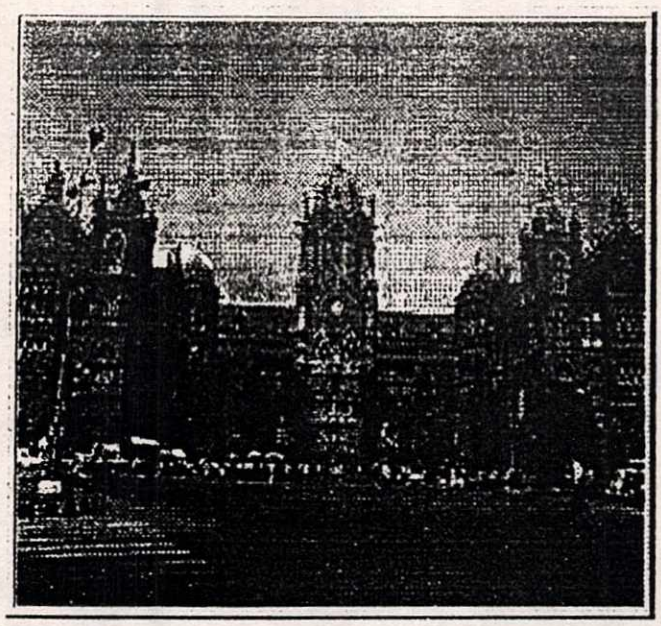
COMPREHENSIVE TRANSPORT STRATEGY DOCUMENT FOR MUMBAI

Volume - I



Prepared For

BOMBAY FIRST

by

MRS. BINA C. BALAKRISHNAN
Consultant
Transportation Planning and Engineering

COMPREHENSIVE TRANSPORT STRATEGY DOCUMENT FOR MUMBAI

VOLUME- I

MAIN REPORT

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ACKNOWLEDGEMENTS

In the course of preparing this report, I sought and received information from a large number of organizations and people, and my thanks are due to all of them.

Although my source for the reports was supposed to be only the MMRDA, I was given access to the reports with the Railways also, and I would like to thank Mr. R. S. Varshneya, Managing Director, MRVC for opening those doors for me.

In an assignment of this nature, the most important inputs are those that come from outside the printed page – from the experience of those in the profession.

This report would not be in the form it is in today without the continuous inputs I received from Mr. A.R. Gangurde, Chief, Transport and Communications, MMRDA and Mr. V.K. Phatak, Chief, Town and Country Planning, MMRDA, who gave generously of their knowledge, time and experience. My thanks are also due to Mr.P.R.K. Murthy, Senior Transportation Planner, for taking the time to locate his personal copies of the reports for me; to Mr. Anil Sule, Transportation Planner and Mrs. K. Vijayalakshmi, Dy. Transportation Planner, all of the MMRDA, for never saying no when I asked for their time. My special thanks are due to Mr. Sule for his near encyclopedic knowledge of the transportation network of Bombay and its suburbs, and the historical evolution of the street names.

Bina C. Balakrishnan
Mumbai, August 2000

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Volume I

CHAPTER –1
INTRODUCTION

1.1 BOMBAY FIRST

Bombay First is an initiative by the Bombay Chamber of Commerce and Industry, which looks at the city holistically, helping it to adapt and restructure, as economic environments alter. It aims to serve the city with the best that private business can offer.

Bombay First aims to achieve its mission by:

- Advocating: creating public opinion based on facts and researched information.
- Networking: bringing together people and institutions from diverse fields to resolve problems and find solutions.
- Catalyzing: creating an environment, by setting in motion processes whereby things begin to happen.
- Facilitating: forming an agenda for action and helping to organize resources for effective, efficient performance.

Within this framework, the Bombay First Transport Committee realized that it was time that someone took the initiative to organize the haphazard planning that is currently taking place in the transport sector in the Island City. Many of the proposals currently being implemented are based on decisions taken as far back as 40 years ago, and viewed in the context of the current transportation scenario, may be totally irrelevant or contradictive.

It was therefore decided to make a comprehensive study of all the recommendations made in the various transportation studies done for Mumbai since 1962, bring them all under one umbrella, and recommend a phased programme of implementation wherein maximum returns are obtained in the shortest possible time, for a minimum of investment. Bombay First therefore engaged an independent consultant in the field of Transportation Planning and Engineering, Mrs. Bina C. Balakrishnan, to carry out this study, under the guidance of the MMRDA. The study commenced in November, 1999, and was completed in April, 2000. This document, **Comprehensive Transport Strategy Document for Mumbai,** will be widely disseminated to the government agencies and the corporate sector and will be used for advocating important transport projects for the city. This will also be made available to the public.

1.2 Scope and Terms of Reference

The scope of the study was to examine all Comprehensive Transportation Planning Studies made for Mumbai since 1962, and also some project specific studies, like the Light Rail Transit Study and the Mumbai Metro Project- 7th Rail Corridor, the Worli Bandra Sea Link, etc. that are currently being considered for implementation.

The terms of reference were:
To summarise all the recommendations of the reports studied, and to evolve Short, Medium and Long Term Plans for their implementation.

1.3 Methodology:

Each report was studied in isolation at first, and those recommendations that had been translated from paper to ground were first screened out. This was done for each of the reports. All the remaining recommendations made in all these studies were then summarized, and consolidated to highlight commonalities.
Next, meetings were held with almost all the agencies involved in the transportation field, and plans and proposals made within their offices were also obtained. Meetings were held with the Managing Director, Mumbai Rail Vikas Corporation - Mr. R. S. Varshenya; the Chief Transport Planning Manager, Central Railways- Mr. A. K. Shrivastava; the Chief Transport Planning Manager- Western Railways- Mr. Kuldeep Chaturvedi, the Secretary of the Bombay Port Trust- Miss Tehiliani, the Chief Hydrographer, Maharashtra Maritime Board- Commander S.K.Jha; Dy. Chief Engineer, Municipal Corporation of Greater Mumbai- Dr. S. Vishwanath, the Chief Engineer (Special Projects) , PWD – Mr. R. H. Tadvi and Executive Director, Maharashtra State Road Development Corporation- Mr.R.K.Jha. They were very generous with their time and information, and we were informed of a number of on-going projects and conceptual plans with many of them, that had not originated from any of these reports, but which had been generated through a perceived need for improvement in their current area of operation.
These projects were also added to the above list, and then the whole list screened a second time round, with the Chief of Transport and Communication, MMRDA- Mr.A.V.Gangurde, and the Chief of Town and Country Planning, MMRDA - Mr. V. K. Phatak. This time the screening was for those proposals that had lost their relevance due to shifts in the transport scenario- i.e., changes in the network or in travel behaviour, or due to the introduction of a new element in the overall picture.
It was found that the bulk of the recommendations of these studies had not been implemented mainly due to the paucity of funds for such capital-intensive improvements. In the course of the study, Bombay First felt that the need of the hour was to shift the focus of improvements from capital- intensive engineering improvements to low-cost management solutions that can be easily implemented, and which will show dramatic results in a very short time.
It was also found that the level of integration between the various modes of transportation was inadequate, and this was also responsible for a lot of the ills currently plaguing the city.
The outcome of the last screening was therefore examined in the framework of "**Demand and Traffic Management before Engineering, and Integration of all Mass Transportation Services**", in order to assign priorities and arrive at a phased programme of implementation.

1.4 Limitations

1. The study was restricted to the Island City and the Suburbs of Bombay, and does not cover Navi Mumbai.
2. It was also not possible, for obvious reasons, to cover all the studies that have been made on the various aspects of the transportation system of Mumbai. However, all those considered relevant have been covered in detail.
3. Costing of projects:
   Working out the actual costs of the various projects identified was outside the scope of this study. But it was acutely felt by everyone that some ballpark figure was required to get an idea of the relative costs and quantum of finances involved in the various phases in order to mobilize resources. Towards this, therefore, the estimates made in the various studies were taken, and the costs estimated for year 2000, using the Consumer Price Index and the Wholesale Price Index for Bombay. However, it must be noted that these studies were made in 1983-84, and 1993-94, and these extrapolated costs can in no wise be considered as final. Fresh estimates of the project costs will therefore have to be called for, prior to implementation.

1.5 Further Action by Bombay First

Bombay First intends to publish this document for wider circulation, to create awareness in the public at large, of the seriousness of the problem and also the necessity for the remedial measures proposed in this document.

Bombay First will bring together the concerned agencies- that is, the MMRDA, the Western and Central Railways, the BMC, the BEST and the MMB in order to evolve an Integrated Metropolitan Transport Systems Plan, and to evolve a consensus to establish priorities within the Plan.

A High Powered Committee will be formed to monitor the planning and implementation of this strategy, comprising of representatives of the above agencies.

Bombay First will also serve as a platform to review the funding position of the various agencies, and propose innovative methods of funding to achieve the objectives of the Plan.

CHAPTER 2
BACKGROUND TO THE PROBLEM

2.1 INTRODUCTION

Bombay derives its name from the Portuguese word, "Bom Baia", which means "Good Bay". This was later corrupted by the British to "Bombay", when the East India Company moved their headquarters from Surat to Bom Baia. The original Bom Baia consisted of seven islands- Colaba, Mazagaon, Old Woman's Island, Wadala, Mahim, Parel and Matunga-Sion. These islands have since been joined together by a series of reclamations to form one large land mass.

The original residents of these islands, the Kolis, referred to it as "Mumba", after the Goddess Mumba Devi, whose temple stands at Bhuleshwar near Pydhonie. The city has now officially been renamed after this Goddess again, as "Mumbai".

The first dock of Bombay Port was constructed by the British East India Company in 1875. Since then, Bombay has grown substantially from the port town of the colonial period to the behemoth metropolis it is today. The port town served the trading pattern of the British well - the export of raw material from India, and the import of finished goods into the country. The port was situated on the southern tip of the island, and so they laid railway tracks to provide access from the hinterland to the port. Railway termini for both passenger and goods were therefore located at a stone's throw from the port. As trade and commerce grew, it was logical for the wholesale markets of all types to be located where growth was already taking place – in South Bombay. Finally, as normally happens in the wake of prosperity, the tertiary sector- i.e., banking, offices, financial institutions, insurance houses, etc. also located themselves in the same area, induced by the economies of agglomeration.

With the success of the backbay reclamation scheme in the late 1960's and early 1970's, Nariman Point became the hub of the business activity. Several offices shifted from Ballard Estate to Nariman Point, which ultimately became one of the most expensive real estate in the world, as demand pushed prices to astronomical levels.

Today, Bombay, on the western coast of India, is one of the world's largest, most crowded and most expensive cities. Its 1991 population of 14.4 million is expected to increase to 22 million by the year 2011. Bombay is the leading commercial city in India and is still one of the most important industrial centers in the country. A shift in employment from the industrial to the service sector is underway, and is expected to continue, while the informal sector employment is expected to remain important, accounting for about 30% of gainful activity now and in the future.

2.2 Present Scenario.

As this trend continued, and land became scarce, the price of land began to go beyond the reach of the common man for residential purposes. Commercial / industrial uses thus began to edge residential uses out of South Bombay. People began to settle along the railway line at increasing distances from the CBD, which was at the southern tip.

During the second half of the twentieth century, Bombay's place as the premier city, as also the financial capital of India, drew a large number of migrants to it. Refugees and migrants from the rural areas encroached on open lands, footpaths and along railway tracks. Hawkers, peddlers and homeless beggars abounded. Slums mushroomed in the island, especially along the railway tracks.

Spiraling land values in the CBD and the island city prompted the conversion of several residential apartments on the lower floors of buildings to commercial uses, resulting in a highly mixed type of land use pattern. Job opportunities therefore, continued to remain high in the CBD and the island, with the result that a tidal pattern of commuting developed in the city.

In the mid-eighties, with the launch of the Maruti- "The common man's car", vehicle ownership increased. Easy finance from non-banking financial companies and other financial institutions made ownership of personal transport very easy. The increasing volumes of vehicles being sold in India attracted international car manufacturers to set up manufacturing facilities in India, which in turn enlarged the market for all types of personal transport. Increases in incomes increased the vehicle ownership per family, and the streets of Mumbai, designed for an era of horse-drawn carriages, suddenly became a nightmare of gas- belching automobiles, leaving noise, pollution and environmental deterioration in its wake.

Mumbai today has 3,10,943 private cars, 3,79,441 two-wheelers, 1,06,114 three-wheelers, 49,341 taxis, 8,426 buses, and 36,530 trucks, tankers, etc., adding to a total of 8,90,795 vehicles.

2.3 Transportation Network

The linear form of the island has resulted in a unique transportation network. The city is served both by road and rail systems, both of which are linear in pattern, and run in a north-south direction.

2.3.1 Rail Network:

The suburban railway service is provided by the Western Railway and the Central Railway, operating along the West Coast and the East Coast respectively. There are currently 5 rail corridors, two on the Western and three on the Central Railway.

The suburban services on the Western Railway stretch from Churchgate to Borivili and Churchgate to Virar, and on the Central Railway, from Chatrapati Shivaji Terminus (CST) to Karjat and CST to Kasara on the Main Line, and upto Panvel, New Bombay on the Harbour Line, with a branch from Wadala Road to Mahim, Bandra and Andheri.

The suburban railway system runs about 2000 trains per day, with a complex pattern of slow, fast and semi-fast trains on both Western and Central Railway corridors. The morning peak is between 8.30 am and 11.00am, and the evening peak is from 5.00 pm to 8.00pm. Frequency of trains at present is 3-4 minutes. The total number of trains run per day is 922 on WR and 1077 on CR. Conditions of travel are unbearable, even in the first class section.

The lack of integration between the two suburban service providers, and the absence of any East-West link causes enormous strain to the traveling public in terms of longer distances and time of commute, longer periods of stress. The costs of travel are higher, because of more circuitous routes. The only point of integration of the two services is at Dadar.

2.3.2 Road Network:

The road network has three main North-South corridors, the Western Corridor, the Central Corridor and the Eastern Corridor. Of these, the Eastern Corridor carries heavy truck traffic, and is therefore generally avoided by the average motorist. This route- along Rafi Ahmed Kidwai Road, Jakeria Bunder Road, Nath Pai Road, P. D'Mello Road, and Shahid Bhagat Singh Road, hugs the Eastern coast along the Port Trust land, and ends in Ballard Estate.

The Central Corridor runs along Mohammed Ali Road, J.J. Road and Dr. B. Ambedkar Road, and terminates at Sion. An additional corridor is available along N.M. Joshi Marg, Gokhale Road and Lady Jamshetji Road.

The Western Corridor, which seems to be the most popular, offering a slightly better level of service in terms of road width, linked traffic signal system and intense management by the police, runs along Marine Drive, Peddar Road, Bhulabai Desai Road, Lala Lajpat Rai Marg, Dr. Annie Besant Road, Cadell Road/ Lady Jehangir Road upto Mahim, where it joins Swami Vivekanand Road to feed the suburbs. In the Island City, road widths are mainly two lanes in each direction, with a few roads having been upgraded to three lanes in each direction.

There are very few East-West routes with continuity across the Island, due to the limited crossings of the railway line and the density of development. Consequently, traffic is concentrated on a few routes, which become heavily congested.

The road network of the city is organic in nature, and was constructed before the advent of the automobile. These roads were not meant to cater to the traffic of the magnitude using them today. The north-south orientation of the arterial roads has

been dictated by the geography of the island, but serves the trend of feeding the CBD during the day and the suburbs in the evenings. Many segments are poorly suited to the function they now perform, with resultant congestion, extreme delays, poor journey speeds, and degradation in environmental quality.

The road network is currently being extended and improved by the addition of a number of over bridges, link roads and flyovers to relieve congested junctions.

2.4 Commuting Pattern

The daily commuter travel pattern swings like a pendulum to the CBD in the south in the mornings, and then swings back to the dormitories in the north in the evenings.
Mass transportation takes the brunt of the traffic load, bringing over 80% of the commuters to their destinations in the CBD. Of this the major share is obviously the railways, who carry a crush load of 4500 –5000 passengers per train, as against the design load of 1800 passengers, and a maximum load of 3600 passengers per 9-car train.

The tide of commuters flows south from the residential dormitories in the northern suburbs, to the work centres in the south. The bulk of this tide spews out of the suburban stations of Churchgate and Chattrapati Shivaji Terminus (Victoria Terminus) in the mornings, and then is swallowed back in the evenings, when the tide reverses. The area around these stations is a sea of humanity during the peak hours of the morning and evening, flowing at will through the transportation channels to their final destinations, mainly in Fort, Nariman Point and Cuffe Parade. The suburban trains carry about 22040 Lakh persons per day, which together with the BEST buses accounts for about 88% of the work trips performed per day in Mumbai. The remaining 12% travel to work by other modes, including private cars and taxis.

On the suburban train corridors, the only point at which there is integration of the two services is at Dadar. Consequently, commuters wishing to cross the railway corridors at any point are forced to travel upto Dadar and change from Western Railway to Central Railway or vice versa, in order to get to their destinations. This obviously loads the trains upto Dadar far beyond their capacity, while both terminals at Dadar are like a turbulent estuary, where two opposing waves of humanity clash in an attempt to change direction.

On the road network, during peak hours, all arterial roads are operating at maximum capacity, carrying bumper-to-bumper traffic at speeds as low as 15- 20 kmph, with average journey time of about 90 minutes for a distance of about 20 kms, while for the buses the average speed is as low as 6 kmph. On many arterials, one lane is borrowed from the opposite carriageway in order to accommodate traffic in the peak direction. Roads that are actually designed as 2-lane manage to squeeze in a third

lane, and lateral clearance between the lanes is practically only paint-width. This causes a further reduction in speeds, and at an intersection, the discharge capacity gets affected, when 3-4 lanes bottleneck down to 2 lanes. Queue build-ups very often extend the length of the road into the junction behind, effectively locking it. Buses stopping at the bus stop hold up the entire lane behind it, while merging/ diverging movements of buses in the absence of bus bays effectively stop all traffic behind them.

Brihan Mumbai Electric Supply and Transport Undertaking (BEST), which provides road based mass transportation in Mumbai has 27 bus depots, and a fleet of 3469 buses, which comprise single decker, double decker, CNG and A/C buses. The BEST provides transportation to about 45 lakh passengers per day.

In addition to the BEST, there are also a large number of private bus operators who provide contract services to those who want and are willing to pay for a better level of service than that afforded by the trains and the buses. This is, of course a para transit, or intermediate public transport service, where the level of service lies between that of a private mode and a public transport service. Normally these buses operate a point- to- point service, and the comfort level is quite high. During peak hours, taxis operate a shared-taxi service from railway stations to various destinations in commercial complexes, from designated stands. Peak hour traffic therefore finds almost one whole lane taken up by a large volume of these taxis who collect a substantial volume of passengers at these points.

2.5 Traffic Environment.

Once a model of efficiency, the suburban train system is almost crippled by the loads it carries, and the conditions it operates in. Slums almost along its entire length have curtailed lateral clearance so as to reduce speeds to10 –15 kmph on certain sections, from a maximum operating speed of 80 kmph. Slum dwellers are so inured to the proximity of the locomotive that they continue to squat on the tracks even in the face of an approaching train. Despite low speeds and extreme vigilance on the part of the motormen, accident rates have been high. In 1998, the number of run-over cases on the Central Railways was 572, in 1999 it was 637, and in the first half of 2000, it is already 358 cases. To make matters worse, the slum dwellers have discovered a dangerous past- time – throwing stones at a moving train. There have been several instances in the past year, where innocent commuters have lost an eye to this devilish past- time of the slum dwellers.

Limited road widths, mixed land uses, heavy demand for limited supply of parking, encroachment of footpaths and open spaces and along railway tracks and very high volumes of traffic combine to create a very poor traffic environment.
Traffic in the suburbs is highly mixed, although in the island, three- wheelers and other slow moving vehicles are banned. Direct access to individual properties takes place along all roads in the island, and vehicles slowing down to access these

properties hold up an entire stream behind them. Vehicles leaving these properties to enter the stream do not try to merge, but cut across at least two lanes, causing further delays to the traffic stream. On- street parking maneuvers are another source of friction. To make matters worse, drivers impatient with low speeds and continuous interruptions refuse a legitimate lane- changing request, forcing the other driver to slow down.

Off-peak traffic movement exhibits very high lateral movement of the traffic. Drivers change lanes at random, and for no reason but that one car space is available in the adjoining lane.

Pedestrian volumes are always high, and during peak hours, it is extremely high. However, design of pedestrian facilities is very poor, and in many cases, non-existent. Several of the major arterials have been designed with footpaths, but these have all been encroached upon by hawkers or slum dwellers, denying the pedestrian his rightful, safe environment, and forcing him to walk along the kerb-side lane of the carriageway in a highly risky manner, causing conflicts with vehicles and loss of carriageway capacity. This has become such an accepted part of the Mumbaikars' psyche, that even where there is a footpath available, he walks on the carriageway. Illegal garages, mixed land uses that require loading and unloading of commercial goods, take up another half of lane. Pedestrians are always in a highly exposed situation on the streets of Mumbai, weaving an obstacle course between parked vehicles and other hurdles in their path. In flagrant violation of all traffic rules, pedestrians and moving vehicles vie for the right to cross the junction at the same time.
Absence of pedestrian facilities results in mass jaywalking around bus stops, and at railway stations, a moving wall of pedestrians effectively dams the vehicular flow, at any random point.
Beggars –varying in age from babes-in arms to grandmothers- hang around signals, and as soon as the stream halts at a red light, they approach the vehicles for alms. Street urchins have been engaged for the marketing of books, periodicals and mineral water at the same junctions, with the result that as soon as the vehicle stream halts, there is an army of walkers weaving between the vehicles, all along the length of the queue.

2.6 Environmental Deterioration:

The uncontrolled growth of the city has had a number of undesirable fallouts, apart from the increase in vehicular traffic. A by-product of this, especially in Bombay where almost all the roads have residential uses abutting, is deteriorating levels of health due to very poor air quality, noise and vibration.
Studies show that the health of residents on major arterials is badly affected by noise and air pollution, with a very high incidence of asthma and other respiratory diseases. The worst sufferers are the children. It has been found that the percentage of children with asthma has increased substantially in the past decade. It is estimated

that annually, about 2.2 lakh children and 24,000 adults suffer the consequences of air pollution in Mumbai. About 60% of the policemen suffer from respiratory diseases, including lung cancer, while 81% of the taxi drivers suffer from windpipe congestion.

Studies show that 69% of the air pollution of Mumbai is caused by vehicular pollution. Of the 24 mega cities studied by the WHO on Urban Air Pollution in 1992, alarmingly high levels of SPM (Suspended Particulate Matter) were reported in Mumbai, Calcutta and Delhi, which ranked 3rd, 6th and 7th respectively.

The following table gives the average annual levels of various pollutants in Mumbai, with a comparison to the prescribed international and Indian standards. It will be noted that the Indian standards are far more stringent than the WHO standards.

Table 2.1 Average Annual readings of Pollutants for Mumbai (micrograms per cubic metre)

Pollutant	Annual Average	NAAQS (India)	WHO Std
SPM	226	140 (Residential)	75 All
Sox	27	60	50 All
Nox	26	60	100 (US-EPA)
CO	5 ppm	4 ppm	Max exposure 100 ppm for 15 mts.
Benzene	Not regularly monitored		

Source: CLEAN AIR ("Slow Murder- The deadly story of Vehicular Pollution in India"-Centre for Science and Environment)

The table gives the average figure for all of Mumbai, but the spot readings are very much worse. SPM measured at Worli was as high as 645 micro gms/ cu.m., while at Sion it is a terrifying 1365 micro gms /cu.m. At Parel, it is 834 micro gms / cu.m., while even Colaba has 265 micro gms./ cu.m of SPM.

Although the levels of Benzene are not regularly monitored, a study conducted by NEERI measured the emission levels of Benzene at a few places. The results are shown in the following table. As is well known, Benzene is a carcinogenic compound.

Table 2.2 Emission Levels of Benzene at a few locations.

Junction	Benzene Levels	WHO PELs	EC
Haji Ali	100- 660 ppb	5ppb	1 ppb in the long term and 5 ppb in the short term
Worli Naka	120-320 ppb	5 ppb	
Pertol Station	56 –970 ppb	5 ppb	

PELs: Permissible Emission Levels; ppb – parts per billion

Source: CLEAN AIR (The Times of India, dated 28/9/99)

2.7 Institutional Aspects

There are a vast number of agencies in Mumbai who are collectively responsible for the construction, design, maintenance and operation of the transportation services. Each of them seem to be operating in their own water tight compartments, with the result that the resident of Mumbai is often left with a sense of helplessness at the plethora of well-meaning plans that seem to come at him with no sense of direction.

These agencies are

1. The Mumbai Metropolitan Region Development Authority (MMRDA)
2. The Department of Transport,
3. The Motor Vehicles Department,
4. Ports Organisation and Department of Inland Water Transport,
5. Urban Development Department,
6. Public Works Department (PWD)
7. Greater Mumbai Traffic Police,
8. Municipal Corporation of Greater Mumbai, (MCGB)
9. Brihan Mumbai Electric Supply and Transport Undertaking (BEST)
10. Maharashtra State Road Transport Corporation (MSRTC)
11. The Indian Railways
12. Private Bus associations.
13. The Maharashtra State Road Development Corporation (MSRDC)

A brief outline on each of these agencies is given in Annexure No.7, giving their specific areas of control and jurisdiction. It then becomes apparent why there seems to be such lack of coordination in the transportation systems of Mumbai. Mention is made here of the aspect of traffic control and management, which seems to be no-body's child, is therefore tossed between the Traffic Police and the BMC, and generally ends up falling between the two of them.

As per the Motor Vehicles Act and the Bombay Police Act, the function of Traffic Management lies with the Traffic Police, who, in the absence of in-house resources, access all their engineering requirements from the BMC. The Traffic Police and the BMC currently function in complementary roles, with the decisions regarding the requirement and location of traffic management aids like signals, road signs and markings, etc. resting with the Traffic Police, whilst the installation is done by the BMC. The Traffic Police and the BMC co-ordinate with each other on a continuous basis.

However, the BMC does not have a separate fund for Traffic and Transportation or for Traffic Management, because these do not find mention in the BMC Act. Funds

are allocated for construction and repair/ maintenance of roads, but not for aids to control traffic. In actual practice, however, at the discretion of the Municipal Commissioner, a small allocation is made for expenditure on traffic control aids.

The Traffic Police, based on their observations, decide on the location of a particular sign or road marking, and then approach the BMC for the installation of the same. The BMC accordingly carries out the instructions, and submits a bill for the charges incurred to the Traffic Police, who in turn forward it to the Home Department. The expenditure on Traffic Management aids was therefore, until 1996, met as a grant-in-aid to the BMC through the Traffic Police. However, since 1996, this arrangement has been terminated by the Home Department, who are now willing to pay only 50% of the cost of installing a NEW Signal, and refuses to meet the expenses of maintenance of traffic control aids.

The entire burden of maintenance therefore, now lies with the BMC, who not just do not have any provision for this, but are already burdened with a deficit of Rs.614 Crores. Until 1996, the BMC's expenditure on Traffic Management aids was in the range of Rs. 5- Rs 6 Crores. This year, however, it has been reduced to Rs. 2.5 Crores. It must be noted that this amount of Rs. 2.5 Crores includes expenditure on new signals, repair and maintenance of existing one, improvement of street lighting, festival lighting (during the Ganpathy and Moharram festivals, for instance) etc.

CHAPTER – 3
OUTLINE OF REPORTS

The list of studies done on Bombay was provided by the MMRDA, and from this list those studies that were of maximum relevance to the city were selected for this project. A brief outline of the reports studied is given below, while a more detailed summary of each is given in the Annexures in Volume II of this Report. The summary highlights the recommendations of the studies, with a brief note on the costs and approach. For further detail, the reader is referred to the original reports, which will be available in the MMRDA or the Bombay First Libraries.

3.1 Wilbur Smith and Associates: Bombay Traffic and Transportation Study, 1962

This study was carried out between 1962 and 1963, and was financed by a World Bank loan and sponsored by the Central Government, the State of Maharashtra and the Bombay Municipal Corporation. The recommendations of the study have been based on the belief that "The traffic of Bombay can be adequately served only by freeways. If urban freeways are not constructed, congestion will increase to such a point as to seriously retard future economic growth and increase substantially the cost of travel in the area." The concept that a dedicated road network was required to move traffic efficiently from origin to destination found expression in a system of high speed roads, with the city bound by a set of freeways and criss-crossed by expressways, all liberally served by interchanges.

The key recommendations of this study were the West Island Freeway, including the Worli Bandra Sea Link, the East Island Freeway, the Western Expressway, the Eastern Expressway, the Mahim Creek Connector and the Cross Island Connectors.

Mass transportation, however, received very little attention in this study, although the modal split was already in favour of mass transportation.

The total cost of the recommendations made in this study was Rs.9,318 Lakhs. Of the expressways and freeways recommended, at a cost of Rs.7609 Lakhs, none have been constructed. The Bandra-Worli Sea Link and the Worli Nariman Point Sea Link currently being actively pursued for implementation by the MSRDC are part of the West Island Freeway as recommended in this study.

Only 8 of the 25 recommended roads of the Major Street Plan have been widened or constructed. Interestingly, the Andheri-Ghatkopar Link Road, the Santa Cruz- Chembur Link Road (SCLR) and the Jogeshwari-Vikhroli Link Roads (JVLR) are all part of the recommendations of this study.

3.2 Traffic Cell, Town Planning and Valuation Department: The Mass Transportation Study, 1969

This study was a sequel to the 1962 study, and was intended to fill the gap left with regard to mass transportation in the earlier study. The objective was to determine the existing conditions of mass transportation services, to determine

future travel desire lines and to evolve a comprehensive, long term mass transportation plan. Travel projections were made upto 1981, to coincide with the Wilbur Smith Study. These projections formed to basis for identifying the 6th and 7th rail corridors.
Most of the recommendations of this study have been, or are in the process of being, implemented.

3.3 Central Road Research Institute, New Delhi: Planning of Road System for Bombay Metropolitan Region, 1983

With the accelerated growth of population in the suburbs and the outer areas, and the definition of Bombay Metropolitan Region, it was felt necessary to review the Wilbur Smith proposals. The Central Road Research Institute was therefore engaged by the Government of Maharashtra, with the main objective of developing an arterial road network for the Bombay Metropolitan Region.

In addition to re-validating the recommendations of the Wilbur Smith Study, this study gives detailed alignment plans, designs for interchanges, junction improvement plans and also detailed designs for improvement of station areas. The study report runs into six volumes. The main emphasis is on improvements in the road network. However, probable improvements in the mass transportation services of the city have not been given adequate attention.

The total cost of the recommendations was Rs.83, 516.36 Lakhs. Again, none of the freeways and expressways have been constructed. Only the Drainage Channel Road and the Sion –Mahim Link Road have been constructed out of a total of 11 roads recommended. Of the 15 junction designs given in detail, 10 have been implemented with regard to geometrics and signalisation. Four of the designs have been replaced by flyovers. Improvements to a few railway stations, and some pedestrian facilities, as recommended in the study, are going on.

3.4 Passenger Water Transport Around Bombay: Report of the Expert Group for the Study of Development of Waterways around Bombay Harbour for Commuter Traffic, (Dutta Committee), February 1983

In 1982, realising the need for exploring the use of the waters around Bombay for passenger movement, The Government of Maharashtra appointed an Expert Group under the chairmanship of Vice Admiral N. P. Dutta to examine the feasibility of establishing passenger water transport around Bombay. Given the North-South pendulum swing of the travel pattern in Bombay, the possible routes for PWT services are:

- Along the West Coast (WC) in a North –South direction
- Along the East Coast in a North-South direction
- Along the Harbour and/or Thane Creek in the East-West direction.

This report examines the feasibility of operating passenger water transport services and locating terminals along these routes. The recommendations are

that these services would be very feasible along the East Coast and across the harbour, in the East-West direction. Services along the West coast would run into problems during the monsoons, as the West Coast is a totally exposed lee shore.
None of the recommendations of this study have been implemented.

3.5 Paranjpe Committee: Report of the High Level Committee for Prioritisation of Road Works in Greater Bombay, May, 1988

This is the outcome of an examination of all the studies done on the traffic and transportation problems of Bombay, and lengthy discussions held with various groups of interested organizations and individuals, peoples' representatives and experts. The terms of reference of the Committee were to work out a package of various short and long-term measures for easing the traffic congestion in Greater Bombay.
The recommendations of the Committee included traffic management proposals designed to give immediate relief to the commuter, and which could be implemented immediately, at a cost of Rs. 5 Crores, and another set of recommendations to be completed within two years at a cost of Rs. 12 Crores. However most of these "immediate remedial measures" were not implemented. The Committee also prepared a medium term plan costing about Rs. 56 Crores, meant to be completed within 3- 4 years and a long term plan costing Rs. 185 Crores, which was meant to be taken up for implementation in the 8th Five Year Plan period.
The Committee largely went by the proposals of the CRRI Study, re-emphasising the necessity of the recommendations. In addition, it came up with a large number of traffic management schemes, a few of which have been implemented. Several large markets have been shifted out of Bombay, no new reclamation is permitted in South Bombay, and an intercity bus terminus has been constructed at Wadala.
One of the recommendations of this committee- for the restraint of traffic entering the Island City by the number plate method- has been recommended for immediate implementation by the V.M. Lal Committee.

3.6 W.S. Atkins International et al: Comprehensive Transport Plan For Bombay Metropolitan Region, 1994

This study assess the prospects for transport in the Bombay Metropolitan Region, given the present direction of policies, and goes on to recommend a strategy for transport development in the region. This includes investment projects and policies for pricing and control of road traffic.
Economic analysis shows that the aggregate economic return is highest for a strategy with substantial investment in the metropolitan railway system and a modest investment in the road system. The study therefore recommends augmenting and optimizing the railway system and to an extent, the bus services also.

However, it is clearly stated that, "There is no case for major road improvements within the island city as in most cases the cost is very high and parking capacity to accommodate ever increasing number of private vehicles cannot realistically be achieved in the major south island destinations." Improvements in the road system, therefore, especially in the island city, is through traffic management measures. The recommended strategy emphasizes the need for using traffic restraint measures as a key instrument towards demand management, especially in the Island City.

There are a large number of recommendations for improving the suburban railway system, most of which have been, or are in the process of being, implemented. Roads in the suburbs have been approached with the objective of improving east-west connectivity, and all level crossings over major arterials have been recommended to be provided with road-over bridges, to avoid delays. Many of these roads and road over bridges have been included in the Mumbai Urban Transport Project, to be funded by the World Bank.

The recommended strategy covers investments worth a total of Rs.11,300 Crores, including rail system investments of Rs. 7,000 Crores, bus and ferry system investments of Rs. 570 Crores and a highway programme of Rs. 3,730 Crores including a substantial traffic engineering and management component.

3.6(a) W.S. Atkins International et al: Comprehensive Transport Plan for Bombay Metropolitan Region; Technical Working Paper No.1: Institutional Arrangements

3.6(b) W.S. Atkins International et al: Comprehensive Transport Plan for Bombay Metropolitan Region; Technical Working Paper No.9, Part 1.

The main study report is accompanied by several very interesting and relevant working papers, most of which have not been studied here. The two that have been studied are mentioned above. Technical Paper No. 1, which gives an analysis of the various agencies and institutions involved in the transport sector of Mumbai, has been summarized in the Annexures. Technical Paper No 9, which gives novel methods of funding for transportation projects, has also been studied in detail and summarized in the Annexures. There are several methods of funding mentioned here that can be applied to Mumbai.

3.7. Mumbai Metropolitan Region Development Authority: Regional Plan for Mumbai Metropolitan Region- 1990-2010

The transportation plan as suggested by W.S. Atkins forms part of the Regional Plan, and therefore has not been presented separately.

3.8 Mumbai Metro Planning Group: Mumbai Metro Study – 7th Rail Corridor, June 1997

The existing railway network handles about 50 lakh person trips per day, but insufficient investment on railway infrastructure has resulted in

overcrowding levels reaching a peak value of 4500 to 6000 commuters per train as against the seating capacity of 900, design capacity of 1800 and tolerable limiting capacity of 2600 per train. Many railway commuters have been found to have both the desire and capacity to pay fares commensurate with the quality of service provided, and with the freedom to set fares as determined by costs and the market forces, there is a distinct possibility of attracting private investments in new rail corridor projects.

The principal objective of this study therefore is to determine if a new rail commuter corridor can be built and operated with private investment. The study examines the feasibility of constructing and maintaining the 7th rail corridor as a heavy metro, and covers a detailed techno-economic study, market survey, estimates of ridership on the new corridors, cost estimates of capital investments and operation, revenue expected and other financial aspects.

The conclusion of the study is that the seventh corridor would have the estimated traffic only if it is operated for the full length, and therefore, operational phasing is not recommended. It should be implemented as a BOOT project, with a concession period of 30 years.

The total cost of the project is estimated at Rs.7,433.63 Crores, which includes cost of infrastructure building, signaling and telecommunication and electrical equipment, rolling stock, etc.

There is very little interest in this project, in view of the high cost, as well as the fact that it would not really serve the interests of the commuting public.

3.9 Consulting Engineering Services: Mumbai Trans Harbour Link: Feasibility Study, January 1998

This report reviews and updates the feasibility study of MTHL northern link and presents the project on a commercial format to be implemented on BOT basis. The Trans-Harbour Link is proposed to connect Sewri on the island side with Nhava on the mainland side. It is proposed as a Rail-cum-Road Link.

Since provision of this link will place an additional burden on the existing surrounding road network, especially on the island side, construction of this link will therefore have to be coupled with provision of certain road links and /or improvements of the existing roads for proper dispersal of traffic at both ends. The principal one is the Eastern Freeway, including its Wadala and Anik Connector, linking the Western and Eastern Freeways. In order to handle the traffic flows estimated, suitable interchange layouts need to be planned to cope with the horizon year peak hour traffic flow. The consultants recommend an underpass scheme for the terminal at Sewri, while the Nhava terminal at Surangapada / north of Chirle is proposed to be provided with a trumpet interchange to cater to the traffic destined to the south (at Uran), north (at Panvel and Belapur) and to the east (towards Pune and NH-17) via the Mumbai-Pune expressway corridor.

The MTHL rail link is to be integrated with the 6th Rail Corridor on the island side. The 6th Rail Corridor at Sewri is proposed as an elevated (1st level) facility. The MTHL Rail is also proposed to run at 1st level and connect at north and south of the 6th rail corridor. On the mainland side, the MTHL Rail Link is to be connected with the proposed Belapur- Uran Railway line between the stations at Kharkopar and Gavhan, and later to meet with the Panvel-Karjat railway line, which is currently under construction.

The cost has been updated by M/s Consulting Engineering Services to Rs.13,500 million, in this report (1997) for an embankment approach, and Rs.15,500 million for a viaduct approach replacing embankments on Sewri and Nhava mud flats.

It also seems that if the proposed international airport at Mandwa does not come up, the Trans- Harbour Link may not be justified. There is a line of thinking that this link may be included as part of the international airport infrastructure, as without this, the airport may not be fully utilized. The environmental clearance for this project is still pending.

This project is currently being actively pursued by the MSRDC, for construction as a Road-cum –rail Link, on a BOT basis.

3.10 Feasibility Assessment for Mass Rapid Transit for Mumbai CBD, December 1999: Selection of a Mass Rapid Transit System for Mumbai (SMART)

The SMART project was started in November 1997, and was carried out by a consortium of German and Indian consultants, with MMRDA as the nodal agency. The project consisted of two study areas-

- Mumbai CBD, defined as the area south of Chatrapati Shivaji Terminus and Churchgate stations, extending south upto the World Trade Centre, and
- Greater Mumbai, excluding the CBD, comprising the area north of CST and Churchgate Stations, to the boundary of Greater Mumbai.

The study objective was to identify two rail- based Mass Rapid Transit (MRT) Systems which are bankable, one for the CBD and one in Greater Mumbai outside the CBD, and to develop feasibility studies for the two projects.

The alignment selected for the CBD starts from CST and runs via Hutatma Chowk and Churchgate, then goes south via Jamshetji Tata Road to Madam Cama Road, where it passes Mantralaya. From there it turns south via Badhwar Park to the World Trade Centre. The total length of the alignment is 4.3 Kms. Analysis of the carrying capacities and costs was in favour of Light Rail Transit (LRT) over Heavy Metro as the preferred system for the CBD.

Since the CBD of Mumbai is a mature, fully developed area suffering from a considerable degree of surface congestion, it is not possible for LRT to

operate at grade along existing roads. The optimal vertical alignment selected has the LRT underground from CST to south of Churchgate, and elevated from there to World Trade Centre. This option was selected keeping in view the aesthetic impact on the heritage buildings on D.N. Road and Martyr's Monument.

The proposed LRT system will serve as a distributor system for the numerous rail passengers arriving at CST and Churchgate on the way to their destinations- mostly in the CBD area, thus forming part of an integrated public transport system for Mumbai. The present deficiency in the existing rail system – that it ends too far north for passengers with destinations in the CBD- will be reduced. The interfaces between the two systems will be at CST and Churchgate.

3.11 Feasibility Assessment for Mass Rapid Transit for Greater Mumbai, December 1999: Selection of a Mass Rapid Transit System for Mumbai (SMART)

The alignment of MRT for Greater Mumbai was selected from a wide range of potential alignments, each of which was evaluated with regard to parameters related to ridership, population, growth of catchment area, integration with other existing public transport, environmental acceptability, etc. The most feasible alignment was selected as C5, Andheri to Ghatkopar, with a spur to Sahar, because

- North –South movements are already served by the railways
- East-West movements are not catered to at present. The East-west link will also take the pressure off the interchange at Dadar between Central Railway and Western Railway.
- It could include a connection to serve the international airport at Sahar.
- This alignment could be extended at a later date to the northwest (Charkop Village), northeast (Mulund) and south (via the Western Express Highway.

The system design allows for direct train runs between Andheri and Ghatkopar, and Andheri and Sahar. There is no direct link between Ghatkopar and the Airport. The proposed line will be electrified, double track, standard gauge line. The third terminal at Sahar has one track only because of low demand. The stations along this line will be at Andheri Station, Western Express Highway, Chakala, Airport Road with branch to Sahar International Airport, Marol Naka, Saki Naka, Subash Nagar, Asalpha Road and Ghatkopar Station. The lengthy of the run between Andheri and Ghatkopar is 7.826 Kms, and between Andheri and Sahar is 4.431 Kms.

At-grade alignments were in general ruled out because of conflicts with road traffic and unavailability of space. The alignment is therefore elevated for the entire stretch, except for the section below the Western Express Highway of MV Road. Here, the alignment of the elevated right of way is blocked by the

current construction of the flyover-cum-shopping mall. At this section, it is necessary to have a tunnel section.

It was decided that an MRT system based on the use of RRT (Rapid rail Transit) technology, operating on a completely segregated alignment was the most appropriate technology. RRT has the high capacity characteristics of Heavy Metro, but retains the horizontal and vertical design characteristics of Light Rail.

3.12 MMRDA: Mumbai Urban Transport Project, April 2000

The first Bombay Urban Transport Project (BUTP) was taken up in 1977 and completed in 1984, at a cost of Rs. 390 million, with a World Bank loan of US $ 25 million. This project had focused on the BEST services, augmenting the fleet and adding a few depots, while at the same time installing a modern traffic signaling system to control 76 junctions in the CBD. A number of road over bridges were also constructed.

Based on the success of the first BUTP, the second such project- BUTP-II, was prepared in 1985 for seeking World Bank assistance. Now called Mumbai Urban Transport Project (MUTP), its project development objectives are

- to enhance the **capacity, efficiency and financial viability** of the urban transport system in MMR, **particularly the mass transport system**, by appropriate investments in transport infrastructure, complemented by appropriate policies on key issues
- to promote institutional development and capacity building for efficient and sustainable management of transport sector

Based on the project preparation studies, the components of MUTP have been identified. The total estimated costs of the main components are given in the table below:

Sl.No.	Component	Estimated Cost (Rs. In Crores)	Percent-age
1	Rail Component	2842	73.62
	R & R for Railway projects	265	6.87
	Total for Railways	3107	**80.49**
2	Non-Rail Component		
a)	Road Improvements, ROBs & New Roads	385	9.97
b)	Procurement of Buses	120	3.11
c)	Traffic Management	65	1.68
d)	R & R for Road Projects	108	
3	Technology acquisition, technical assistance & training	50	1.30
4	Environment – air quality	25	0.65
	TOTAL	3860	100.00

The World Bank will provide a loan to the extent of 61% of the total project cost, and the balance amount will have to be provided as counterpart funds by the implementing agencies. The implementation period of MUTP is 5 years, 2000- 2005.

CHAPTER- 4
FINDINGS AND OBSERVATIONS

4.1 Findings from the Studies

1. The population of Bombay Island has increased only marginally from 1971 to 1991, and is expected to drop in 2001 and 2011. But in the suburbs, the population has increased by over 130% from'71 to 91, and is expected to more than treble by 2011. The vehicle statistics however, show an increase of almost 440% during the '71 to '91 period. The number of bus passengers increased by about 83% in the decade 1971 to 1981 but dropped by almost 4% in the next decade. This could be due to increased ownership of two-wheelers.
2. The suburban rail passenger traffic shows an increase of over 50% each decade, with the decade '61-'71 showing almost 100% increase in the number of commuters.
3. Increases in income and vehicle ownership, coupled with poor traveling conditions on the suburban trains have caused a spillover from the trains onto the roads, with resultant increase in the volume of traffic using the road network.
4. The first study for Bombay was carried out in 1962, when the need was perceived for long range planning to pre-empt the problems of Bombay's rapid expansion. The network of arterial roads in the Island city today is the same as it was in 1962, the only difference being the flyovers that have been constructed all over the network. In 1962, the population in Greater Bombay was 43.45 Lakhs. The vehicular population was a mere 61,381 vehicles, with cars forming 36,899 of this figure. In 1991, the area under roads in the Island City remains almost unchanged, at about 13%, the population in the Island City *alone* stands at over 32 Lakhs, but the vehicular population has increased to a whopping 8.91 Lakhs in the Region.
5. Most of the job opportunities continue to be concentrated in the Island and in the CBD, which is at the southern tip of the Island, while the residential areas are concentrated in the northern suburbs.
6. The fixed land mass and the intensity of development on the Island make any widening or augmentation of the existing road transportation network to accommodate more traffic very difficult.
7. The two key comprehensive studies with wide ranging proposals are the 1962 Wilbur Smith Study and the 1994 W.S. Atkins Study. The CRRI study primarily validated the Wilbur Smith Study, while the Paranjpe Committee studied the recommendations of the earlier studies and incorporated the recommendations of experts and the public. The 1962 Wilbur Smith Study and the 1994 W.S. Atkins Study therefore, have been examined in relation to each other.

Table: 4.3 Break-up of Population in BMR (in '000)

Area	1971	1981	1991	2001	2011
Bombay Island	3070	3285	3275	3000	2825
Bom. Suburbs	2900	4958	6750	8430	10106
Gr. Bombay	5970	8243	9925	11430	12931

Source: Draft Regional Plan for MMR-1996-2011, Task Force for Decongestion of Bombay

8. The total cost involved in the 1962 study by Wilbur Smith was Rs.9,318 Lakhs- out of which Rs. 2,412 Lakhs was for the West Island Freeway alone. Of the expressways and freeways recommended, at a cost of Rs.7609 Lakhs, none have been constructed. Only 8 of the 25 recommended roads of the Major Street Plan have been widened or constructed. Interestingly, the Andheri-Ghatkopar Link Road, the Santa Cruz- Chembur Link Road (SCLR) and the Jogeshwari-Vikhroli Link Roads (JVLR) are all part of the recommendations of this study. The original estimate for the AGLR was Rs.92 Lakhs, the SCLR was Rs. 60 Lakhs and the JVLR Rs 55 Lakhs. The SCLR and the JVLR are today part of the World Bank aided MUTP, at a cost of Rs.80.3 Crores and Rs.73.5 Crores respectively.
9. The CRRI study in 1983 re-validated this study, giving in addition, the detailed designs for several interchanges and intersections. Twenty years after the Wilbur Smith study, the total costs of their recommendations as estimated by CRRI stood at Rs. 83,516.36 Lakhs, with the Freeways and Expressways accounting for Rs. 49,027 Lakhs. The Paranjpe Committee attempted to initiate the implementation of some of the recommendations from the CRRI study, but again, nothing much came of that either.
10. A detailed study of the reports found that almost all of them have approached the problem from the engineering angle. Except for the W.S. Atkins Study, all had recommended engineering improvements to the road network- i.e. higher levels of control at junctions- which generally means flyovers, roadways to be upgraded to freeway and expressway standards, etc. as a means of improving the traffic conditions to accommodate the increasing volumes of vehicular traffic.
11. The over-riding reason for non-implementation of these recommendations is the non-availability of funds of the magnitude involved in all of them.
12. The total cost of the W.S. Atkins study of 1994 is Rs.4,045 Cr in the first phase, out of which Rs.2,300 Crores has been identified as top priority and potentially affordable.

Table- 4.1 Vehicle and Population Statistics of BMR

Year	Vehicle statistics				Total Population	Work Place Employ-ment
	2-Whee-lers	Private Cars	Taxis	Total		
1971-72*	24,786	83,360	15,951	1,52,082	77,77,531	18,00,154
1981-82*	93,080	1,59,365	30,039	3,51,796	1,10,78,029	27,91,052
1991-92*	3,43,707	2,91,465	35,285	8,20,828	1,45,34,364	33,96,089
2000 **	3,79,441	3,10,943	49,341	8,90,795	222,00,000 (Projected)	

Source: *: Draft Regional Plan for Mumbai Metropolitan Region-1996-2011
** V.M. Lal Committee Report, April, 2000

Table- 4.2 Commuter Statistics for BMR

Year	BEST Pass. Trips (lakhs)	Suburban Rail Passenger traffic (in lakhs)		
		Central	Western	Total
1950-51*		3.82	4.01	7.83
1960-61*		5.66	6.05	11.71
1970-71*	23.48	12.38	10.92	23.30
1980-81*	42.95	18.83	19.86	38.69
1990-91**	41.20			
2000				

Source: * Basic Transport & Communication Statistics for BMR-Transport & Communication Board, BMRDA, April, 1982
** Fact –Book on Mumbai, Bombay First, March 2000

13. There has been a major shift in the approach to solving the transportation problems of Mumbai from the '60s to the '90s. In 1962, the focus of the planning process was to ensure accessibility to a major arterial within a distance of 1 mile. " Bombay's increase in overall growth will require an adequate and efficient roadway system to meet the nearly 100% increase in population anticipated by 1981. From the future roadway needs, as determined from extensive origin-destination studies, a recommended system of freeways, expressways and major streets....has been developed for the Bombay area needs through 1981.

The Freeway and Expressway systems have been planned to provide maximum service at minimum cost and disruption to service. Bombay Island will be encircled by freeways and bisected by an expressway. All portions of the island will be within one mile of a freeway or expressway." (1)

14. But in the 1994 study done by M/s W.S. Atkins International, the recommended strategy is to **optimize and maximize the use of the facilities** as existing in the island city, through traffic management and minimal engineering. The existing main road network capacity should be optimized by more efficient use of the ROW, control of parking, removal of encroachments, junction improvement- largely through traffic management

measures- and urban traffic control systems. " The major feasible investments designed to promote efficient use of the existing street system in the Island City are intersection redesign, one-way traffic systems, traffic signaling and provision of bus lanes. Major policy initiatives recommended to achieve the same goals are greater control of traffic movement through banned turns and selective route designations, control and pricing of both on-street and off- street parking, and demand management through cordon pricing for access to certain areas. The pricing of parking and cordon entry are also major potential sources of revenue for financing transport improvements."(6)

15. The W.S. Atkins study also emphasizes the importance of the public transport system, especially the urban rail system, in the future. In Mumbai, at present, "improvements in the transportation system" is taken to be commensurate with engineering improvements to the road network, and this is translated into construction of flyovers all over the road network. But 88% of the trips made in Mumbai are by public transport – both road and rail- and it is therefore apparent that if the majority of the city are to benefit from investments made towards improvement of the transport system, then these investments have to be made in the mass transportation systems- i.e.- rail based, road based and water based mass transportation, and not on the road network only. That is, the improvements should concentrate on improving the levels of service currently afforded by these services, in terms of the frequency of service, level of comfort, and improved connectivity that will reduce the time and stress of travel.
16. The Wilbur Smith recommendations of 1962 do not pay much heed to the mass transportation requirements of the city, and are primarily improvements to the road network. Moreover, buses are unlikely to be able to use the freeways and expressways recommended therein, since pedestrian traffic is normally banned on such high-speed facilities, because of the high risk of accidents, and therefore bus stops cannot be located on them. The 88% using mass transportation therefore, are unlikely to benefit from these facilities, and it is only the 12% of trips made by road-based private cars or taxis that will be benefiting from them.
17. The rail connection from Kurla to New Bombay, and the three proposed East-West rail links – Bandra-Kurla, Vasai Road- Bhiwandi- Diva Junction and Churchgate to CST or Carnac Bunder could help to convert the Western and Central Suburban railways into an integrated metropolitan rail system. Towards this, the formation of the Mumbai Rail Vikas Corporation has been the first step, and the construction of the East-West link from Bandra to Kurla is being actively pursued by the Central Railways. The rail components of the MUTP package are all targeted towards optimizing and augmenting the system capacity of the railways. The shifting of the mail / express passenger exit from CST to Carnac Bunder, as proposed by the CR, is again with the objective of providing more platforms for suburban services and increasing the frequency and length of the trains.

18. Most of the arterial street network considered by Wilbur Smith for expressways has been reduced to urban streets, and many of the recommendations are not really implementable. There have been rapid changes in land use, new constructions have come up, and encroachments now form a very visible part of the streetscape. The urban structure has changed substantially since these recommendations were made.
19. Additionally, the recommendations made by Wilbur Smith and Associates in 1962 need to be reviewed in the context of the present transport scenario. For instance, the Cross Island Connector as recommended by Wilbur Smith in South Bombay, which is an elevated roadway over Madam Cama Road, connecting the West Island Freeway and the East Island Freeway, will have no meaning in the absence of the East Island Freeway and the Cross Harbour Connector from Colaba. The Cross Island Connector was intended to provide the connection from the West side of the Island onto the Mainland through the Cross Harbour Connector. The Cross Harbour Connector was originally intended to take off from Colaba on the Island to Uran on the Mainland. This alignment has now been changed to Sewri on the Island and Nhava on the mainland.
20. Where considered no longer relevant, therefore, the recommendations made by Wilbur Smith and Associates have been dropped. A consolidated summary of the recommendations as obtained from the procedure outlined in Chapter I were then examined with respect to their immediate relevance to the transportation scenario to assign priorities, and achieve the components of the First, Second and Third Phase.

21. The construction of the West Island Freeway, with a modified alignment, is being actively pursued by the MSRDC as the Worli-Bandra and Worli Nariman Point Sea Links. W. S. Atkins has clearly shown that the effect of the West Island Expressway and the East Island Expressway would be to attract more traffic to south island destinations, and for traffic congestion in the Tardeo, Bombay Central, Opera House, Nana Chowk and Kalbadevi areas to be worsened. "**These new expressways would only tend to shift the bottlenecks around, and have little effect on overall system capacity.**"(6)
22. Although this traffic will use the expressways out in the oceans to reach south Mumbai, they will eventually have to come onto the land –based roads to reach their destinations. In other words, once the vehicle gets off the freeway, where it has been traveling at an appreciably high speed, it is going to get bogged down in a network where speeds are going to be even worse than what they are today. And after it reaches its destination, it is more than likely that a parking slot will not be available.
23. Mumbai has a vast untapped resource in water which has to be exploited to supplement the rail and road based mass transportation services. W.S. Atkins and the Paranjpe Committee recommend the use of passenger water transportation as an environment- friendly, low cost alternative to capital-intensive improvements to the road and rail network. The Maharashtra

Maritime Board has also recognized this potential and its urgency, and is making rapid progress towards introducing Passenger Water Transport along the west coast. It has already identified sites and acquired land for locating PWT terminals. Negotiations are under way with a private party for commencement of these services.

24. Traffic Management function seems to be no-body's child. The Traffic Police, based on their observations, decide on the location of a particular, sign or road marking, and then approach the BMC for the installation of the same. The BMC accordingly carries out the instructions, and submits a bill for the charges incurred to the Traffic Police, who in turn forward it to the Home Department. The expenditure on Traffic Management aids was therefore, until 1996, met as a grant-in- aid to the BMC through the Traffic Police. However, since 1996, this arrangement has been terminated by the Home Department, who are now willing to pay only 50% of the cost of installing a NEW Signal, and refuse to meet the expenses of maintenance of traffic control aids. The entire burden of maintenance therefore, now lies with the BMC, who not just do not have any provision for this, but are already burdened with a deficit of Rs.614 Crores. Until 1996, the BMC's expenditure on Traffic Management aids was in the range of Rs. 5- Rs 6 Crores. This year, however, it has been reduced to Rs. 2.5 Crores. It must be noted that this amount of Rs. 2.5 Crores includes expenditure on new signals, repair and maintenance of existing one, improvement of street lighting, festival lighting (during the Ganpathy and Moharram festivals, for instance) etc.

25. One of the preconditions therefore, to the sanction of the World Bank loan for the MUTP, is the formation of a full-fledged Traffic Management Unit in the BMC, with staff that include traffic engineers and planners, so that traffic planning, engineering and management become the responsibility of the Municipal Corporation, and only enforcement be the responsibility of the Traffic Police. This requires an amendment to the Municipal Corporation Act, making Traffic Management an obligatory duty of the BMC. This amendment is now before the Joint Selection Committee of the Legislature, for approval.

The Traffic Management Unit, as required by the World Bank, will have full-fledged divisions for Highway Planning, Traffic Planning, Parking Control and Traffic Signals, each headed by an Executive Engineer. There will also be a division for survey and collection of traffic data. The unit will be headed by a Chief Engineer.

Operation and Enforcement of Traffic Management measures will continue to remain with the Traffic Police. Continuing co-ordination between the BMC and the Traffic Police therefore, is essential.

26. The W.S. Atkins Study also carries a Working Paper on Novel Methods of Funding Transport Infrastructure. This Technical Working Paper No.9, Part 1, gives possible sources of revenue that could be tapped for generating funds for transport infrastructure. Bombay First feels that there is some merit in a few of these proposals, which in addition to being sources of revenue,

can also be used effectively to achieve the objective of restricting the demand for road space.

4.2 Observations

27. Taxi population and culture:

The city of Bombay has about 50, 000 taxis, who are apparently a law unto themselves. They have a very large effect on traffic conditions in the city. Surveys and the CTS Traffic Model indicate that taxis account for over 50% of the private (car plus taxi) trips during the morning peak period within the Island City. In some areas, the percentage is even greater, rising to 60-65% and at times their occupancy is very low. (20).

During peak hours they operate a shared taxi service from all bus and rail termini, and have stands that are designated as shared taxi stands. However, their queues extend far beyond the limits marked for their stand, sometimes parking double along the length, and their maneuvers in and out of the queues are extremely disruptive to the main stream of traffic. Large volumes of commuters also flow across the road at these points in order to access these vehicles.

28. During off-peak hours, regardless of the fact that a large percentage of available kerb-side parking is already demarcated for taxi parking, they park as and where they please, and most often double park on the carriageway. Even at the designated stands, they do not pull up at the kerb, but leave at least half a lane between their vehicle and the kerb while waiting for a fare. When they stop for passengers to alight or board their vehicle, they do not draw up to the kerb, but stop well away from it, holding up the stream behind them. In search of a fare, they cruise at slow speed in the fast lane-i.e. in the median lane, so that they can scan both sides of the road for a potential fare, unmindful of the delay to the rest of the traffic. Double-parking by taxis at points of potential fares, especially in front of schools, at giving-over time (when traffic is already in a state of major upheaval), at bus stops or right at the mouth of a junction, are common.

29. A substantial percentage of these taxis are very old, and their exhaust emissions do not conform to the required PUC Standards. Yet they continue to ply their vehicles throughout the city. Lane changing is at random, and they overtake any which way they please. It is a common sight to see taxis in the extreme right lane calmly cut across all the other streams of traffic at the green signal, to turn left. Pre-empting the green phase is another feature of the driving characteristics of these vehicles.

30. During the taxi strike early this year, the absence of taxis, although a great inconvenience to a large number of people, found the roads of Mumbai with a lot of spare capacity, and journey speeds were higher by at least 50%. Apart from their sheer volumes, this was due mainly to the absence of their erratic and unprincipled driving pattern, absence of parked vehicles at junctions, no stopping to load/ unload passengers in the middle of a stream. These vehicles and their drivers will have to be made to conform to the rules

and regulations that apply to the rest of the motorists if there is to be any major improvement in the traffic environment.

31. Auto Rickshaws

The auto rickshaw is presently confined to the suburbs, although there is a demand for these vehicles to be permitted to ply in the Island City also. This would be disastrous to the already congested road system here because the ratio of passengers carried to road space occupied of an auto rickshaw is very low in relation to that of buses. They can also adversely affect the speed of buses.

Moreover, because of their wedged- shape and high maneuverability, they are generally considered as initiators of accidents, although they may not always be directly involved in the accident. They are also a major source of both air and noise pollution.

The argument that these vehicles are required to supply the intermediate public transport to cover lead distances in the Island does not hold water, because the Island City is very well served by the suburban railway system as well as the BEST services, so that average lead distances is well below 0.5 km, and is more generally in the range of 100 –200 metres. (Lead distance is that distance covered from the actual origin / destination to the boarding/ alighting point of the main mode of transport). This can easily be covered on foot. It is therefore not advisable that these vehicles be permitted south of Bandra, upto which point they are presently confined.

32. *Road Geometrics*

Several of the junctions have inadequate or improper geometric design, with mainly the islands / channelisers missing. Vehicles often bunch up at the mouth of the intersection, forming far more lanes at the mouth of the discharging arm than there are at the mouth of the receiving arm, thereby both blocking the discharge of the other arms, while at the same time, lowering the discharge speed of this arm. This happens because as much as 4 or 5 lanes have to bottleneck down to 2 lanes on entry. This can be prevented by designing the right type of channelisers and thus streamlining the discharge.

33. Road Signs and Markings

Road signs and markings in the City and its suburbs are not as per standards. In most cases they are generally missing. There is specially a dearth of directional signs, and mandatory signs and cautionary signs are either missing or non-compliant with standards. The location of these signs are also not very visible, so that they are easily overlooked.

34. Enforcement:

The traffic police seem to have a 'Nelson's Eye' as far as traffic violations in Mumbai are concerned. The reason is quite likely to be the extreme pressure under which they function, but the result is a total disregard for rules and regulations by the motorists. Pedestrian signals and red lights seem to have

no meaning, with taxis, buses and private cars all violating them with impunity. The motorists have learnt to know the phasing pattern of signals on their regular routes, and as soon as the phase preceding theirs turns amber, they leap forward, without waiting for that signal to turn red, or for this to turn green. The result is a mad scramble by motorists and pedestrians to get out of the danger zone. Apart from the high risk of accidents, such driver behaviour also reduces the discharge capacity of the junction. If the motorist at the head of the queue is disinclined to such haste, he is bellowed on his way by a cacophony of horns from behind him.

Very often, an entire stream ignores the fact that the lights have turned red for them, and continue to keep going, causing another arm to lose its green phase. The noise from horns is deafening at such times.

Similarly, stop lines and zebra markings also have no meaning, with motorists invariably stopping well ahead of a clearly drawn stop line at a red light. Those behind him stop on the zebra markings, leaving the pedestrian to weave between the vehicles while crossing. Again the volume of pedestrians cleared is affected, apart from the risk of accidents. Additionally, this also encourages jaywalking.

In anticipation of the signal changing in his favour, the driver starts inching his vehicle forward, and continues to keep doing this right upto the centre of the junction, followed by others behind him, causing the other stream to have to maneuver around them in order to keep going.

Lane changing happens as and when the driver feels like it. They change lanes for no apparent reason. There is absolutely no lane discipline, and the traffic stream especially during off-peak hours exhibits a great deal of lateral movement. At the mouth of the junction, after a recent drive to control traffic indiscipline, the lane control is maintained, with the right lane turning right, and so on. But this happens only if the traffic police are visible in the area, and the control promptly breaks down in his absence.

Vehicles are parked right at the bus stops or at a No-Parking sign, if the driver is in attendance, while the owners are out shopping. This is a regular feature with taxis. The presumption being that the vehicle cannot be towed away as long as someone is sitting in the car. This happens even during peak hours, on main arterials, causing untold delays and frustrations to the rest of the motorists.

All this is a result of very poor enforcement on the part of the police, all of which are factors that contribute to reduced capacity, and a certain amount of lawlessness, on the city roads.

4.3 On-Going Projects

4.3.1 MUTP

The W.S. Atkins study of 1994 was the first really comprehensive transportation study, where all modes of transport were studied as part of an overall metropolitan transport system, and various scenarios examined for the future, before arriving at the recommended strategy. This strategy recommends a large

investment on rail transport, with a moderate investment in the road network. The major recommendations of this study were therefore culled out, and seriously considered for implementation. These recommendations form the components of the MUTP and are being actively pursued for implementation today. A summary of MUTP is given in the Annexure- 13.

4.3.2 PWD

The PWD are pursuing the construction of the pedestrian subways as per the list given in Table 5.16. Those subways listed under phase-I are under construction, except for the subway at Godrej Colony, on the Eastern Express Highway. The PWD are also actively following up on the completion of the East-West connectors in the suburbs- the Jogeshwari- Vikhroli Link Road, the Andheri-Ghatkopar Link Road and the Anik- Panjrapole Link Road.

4.3.3 MMB

The Maharashtra Maritime Board are actively pursuing the preliminary requirements for introducing Passenger Water Transport along the West Coast. They have identified and acquired land at Worli, Bandra, Juhu, Versova, Marve and Borivili. They are in the process of negotiating for land at Nariman Point, and are also negotiating with a private party for operation of the services.

4.3.4 MMRDA

Truck Terminal

The MMRDA have a full-fledged truck terminal under construction at Wadala, with a total area of 80 hectares. In the first phase, 33 hectares have been fully developed, with 8 buildings ready for occupancy, and 20 buildings under construction through associates. All necessary infrastructure are complete, including roads, street lighting, a diesel filling station, and a building for amenities like post office, telegraph, etc. The area is ready for immediate occupancy.

Inter State Bus Terminal

There is also an Inter State Bus Terminus (ISBT) under construction at Wadala, for idle parking of the inter-city tourist buses. In the first phase, this will be developed as a bus terminus, and in the second phase, it is planned to upgrade this facility to a passenger terminus.

As a bus terminus, it will have provisions for idle parking of 160 buses. There are also 4 bays for washing buses, canteen, and bath and toilet facilities for the crew. The temporary ISBT is expected to be operational by Dussehra this year. The buses will be permitted entry into the city at fixed times, and along strictly regulated routes, to pick up and drop off passengers, again at fixed points in the city. The objective is to relieve traffic congestion caused by idle parking along arterials, without interfering with their operational pickup points, routes and

other arrangements. Emergency repair and maintenance facilities will also be available at the ISBT.

The proposed activities in the ISBT include operators' offices, rest rooms and facilities for running staff, City bus (BEST) terminal, platforms and ticketing facilities including advance reservation, waiting rooms and associated infrastructure for passengers, hotels, restaurants & entertainment facilities, public addressing and information systems, Post and Telegraph facilities, fire fighting & emergency medical facilities

4.3.5 MSRDC

Fly Over Projects

The Public Works Department and the Maharashtra State Road Development Corporation have embarked on an ambitious project of constructing flyovers at all points mentioned in the various reports, and also at a few additional junctions were they perceived a need for a grade separation. The result is that about 35 flyovers out of a total of 55 proposed have been constructed all over the city and its suburbs. These projects have been initiated without actually verifying whether the traffic conditions warrant such a facility at that point, its impact on the adjoining intersections, or the actual orientation of the facility for best results. They have also not taken into account any other projects like subways or Light Rail Transit routes in the area, with consequent conflicts with other projects. The location of the subway at C.S.T., for instance, refused to make allowances for the Light Rail Transit (LRT) alignment in the same area, with the result that the integration of the LRT with the suburban services at CST now poses a problem.

Similarly, the height of the controversial flyover at Andheri was raised to accommodate the extra floor space for commercial use below the flyover. The present height is such that it will be impossible to upgrade it to a partial/ full interchange at a later date. Nor will it be possible to utilize the additional headroom below the clear span for running an LRT alignment, as it falls short of the requirement. Despite the very heavy cost involved, this flyover can only remain as an elevated corridor for north-south movement of traffic.

It is very important that any further construction of flyovers is examined carefully for relevance and impact before clearance is given for the construction.

4.3.6 The Central Railways:

Work on the 5th and 6th lines from Kurla to Thane has commenced. The conversion of DC supply to AC is also under full swing, and is completely financed by the Central Railways.

4.3.7 The Western Railways:

Western Railway proposes to extend the 5th and 6th line upto Bombay Central from Borivili. Surveys and land acquisition are currently in progress. The objective is to separate the main line from the suburban line, with the 5th and 6th corridor being dominantly for main line movements Extension of platforms to accommodate 12 coach trains is also under way.

CHAPTER 5

RECOMMENDATIONS:

5.1 Principle

Bombay First realized that the planners have been looking at the problem from the same angle for the past 40 years – how **to accommodate the travel desires of every individual while giving him total freedom to choose his mode of transport,** all within the best principles of Transportation Planning and Traffic Engineering.
As the W.S.Atkins Report says, "Bombay has become the worst example of restraint through congestion." What is meant here is that the city is slowly strangling itself because of unrestrained use of personalized modes of transport. The citizen of Mumbai is left with no choice, really. The trains are unbearably crowded, the buses are also crowded and additionally move at a snails pace, while the car and bus have a mutually restraining relationship with regard to speed.

In view of the fact that paucity of funds seems to be the crux of the problem of Mumbai's transportation systems, the objectives of the first phase should be to achieve the maximum results in the shortest possible time, with the minimum of investment. The statistics shown in the earlier chapters clearly reveal the lack of road space to accommodate the huge volumes of private vehicles. There is also no scope of widening the arterial street system without large-scale land acquisition- a major constraint. The solution therefore lies in discouraging the use of private vehicles and encouraging the use of mass transportation, especially during peak hours.

Lack of proper integration of the various modes of travel is the cause of a lot of delays and congestion today, especially at points where a transfer is affected from one mode to the other, such as at bus and rail termini. These inter-modal transfer points need to be designed such that delays are reduced to the minimum, and transfer from rail to road based modes, or vice versa, are affected efficiently, as far as possible within the terminal area itself. This implies an integration of all mass transportation modes and intermediate public transport modes such as shared taxis and contract carriages.
Therefore, considering the restrictions of right of way and the problems related to the acquisition of property, and the fixed landmass of the island Bombay First realized that the problem had to be approached from another angle. The solution, we feel, lies in shifting the angle of the perspective slightly, and **viewing the situation as a management problem, rather than an engineering problem.**
Bombay First believes that the best approach to resolving the transportation problems of Mumbai City lies in

"Demand and Traffic Management before Engineering, and Essential Integration of all Mass Transportation Modes".

Bombay First recommends that the use of private modes of transport be curbed to some extent by the use of some form of restraint- either policy restraint or fiscal restraint- while at the same time upgrading and augmenting the two existing forms of mass transportation to absorb this restrained demand, and additionally, introducing a third form of mass transportation- Passenger Water Transport (PWT). 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. This will provide the following corridors of travel in the north-south direction: -

- 4 corridors of road transport
- 5 corridors of rail transport
- 2 corridors of water transport, plus one trans-harbour PWT route.

All these mass transportation modes have to be well integrated 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.
Phase-I should therefore focus mainly on Demand and Traffic Management measures, with only essential engineering inputs, which by and large are met by the components of the MUTP, while Phase-II should contain those recommendations required to further streamline the Integrated Metropolitan Transport System. Phase – III carries capital-intensive long-term road proposals. Phase I is for a time frame of 5 years, Phase II is 10 years and Phase III is over 10 years.
In each Phase, the recommendations have been clubbed under various heads.

In addition, if the proposals selected for implementation in the first phase could also become sources of revenue, then the funds generated could contribute towards implementation of the more capital intensive, long- term proposals of the Second Phase.

5.2 PHASE- I

5.2.1 Objectives

Within this framework, the objectives of the first phase were seen as the following:

1. Use of private automobiles should be discouraged through a two-pronged strategy, which is a combination of fiscal restraint measures on the automobile, with a simultaneous and corresponding improvement in the bus and train services. The fiscal restraint on the use of the automobile would be through the imposition of higher parking fees and cordon pricing/ area licensing.

2. The improvement in bus transportation should be with regard to speed, comfort, frequency and accessibility. Introduction of more air-conditioned buses that operate in exclusive Bus Only lanes, will take care of the comfort and the speed aspect, while the exclusive bus lane will also ensure a more reliable service, as they will no longer be subject to the delays of the overall traffic stream. The net result could be that the journey speed of buses would be higher than that of cars, for a corresponding level of comfort. The current routes on which these buses operate are very limited, and this can be increased to improve accessibility. This, coupled with the absence of parking requirement, parking charges and the cost of the license can draw away trips from private modes to mass transportation.

3. The suburban railway system is currently being upgraded and optimized as part of the MUTP, and Bombay First recommends the introduction of more First Class carriages, and also a few air-conditioned carriages on their fast lines. This can result in the shift of a substantial number of trips from private car and taxi to rail.

4. The improvement to the road network should be through traffic management, with minimal engineering, which should ideally be confined to junction improvements and signaling systems to support the traffic management measures. As a first step, though, the road capacity that has been lost to encroachments and slow traffic should be recovered

5. In this context, it should be mentioned here that the spate of construction in the road transport sector in the Island City should be controlled. This construction of flyovers in locations considered relevant as long back as 40 years ago, is misplaced, especially in the absence of any recent study that justifies their requirement. Additionally, they are constructed on a network where the intersections are located too close together. As many as three junctions have been covered by one long grade separation in one case, but this only defeats the purpose when the vehicle stream reaches the next signalized junction. The solution lies in linking the signals of these corridors, especially in cases where the intersection spacing is very small, so as to provide a green channel for traffic in the peak direction.

6. In order to overcome the current lacunae in the planning, design and execution of traffic engineering and transportation projects, W.S. Atkins has recommended the formation of a full-fledged Traffic Systems Management Department within the BMC, headed by a Chief Engineer. The broad structure of the organisation has also been given in the Report. This has been included in the World Bank aided MUTP as formation of a Traffic Management Unit within the BMC. Bombay First recommends the speedy formation of this Unit.

7. One of the functions of the TMU as designed by W.S. Atkins is Parking Control. In this context, the 1996 study by Wilbur Smith Associates et al on Non-Rail Components includes a very large chapter (Chapter 13, in Volume 3 of 11) on Parking, where the entire parking scenario is studied in very great detail, and covers aspects of illegal parking also. The study also recommends the formation of a Mumbai Municipal Parking Authority within the BMC, which will decide how much parking should be provided, where and how the parking should be charged. The collection of parking fees would also be by this agency, and the provision of parking and rates charged could be used to achieve the objective of demand management-i.e. - restraining the use of the automobile in the particular area. Enforcement of parking controls and collection of fines would also be with the same agency.

8. Bombay First believes that such an Agency should be formed, with the structure as designed in the above Report, but should be given additional authority over the Cordon Lines and the Area Licensing Schemes that are recommended to be evolved. Design, execution and control of this aspect of demand management also should be with the same MMPA, and the revenue collected from this restraint measure also should go to the same fund. These resources could be used for carrying out capital-intensive improvements to the transportation system, as recommended in the long-term plans. A part of it should be earmarked for annual maintenance of the systems.

9. The W.S. Atkins Study also carries a Working Paper on Novel Methods of Funding Transport Infrastructure. This Technical Working Paper No.9, Part 1, gives possible sources of revenue that could be tapped for generating funds for transport infrastructure. One of the sources mentioned here is the revision of Wheel Tax, which could generated a 1993 estimate of 30 Crores. This tax has instead been abolished by the Government, thereby losing a major source of revenue. Bombay First recommends re-introducing this Wheel tax, after revision.

10. Another potential source of revenue that would also act as a deterrent to indiscriminate hiring of staff by large organizations is a Payroll Tax, which should be paid by employers who employ more than a minimum number of staff. Several countries- especially France- use this revenue to underwrite major fixed capital investment in urban public transport. The logic behind this is that the peak demands for transport are created almost entirely by the journey to work, and the intensity of this demand arises from the concentration of employment in and around the Central Business District.

5.2.2 Broad Recommendations:

With these objectives, the recommendations were re-organised under the following heads to form the recommendations under Phase-I:

- ***To streamline road based mass transportation services to the maximum extent possible, through bus-priority measures.***
  The efficiency of bus services can be greatly improved by providing a separate bus lane, and locating spaces for provision of bus bays. Additionally, certain turning movements can be restricted for other traffic, while only buses are permitted to make the turn- for example- right turns. Bus journey speeds will improve, and delays from other traffic will be eliminated. More air-conditioned buses should be introduced, in order to affect a shift from private transport and taxis to the buses. These should preferably be CNG buses, so that the environmental quality is also improved.
- ***To reduce vehicular access to the CBD area, and the island city through some form of demand management;***
  This will be required in order to reduce the number of non-essential trips that are made in private vehicles. If a charge is levied on private vehicles for entry to a zone or area, and a hefty parking charge imposed on top of that, then the chances of the trip being transferred to a mass transportation mode is higher. This can also become a source of income for the BMC. This type of restraint, however, has to be supplemented with a parallel improvement of the bus services as mentioned above, otherwise the entire scheme is likely to collapse.
- ***To restrict parking on major arterials, with all parking to be charged, and no free parking, irrespective of location.***
- Parking fees are already being charged in a few areas, but this should be applied uniformly across the island, and the income from this can be channeled into a fund for improvement of roads, along with the above from income from the restraint measures.
- ***To improve movement and control of traffic by restraining slow moving/ heavy traffic***, especially during peak hours.
  At present, slow moving vehicles and trucks are found plying on major arterials even during peak hours, seriously hampering the flow of traffic.
- ***Introducing one-way streets and providing better signals.***
  Many arterial roads do not have the necessary carriageway width to accommodate two- way traffic, especially during peak hours. These may need to be converted into one-way streets, in order to streamline the flow. The Century Bazaar- Siddhivinayak scheme is working very successfully, and we recommend more such schemes.
- ***Removal of encroachments (R & R) on footpaths and roads, and spillover of commercial activity.***
  This would be the logical first step towards optimizing use of the roadway elements for their original purpose.
- ***To design the maximum possible pedestrian facilities,***
  If the pedestrian environment is attractive and safe, it will draw the pedestrians away from the carriageway and onto the footpath. This will release precious carriageway width for the vehicular traffic, while also reducing the conflict with pedestrians, thus reducing accidents. This is

expected to produce a better pedestrian environment, lower congestion on roads, lower levels of pollution, and result in a much better traffic environment with higher speeds and less delays;

- ***To introduce Passenger Water Transportation (PWT).***
  Mumbai is blessed with an abundance of this natural resource, and water transportation is a non-polluting, environment friendly mode that is also much cheaper than road or rail transport, especially in terms of infrastructure required. The linear form of the Island can again be used to advantage, to run PWT in the North-South direction, supplementing the rail services. PWT can also be run across the harbour to the main land, reducing the commuting time of passengers currently making the trip by a very circuitous rail route to the Fort / Nariman Point area.
- ***To augment rail services.***
  The traveling conditions of the public should be eased by increasing the length of trains and frequency of service, and improving East-West connectivity of rail transportation.
- ***Integration of all mass transportation modes,***
  Road based mass transportation should be designed to be complementary to rail and water transportation. At present, road and rail services are more or less competitive modes. This should be changed, with road based mass transportation and intermediate public transport services providing the short-haul, feeder services from the rail and water transport termini to the commercial areas/ CBD.

5.2.3 Recommended Actions

The recommendations were then studied to meet these objectives, and the results have been summarized into the Phase- I, Phase –II and Phase –III Plans shown in Tables 5.1 to 5.1[illegible]. A brief discussion on the actual recommended action under various heads, as mentioned in these Tables, is given below.

5.2.3.1 Traffic Management:

Separate Bus lanes on major arterials; Right turns for buses only; Banning right turns; Restricting truck and other slow moving traffic:

This covers the bus priority schemes, one-way schemes and restrictions on slow/ truck traffic. With the help of the traffic police, major arterials that can accommodate a separate bus lane need to be identified. Similarly, junctions where capacity can be improved by banning right turns, or permitting right turns for buses only, need to be identified, again with the help of the traffic police, and modifications made to the signals in existence. Additionally, proper signage also needs to be installed.

Dadar- Mahim One Way Scheme :

As part of the MUTP Project, plans have already been drawn up for a one-way scheme in the Dadar –Mahim area. This includes a one-way scheme for buses with separate lane, channelisation at junctions, footpath improvements and signal improvements. This needs to be implemented at the earliest.

Possible areas for more such schemes also need to be identified. The road network of Bombay Island lends itself to the design of several small one-way schemes, which can gradually be extended and integrated into a composite whole.

Permit local traffic to use roads in Port Trust Area :

Local traffic needs to be permitted to use the roads in the Port trust Area, to relieve congestion along the eastern corridor. If necessary, a toll may be charged for this use.

5.2.3.2 Traffic Engineering:

(a) Upgrading & extension of Traffic Signals; Area Traffic Control Systems; Station Area Improvements (SATIS) as per list attached; WEH ROB at Bandra partly completed, 8-laning to be completed:

This covers the upgradation and extension of traffic signals and the Station Area Traffic Improvement Schemes (SATIS) that are also part of the MUTP Project. Although the cost seems high, 70% of the cost of SATIS and 90% of the cost of the Area Traffic Control Systems are being provided by the World Bank under the MUTP. This includes computer controlled traffic signal system with adoptive software, communication links and control room facilities, and supporting junction improvements at about 240 intersections in Mumbai.

The Station Area Traffic Improvement Scheme includes improvement of bus stops, facilities for taxis, auto rickshaws, grade separation for pedestrians and vehicles, rearrangement of parking and hawkers and widening of approaches and junctions at railway stations.

Included in this section is the Road –Over- Bridge on the Western Express Highway that has been lying incomplete for the past year, causing untold hardships to the traveling public. This needs to be completed on a priority basis.

(b) Pedestrian Subways to be provided as per list attached; Footpath Demonstration Programme; Moving Walkway for pedestrians in CBD at Churchgate and CST:

Also under Traffic Engineering come the pedestrian facilities that are actually top priority. The MCGB have prepared a list of locations identified by them as having high concentration of pedestrians, and where some form of grade-separation for pedestrian movement is required. This list is given in Table No. 5.17 of the Annexure. The list of locations mentioned in the studies is given in Table 5.16. The priority as seen by Bombay First is also mentioned alongside.

The Moving Walkway Project from CST to Churchgate is currently being actively followed by the BMC. However, Bombay First feels that this is not required, if the footpaths between CST and Museum are cleared of encroachments. This will create a very appealing environment-i.e. the heritage arcade -being released for pedestrians, and a covered walkway will consequently be available from CST upto Museum. Similarly, the footpaths between Flora Fountain and Churchgate are also quite wide, and need to be cleared of encroachments. It therefore follows that the Moving Walkway will be redundant in this area.

This also needs to be studied in conjunction with the proposal for a Light Rail Transit System from CST to Cuffe Parade, via Churchgate. Bombay First feels that this would be a better option than the Moving Walkway, because of better carrying capacity and greater penetration to the south of the Island. Moreover the moving walkway incorporates a provision for commercial space alongside the walkway, and Bombay First feels this is undesirable, as these spaces invariable tend to get misused.

The MRT proposed for Andheri –Ghatkopar should be given priority over the LRT for the CBD, as this will provide crucial East –West connectivity, and ease the load on the other systems in the area. The system is also integrated with the railways at both Andheri and Ghatkopar, and will enable transfers from the Western to Central Railway. This link also has a spur connecting it to the International Airport at Sahar.

In the CBD area, the following four proposed projects need to be studied in conjunction, with respect to their total costs, practicality and maximum benefit to the overall transport scenario, before implementation:

- Underground rail loop connecting Churchgate and CST, as recommended in the 1969 Mass Transportation Study and the 1994 W.S. Atkins Study;
- Mass Rapid Transit System- 7th Rail Corridor (Heavy Metro)
- Light Rail Transit Corridor from CST to World Trade Centre; and
- The Moving Pedestrian Walkway in Churchgate and the CBD.

It is felt that any one of these projects will suffice in the CBD area, since all of them are underground.

(c) Pedestrian Studies:

Detailed studies to be undertaken to understand the pedestrian flow characteristics and work out a system of pedestrian facilities for different parts of Mumbai:

Pedestrians form an integral part of the traffic system in Mumbai, rather than an adjunct, and it is therefore important to study the pedestrian flow characteristics in different types of areas of their concentration, and design the facilities accordingly- i.e. at railway stations, bus stations, commercial areas, office complexes and along arterial roads.

5.2.3.3 Removal of Encroachments, Resettlement and Rehabilitation:

Removal of encroachments on S.V. Road; on L.B.Shastri Marg; Removal of slums and R&R of Western Expressway:

Encroachments, as already discussed, are a major reason for the current problems in the transportation system. Major arterials need to be cleared of these encroachments, and the slum dwellers resettled and rehabilitated. This actually has to be handled on a priority basis, as this is the bane of both the road and rail system.

5.2.3.4 Demand Management:

Curtail Car entry through Cordon Lines during peak hours; Cordon Pricing & Park & Ride Schemes; Area licensing for car & motor cycle use within restraint area; Parking Restrictions through pricing, & charged off-street parking:

It is envisaged to try and reduce vehicular access to the CBD through some form of restraint. This could be through the use of cordon lines, using the method outlined by the Paranjpe Committee, based on the number plates or by the use a cordon fee.

(Mention should be made here of the very successful attempt on similar lines made in Rohtak, Punjab, earlier this month on the restriction of auto rickshaws into the city, based on their number plates. Those bearing odd numbers were permitted to ply only on alternate days, and those bearing even numbers on the other days. This scheme was well accepted both by the auto rickshaw drivers and the public, with resultant relief in road congestion.)

In the former, only those vehicles having odd or even numbers will be permitted to enter the CBD on a given day, while in the latter, the occupants have to perforce park in parking lots provided outside the CBD and transfer to a mass transportation mode to enter the CBD, or pay a charge for taking their vehicle into the restricted area. These two methods are easier to implement than that of the Area Licensing Method, where special licenses would need to be issued for use of private vehicles within the CBD /restraint area.

Whilst any of these methods will definitely reduce the number of cars and two wheelers in the island /CBD, the restrained demand for movement within the CBD will have to be met by adequate number of buses plying from the periphery of the restricted area to the various destinations within the restricted area. The frequency and level of service of these bus services will have to be very high if the plans are to succeed, since the users will be individuals who are required to give up the comfort of their private vehicle for a mass transportation mode. The buses would need to be of low capacity, high frequency and high comfort. In this context, it might be worthwhile to consider the introduction of private bus operators to run shuttle or circular services from these peripheral parking lots to various destinations within the CBD.

As part of this process, it is necessary to identify large parking lots at the periphery of the identified restraint area, and design the space to accommodate the estimated parking load. While the identification will be in the first stage, the design and construction may go into the second stage.

Mention should be made here of the study made by Wilbur Smith Associates et al on ***"Road Transportation Study for Non-Rail Components for MUTP II"***, which includes a chapter on Congestion Pricing. Results of the analysis show that congestion is largely internally generated, and is concentrated in the middle and northern sectors of the island. This would make cordon pricing at locations like Mahim Creek or at the CBD boundary ineffective in reducing congestion, whereas a cordon in the middle of the island would be more effective, if feasible

locations could be found. The study therefore recommends area licensing or electronic road pricing as being more effective than cordon pricing in reducing congestion in Mumbai Island.
Planning for this demand management should start in the first phase, while the implementation will run into the second phase.
All parking should be charged, whether within or with-out the restraint area. Off street parking areas should be identified, and all parking should be confined to such areas. Parking charges within the CBD area can also be made steeper than in other areas.

Restrict permission to convert residential use to commercial; Provide disincentive to large wholesale markets located in the Island
Conversion of residential use to commercial use should be permitted only against a Traffic Impact Statement or Traffic Management Plan, which will assess the impact of such a conversion on the traffic movement in the area. A fiscal restraint may also be imposed in the form of an Impact Fee for any adverse traffic impact. New constructions should be required to show provision of off-street parking made by them, and no clearances should be given in absence of such provision.
As part of demand management, in order to accelerate the shift of large whole sale markets out of the island, dis-incentives may be imposed on them, in terms of fiscal measures, restrictions on operating hours, restrictions on loading / unloading times, etc.

5.2.3.5 Road Based Mass Transportation / Intermediate Public Transport:

Enhanced bus services to carry restrained demand into CBD; Procurement of buses (MUTP) CNG buses, AC buses, Single decker buses; Intercity bus terminal at Wadala for Private Bus Operators; Bus services to be run from new bus & rail termini; Introduction of private bus operators:
A larger bus fleet will be required to carry the restrained demand for transport into the CBD/ Island City. The bus fleet of BEST is proposed to be augmented by more environment friendly CNG buses, as also with Air-conditioned buses, as part of the MUTP Project. These air-conditioned buses have been found to be quite successful in weaning away a section of the upper middle class from personalized transport, and a higher percentage of these buses with more reliable service is expected to be very successful. It is also important that as many existing buses as possible be converted to CNG.
In the event that BEST are unable to meet the demand for transportation, then private bus operators should be introduced, so that the demand is adequately met.

MMRDA have identified a location at Wadala for an Intercity Bus Terminal for private bus operators, with a capacity to handle about 160 buses (Refer Section 4.3.4). These private operators currently are located at various points in South Bombay, and their vehicles are parked on the roadside, using up scarce

carriageway width. These buses are parked for the entire length of the day, since they operate only at night. This idle parking of the vehicles needs to be shifted to this terminal at the earliest. Regular bus services will also require to be run from this point to the city and suburbs, if the terminal is to be successful.

Shared Taxi & bus service at terminals of Fast Ferry services along West and East Coast

In addition, buses services will also need to be integrated with the proposed ferry services along the West and East Coast, and also with the rail services. Shared taxi services can be designed to supplement the bus services at these points from well-organised stands. In other words, what is required is an integrated mass transportation system for road based mass transportation, rail based mass transportation, and passenger water transportation.

5.2.3.6 Rail Based Transportation:

Increase length of trains to 12 coaches; Increase frequency of trains to 3-5 minutes; Integration of both suburban systems; Redesign of rolling stock- for higher capacity & less seating on short routes MUTP; Investments to be made on stabling & repair facilities, longer platforms;

The recommendations summarized under the heading "Rail Based Mass Transportation", are all targeted towards promoting a shift of usage from road-based transport modes to the railways, by improving the level of service, comfort, and reducing travel time through improved east-west connectivity.

As part of the MUPT package, the design of the railway coaches are being changed with less seating on short routes. Integration and optimisation of the two suburban train services is essential to their successful functioning. The length of trains has already been increased to 12 cars on some fast lines, and the frequency has also been increased to 4 minutes on the Central Railway and 3.5 minutes on the Western Railway. The design of coaches is being changed to RDSO under the MUTP Project. Simultaneously, the length of platforms is also being increased to accommodate the 12 coach trains, while available repair and stabling facilities are being augmented.

Strengthening Power Supply and Signaling; Conversion from DC to AC;

In order to support this increased frequency of trains, the power supply and signaling system also will need to be upgraded. This also falls within the MUTP. The power supply to the suburban train system is also being changed from DC to AC, and the work is already under progress

Bandra-Kurla Rail Link including R&R;

The number of lines is also in the process of being augmented. But most important is the East-West Connection that can be provided by the Bandra-Kurla Rail Link. This link, in addition to providing accessibility to the burgeoning

Bandra-Kurla Complex, will also reduce the load on Dadar Station. This link needs to be given priority in construction.

Better passenger circulation facilities at interchange stations-one way circulation;

At interchange stations, in view of the enormous volumes of pedestrian traffic handled especially during peak hours, it is felt that a system of one-way circulation for passengers will need to be introduced in order to improve safety and efficiency. This might involve the construction of separate foot-Overbridge for both direction of flow of passengers.

Rapid Rail Transit System from Andheri to Ghatkopar via Sahar; 5th and 6th Lines - Kurla to Thane (under construction) including R&R; 5th line- Santa Cruz –Borivili (MUTP) including R&R; Additional coaches between Bandra and Virar; Quadrupling of section between Borivili and Virar (MUTP-under implementation); Widening tracks between Virar and Dahanu, for extension of suburban train services upto Dahanu; The Mass Rapid Transit System proposed for the suburbs, linking Andheri on the West with Ghatkopar on the East should be given priority, since it provides a vital East-West connection while at the same time being integrated with the suburban rail services at both ends. This integration provides for transit from long distance trains to the MRT. The MRT also has a spur to the Sahar Airport, thereby improving accessibility to the international airport also.

There are also proposals to improve accessibility to the rapidly developing regions of Thane, Kurla and Dahanu, while augmenting the current services to Borivili and Virar. These include resettlement and rehabilitation of the slum dwellers along the railway tracks.

Skywalk from Bandra Terminus to existing FOB at Khar; Pedestrian dispersal & facilities required to be studied at Churchgate, Bandra

At the stations, the necessity for integrating the bus services with the rail services cannot be adequately emphasized. Bus stops have to be located such that the cross movement of commuters is kept to the minimum, and the frequency of buses designed to meet the load spilling out of the stations.

In this context, the need is felt for the construction of a skywalk from Bandra Station to Khar, linking with the existing Foot Overbridge at Khar, thereby reducing a large amount of pedestrian conflicts at ground level at Khar. The WR are considering such a structure. There is also an urgent need to study the pedestrian dispersal pattern at both Churchgate and Bandra, and design for their dispersal so that the existing situation is ameliorated.

5.2.3.7 ***Truck Traffic:***

Shift trucker activity away from Masjid Bunder & Eastern side of the island to Wadala Truck Terminal (5,6). The Wadala Truck Terminal act has been approved, and legal provisions require to be enforced;
Restrictions on truck traffic and other slow moving vehicles on major arterials during peak hours should be imposed at the earliest. A fully developed truck terminal is in existence at Wadala, (Refer Section 4.3.4) but trucker activity is yet to be successfully shifted here from Masjid Bunder and the Eastern side of the Island. The Wadala Truck Terminal Act has been approved, but the legal provisions are yet to be enforced.

Establishing Truck Terminal Authority and enforcing regulations on movement of goods vehicles; Road network around Wadala to be developed;

It may be necessary to establish a Truck Terminal Authority to enforce regulations on the movement of goods and idle parking of truck, the routes to be opened for truck traffic, and their loading and unloading times.
The road network around the terminal also needs to be properly developed, if the shift is to be accelerated. At present, the truck terminal serves as a dumping yard for obsolete trucks.

5.2.3.8 Road Proposals- Freeways and other roads:

Resolve conflict between EF and elevated 6th Rail corridor; Traffic Management along P.D'Mello Road, with proper controls on entry and exit, & R&R of encroachments upto Barrister Nath Pai Road & King's Circle;
The current alignment of the Eastern Freeway runs past Horniman Circle, Blue Gate, Carnac Bridge and Wadi Bunder, upto Victoria Bridge largely along Shahid Bhagat Singh Road and P.D'Mello Road, before swerving towards the east to run over the MBPT railway lines and Messant Road. In the event that the Mumbai Trans Harbour Link is constructed, this freeway will become essential to disperse the traffic generated by the bridge. It is hoped that the MBPT will permit the necessary right of way required for the Eastern Freeway through their lands.

The alignment of the 6th rail corridor as proposed by MTP(R) would be running over Dock Expressway and Mineral Ore Depot (MOD) Link Road of the MBPT. Significant goods and container traffic ply on the MBPT roads. The proposed Eastern Freeway from Wadi Bunder to Victoria Bridge is elevated and some stretch from Nawab Tank Road to Victoria Bridge also runs over the MOD Link Road. There would be a conflict between the alignments of 6th rail corridor and the Eastern Freeway, especially at the crossing of Nawab Tank Road and Victoria Road Overbridge.

This conflict needs to be resolved between the concerned authorities before any further progress is made on either of these proposals.
Additionally, P.D'Mello Road becomes an important link in the dispersal system of the MTHL, and there will need to be adequate controls on the entry and exit points to this road along its length. A substantial amount of resettlement and rehabilitation of encroachments will also be required upto Barrister Nath Pai Marg and King's Circle.
Even assuming that the MTHL does not materialize in the immediate future, P.D'Mello Road will need to be cleared of its encroachments, so that this corridor is open to south-bound commuter traffic with destinations in the Fort area. This volume of traffic can then be diverted from the Western and Central Road Corridors onto the Eastern Corridor, thus resulting in a better distribution of traffic on the existing system. At present, commuters tend to avoid this route because of the encroachments and the truck traffic.

East-West connectors through Dattaram Lad Marg, Acharya Donde Marg and Sant Savta Marg to be widened;
In addition to being required as part of the MTHL dispersion system, the East West Connectors through Dattaram Lad Marg, Acharya Donde Marg and Sant Savta Marg will provide the cross connections in the Island network that is badly restricted as at present.

Improve Senapati Bapat Marg with a ramp to Western Express Highway;
Upgrading Senapati Bapat Marg will open up another major north –south corridor that is currently grossly under-utilised. The process of grade separation along this road is underway, but simultaneously, other roadway elements also need to be attended to. Additionally, if this is to become an alternate/ supplementary corridor, it is essential that a well-developed connection be provided to the Western Express Highway, through a ramp. In the next phase, Senapati Bapat Marg should be extended upto Turner Road junction in Bandra through an underpass below Western Express Highway.

Completion of Santa Cruz to Chembur Link Road including ROB at Kurla (MUTP); Completion of Andheri to Ghatkopar Link Road; Jogeshwari to Vikhroli link Road (MUTP); Road-Over Bridges at Level Crossings;
The Santa Cruz Chembur Link Road, the Andheri-Ghatkopar Link Road and the Jogeshwari-Vikhroli Link Road, all provide East-West connectivity in the suburbs. Provision of these links will reduce the traveling time and the loads on the suburban railways as well as on the buses. The level crossings at Jogeshwari Station and at Borivili Station need to be replaced by road over bridges. The Jogeshwari LC falls under the MUTP, while the Borivili, Kandivili and Dahisar LC's are underway.

Construction of Anik – Panjrapole Road with a link to Wadala Railway Overbridge, including R&R; Completion of Western Relief Road from Jogeshwari to Dahisar (MUTP)

The Anik Panjrapole Road will bypass the congested Chembur /Institutional area, and provide better access to the Sion- Panvel Road. The Western Relief Road is planned as a relief to the busy Swami Vivekanand Road, from Jogeshwari to Dahisar.

5.2.3.9 Water Transport:

Provision of fast ferry services along Western and Eastern Coastlines and Trans harbour, with shared taxi services / bus routes at CBD destinations; Landing stages, shore facilities & navigational aids;

Fast ferry services are recommended along both the West and the East Coast and across the harbour. However, it would be quicker to commence these services along the East coast, as there are several facilities already existing that could be pressed into use. If these services are to succeed, it is imperative that they be integrated with road based mass transportation, and also shared taxi services.

The Report of the Committee to Consider the Location of Landing Points for Hovercrafts, August, 1996, is of the opinion that landing points for Hovercraft services on the West Coast of Mumbai may be constructed on the following locations:

- Cuffe Parade (between IDBI and Maker Towers)
- Nariman Point (behind MLA's Hostel and opposite Raheja Centre)
- Girgaon Chowpatty (next to Mafatlal Swimming Centre on the south side)
- Haji Ali (opposite NSUI and on the road junction of Worli)
- Bandra (in the Mahim bay on the North bank)
- Juhu Tara Bunder (near Juhu Koliwada on the southern end of Juhu beach) and a temporary landing point near Holiday Inn
- Versova beach (near Ruia park and Vidnyan Sheela building)
- Erangal beach (next to proposed beach resort by MTDC) or near Aksal Beach (behind Resort Hotel)
- Essel World Jetty (Manori Creek)
- Gorai Jetty (Borivali)

MMB have already identified landing sites at Worli, Bandra, Juhu, Versova, Marve and Borivili, and the GOM have already given them land at Bandra. Land acquisition is in progress at the remaining sites. They are currently in the process of identifying the landing site at Nariman Point. MMB are also negotiating with a private party for commencement of PWT along the West Coast. The type of craft and technology is yet to be finalized.

5.3 PHASE- II

In the second phase, we have assigned those traffic engineering measures that we feel can streamline and facilitate the functioning of the measures under the first phase.

5.3.1 Traffic Engineering

Upgrade Samrat Ashok Road (partially done); Improve Senapati Bapat Marg from Mahim to Turner Road Junction;

Upgrading Samrat Ashok Road will open up the East- West connection from Sion Hospital to Mahim and improving this link is of vital importance. Some form of pedestrian segregation – either a low-level flyover or pedestrian subway is essential, as the volume of pedestrian traffic is very high. Senapati Bapat Marg should be extended upto Turner Road junction in Bandra through an underpass below Western Express Highway, which will make it a much stronger North-South corridor.

Access Control of WEH through provision of service roads; Access Control of EEH through provision of service roads; Eastern Express Highway (E.E.W.) to have 8 lanes north of Sion (1) (Underway);

These are primarily the provision of service roads along the Highways. Abutting land uses and minor roads have direct access to these roads, thereby reducing their capacity. These accesses should be directed to a service road along them, and the access from the service road to the highway should be spaced and controlled as per standards.

Tilak Bridge to be widened; Elphinstone Bridge to be widened (5)(by a 2nd level bridge; Road-Over Bridges;

Elphinstone Bridge and Tilak Bridge are current bottlenecks in the network, and some form of widening will be required. The remaining Road over bridges across the railway tracks at Ville Parle, Dahisar, Naigaon- Vasai Road, Vasai Road-Nalasopara, Virar and Chunnabhatti are also to be completed in this phase.

Construction of some of the pedestrian facilities that have been identified also will spill over into the second phase.

Interchange with Sion-Trombay Road (1)(Swastik Compound); Flyover at Saki Naka;*

Interchange with Sion-Trombay Road (Swastik Compound) depends on the ROB over Burmah Shell rail tracks, which will need to be raised. However, in view of the flyover at Kurla, it may not be relevant any longer. A flyover may be necessary at Saki Naka, as recommended by CRRI and the Paranjpe Committee, but this has to be revalidated by a study before any work is commenced.

5.3.2 Rail improvements

5TH line- Kurla – CSTM; 6th Line- Santa Cruz- Borivili; Conversion of Kalwa-Thurbe Goods line to Passenger line; 6th Line between Bombay Central –Santa Cruz (WR)

There has been a very fast growth of housing development in the northern suburbs, especially between Borivili and Virar, and commercial development in the Andheri- Kurla area and the Bandra Kurla area. The 5th line from Thane to Kurla is proposed to be extended southwards to CSTM in the second phase, while the 6th line will be extended northwards from Santa-Cruz to Borivili, to meet the demand from these areas, and later extended southwards to Bombay Central.

Similarly, the existing Kalwa- Thurbe goods line will be converted to passenger line to further augment the rail network for suburban services.

Cross Platform for Interchange between services; Mezzanine circulation/ ticketing areas across tracks at busier stations;

In order to facilitate transfers between services- i.e. shifting from Western to Central Railway or vice versa, it is necessary to have well designed cross platforms so that such transfers are affected efficiently. Additionally, provision of ticketing booths on these elevated platforms would further improve the efficiency of the transfers, while reducing congestion on ground level.

Shifting of Mail / Express Passenger Exit from CST to Carnac Bunder (CR); Beyond 2011, case for underground rail loop in CBD;

The Central Railway plans to shift the exit for passengers from long distance trains from the GPO side to P D'Mello Road at Carnac Bunder. As has already been mentioned, they are in the process of supplementing the number of platforms for suburban services at CSTM, and the idea is to give priority to the suburban commuters at CSTM. The P. D'Mello Road exit will actually be an alternative exit for the long distance passengers, as the CR intends to continue the access for long distance trains from the GPO side also.

The 1969 Mass Transportation Study makes a case for an underground loop from Churchgate to CSTM, which will convert the suburban services into a more efficient ring railway service. It is however felt that this may be required only after 2011.

Light Rail Transit System from World Trade Centre to CST;

The Light Rail Transit System recommended for the CBD will provide access from both Churchgate and CSTM upto the World Trade Centre at Cuffe Parade. This system is planned to be integrated at Churchgate with the suburban services, and will also provide accessibility to Nariman Point. Integration is also planned at CSTM, however the existence of the new subway here is expected to pose a problem. Of the two sections of LRT/ MRT proposed for Mumbai, the MRT in the suburbs, linking Andheri with Ghatkopar, with a spur to Sahar, is considered to be more urgently required, since it will provide vital East-West connectivity and also reduce the load on the suburban services. The LRT in the CBD is preferred to the various other alternatives like moving walkway, and the Metro

Rail, because of better carrying capacity and better penetration to the south of the Island City.

Provide new long distance rail terminus at Bandra;
Western Railway has a proposal for the construction of a new long distance train terminal at Bandra, to ease the load at Bombay Central. This is however only in the planning stage, and any construction is likely to commence only after 2003.

5.4 PHASE-III

Western Freeway from Worli to Nariman Point; Western Freeway from Worli to Bandra; Mumbai Trans Harbour Link (Road –cum-Rail); Eastern Freeway from Museum to Sewri;
The capital-intensive long-term projects that have been proposed for Mumbai have been put under Phase 3. These are the Western Freeway, the Eastern Freeway and the Mumbai Trans-Harbour Link.
In the context of these projects, especially the Bandra- Worli- Nariman Point Sea Link, Bombay First analyses the requirement as follows:

1. Attracting more traffic to the southern part of the Island City through the Worli-Bandra and Worli- Nariman Point Sea Link means the requirement of parking spaces in the island will increase, and this is already a limited resource anywhere in Mumbai. If on-street parking is allowed all over the network, this will only erode the system capacity further, and reduce the travel speeds that the Expressways intend to improve.
2. This implies that simultaneous with the construction of these freeways, it is of utmost importance that large multi-storied parking lots be identified and construction of the same be completed before the freeways are opened to the public. These should be in accordance with the Amendment to the Development Control Regulations prepared by the Bombay First Committee headed by Mr. D. T. Joseph, which has recommended several incentives for increase in parking spaces.
3. Bombay First however, feel that if the traffic and demand management measures recommended by it are implemented with immediate effect, there will be a willing and substantial shift from private modes to mass transportation, with resultant decongestion of the road network of Mumbai. This will mean that the road network will have adequate if not surplus capacity, and the construction of these high speed, capital-intensive roads will not be necessary. It may be recalled that the effect of having just 55,000 taxis off the roads a few months ago during the taxi strike resulted in journey speeds going up by at least 50%, delays being cut down to the barest minimum, and driving conditions becoming almost pleasant.
4. The Bandra- Kurla Complex and the Andheri –Kurla Complex are developing very fast as commercial areas offering a very high quality of construction, lower prices, better accessibility, lower levels of congestion, and lower levels of pollution. The restrictions that Bombay First recommends

with respect to the Island City and the CBD can help to accelerate the shift of job opportunities outwards to these areas. This being the case, the sea links to Nariman Point and Cuffe Parade will be redundant.

5. It is therefore recommended that the construction of this facility be deferred for at least 5 years, until the demand and traffic management measures are implemented, and their results obtained. The cost of construction of this link is Rs.1500 Crores, and part of these funds could be diverted to the recommendations made below.

With regard to the Mumbai Trans-Harbour Link, Bombay First feels that it can become an effective tool towards decentralization and accelerate the development of the mainland. However, the dispersal system for the MTHL with regard to the road network of the Island City has to be given equal priority, and this system has to be in place before the MTHL is opened to the public. Otherwise the resultant congestion and chaos would be enormous.

The Eastern Freeway as recommended here is an integral part of this dispersal system, and design and construction of this facility will need to be dovetailed with that of the MTHL. Similarly the East-West Connectors of Acharya Donde Marg, Sant Savta Marg and Dattaram Lad Marg as identified in Section 5.2.3.8, will also need to be widened to accommodate the increased traffic expected to be generated by the MTH Link.

5.5 FUNDING OF TRANSPORTATION PROJECTS:

In order to carry out these improvements to the transportation system, it is necessary to have a source of funds that can be readily accessed. The revenue required for these projects can be obtained from the following:

- Parking charges are expected to generate revenue of about Rs.13.38 Crores per annum, if all parking is brought under the control of the Parking Authority, and it is vested with the powers of imposing and collecting parking penalties also. This revenue is expected to come from parking fees and penalty tickets.
- Income from the cordon pricing scheme, if implemented, has been estimated at Rs.1,100 to Rs.1,350 Crores per annum, assuming a 20% suppression of trips, and a License fee charge of Rs.15 for private cars and Rs.30 for taxis (at 1996 prices).
- Bombay First recommends the re-imposition of the Wheel Tax, in a revised form. This tax had been abolished by the Government a while ago, but the tax had been in its original form, unrevised since 1950. This is also expected to generate a revenue of about Rs.30 crores per annum
- In addition to the above, Bombay First also recommends the imposition of a "Payroll Tax". The logic for a payroll 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 central business district. 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). The rate of the payroll tax is in the range of 1% to 1.75% of the total payroll costs of the employers with establishments within the urban area.

The imposition of a payroll tax payable by the employers may be deemed a corporate tax. If so, under Articles 265 and 246(1) and the seventh schedule of the Constitution, it would require legislation by the Parliament in Delhi for its implementation.

- Annexure –19 gives a summary of novel sources of funding for transportation projects, as given in the Working Paper by W.S. Atkins. These may be examined in detail for relative merits as additional sources of revenue.

5.6 RECOMMENDED ORGANISATIONAL STRUCTURE:

W.S. Atkins have recommended a reorganization of the Traffic Department within the Municipal Corporation, to include departments of Highway Planning, Traffic Planning, Parking Control, Traffic Signals and Traffic Data and Survey. Each department should have well qualified Engineers and Planners and Economists.

This reorganization is being funded by the World Bank aided MUTP, as the formation of a Traffic Management Unit (TMU) within the BMC.

The formation of the TMU should to a large extent do away with the problems so far associated with the plethora of organizations handling the transport sector. The railway sector is handled only by the department of railways, and it important that any changes in the road network also be controlled by one central agency.

Chapter –6
IMPACT OF RECOMMENDATIONS

The basic idea behind the recommendations detailed in the preceding chapters has been to curtail the indiscriminate use of the automobile, while ensuring that the available facilities are equally accessible to a larger section of the population. A greater level of comfort is expected on the mass transportation systems –rail, road and water transport, with the increased frequency and number of coaches on the suburban services, being supplemented by water transportation and the road based bus transportation systems. Allowing for a marginal increase in the number of trips being made to the south of the Island City, the total number of trips currently being made by mass transportation is expected be distributed over these three systems. A substantial shift from private cars and taxis to mass transportation is also expected, in view of the restraints planned to be imposed on the modal choice.
The increase in the number of lines will also dedicate a network for the suburban services, which at present experiences delays when long distance trains arrive.

The recommendations are expected to have the following impacts:

Rail Transportation:

- Better traveling conditions and therefore less stress;
- Shorter trip length due to better E-W 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 removal of encroachments along the tracks;
- Lower rate of accidents.

Road Transportation:

- Lesser congestion because of lower volumes of cars on the streets;
- Higher ratio of people moved to number of vehicles, because of greater number of buses;
- 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
  - More number of CNG vehicles (Buses)
  - Less volume of cars on the streets
  - Higher speeds, and therefore less number of stop- start sequences.
- Better Intermodal transfers and therefore absence of congestion due to pedestrians on the streets;

- 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 revenue, which can be used for the periodic maintenance of the road network, including 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 much needed relief in the form of decentralization of jobs. Additionally, 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.

TABLES

AND

REFERENCES

Table: 5.1

PHASE –I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
TRAFFIC MANAGEMENT								
1.Separate Bus lanes on major arterials (5)	TP/BEST	X	X	X	X	-	I	I
2.Right turns for buses only (5)	TP	X	X	X	X	-	I	I
3. Banning right turns (5)	TP	X	X	X	X	-	I	I
4.Permit local traffic to use roads in Port Trust Area (5)	MPT	X	X			-	I	I
5.Restricting truck and other slow moving traffic (5)	TP	X	X			-	I	I
6.Dadar- Mahim One Way Scheme (MUTP)	TP		X			5	I	I
IMPACT: Priority to bus traffic will reduce delays to mass transportation vehicles. As levels of service improve, it can accelerate a shift to mass transportation. Banning right turns can increase junction capacity; movement of traffic on Port Trust Roads will augment Eastern Corridor. Dadar Mahim One way Scheme includes contra flow bus lanes, linked signals and one- way streets.								

Table : 5.2

TRAFFIC ENGINEERING	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost- in Rs Cr	Priority	
							Planning	Implement
1.Upgrading & extension of Traffic Signals (6)	TP/ BMC	X	X	X	X	TBE	I	I
2.Area Traffic Control Systems (6)(MUTP)	TP/ BMC	X	X	X	X	50	I	I
3.Station Area Improvements (SATIS) as per list attached (3,5,6)(MUTP)	IR/ BMC	X	X	X	X	30	I	I
4.WEH ROB at Bandra partly completed, 8-laning to be completed	PWD			X		*	I	I
IMPACT: Better controls mean better flow conditions. SATIS aims at reducing pedestrian- vehicular conflicts, reducing delays. * The work is already partly completed, and so no cost is involved here.								

TBE: To be estimated

Table: 5.3

TRAFFIC ENGINEERING - PEDESTRIAN FACILITIES	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
1.Pedestrian Subways to be provided as per list attached	BMC	X	X	X	X	30	I	I,II
2.Footpath Demonstration Programme (MUTP- under consideration by BMC)	BMC	X	X	X	X	--	I	I
3.Moving Walkway for pedestrians in CBD at Churchgate and CST	BMC	X				300	I	I
4. Detailed studies to be undertaken to understand the pedestrian flow characteristics and work out a system of pedestrian facilities for different parts of Mumbai (3) at - Railway stations - Bus stations - Commercial areas - Office complexes - Arterial Roads	BMC	X	X	X	X	TBE	I	I,II
IMPACT: Pedestrian facilities need to be augmented urgently, to reduce pedestrian-vehicular conflicts and improve road capacity.								

TBE: To be estimated

Table : 5.4

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
REMOVAL OF ENCROACHMENTS, RESETTLEMENT AND REHABILITATION								
1. Removal of encroachments on S.V. Road (3,5)	BMC			X		2.27	I	I
2. Removal of encroachments on L.B.Shastri Marg (3,5,6)	BMC				X	2.27	I	I
3. Removal of slums and R&R of Western Expressway (5)	BMC			X		25.0	I	I
IMPACT: Removal of encroachments should be the first step towards optimizing the existing elements of the roadway.								

Table: 5.5

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
DEMAND MANAGEMENT								
FISCAL MEASURES- RESOURCE GENERATORS								
1. Parking Restrictions through pricing, & charged off-street parking (5,6)	BMC / TP	X	X	X	X	--	I	I
2.Curtail Car entry through Cordon Lines during peak hours (5,6)	TP	X	X			--	I	I
3.Cordon Pricing & Park & Ride Schemes (5,6)	TP	X				TBE	I	I
IMPACT: 2,3 and 4 need to be studied relatively, to determine what is best for Mumbai. In addition to reducing vehicles, these can also be a source of income, which can be used for traffic improvement schemes.								

Table: 5.5 Cont.

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
POLICY MEASURES								
4.Area licensing for car & motor cycle use within restraint area (5,6)	TP	X	X			--	I	I, II
5. Restrict permission to convert residential use to commercial use (5)	MMRDA	X				--	I	I
6. Provide disincentive to large wholesale markets located in the Island City(5)	MMRDA/BMC	X	X			--	I	I
IMPACT: Private bus operators can be used to run shuttle or circular bus services from the peripheral parking lots to the CBD or restraint area Removal of wholesale markets to the suburbs / Navi Mumbai will be a major step towards decongesting the inner roads of the Island.								

TBE: To be estimated

Table: 5.6

PHASE- I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
ROAD BASED MASS TRANSPORTATION/ I.P.T.								
1. Enhanced bus services to carry restrained demand into CBD (5)	BEST	X	X			TBE	I	I,
2. Procurement of buses (MUTP) - CNG buses, AC buses, Single decker buses	BEST	X	X	X	X	120	I	I,II
3. Intercity bus terminal at Wadala for Private Bus Operators	MMRDA		X			--	I	I
4. Bus services to be run from new bus & rail termini	BEST/ MSRTC	X	X	X	X	--	I	I,II
5. Introduction of private bus operators	GOM	X	X	X	X	--	I	I
6. Shared Taxi & bus service at terminals of Fast Ferry services along West and East Coast (5)	RTO/ BEST	X	X	X		TBE	I	I,II
IMPACT: Integration of mass transportation services at terminals is essential to reduce inter-modal transfer delays, and reduce conflicts with pedestrians at these points. Private bus operators can be used to run the shuttle/ circular service from the peripheral parking lots to the CBD or restraint area.								

TBE: To be estimated

Table: 5.7

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
RAIL BASED MASS TRANSPORTATION								
1. Increase length of trains to 12 coaches (MUTP)(6,13)/ WR & CR - on fast lines - on slow lines	IR	X	X	X	X	501	I	I
2. Increase frequency of trains to 3-5 minutes (6,13)/ WR& CR	IR	X	X	X	X	809	I	I
3. Integration of both suburban systems (6) (MRVC in place)	IR					--	I	I
4. Redesign of rolling stock- for higher capacity & less seating on short routes MUTP(6,13)	IR	X	X			1126	I	I
5. Investments to be made on stabling & repair facilities, longer platforms(6)	IR	X	X	X	X	969	I	I
6. 5th and 6th Lines - Kurla to Thane (under construction) including R&R (6)	IR				X	399	I	I
7. Bandra-Kurla Rail Link including R&R (6)	IR			X	X	975	I	I
8. Strengthening Power Supply and Signalling (6,13)	IR	X	X	X	X	348	I	I

Table: 5.7 Cont.

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
9. Conversion from DC to AC (6. MUTP)	IR	X	X	X	X	253	I	I
10. Better passenger circulation facilities at interchange stations- one way circulation (6)	IR	X	X	X	X	TBE	I	I
11. Rapid Rail Transit System from Andheri to Ghatkopar via Sahar (12)	IR			X	X	820	I	I
12. 5th line- Santa Cruz –Borivili (MUTP) including R&R (6)	IR			X		158	I	I
13. Additional coaches between Bandra and Virar (6)	IR			X		---	I	I
14. Quadrupling of section between Borivili and Virar (MUTP-under implementation) (6)	IR			X		577	I	I
15. Widening tracks between Virar and Dahanu, for extension of suburban train services upto Dahanu (WR)	IR			X		TBE	I	I
16. Skywalk from Bandra Terminus to existing FOB at Khar (WR)	IR			X		TBE	I	I
17. Pedestrian dispersal & facilities required to be studied at (WR) - Churchgate - Bandra	IR	X		X		TBE	I	I
IMPACT: Augmentation of rail services will improve the traveling conditions, and accelerate a shift from road to rail.								

TBE: To be estimated

Table; 5.8

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
GOODS TRANSPORT:								
1. Shift trucker activity away from Masjid Bunder & Eastern side of the island to Wadala Truck Terminal (5,6). The Wadala Truck Terminal act has been approved, and legal provisions require to be enforced	MMRDA/GOM	X	X			---	I	I
2. Establishing Truck Terminal Authority and enforcing regulations on movement of goods vehicles	MMRDA/GOM					---	I	I
3. Road network around Wadala to be developed (6)	BMC		X			TBE	I	I
IMPACT: Removal of trucks currently parked along arterial streets and along P. D'Mello Road will provide one extra lane for movement of regular traffic, and also open up the eastern corridor.								

TBE: To be estimated

Table: 5.9

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
ROAD PROPOSALS: **FREEWAYS AND OTHER ROADS**								
1. Resolve conflict between EF and elevated 6th Rail corridor (possible solution has been given in Vol.V of MTHL Report by CES)	MMRDA/IR					---	I	
2. Traffic Management along P.D'Mello Road, with proper controls on entry and exit, &	TP	X	X			TBE	I	I
3. R&R of encroachments upto Barrister Nath Pai Road & King's Circle (5)	BMC						I	I
4. East-West connectors through Dattaram Lad Marg, Acharya Donde Marg and Sant Savta Marg to be widened	BMC	X	X			5.68	I	I
5. Improve Senapati Bapat Marg with a ramp to Western Express Highway	PWD		X			TBE	I	I
6. Completion of Santa Cruz to Chembur Link Road including ROB at Kurla (3,5,6)(MUTP)	PWD			X	X	83	I	I
7. Construction of Anik – Panjrapole Road with a link to Wadala Railway Overbridge, including R&R	PWD				X	269	I	I

Table: 5.9- Cont.

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
ROAD PROPOSALS: **FREEWAYS AND OTHER ROADS**								
8. Completion of Andheri to Ghatkopar Link Road (3,5,6)	PWD			X	X	16.5	I	I
9. Jogeshwari to Vikhroli link Road (3,5,6) (MUTP)	PWD			X	X	84	I	I
10. Completion of Western Relief Road from Jogeshwari to Dahisar (MUTP) Including R & R	PWD			X		211	I	I
11. Road-Over Bridges at	BMC							
- Jogeshwari Station LC NO 24,25,26,27(6) (MUTP)				X		61.9	I	I
- Borivili LC no, 33 underway				X		40.1	I	I
- Kandivili LC no.31 underway				X		33.3	I	I
- Mira Road- Bhayander LC No 35 underway				X		19.3	I	I
- Vikhroli LC No. 14 (6)(MUTP)					X	25.6	I	I
IMPACT: Traffic movement along Eastern Corridor will improve. East-West connections will improve. Senapati Bapat Marg becomes an additional N-S Corridor. Bottlenecks at level crossings removed.								

Table: 5.10

PHASE – I Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
WATER TRANSPORT								
1. Provision of fast ferry services along Western and Eastern Coastlines and Trans harbour, with shared taxi services / bus routes at CBD destinations (4,5,6)	MMB/ RTO	X	X	X		178	I	I
2. Landing stages, shore facilities & navigational aids (6)	MMB	X	X	X		TBE	I	I,II
IMPACT: Commencement of PWT service along the eastern coast and trans-harbour, where some kind of terminal facilities are already available, will relieve the load on the rail and bus services to a large extent.								

Table: 5.11

PHASE – II Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
TRAFFIC ENGINEERING								
1. Upgrade Samrat Ashok Road (partially done)(3,5)	BMC		X			2.27	I	II
2. Improve Senapati Bapat Marg from Mahim to Turner Road Junction (3,5)	PWD		X			52.8	I	II
3. Tilak Bridge to be widened (5,6)	BMC		X			11.4	I	II
4. Elphinstone Bridge to be widened (5)(by a 2nd level bridge)	BMC		X			TBE	I	II
IMPACT: Access control on arterials will improve speeds & reduce conflicts. Samrat Ashok Road will provide East-West connectivity. Tilak Bridge and Elphinstone Bridge are currently bottlenecks in the system.								

Table 5.12

PHASE – II Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implemnt
ROAD PROPOSALS: **OTHER ROADS:**								
1. Access Control of WEH through provision of service roads (3,5)	BMC			X		TBE	II	II
2. Access Control of EEH through provision of service roads (3,5)	BMC				X	TBE	II	II
3. Eastern Express Highway (E.E.W.) to have 8 lanes north of Sion (1) (Underway)	PWD				X	--	II	II
4. Interchange with Sion-Trombay Road (1)*(Swastik Compound)	MSRDC				X	TBE	II	II
5. Flyover at Saki Naka (3,5)	MSRDC				X	TBE		
6. Road-Over Bridges at	BMC						II	II
- Ville Parle LC NO 22 (6)				X		4.05		
- Dahisar LC no 34 under scrutiny				X		50.5		
- Naigaon-Vasai Road LC no 36				X		TBE		
- Vasai Road-Nalasopara LC no 38				X		TBE		
- Virar LC No 40				X		10.5		
- Chunabhatti (5,6)					X	TBE		
IMPACT: Access control on the WEH &EEH as per standards is essential if they are to function as Expressways.								

Table : 5.13

PHASE – II Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
RAIL BASED MASS TRANSPORTATION								
1. 6th corridor from Wadala (elevated) Fort (6)	IR	X	X			---		
2. 5TH line- Kurla – CSTM	IR	X			X	219	II	II
3. 6th Line- Santa Cruz- Borivili (WR)	IR			X		207	II	II
4. Conversion of Kalwa-Thurbe Goods line to Passenger line (5) (under progress)	IR				X	--	II	II
5. Doubling system capacity North of Kurla (6)	IR				X	365	II	II
6. Cross Platform for Interchange between services (6)	IR	X	X	X	X	TBE	II	II
7. Mezzanine circulation/ ticketing areas across tracks at busier stations (6)	IR	X	X	X	X	TBE	II	II

Table : 5.13 Cont.

PHASE – II **Type of Action**	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
8. Shifting of Mail / Express Passenger Exit from CST to Carnac Bunder (CR)	IR	X				TBE	II	II
9. Beyond 2011, case for underground rail loop in CBD (2)	IR	X				TBE	II	III
10. Light Rail Transit System from World Trade Centre to CST (11)		X				520	II	II
11. Provide new long distance rail terminus at Bandra (5,WR)	IR			X		TBE	II	II
12. 6th Line between Bombay Central – Santa Cruz (WR)	IR		X	X		TBE		

TBE: To be estimated

Table:5.14

PHASE – III Type of Action	Agency	CBD	Rest of Island	Western Suburb	Eastern Suburbs	Cost-in Rs Cr	Priority	
							Planning	Implement
ROAD PROPOSALS: **FREEWAYS :**								
1. Western Freeway from Worli to Nariman Point, (1,14) the alignment being modified by MSRDC with the following interchanges	MSRDC	X	X			1585		
a. Worli at Love Grove Pumping Station			X					
b. Haji Ali			X					
c. Bhulabhai Desai Road			X					
d. Nariman Point, with a bridge to		X						
e. Cuffe Parade		X						
2. Western Freeway from Worli to Bandra (1,14)	MSRDC		X	X		733		
3. Mumbai Trans Harbour Link (Road –cum-Rail)	MSRDC		X			6600		
4. Eastern Freeway from Museum to Sewri (1,15)	PWD	X	X			TBE		
a. Flyover at Carnac Bridge		X						
b. Interchange at S.V. Patel Road at Wadi Bunder			X					
c. Ramps at Nath Pai Marg			X					
d. Interchange at Victoria Bridge			X					
e. Interchange for Acharya Donde Marg near Sewri Railway Station			X					

Table 5.15 Station Area Improvements at

Grant Road (5) **Dadar (5)** **Santa Cruz (3,5)** **Goregaon (3,5)** **Borivili (3,5) (MUTP)** **Chembur (5)**	**Wadala (5)** **Bandra (3,5)** **Andheri (3,5) (MUTP)** **Malad (3,5)** **Kurla (5)** **Ghatkopar (5) (MUTP)**

Table: 5.16 PEDESTRIAN SUBWAYS AND FOOT OVER BRIDGES AS RECOMMENDED IN STUDIES AND BY MMRDA

1. Opposite Mantralaya (5). 2. Opposite Air India Building (5) 3Near CTO (5) * 4. Adelphi (6)(MUTP)* 5. Metro Cinema 6. Nana Chowk * 7. Masjid* 8. Tejukia * 9. Sterling Apartments, Peddar Road * 10.Passport Office, Worli (6) * 11. Opp. Sion Hospital (5) 12. Samrat Ashok Road * 13. JJ Hospital, Hume School 14. Bharat Mata 15. Hind Mata 16. Kataria Junction, L.J.Road 17. Plaza Cinema Junction 18. Gadkari Chowk, near Sena Bhavan 19. Poddar hospital, A.B.Road 20. Worli Naka 21.Siddhivinayak Junction 22. Shivaji Park, Keluskar South Road junction, Veer Savarkar Marg 23. Mahim Church * First Priority as seen by Bombay First	24.Bandra, Hill Road junction (5) 25.Near Bada Masjid, S.V. Road, Bandra (West) Near Lucky Restaurant, S.V.Road, Bandra (West) Lotus Tank, S.V. Road 28. Barfiwala Lane Flyover 29. Bahar talkies, WEH (5) 30. Across S.V. Road, Jogeshwari Station (West) 31.Ratna Hotel, S.V.Road, Goregaon (West) 32. Vakola, WEH (5) 33. Swami Vivekanand Road, Andheri (5) 34. Chandavarkar Lane, S.V. Road, Borivili (East) (5) 35. Hanuman Nagar, WEH (5)* 36. Kurla Andheri road (5) 37. Swami Vivekanand Road, Malad (5) 38. Dube Marg (6)* 39.Mantri Park, Chembur 40. Chembur Naka 41. Bainganwadi, Across Ghatkopar-Mankhurd Link Road 42. L.B.S. Marg, Hiranand desai Marg, Ghatkopar 43. L.B.S.Marg, Adishankaracharya Marg, Kanjur Marg 44. L.B.S.Marg & Bhandup Station Road, Bhandup (West) 45. L.B.S.Marg and Dr.Rajendra Prasad Marg, Mulund

Table:5.17

PEDESTRIAN SUBWAYS AS PROPOSED BY BMC		PEDESTRIAN SUBWAYS AS RECOMMENDED BY BOMBAY FIRST
Within One Year:	**Phase –II**	
1. Teachers Colony (WEH)	14. Shankarwadi (WEH)	1. Near CTO
2. Agripada (WEH)	15. Vanrai (WEH)	2. Adelphi
3. Rajaram Nagar (WEH)	16. Asha Nagar near Dattani Park, Devipada (WEH)	3. Nana Chowk
4. Malpa Dongri (WEH)	17. Rajendra High School, Shanti Nagar (WEH)	4. Masjid
5. Everard Nagar (EEH)	18. Suman Nagar, Chembur (EEH)	5. Tejukia
6. Priyadarshini Chowk (EEH)	19. Kannamvar Nagar, Vikhroli (EEH)	6. Sterling Apartments, Peddar Road
7. Postal Colony (EEH)	20. Pravin Nagar (EEH)	7. Passport Office, Worli
8. Chheda Nagar (EEH)	21. Tagore Nagar (EEH)	8. Samrat Ashok Road
9. Kamraj Nagar (EEH)	22. Navghar Junction, Mulund (EEH)	
10. Godrej Colony (EEH)	23. Thane Mental Hospital (EEH)	
11. Near Mankhurd Railway Station	24. Louiswadi (EEH)	
12. Ramabhai Nagar		
13. Garodia Nagar		

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