

Towards a discussion of support to Urban Transport development in India

**Energy & Infrastructure Unit
South Asia Region**



March 2005

Document of the World Bank

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

ACRONYMS

BDA	Bangalore Development Authority
BMC	Bangalore Municipal Corporation
BMTC	Bangalore Metropolitan Transport Corporation
BMRTL	Bangalore Mass Rapid Transit Ltd
CMA	Chennai Metropolitan Area
CMDA	Chennai Metropolitan Development Authority
CMC	Chennai Municipal Corporation
CMTC	Chennai Metropolitan Transport Corporation
CTTS	Chennai Traffic and Transport Study (1995)
KRDCL	Karnataka Road Development Corporation Ltd
KUIFDC	Karnataka Urban Infrastructure Development Corporation
LRT	Light-rail Transit
MTC	Metropolitan Transport Corporation
MRTS	Mass Rapid Transit System (Chennai urban railway)
TM	Traffic Management
T&PM	Traffic and Parking Management
TNUDF	Tamil Nadu Urban Development Fund
UTP	Urban Public Transport

CONTENTS

	<u>Page</u>
PREFACE	i
How significant is the urban transport problem in India?.....	1
What is the Government of India policy response to the Urban Transport problem?	2
What is currently being implemented to address the Urban Transport problem?	4
Putting policy into practice – the case of Chennai and Bangalore	5
A Way Forward.....	7
A Potential Role of the World Bank.....	9
ATTACHMENT I: URBAN TRANSPORT IN BANGALORE AND CHENNAI.....	12
1. OBJECTIVES AND CONTENT OF THE REPORT	12
2. THE BACKGROUND	13
3. URBAN TRANSPORT ISSUES	18
4. THE WAY FORWARD.....	28
5. THE POTENTIAL ROLE OF THE WORLD BANK	30
ATTACHMENT I-A: URBAN TRANSPORT IN CHENNAI.....	34
ATTACHMENT II-B: URBAN TRANSPORT IN BANGALORE	53
ATTACHMENT III: URBAN TRANSPORT IN INDIA – BIBLIOGRAPHY	64
ATTACHMENT IV: CITIES ON THE MOVE – EXECUTIVE SUMMARY	69

Towards a discussion of support to Urban Transport development in India

PREFACE

The purpose of this *policy note* is to respond to the request from the Government of India for the World Bank to provide support to the development of the urban transport agenda in India and to provide lending support. During the discussions between the World Bank and the Government of India represented by the Ministry of Finance, the Department of Economic Affairs (DEA) agreed on a three year program of support 2005-2008 reflected in the World Bank's *Country Strategy for India* September 15, 2004 (Report No. 29374-IN). Support is currently reflected in the Operations Program as an Urban Transport project under consideration and as a *policy note* as part of the non-lending services. In conjunction with these operations support to urban roads are included in Chennai under the proposed Tamil Nadu Urban Development Project III and in Bangalore under the proposed Karnataka Municipal Reform Project.

This report was written by Slobodan Mitric, Urban Transport Specialist (consultant). Isabel Chatterton, Financial Specialist (SASEI) contributed to the Chennai case study. The task leadership was shared by A.K. Swaminathan, Zhi Liu, and Sally Burningham (SASEI). Guang Zhe Chen is the Transport Sector Manager in SASEI and Vincent Gouarne is the SASEI Director.

Towards a discussion of support to Urban Transport development in India

How significant is the urban transport problem in India?

1. Efficient and reliable urban transport systems are crucial for India to sustain a high growth rate and alleviate poverty. Indeed, the significance of urban transport in India stems from the role that it plays in the reduction of poverty, both through its indirect effects as a stimulator of poverty reducing growth and through its direct effects on the quality of life of people¹.

2. Services and manufacturing industries particularly concentrate around major urban areas, and require efficient and reliable urban transport systems to move workers and connect production facilities to the logistics chain. In China for instance, service industries as well as manufacturing and labor-intensive industries have developed in economic centers endowed with good transport systems that could efficiently handle mobility needs of millions of workers and facilitate the movement of goods. India's economy is currently more service-oriented than China, with only about one million people employed in the IT industry—the mainstay of the tertiary sector². But growth in the services sector and development of Indian manufacturing industries will put more pressure on already saturated urban transport systems. Many Indian cities such as Bangalore and Chennai have attracted significant investments in high-technology industries thanks to a competitive and highly qualified workforce. In the past few years however, urban infrastructure, and transport systems in particular, have been struggling to keep up with the growing number of firms moving into these cities. Local and international media have been continuously reporting the cities' difficulty in coping with growing demand for efficient transport systems³. The financial press has been describing Bangalore for example as a city of 60,000 unfilled potholes and where software workers' morning commute to work can take up to two hours. Developing an efficient urban transport system should be part of the broad Government policy aimed at improving the attractiveness and competitiveness of Indian cities.

¹ The importance of growth to poverty reduction can be demonstrated by comparing the performance of the Indian and Chinese economies over the last two decades. Over that period the GDP growth rate in India has been around 5.5% with the economy growing about 2.6 times reaching a level of about US\$510 billion in 2002. In China the GDP has been growing at about 9.5 % over the same period with the economy growing more than five fold between 1982 and 2002 reaching a level of about US\$ 1,232 billion in 2002. In terms of impact of the economic growth on poverty reduction, by 2002 China had lifted 400 million people out of poverty and its poverty rate had declined to 4.6%. In India over the same period the poverty rate only declined from 36% to 29%.

² The Indian and Chinese economies have evolved differently in the past two decades, with the share of the agriculture sector declining more sharply in China – to less than 15% of GDP in 2002 – while in India it was nearly 23%. In India the contribution of services to GDP grew to above 50%; in China services contributed 33.7 %. In India, industry share of GDP is about 27% and in China it is 52%. Moreover, by 2002/2003, the amount of foreign direct investment and volume of trade in China have reached a level that is many times of those in India.

³ See for example: The Economist, March 3, 2005: *A Survey on India and China*. The Guardian, September 24, 2004: *India's silicon city booms to busting*. Business Week, November 1, 2004: *Bangalore: Tech Eden No More; India's IT center has exploded – and so have its infrastructure problems*.

3. Responding to the needs of the economy is not just a matter of the cost of transport, but also of the quality of service provided. A 2003 Confederation of Indian Industry survey of urban populations in Southern India showed 90% dissatisfied with roads, and 58% dissatisfied with public transport services. Interestingly, the same survey showed that 89% were willing to pay for good-quality toll roads and 65% are willing to pay higher public transport fares to get more comfort and frequency. A survey of the business community recorded similar answers. Developing a degree of flexibility in public transport supply so that differentiated services may be tailored to the needs of different groups of the population is thus an important requirement of a future urban transport policy.

4. The impacts of transport on the quality of urban life go even further than that. In the 1990s, as India experienced a period of economic and urban growth, air pollution in its major cities became a cause of national concern and generated worldwide attention. The levels of airborne suspended particulate matter recorded in largest metro-cities far exceeded the ambient air quality standards adopted by India and many other countries. As manufacturing and power sectors are progressively cleaned up the relative importance of the urban transport sector to air pollution increases. There is much current discussion about the development of Mumbai as a “world class city” rivaling Shanghai. For the Indian cities to retain their attractiveness to international capital, and to compete with other international centers, they must be livable. The environment is important to the economic health of the cities as well as the medical health.

5. In parallel with the growth related impacts of urban transport on poverty are the direct impacts of urban transport on the life of the poor. The worst off in urban transport may be the pedestrians, whose mobility and safety are hindered by non-existent, broken-down, and/or obstructed sidewalks; difficult street crossings; and flooding in monsoon seasons. The bicycle riders, once a major urban transport mode in India, are gradually being pushed off busy roads by motor vehicles. These two groups account for half of all traffic fatalities. Secondary and tertiary road networks appear to have received little attention or funding, especially in low-income areas

What is the Government of India policy response to the Urban Transport problem?

6. The Government of India is addressing these issues. The Ministry of Urban Development, has recently issued a draft *National Urban Transport Policy* for consultation which can be found on their web site. They recognize the increasing urban road congestion and its associated air pollution. Their strategy puts primary emphasis on the need to increase the efficiency of use of road space by favoring public transport and by the use of traffic management instruments to improve traffic performance and by restraining the growth of private vehicular traffic. Complementing this is a strategy to reduce vehicle emissions by technological improvements in vehicles and fuels. Key instruments identified for support of this strategy are highlighted in Box 1.

Box 1: A selection of key points from the draft *National Urban Transport Policy*

Public vs personal transport – modal split

- Encourage and support investments in facilities which would wean people away from the use of personal vehicles rather than build facilities which would encourage greater use of personal motor vehicles. This would imply the need for investments in improving public transport.

In-street traffic and parking

- Adoption of mechanisms to restrain the use of private motor vehicles through the market mechanisms such as higher fuel taxes, higher parking fees, reduced availability of parking spaces
- Address safety concerns of pedestrians and cyclists by providing segregated right of ways through construction of cycle tracks and sidewalks
- Develop a public bicycle program
- Develop creative facilities like shade giving landscaping

Public transport services

- Provide differentially priced services, with cheaper fares for those who cannot afford higher prices and premiums and premium services for those who would shift from personal vehicles if they get quality services.
- Services to be provided by the private sector by removing barriers to entry.
- Greater involvement of the private sector in public bus transport, where competition is possible, under close regulation and with well structured contracts
- Where bus-based systems can serve the expected demand to opt for this first before considering rail based systems.

Vehicular technologies

- Develop a strategy to introduce 4-stroke motorcycles.
- Develop a pricing strategy to prevent the use of diesel vehicles for personal use – this could be by way of a much higher registration fee.
- Consider imposing a “vintage” tax for vehicles over 15 years old which are typically more polluting than newer vehicles.

Metro systems

- The Ministry to whom the subject of rail-based urban transport is allocated should come out with a paper clearly laying down a national policy. Provision to cities of more than 5 million through the public sector is proposed.

Coordination

- The current structure of governance for the urban transport sector is not really equipped to deal with the problems of urban transport. Unified Metropolitan Transport Authorities are recommended.

7. The Government of India’s proposed strategy is in many respects along the lines of international thinking on the approach to the urban transport problem. For example, the World Bank completed an Urban Transport Strategy review, *Cities on The Move*⁴, in 2002, after consultation with major stakeholders in client countries, including governments, transport operators, and nongovernmental organizations, as well as with representatives of other international institutions. That review linked urban development and transport sector strategies with a strong poverty focus. It noted that sprawling cities are making the journey to work excessively long and costly and that throughout the per capita motor vehicle ownership continues to grow with adverse impacts on traffic congestion and air pollution. Public transport is being stifled by this congestion and its relative performance tends to decline in comparison with the private modes. So the vicious circle of congestion and the decline of public transport is perpetuated. The safety and security of urban travelers are also emerging problems worldwide.

8. The key policy recommendations of the *Cities on The Move* review are not dissimilar to those of the Government of India policy paper. The review emphasizes

⁴ An Executive Summary of *Cities on The Move* can be found in Attachment III and the full report on request.

better maintenance of road facilities and improved traffic management, and gives pride of place to the importance of public transport in addressing the burgeoning demand for movement in urban areas. Improved public transport and allocation of road space has been shown to also lead to an improved level of service for those in private vehicles (examples of Santiago and London). This requires improvement in the efficiency of operations (to be achieved through progressive involvement of the private sector in supply under strictly regulated contracts with the public authorities), priority use of existing infrastructure (including fully segregated bus rapid transit systems as well as more modest bus priorities), and efficient use of funds in the investment in new infrastructure. In this latter context it is noted that metro-rail systems while potentially having a role to play address only a small proportion of transport demands, at a very high cost premium, and in any case do not remove the requirement for a city to provide efficient on-street public transport. Cities such as New York, London, Paris, Rio, Sao Paulo and others which have high capacity metro systems also have high capacity bus services with priority on-street facilities. The need to tap the efficiency of the private sector has been demonstrated. The social dimension of urban transport was addressed both through a concern with the affordability of public transport and through a concern for non-motorized transport and walking.

9. That summary of the declared positions of the Government of India and the World Bank discloses a degree of agreement in principle, which should be the basis for a very fruitful collaboration in assisting the development of urban transport in India.

What is currently being implemented to address the Urban Transport problem?

10. The Government of India and many city authorities are dealing with the urban transport issue on many fronts. In **Delhi**, they are undertaking a major investment in the new Delhi metro system (with funding support from the JBIC). Several new flyovers have been constructed in recent years. Public transport vehicles have been converted to CNG. In **Mumbai**, the government is investing in a number of urban roads and suburban rail projects. The Mumbai government is also considering implementation of metro system. In **Chennai**, there has been recent development of a section of elevated MRT system which is a continuation of the suburban rail system, ring roads have been completed and urban expressway construction planned. In **Bangalore**, there has been extensive discussion of the severe urban traffic congestion problem and urgent measures need to be taken to address this. The city has been discussing metro options.

11. On the environmental front several measures have been taken to mitigate adverse effects of urban transport on air quality. India now has switched to unleaded fuel. In Mumbai at least the sulfur content of diesel has been reduced to levels at which Euro 3 standards for vehicle emissions can be set. Delhi set an example by undertaking a comprehensive and far-reaching program of measures, of which the most publicized is the mandatory conversion of city's public transport to compressed natural gas (CNG) in 2000-2002. This clearly reduced the visual impact of "black smoke" in the major public transport corridors. The Supreme Court has now directed a number of other highly polluted cities in India to prepare "action plans" for addressing urban air pollution, incorporating many of the measures adopted by Delhi. But much remains to be done.

There remains a need to address the content of sulfur in diesel more generally. With the dramatic increase in use of two-wheelers (especially for example in Chennai), there is a need to introduce measures to ensure the switch of motorcycles from two-stroke to four-stroke. One consequence of opening up of the automobile market to international competition coupled with the introduction of increasingly tighter emission standards has been a shift from two-stroke to four-stroke engines among two- and three-wheelers. According to the new vehicle sale figures, the sale of four-stroke engine two-wheelers increased from 21 percent in 1997-1998 to 79 percent in 2000-2004, with a corresponding decrease in the sale of two-stroke engine two-wheelers (SIAM 2004). There is a need to speed this up to only four-stroke being sold in India and to introduce measures to switch older in-use vehicles to four-stroke⁵.

12. So far the World Bank contribution to urban transport in India has been relatively limited, despite the very large commitment to inter-urban road development. The Bank is currently providing funding support to the US\$945 million equivalent Mumbai Urban Transport Project (Cr. 3662-IN/Ln. 4665-IN) which supports expansion of the suburban rail system, development of key connecting roads, and pedestrian facilities. In Chennai a further US\$150 million equivalent of urban roads are proposed for development under funding of the proposed Tamil Nadu Urban Development Project III. Urban road construction in Bangalore will be included in the proposed Karnataka Municipal Development Project.

Putting policy into practice – the case of Chennai and Bangalore

13. Given the extreme need for immediate infrastructure investments there has been an ongoing investment in urban roads. In moving forward these type of investments will need to give greater support to the implementation of the urban transport policy. While Indian cities have developed comprehensive urban transport strategies which highlight the decline in public transport due to lack of attention to provision of facilities for public transport, there is little on street attention to the need for public transport priority in any of the urban road projects. Similarly, despite the discussion of non-motorized transport, there is little attention to the needs of the walking public through proper sidewalk provision (for example, in Mumbai 40% of commuter trips are by walking).

14. With the intent of moving forward on the discussions on possible further World Bank support to Urban Transport the Bank undertook a review of the urban transport situation in two cities, namely Chennai and Bangalore. The reason for the focus on these two cities was that there is ongoing discussion of support to urban development projects

⁵ In parallel to this *policy note*, the Bank is preparing for “A breath of Fresh Air: *Ten Years of Progress and challenges in urban air quality management in India 1993-2002*”. This report, prepared in collaboration with the Central Pollution Control Board, is a contribution to the on-going efforts to assist cities with developing or updating their air quality management strategies. The study objective was to assess the impacts of ten years of actions and interventions in five metro-cities, so as to assist these and other cities in India in designing better-informed strategies and action plans to combat urban air pollution. The report presents a retrospective analysis of urban air pollution data with a focus on particulate air pollution from 1993 to 2002 in Delhi, Kolkata, Mumbai, Hyderabad, and Chennai.

namely the proposed Tamil Nadu Urban Development Project III and the proposed Karnataka Municipal Reform Project which could provide a forum for discussion of development of urban transport projects and policy reforms.

15. In the past 15 years, both cities have experienced a combination of population, economic and spatial growth that is placing a tremendous strain on their public infrastructure and services. Bangalore metropolitan area has a population of 5.7 million and is growing at 4.9% per annum, while Chennai area has a population of 7.5 million, with a slower growth rate, just under 1%. Motor vehicle ownership is increasing very rapidly; Chennai already has 324 vehicles per 1,000 people and Bangalore has 298 vehicles per 1,000 people. Motorized 2-wheelers are the main growth category, with more than one million registered in each city compared with about a quarter million cars. Despite this overall mobility rates are low, just above 1 trip per capita per day, and the passenger markets are highly heterogeneous, reflecting great inequality of income and wealth. Walking and cycling account for 44% trips in Chennai and 17% in Bangalore, and more than 40% of daily trips take place on public transport services. Chennai's public transport system is dominated by street-based buses (38% of trips), but it also has three commuter rail lines and one urban rail rapid transit line in the making. Bangalore relies on street buses only, though for some years it also has been trying to acquire some form of higher-capacity, rapid transit system. All operators are public sector owned. Due to modal shifts to 2-wheelers, the trend for the usage of public transport services has not risen in the past decade, despite population increases and (suspected) higher travel rates.

16. Beyond the sheer scale and diversity of the demands posed by the growth in population and incomes would have proved taxing for most world cities, there are some local factors, all interconnected, that explain this unsatisfactory state of affairs:

- On the institutional side, the transfer of powers and resources from states to local governments has been slow. The political constituencies of state and local institutions being different, the continuing dominance by the state produces transport policies and investments not well aligned with local interests. Large-scale investments (elevated highways, ring roads) tend to get more attention than street maintenance.
- The proliferation of state and local institutions and parastatals is unusually high, resulting in diluted regulatory and funding authority, and accountability for urban transport matters. Neither city has developed capacity for public transport regulation.
- The urban transport sector does not generate any revenue surpluses directly available at the local level. National and state taxes on fuel and motor vehicles are substantial, but only a fraction (25% nationally) is returned to the sector, and then in a circuitous way. Public transport has traditionally been a subsidized sector. The bus operator in Bangalore has in recent years turned an operating profit, but not yet in Chennai, where cost recovery is about 90%. Commuter lines in Chennai are deep in the red, with 50% recovery of direct operating costs. Funds for current and capital spending come from state budgets (under severe pressure in both states), and from the central government, via Central Road Fund, the Ministry of Railways, and city-bound programs like the Megacities Scheme. Together with

other factors cited here, this way of funding biases spending in favor of large investment projects, some with dubious rationale, while leaving large urban and social segments poorly served.

- The use of competitive mechanisms is underdeveloped, as is the reliance on private sector funding and the know-how. In fact, it is limited to outsourcing of bus services in Bangalore, contract-based street maintenance, and a budding effort to charge for on-street parking in both cities.
- A laissez-faire approach has been taken with regard to the allocation of street space between competing uses. The losers of this are: (a) pedestrians; (b) bicyclists; and (c) public transport vehicles.

17. Both cities appear to have formulated the urban transport problem as that of street congestion and low safety, to be addressed in four dimensions. The first is to improve traffic flow by intensifying traffic police activities in traffic management and law enforcement, linked with some corridor and intersection improvements. The second is to take strong steps to improve the supply-side of public transport services, though largely staying within the public monopoly paradigm. Both of these efforts were necessary and the results achieved are impressive, especially on reducing traffic accidents in Chennai and improving bus operations in Bangalore. The third policy instrument is the addition of massive new road capacity in the form of multi-grade interchanges, elevated radial roads, and ring roads. The fourth, similarly capital hungry, is to move public transport development off-street onto the rail tracks.

18. Strategically, this approach is supply-oriented, and traffic growth-biased. It conflicts with the principles outlined in the government urban transport policy statement in a number of ways. In the short term it neglects the mobility of low-income and poor travelers, especially the non-motorized ones. It does not involve any use of traffic restraint tools and hence leaves street-based public transport services (the work horse of the transport system) to the mercy of unrestrained competition from individual motor vehicles. Moreover, it favors the most capital-intensive public transport modes (metros and other urban railways) which may not be warranted by either traffic density and passengers' ability to pay, or their budget capacity to pay subsidies in perpetuity. In the longer term the emphasis on increasing road capacity encourages car-based urban development patterns. The actual policies, as opposed to the statements in principle, thus appear to be both socially regressive, and financially unsustainable.

A Way Forward

19. To conform more closely with the strategic directions, the two study cities in particular, and Indian cities more generally, need a demand-segmented, service-oriented urban transport strategy, which would balance growth with equity concerns, with a strong but cost-conscious orientation in favor of public transport modes. Practically, this would involve a progression of steps from simple to the more difficult:

- Measure and evaluate the performance of the transport system, regularly, from the point of view of different groups;

- Introduce road and street design standards and practices that are walk-and bicycle-friendly;
- Re-allocate the existing road space to provide substantial exclusivity and priority of use to public transport vehicles on arterial streets. The corollary of this is that general traffic would be restrained. It also implies a great intensification of traffic and parking management activities;
- shift attention and resources to repairing and/or constructing anew secondary and tertiary urban road networks within low-income and poor areas, and connecting them to the arterial network;
- address squarely the issue of public transport fares, subsidies and service levels, balancing social protection and modal split concerns;
- implement a regulatory reform aimed at getting substantially higher-quality services and/or lower production costs (internal incentives for MTCs, a gradual move to competition; new organizational form for commuter rail);
- develop a market for public transport modes suitable to serve travel demands at the low end of the income distribution (this also may involve breaking the monopoly of MTCs);
- introduce rigorous project evaluation for large, risky projects;
- focus on at-grade, bus-based rapid transit lines, with publicly-owned infrastructure and competitively awarded service concessions,(inclusive of feeder/distributor networks); and
- ensure that new primary roads include a provision for rapid public transport modes.

20. To move in this direction three ingredients are essential. First is the political agreement with the strategy, difficult because the proposals run counter to pro-growth forces, unions, motor-vehicle owners and the formidable urban rail lobby. Second is a streamlined and strengthened institutional setting, e.g. lead institution appointed in Bangalore, critical mass of regulatory skills created in both cities, and moving traffic management functions into municipalities.

21. The third aspect is financial. The problem is to reduce the overlong agency chain between what is paid by local road users (a growth sector in two well-off cities) and the funds brought back to bear on the local transport system. There are several ways to do this. The most common way is to escape budget funding and create a closed loop from road user fees via dedicated funds to cities. A less common way, highly successful where it has been implemented, is to introduce local road charging systems, aiming for both revenue generation as well as demand management. Either way, the challenge is to create not merely urban road funds, but urban transport funds. Private sector funding has a potential as a complement, but the prime source of funds should be local.

A Potential Role of the World Bank

22. The Bank's *Country Strategy*⁶ recognizes that in India, urban transport is a high-risk sub-sector with fragmented responsibilities, weak fiscal and implementation capacity of local bodies, and complex safeguard issues. It is also potential high-return, especially if an emphasis on management improvements and traffic engineering helps defer high cost investments in mass transit and flyovers. Given the risks and competing demands on Bank resources, Bank lending support will be through pilots incorporated into operations to support broader municipal reforms. This engagement will be selective, focusing first on investments that have short paybacks, such as traffic engineering and management, bus ways, and slum accessibility. Drawing lessons from these pilot engagements, the Bank will thereafter seek opportunities for scaling up, IFC may also provide support in the area by investing in infrastructure development companies that are constructing and operating urban transport infrastructure.

23. Reflected in the *Country Strategy* are agreed "Guidelines for Bank Lending in Key Sectors", including in Urban Transport where instruments would include Analytical, and Advisory services (AAA) and investment lending limited to a few major urban centers and contingent on:

- Existence of a statewide urban policy aiming to clarify roles in urban development (including transport) and to enable ULBs to become financially viable;
- Quality of municipal management, including capital planning and budgeting, financial management, revenue administration, and financial performance;
- Willingness to prioritize investment using economic criteria; development of a sound urban transport development strategy and investment program, commitment to the introduction of modern traffic management and enforcement; and
- Commitment to institutional reforms required for citywide transport management.

24. The involvement of the World Bank has several beneficial prospects. First, its direct engagement in the growth-equity rebalancing will provide an added weight to the equity camp, much needed in these growth-dominated cities. Second, Bank loans can fund the planning effort for strategy development, and –through stringent engagement and selection criteria—ensure that some of the more difficult policy and investment shifts are tried, evaluated and refined. Third, the implementation of thus selected projects would re-direct immediate benefits to social sectors hitherto neglected in the current transport strategy. Fourth, given its urban and transport operations in the two states, a program approach is feasible.

25. The table below shows a hierarchy of 8 project types defining an exhaustive agenda of policy initiatives and investments. The current series of Bank-funded urban and transport projects in both Tamil Nadu and Karnataka, with their adaptive design and stress on local institutions and finance, provides a ready vehicle to test the three lower-

⁶ India Country Assistance Strategy, September 14, 2004 (Report No. 29374-IN).

rung projects/policy couplings. If these work well, free-standing urban transport projects in Chennai and Bangalore could aim at one of the higher-rung operations. A project to finance a rapid busway corridor (even a network) would be of highest priority in either city, because of its truly strategic investment and regulatory aspects. Proposals for bus-based rapid transit, in the form of sketch plans and outline cost estimates, are said to have been tabled in both Bangalore and Chennai, and could be built on readily and rapidly.

26. The next three rungs (primary roads, commuter rail upgrading, and a metro line or metro access facilities) are project possibilities for the medium-to-long term, to be considered only if the strategic change has occurred.

27. The table does not show any policy/investment couplings that would address the funding constraint cited above (the investment box in the last row is left blank). The introduction of a national system of road user charges with an urban transport provision could only be leveraged through a national transport project or a structural adjustment operation. The Bank is working with the Government of India on the reform of road user charges. This effort should take into account the urban transport dimension before some other arrangement is firmed up. Regarding a possible system of locally based user charges, it is premature to think of an urban transport investment in either city which would have the scale sufficient to leverage such a major policy innovation. Keeping the subject on the agenda, however, is not premature, and could be further advanced through technical assistance.

MENU OF POSSIBLE BANK-FUNDED PROJECTS		
Investments	Policy/institutional aspects	Project type
Traffic & parking control, road and area at-grade improvements	Re-allocation of street space to serve NMT modes; intensification of T&PM	Current state-based urban projects
Area-wide road maintenance and/or road improvements on secondary/tertiary network;	Intro of demand-based resource allocation; shifting funds to benefit low-income communities, local economies	Free-standing UT project or component in a state road project
Multi-grade intersections; rail-bus interchange facilities	Re-allocation of at-grade street space to serve NMT and UPT modes	Current state-based urban projects and/or free-standing UT project
Infrastructure for bus-based rapid mass transit	Introduction of concession-based operations; creation of a regulatory authority	Free-standing UT project
New primary roads	Re-allocation of at-grade street space to serve NMT and UPT modes; provision for rapid transit lanes	Free-standing urban transport project
Upgrade fleet, facilities of commuter rail lines and rail-bus interchanges (Chennai only)	Creation of Chennai Metro Commuter Rail Corporation; creation of a regulatory authority	Free-standing urban transport project
Metro-related investment (Bangalore only)s	Tandem with financing bus rapid transit; test case for rigorous project preparation	Free-standing urban transport project
None	Introduce urban-friendly road use charging system	National transport project; structural adjustment loan

NMT=non-motorized; UPT=urban public transport; T&PM= traffic and parking management

ATTACHMENT I URBAN TRANSPORT IN BANGALORE AND CHENNAI

1. OBJECTIVES AND CONTENT OF THE REPORT

1.1. The cities of Chennai (Tamil Nadu) and Bangalore (Karnataka) are mounting major efforts to deal with urban transport problems generated by exceptional rates of demographic, spatial and economic growth experienced therein over the last decade. The World Bank has a long history and a current presence as a partner in development endeavors of these cities and states. The areas of the current Bank activity include both urban and transport projects, but not specifically focused on urban transport.⁷ Given the perception of a growing importance of urban transport activities in both growth and poverty dimensions, an expansion of the Bank's assistance into this field, in the form of advisory and lending activities, is now being considered by all concerned parties. The report in hand is intended to facilitate the discussions in this context, by providing an external angle of the urban transport problems, prospects and possible ways forward.

1.2. The main body of this report: (i) provides a brief diagnostic of the urban transport infrastructure and services in Chennai and Bangalore; (ii) identifies the underlying strategic issues; (iii) proposes an amended strategy, and (iv) outlines an agenda for the involvement of the World Bank in the short-to-medium term. The case studies of urban transport in Chennai and Bangalore, on which the main report is based, as well as a bibliography, are provided as attachments.

1.3. The report is a first-cut attempt to understand and address a complex subject. It is based on a brief field visit and desk research, both of which have disclosed serious lacunae in data. Other limitations have to do with a narrow focus on urban transport, adopted to make this initial attempt doable. For example, the report does not touch on the environmental aspects of urban transport, even though vehicle-produced air pollution is a major and increasing problem in both Chennai and Bangalore, indeed in all urban India. This omission is not likely to invalidate the proposals made herein, since they focus on potential increases in public transport patronage and on traffic restraint, both of which are unequivocally beneficial with regard to emissions. Conversely, the most important decision variables from environmental point of view (re vehicle emissions and fuel prices) apply at any level of modal split.⁸ A more serious limitation is that the report stays away from urban planning, land markets and municipal funding issues. Major analytical work is being done by the Bank in these areas, and its results are being incorporated into the design of lending operations. In the next stage of the work on urban transport,

⁷ In Tamil Nadu, Urban Development II (TNUDII) is nearing completion and TNUDIII is being prepared. Tamil Nadu Road Sector Project is under implementation since 2003. In Karnataka, an Urban Reform Project is under preparation and Karnataka State Highways Improvement Project is under implementation since 2001.

⁸ Environmental aspects of urban transport were addressed in J. Shah and T. Nagpal, ed., Urban Air Quality Management Strategy in Asia – Greater Mumbai Report, The World Bank Technical Paper No. 381, 1997. See also A. Bertaud, Urban Planning and Air Quality, South Asia Urban Air Quality Management Briefing Note No. 6, The World Bank, April 2002.

stronger links will need to be established between this subject and that of local government organization, funding and planning processes.

2. THE BACKGROUND

A. Transport Demand Characteristics

2.1. The main features of Bangalore and Chennai are shown in the following boxes. The two cities have similar population “masses,” just above 4 million within city boundaries and about 7.-7.5 million in the urbanized area. Chennai is much more dense, but Bangalore is growing at a much greater rate (4.9% per annum in the 1990s). Chennai is a long-established port city, with two adjacent centers also of older vintage - the traditional commercial hub next to a pre-independence administrative and military complex. Development spread from these centers and the port along a few major road and rail radials. Its industries include petrochemicals, machine manufacture, and automotive equipment (both cars and rail rolling stock). Bangalore is land-locked, but at an important cross-roads of state/national roads and rail lines. Better known in the past as a city of gardens and lakes, whose moderate climate attracted pensioners and vacationers in large numbers, it has become a world-known center of information (software) technology, a synonym for outsourcing services for the U.S. and Western European countries. Bangalore’s economy is much broader than its international image: most employment is in fact provided by trade and commerce (60% in 1995), and manufacturing (37%). Traditional activities like silk weaving and garments are also vibrant. Though Bangalore also has inherited two strong centers, it is much more poly-nuclear than Chennai and its road system is more diffuse and complicated. This is in tandem with the fact that rail lines entering Bangalore were neither designed nor operated to cater for urban and regional traffic, so the city’s growth and mobility patterns have been very much road-dependent. Chennai’s transport system, though greatly road dependent, also leans heavily on its commuter rail services and (soon) on its first urban rail line, now only open on a short link.

Chennai at a glance

- 2003 population 4.2 million (city), 7.5 million (metropolitan area)
- port city, major industrial and commercial center
- population growth in the 1990s: 0.9% per annum;
- density in Chennai City: 250 people/hectare, double in sub-areas
- urban pattern: higher-density historical center with developments along major radials
- economic growth (Tamil Nadu state) 6.1% per annum (1997-01);
- 60% households have incomes under Rs.5,200/month, 37% under Rs.3,100/month (1998);
- one million people live in slums (city only)
- informal employment dominant;
- transport system: road-based but with strong commuter rail network
- travel by mode (adjusted data from early 1990s): walking (30%), bikes (14%), MTC buses (38%), urban & suburban rail (4%), motorized 2-wheelers (7%), cars (2.5%);
- motorization: 1.5 million vehicles of which 1.1 million 2-wheelers, 250,000 cars;
- main public transport providers: CMTC (2,400 buses in peak service at 16 km/h, 3.5 million daily passengers); Southern Railway (3 commuter rail lines carrying 643,000 psgrs/day and 1 short urban metro rail line, 9,000 psgrs/day).

2.2. Both cities have in the last 20 years experienced a combination of demographic, spatial and economic growth that has catapulted them into the forefront of India's great jump forward. These same processes have placed a tremendous strain on their public infrastructure and services. For transport management and planning purposes, it is of essence to understand the divergent patterns in population, location and income changes.

Bangalore at a glance

- 2001 population: 4.1 million (city), 5.7 million (metropolitan area) + floating population of about 1 million;
- population growth in 1990s: 4.9% per annum, expected to reach 10 million by 2011;
- poly-centric, land-locked city, major cross-roads in Southern India,
- gross residential density in the city of Bangalore: 113 people/hectare;
- economic growth (Karnataka state): 7.5% per annum (1990s);
- leader in India's information technology, electronics, consumer goods;
- multi-ethnic, multi-layered urban society
- median monthly income (1998): Rs 5,200 per household; 28% have income less than Rs 3,100/month;
- 2.2 million people live in about 750 slums (1998-99 data), sharply up from 1991 (estimates vary in scale);
- motorization: city 1.6 million of which 1.2 million 2-wheelers and 279,000 cars; agglomeration 2 million vehicles, of which 1.6 million 2-wheelers;
- transport system: road based; major railway network is in place but not significant for urban/regional travel;
- main public transport providers: BMTC (2,200 buses in peak service, 675 buses sub-contracted to BMTC), carry 2.6 million trips per day; plus company buses;
- modal split: walk and bike 17%; BMTC buses 41%; other buses 3%; auto-rickshaws 4%; cars and 2-wheelers 38%.

2.3. Economic growth has raised incomes of a large number of people and their expectations as to the services they deem essential. In the transport dimension, the most visible impact of rising incomes is accelerated motorization (vehicle ownership and use), accompanied by a shift from public transport services to individually or company owned vehicles. In the spatial dimension, this means an increase in the degrees of freedom to locate residences. At higher income brackets, this typically means a choice of more distant spots of greater environmental and other types of amenity.

2.4. Motor vehicle ownership in Bangalore and Chennai has been increasing at unprecedented rates, between 10 and 20% per annum. The current ownership level is about 324 individual passenger vehicles per 1,000 population in Chennai, and 298 in Bangalore. These are high rates, similar to those in the wealthiest cities of Eastern Europe and common in Western Europe, but at vastly lower level of incomes than in Europe. The explanation for this seeming anomaly lies in the structure of the passenger vehicle fleet. Motorized 2-wheelers are the main growth category, with about 1.1 million registered in Chennai and 1.2 million in Bangalore.⁹ Cars are a distant second: about 250,000 are registered in Chennai and 267,000 in Bangalore. This motorization pattern is similar to that experienced elsewhere in South and East Asia, e.g. Hanoi and Ho Chi Minh City in Vietnam; Kuala Lumpur in Malaysia. The consequences of 2-wheeler primacy, while a boon for the mobility of many people, are unfortunately quite negative for traffic flow, safety and air pollution. In terms of relations between motorization and incomes, car-

⁹ Two-wheeler group includes scooters, motorcycles and mopeds. Indian two-wheeler industry took off after the introduction of the New Economic Policy in 1985, when restrictions on production capacity were reduced and foreign investment was allowed. Another growth spurt occurred after macro-economic reforms in the early 1990s. The subsequent rise in India's GDP (5.5% per annum) fed the demand for two-wheelers. The annual production towards the end of the 1990s was 3 million vehicles (George et al, 2002).

based motorization is linked to higher and high-middle income households (in addition to business owners). Motorcycles, on the other hand, are bought by low-middle and low-income households. From transport planning point of view, they are bought by households who are “normally” major users of public transport services. Just how deep down the income ladder is motorcycle ownership was illustrated 10 years ago in a survey of bus passengers in Bangalore: 27% of households with monthly income of Rs.500 or less owned a motorcycle (71% owned a bike).¹⁰ For monthly incomes in the range Rs.500-1,500, 47% owned a motorcycle. These numbers must have changed significantly since 1993, but the main point has not: many bus users are not captive and make their modal choice on the basis of some calculus of price, travel time, comfort, convenience, etc.

2.5. This said, the split of daily travel by mode is still not dominated by motorcycles and cars, but by public transport services, walking and biking. According to admittedly aged surveys in Chennai (probably 1992, with modifications based on more recent small-scale surveys), walking and biking accounted for 44% of all trips, and public transport modes carried 42%. The share of cars (2.5%) is downright minor in comparison. In Bangalore, where data are even weaker but of more recent vintage, walking and bikes carry about 17% of all trips, and public transport carried about 41% (up to 60% of all trips longer than 1 km), and individual motor vehicles carry 38%.¹¹ Even after newer and better data adjust these numbers downward, the visual evidence of unrestrained dominance of 2-wheelers, 3-wheelers and cars on the traffic scene in these two cities is misleading. The bias comes from focusing the visits and surveys on major street traffic. Urban transport also takes place elsewhere.

2.6. One of the reasons for the importance of non-motorized and public transport modes in Chennai, and somewhat less in Bangalore, is that economic growth has left many people behind. The new wealth is in sharp contrast to concurrent poverty, with inherited inequalities deepened by the growth processes, or new ones generated by them as the migrants from the countryside pour into cities. The population growth has taken place largely at the low-income end of the economic spectrum. In spatial terms, many of the lowest income people live in informal settlements in peri-urban areas, in older city slums, or encroach any place where development by leapfrogging has left some land unused. It is not that lower-income groups have not benefited from economic growth. Many did, but growth for this stratum of urban residents is in the informal sector, low-paid and unstable jobs held by unskilled workers in construction, diverse services, and informal manufacture.

2.7. Different income strata have different expectations of the urban transport system. Those owning individual motor vehicles, be they households or businesses (the latter including freight vehicles) expect a good road system: well-maintained pavements,

¹⁰ Source: Impact of road transportation systems on energy and environment – an analysis of metropolitan cities of India, Tata Energy Research Group, 1993.

¹¹ Company-owned buses and mini-buses are said to play a major role in employee transport in Bangalore. According to some statistics, there may be as many as 35,000 private buses (all sizes) and vans in Bangalore used for private mass transport. Compare to 2,200 buses operated by BMTC.

efficient traffic control, high travel speeds, easily available parking. Rising incomes have also increased service expectations of some public transport passengers, especially if they own or aspire to own a motor vehicle. They expect higher-quality services: easy access, a seat, high travel speed, air conditioning (especially in Chennai with its humid and hot climate). Since the majority of public transport services in both cities operate on city streets, public transport passengers are also interested in the performance of the road system, as are public transport operators. Finally, and certainly not the least important aspect, a good-quality road system and good-quality public transport services are essential parts of a “package” that Chennai and Bangalore offer to potential investors from outside, in competition with other cities in India and elsewhere.

2.8. Transport expectations of people at the low end of the income distribution are very different from those holding formal and/or better paid jobs: they rely on walking, some in addition have bicycles, and those holding or seeking distant jobs rely also on public transport services. This implies, first, the demand for a basic network of all-weather roads in the secondary and tertiary category, linked to the arterial road system. Second, it implies minimally-priced and easily accessible public transport services.

2.9. This simple 3-way segmentation of the travel market in Bangalore and Chennai does not capture the richness of what takes place on the ground. For example, the high-tech and engineering businesses of Bangalore have quite different transport habits and requirements than those than the traditional businesses, e.g. small-scale manufacture, silk weaving, commerce and services. The former are highly motorized, their job and familial networks are spread widely (well beyond Bangalore, in fact). As a caricature, it is this group that is conscious of traffic speeds and delays, and seeks flyovers, urban expressways and multi-level garages. The traditional businesses are more location-bound, with kin businesses locating in close proximity, and walking retaining importance for interaction between partners and with clients. These businesses may also be concerned for the ease and cost of longer-distance urban transport by motor vehicles, but within their large activity areas they do not seek to “reduce congestion” but thrive on it.¹²

The travel markets in Bangalore and Chennai are heterogeneous: car owners are at one end of the spectrum, and slum dwellers are at the other. Between these extremes are two partially overlapping groups which use public transport services and/or own motorized 2-wheelers. This is where the battle for modal dominance is being fought and where a strategic approach is called for.

B. The Performance of Urban Transport Systems

2.10. How well are the transport systems of Chennai and Bangalore serving their diverse client populations? Answers should be sought both from the service providers (the supply side) as well as those for whom the services are provided (the demand side).

¹² See S. Benjamin “Governance, economic settings and poverty in Bangalore”, Environment and Urbanization, April 2000.

2.11. A comprehensive and rigorous evaluation from the supply side is not available. The urban transport institutions in Chennai and Bangalore have not yet focused on the question of service to citizens in a systematic manner.¹³ The following evaluation is culled from various technical studies consulted for this report, complemented by visual evidence from a recent, but all-too-brief exposure to on-street conditions in the two cities. The overall conclusion is that the performance of urban transport systems in Bangalore and Chennai leaves much to be desired across all economic and spatial strata.

2.12. The worst off are the pedestrians in all parts of the urban areas, due to non-existent, broken-down, and/or obstructed sidewalks; large height differences between sidewalks and frequent driveways/alleyways; danger at street crossings and distance between crosswalk locations; and flooding in monsoon seasons. The next on the list of poorly-served travelers are by bicycle riders, who have few exclusive-use lanes while gradually being pushed out of busy roads by motor vehicles, be these 2- or 3-wheelers, buses or cars. Traffic accident data from Chennai show that pedestrians and bike riders are second- and third-highest group among those killed in traffic accidents, with 190 and 126 killed in 2001, respectively (topped only by 208 dead riders/passengers of 2-wheelers).

2.13. Traffic studies cite poor condition of pavements (30% of Bangalore's road network is in that shape), low travel speeds (down to 10-12 km/h), high intersection delays, and poor or non-existent parking facilities. Traffic accidents are high at about 50 and 40 per 10,000 registered vehicles in Bangalore and Chennai, respectively, with about 700-800 fatalities (Bangalore is responsible for the upper range).

2.14. Bus services are infrequent and slow moving; buses are hard to get on/off, overcrowded (up to 150% of the nominal capacity), with uncomfortable ride, and polluting. Suburban rail services have low frequencies, and difficult access to/from stations. These generalizations apart, a 1997 survey of MTC passengers in Chennai found 75% satisfied with service frequency, 80% satisfied with punctuality, 89% satisfied with reliability, 93% satisfied with safety, and 89% satisfied with vehicle condition. The lowest score (48%) was on "route condition" which probably refers to the road condition and possibly traffic delays. The same survey covered some potential and/or ex-passengers. The ranking of "push-away" factors was as follows: low travel speed, lack of punctuality, poor connectivity and low frequency.

2.15. Are public transport services affordable? A simple analysis of travel fares and passenger incomes for CMTC (Attachment I), based on the price of the monthly fare, concluded that bus fares were onerous at monthly household incomes of less than Rs.1,000 (roughly 10-13% of passengers). At an income of exactly Rs.1,000, a monthly

¹³ There are exceptions to this statement. Chennai Traffic Police, for example, has done a very good job of collecting and analyzing traffic accident data. There was also a passenger opinion survey in Chennai done within a MTC Route Rationalization Study (Pallavan Consultants, 2001). Generally, there is a visible effort to improve accountability of the local government and allow the voice of the public to be heard, e.g. the report card for public services in Bangalore. Web sites have been set in both cities to provide the public an easy opportunity to record their views.

bus pass accounts for 14% of the household income for a 10-km trip by one person, and 26% for a 30-km commute. Commuter rail monthly passes were significantly more affordable. At Rs.2,500 a month per household, a monthly bus pass for one person would be under 10% for most distances, and rail passes were half that.¹⁴ The conclusion is that fares are set at levels acceptable for a majority of passengers.

The worst-served by the transport systems in Chennai and Bangalore are people who walk or ride bikes, who account for more than 40% of all trips, and come mainly but not entirely from lower-income and poor strata. The best served are bus system captives, since the level of service is reasonable and fares are low.

2.16. Answers from the demand side come from two recent surveys. These covered several cities, including both Bangalore and Chennai. A 2003 Confederation of Indian Industry survey of urban populations in Southern India showed 90% dissatisfied with roads, and 58% dissatisfied with public transport services. It is noteworthy that 65% of the respondents were willing to pay higher public transport fares to get more comfort and frequency, and 89% of the respondents were willing to pay for good-quality toll roads.¹⁵ A 2003 study by the National Association of Software and Service Companies, done to evaluate the relative attractiveness of major Indian cities from IT business point of view, cited Bangalore's "weak public transport infrastructure (that) resulted in many people buying their own vehicle" and generally low infrastructure availability.¹⁶ The same study also cited Chennai as lacking in infrastructure. In other words, the dissatisfaction with infrastructure in Bangalore and Chennai is shared between the population and the business community. The evidence of merely two surveys cannot be taken as conclusive. Still, this is a serious situation since both cities perceive their chances of continued economic growth hinges on having much better infrastructure and services than at present, not to mention the satisfaction of their own citizens.

3. URBAN TRANSPORT ISSUES

3.1. The unfavorable evaluation of urban transport performance in the preceding section may be seen as unfair by those actively involved in the operations and planning of transport systems in Bangalore and Chennai. After all, major efforts have been made in both cities. In Bangalore, the last 6 years have seen an impressive revival of BMTC, including fleet renewal, increased punctuality, and lower number of breakdowns. All productivity indicators are up and the company has been making a profit for several years in a row. As for traffic congestion, there have been major road improvements, including an Outer Ring Road, the gigantic 5-km Hebbal flyover (the largest in India), and other smaller flyovers and underpasses at worst-congested intersections. More multi-grade projects are under construction and/or being tendered. The work on building the new international airport has started, and its road connections will be much better than is the

¹⁴ 32% of CMTC passengers reported household incomes between Rs.1,000 and Rs.2,500.

¹⁵ Source: "Urban populace unhappy with infrastructure: Study" The Hindu, 12 March 2003

¹⁶ Source: "At your IT service, India's Hyderabad", Asia Times (on-line), January 7, 2004. The study covered nine cities: Ahmedabad, Bangalore, Chennai, Hyderabad, Kolkata, Kochi, Mumbai, Pune and Delhi (National Capital Region).

case with the current airport. Chennai has constructed an Inner Ring Road and started on the Outer Ring. The most important radial roads in the city have been widened, and some have included pedestrian underpasses, and separate lanes for pedestrians and bicycles. Many intersections have been improved. A major effort was put in traffic law enforcement, lowering traffic accidents from a high of 5,280 in 2001 to 3,680 in 2002, and traffic deaths from 680 to 485 in the same period. New bus and truck terminals have been constructed. Phase I of the rail-based Mass Rapid Transit System (MRTS) was placed in operation in the late 1990s, and a gradual progress of gauge conversion has already made possible serving cross-radial trip ends without transfers. The completion of Phase II of the MRTS is imminent, creating a rapid urban railway of about 20 km which complements the existing suburban rail system.¹⁷

3.2. While acknowledging that valiant efforts have been made in both cities, and real improvements have been achieved, it is clear that the efforts have not sufficed to keep up with loads and expectations generated by the demographic and economic growth. Neither financial nor institutional capacity of state and local governments were up to the task. In addition, some questionable policy and investment choices have been made, and others were left untouched. The rest of this section brings out the major among these factors, choices and underlying issues. Since all these are strongly interconnected, the order of presentation is to start from the most general factors. The working hypothesis is that the ensemble of state/city institutions in charge of the urban transport systems (with links to national institutions) are supply-focused rather than demand-focused. The resulting policy orientations and decisions on how to spend available funds have left large economic and spatial segments poorly served, and have not been as effective as they could have to make these cities competitive.

A. Finances

3.3. The structural problem with urban transport funding, which Bangalore and Chennai share with other Indian cities, in fact with many cities the world over, is that the sector does not generate any surplus revenue directly available to those who regulate, operate the transport systems and plan their development. Thus a growth sector (e.g. demand for roads) in an economically strong local environment (cities that are their states' and the country's leaders) cannot get an adequate supply response.

3.4. In public transport services, the Bangalore Metropolitan Transport Company (BMTC) has started to generate revenue surpluses, but this has yet to be enough to upgrade the company's fleet for a visible rise in the quality of service. In Chennai, both the MTC and the commuter rail lines generate losses, cited above as Rs.1,347 million

¹⁷ A generic term "rapid urban railway" is used here because the MRTS defies an easy classification. Its location and station spacing suggest a metro, but its tracks, the rolling stock and frequency of service suggest a commuter (suburban) railway. It was reported recently that the Government of Tamil Nadu will commission a feasibility study for a (yet another?) metro line in Chennai. In the Indian urban transport context, names given to various transport modes are not based on rigorous definitions, adding confusion to a taxonomy already made fuzzy by a lack of an internationally recognized terminology. Only 3 other cities in India have rail-based systems: Mumbai has a major network of suburban rail lines, whereas Kolkata and Delhi have short metros (the latter is expanding).

(US\$ 28 million) in last year, and the prospect is that these losses will increase considerably when the MRTS Phase II becomes operational. The chances that fares could be raised in a significant way are not high (more on this subject below).

3.5. On the road side, vehicle owners generate large revenues, through a state and national system of vehicle and fuel taxation. The states' taxes focus more on vehicle ownership, while the national tax is somewhat more use oriented. Most of the proceeds, however, are treated as general taxes: road sector expenditures are only 25% of the total amount collected in road user taxes.¹⁸ The stress on vehicle taxation rather than fuel taxation is unfortunate, since it tends to reduce the potential of road use fees as an instrument for demand management. Moreover, the agency chain between what a vehicle owner in Chennai pays in vehicle and fuel taxes and what comes back to bear on road maintenance, traffic control, road rehabilitation and expansion in Chennai is quite long and indirect. In short, there is no close correspondence between increased demand for road space by motor vehicles and resources available to respond to that demand.

3.6. Funds come to the urban transport sector in a variety of ways, from the state budget, from the Ministry of Railways budget (Chennai only) and through various national programs like the Megacities Scheme and the Urban Challenge Fund.¹⁹ While this is not an uncommon approach to urban transport funding, it is not well suited for a situation where an urban economy is stronger than its state's and its country's. Illuminating examples of a different approach, where locally generated funds are at immediate disposal of local institutions, accountable to local constituencies, include that of urban roads in Oslo and Bergen (Norway) and public transport systems in French cities outside Paris.²⁰

¹⁸ Source: "Public Finance of Highways in India" Policy note (work in progress), the World Bank, January 2004. As of 2000, India has a Central Road Fund fed by a fuel cess. The fund has a formula for allocating the proceeds between national, state, rural and urban roads, but the total available is not based on any use-related criteria.

¹⁹ The Scheme was set up in 1993-94, to benefit urban infrastructure in 5 of the largest cities in India, including both Bangalore and Chennai. The funding comes 25% from the national government, 25% from the states, and the balance is to be borrowed. Some aspects of this Scheme's design are salutary. For example, the participating cities should prepare development plans, and prepare their funding propositions using a package approach in conformity with the plan. When it comes to eligible project types, however, the Scheme lists "city transport networks," but specifically precludes "buses and trams, ..., mass rapid transit or light rail transit system projects, projects that are highly capital intensive and of long duration; or long term studies." It does allow "laying of ring roads and outer ring roads and bypasses around megacities provided ... tolls are built into the scheme" and "laying, improving and widening of arterial and subarterial roads ... to remove transport bottlenecks." These stipulations appear at least contradictory, since the development plan in any given city could include priorities for exactly those types of projects which are precluded by the Scheme. In practice, the stipulation on having a development plan and following a consistent package approach appears not to have been followed. As far as urban transport is concerned, the Scheme provided partial funding for ring roads and numerous multi-grade intersections in Bangalore and Chennai, but had no broader strategic impacts. The quotes are from C. Ramachandran, "Case Study of Partnerships in Infrastructure Financing: A Study of India's Megacity Scheme" (1995).

²⁰ These examples are not meant to invite an exact emulation, especially not the employment tax used in France.

B. Institutions

3.7. The process of transferring the jurisdiction and resources from state to local governments, in line with constitutional reforms of 1992, has been slow, though accelerating in recent years.²¹ Municipal Corporations in Bangalore and Chennai are incomparably weaker in both authority and staff capacity. Their resource generating capacity is quite limited, the majority of funds coming in as transfers from their states. The capacity of smaller local bodies, outside the city limits but within the metropolitan area, is correspondingly lower. Given the joint nature of much of the transport infrastructure and services, the State Governments are de facto metropolitan governments. This would not be necessarily problematic if the distribution of political power (and therefore accountability) in state legislatures reflected the weight of large cities, their population and economic output. This has not been the case in either Karnataka or Tamil Nadu, at least not as far as the number of deputies in state assemblies is concerned.²²

3.8. There are several essential aspects in which the distribution of power and accountability between state and local government institutions affect urban transport matters. Risking a broad generalization, state transport agencies have an “aggregate” approach to the sector and ally themselves with big actors in the road and/or rail construction industry and others. This tends to lead to a preference for larger-scale investment projects, such as fly-overs and elevated roads in Bangalore, or even the MRTS in Chennai. City governments, council members as well as the bureaucrats, tend to be more responsive to local economic interests and local voters (including low-income populations). Whether this would also make them follow equitable and efficient urban transport policies has yet to be tested.

3.9. Reflecting the state/local split, neither city has vested the prime responsibility for all aspects of urban/metropolitan transport in one institution. Pieces of decision authority, control over resources and accountability are spread widely between state governments, local governments, and state and national parastatals. It is readily acknowledged that some fragmentation is both necessary and unavoidable. But, at any given level of fragmentation, there should be stable umbrella arrangements to coordinate various institutions. This is not the case here. In Bangalore, the fragmentation is truly extreme: in addition to state and city governments, plus local bodies outside Bangalore Corporation limits, plus two metropolitan area development authorities, the State has set up special-purpose parastatals (Bangalore Mass Rapid Transit Ltd., Karnataka Road Development Corporation, Karnataka Urban Infrastructure Development and Finance Corporation, this last a nodal agency for the Megacities Scheme) all of whom pursue some urban transport

²¹ Until the 74th Constitutional Amendment (74th CA) introduced in 1992, local government institutions in India were merely outposts of the state governments. The intent of the 74th CA is that cities should be managed by locally elected municipal governments and corresponding administrations, rooted in financial independence, and accepting accountability to the local constituency.

²² Bangalore has 6 deputies in the 220-strong state parliament.

activities. The State has attempted to overcome the fragmentation by creating ad hoc bodies, such as Agenda for Bangalore, Transport Advisory Forum, and Task Force for Traffic and Transport, but these appear also to hold merely pieces of the pie. Bangalore Development Authority has no transport group, apparently no transport professionals at all. Indeed, its charter does not include transport planning. The last study with a comprehensive coverage was done long ago.²³ In this forest of institutions, no single body appears to make comprehensive policy or medium-to-long term investment plans.²⁴

3.10. In Chennai, the situation is somewhat better. The charter of the Chennai Metropolitan Development Authority (CMDA) includes transport planning and the institution has a history of involvement with this subject, a team of experts and a well-developed network of local consultants. What Chennai lacks, and CMDA is not authorized to do, is public transport regulation. This subject may not have mattered in the past, but it does now.

3.11. The complicating aspect in Chennai is that the commuter rail services provided by Southern Railway network of Indian Railways play such a vital role in metropolitan transport. Service levels, prices and expansion plans of the commuter rail lines and the new urban railway (MRTS) are decided by different people than those for the bus system. This situation has multiple aspects. For the State of Tamil Nadu and the local governments in the Chennai metropolitan area it is advantageous that Indian Railways provide commuter rail services without any financial input from the state/local level. The gap between fare revenues and direct operating costs of these lines is about 50%, amounting in 2001-02 to Rs.834 million (US\$17.4 million). This compares to Rs.512.7 million (US\$ 10.7 million) received in the same year by the CMTC, as a compensation for non-economic fares and services. On the negative side, the state and local governments have little leverage in situations where the interest of Indian Railways' main lines of business diverges from that of the area's population. This works in the opposite direction as well, in that local government have had little incentive to organize things so as to maximize the ridership on commuter rail lines. In fact, some important decisions may have gone awry because the costs and benefits fell on different parties. The MRTS is a case in point. Phase I of the system was built with the federal funds (the State of Tamil Nadu contributed some land) and its large operating deficit has been met from the Railways budget. It is evident that Phase I has been nothing short of a functional and financial failure (carrying 9,000 passengers per day), made even worse by the CMTC running competitive bus lines. Had the funds used for the MRTS been available to spend locally, with operating subsidy also being a local responsibility, would the MRTS have been built? This said, MRTS Phase II is being built with 2/3 state participation, already a discipline-imposing move. The next step in this process is likely to be a transfer of the operating subsidy load onto the state government.

²³ A study focusing on road corridors was carried out in 1999 by a team of consultants led by Central Road Research Institute (New Delhi).

²⁴ This is not to say that a fragmented institutional setup cannot produce good results. A remarkable turnaround of Bangalore Metropolitan Transport Corporation since 1997 is a case in point. What a fragmented approach probably cannot produce is a network of exclusive bus lanes on the streets of Bangalore.

C. Regulatory Policies in Urban Public Transport

3.12. Historically, state transport undertakings (bus companies) have been the prime providers of public transport services in most Indian cities, including Bangalore and Chennai. Fares have traditionally been set low by state authorities to permit travel by low-income citizens, especially those covering long distances. The inability of the state to pay fair and regular compensation, interacting with inefficiencies on the supply side stemming from the nature of public monopolies, chained public transport services to a low-service, low-priced equilibrium. A traditional and entrenched focus on production rather than service, rigidities regarding staff levels and remuneration, and low financial capacity combined to create a formidable barrier to change. With its ups and downs, this approach was acceptable while a great majority of passengers were captives, interested mainly in low fares. Greater incomes in the 1990s and an increased affordability of motorized 2-wheelers resulted in a large loss of public transport passengers, a process which is still underway and may acquire crisis proportions. In Bangalore, there was a rise in private buses, as businesses moved to ensure that their employees came in on time and in comfort. Raising the level of public transport services therefore became essential. Since the public sector alone was not seen up to the task, the 1988 liberal legislation opened the door to private transport operators. What the legislation failed to do was to create a regulatory apparatus on each of the three levels of government, capable of dealing with a mixed public/private market so that the ensemble would evolve in the public interest. Very high levels of traffic congestion, pollution and safety hazards experienced in cities like Kolkata have demonstrated the dangers of un-restructured public sector combined with un-regulated private providers of public transport services.

3.13. The response to these changes in Bangalore, where the level of services by Karnataka State Road Undertaking had hit the bottom, was not to deregulate but to “cure” the public monopoly.²⁵ This was done through a combination of actions, some on the relation state-company, others company internal. In 1997, Bangalore MTC was separated out of the state-wide company, and its organization re-structured, removing one layer of management. A fare adjustment formula, based on major input costs, was introduced, putting an end to the previous practice of fare approvals arbitrary in both scale and timing. An internal improvement program, focusing on both staff and management conduct, was implemented. The use of information technology was increased. The last but not the least is that BMTC opened the door to the private sector through outsourcing, even in its main business line – transport services. This consists of a “kilometer scheme” whereby private operators compete on gross cost basis to serve specific routes. In 2001-2002, close to 300 private buses were in operation, equivalent to about 13% of the BMTC’s fleet. The sum of these efforts is evident in all technical performance indicators (fleet availability and utilization, passengers carried per vehicle, number of breakdowns, etc). It is also evident in its financial performance: the loss of Rs.78.2 million (about US\$ 2 million) in 1997-98 turned to a small surplus of Rs.39.6 million in 1998-99, rising to

²⁵ This paragraph draws on annual reports from BMTC and CMTC, and on Pradeep Singh Kharola, “Reforms in the public transport – a systems approach”, in X. Godard and I. Fatonzoun, ed., Urban Mobility for All, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002.

Rs.267 million (US\$ 5.6 million) in 2001-2002. The situation in Chennai had not been as dramatically bad as in Bangalore, so changes have also been less striking. CMTC has increased its cost recovery to 80% in 2001-2002 and 90% in 2002-2003, and the compensation payments have visibly increased over the last 5-year period, greatly improving the company's financial position. CMTC also is trying to introduce outsourcing of transport services to transport operators, but this has been challenged by the unions and the matter is in courts.

3.14. Missing from the above account are two essential variables. First, are MTCs in Bangalore and Chennai cost efficient? This question, politically very sensitive, has yet to be tackled. By international standards, both companies are overstaffed (more than 6 staff per vehicle in service). The average staff cost per month (about Rs.10,000) is in excess of what the majority of MTC's passengers receive. Second, what has been the impact of changes in the companies' performance on the service quality offered to passengers? Annual reports of both companies reflect very little interest in this subject. The performance indicators, other than the total number of passengers, are all supply-related. This may have been a normal and acceptable approach when most passengers were captives, but not when more than a half of them already own 2-wheelers, not to mention those who have already given up on bus services.

3.15. The essential remaining question is this: can the current regulatory arrangement, a public-sector monopoly, with an outsourcing complement, produce the cost efficiency and service levels to make this mode competitive with individually owned motor vehicles? A clear and promising option is to move toward a market-based arrangement, by separating regulatory and service planning functions from the provision of operations, organizing the latter through the medium of competitively awarded service contracts.

3.16. A similar dilemma has to do with the organizational status of commuter rail lines in Chennai, with the added complication that the current public sector owner is not the State of Tamil Nadu but the nation (through Ministry of Railways). While the nature of competition available to with rail-based lines is much more limited than with street-based buses, the potential of service concessions is real.

D. The Fare/Quality Nexus

3.17. The co-existence of large "captive" and "choice" markets for passenger transport services, and the growth of the latter in proportion to the economic growth in cities places urban transport regulators in a dilemma. Keeping the fares low to assist low-income and poor travelers creates pressure on the budgets available for subsidies and involves a leakage of benefits to better off passengers. The lower the fare, for a given level of service, the higher the subsidy load becomes and so does the leakage. Conversely, for a given fare, increasing the level of services will also increase the subsidy load. Rail-based modes are especially sensitive to this, due to rigidities of large fixed costs. This in part explains exceptionally low fares on Chennai commuter rail lines.

3.18. The practice in both Chennai and Bangalore, low fare and a low level of service, has produced a flight to 2-wheelers. This in turn has produced a very heavy load on the road system. Both companies have introduced differentiated services (e.g. express and skip stop), and commuter rail in Chennai has different classes, to try to capture the quality-seeking passengers. Still, the flight continues and it will intensify if the current pace of motorization continues. The fare/quality issue has yet to be tackled as a strategic matter in either city. Proposals to increase fares have been made, but arguments for doing so were limited to the finances of public transport operators. A full argument would include the predicament of lower-income and poor travelers. This would allow a full range of options to be considered, not just in the fare and service quality dimension, but also regarding the regulatory framework and the approach to social assistance. In other words, certain “informal” public transport modes may be better suited to serve low-density, low-income communities than the conventional ones. Also, direct financial assistance to poor travelers may be “cheaper” than keeping fares low. At this point, it would be difficult to have such a consideration, since demand-related data are so inadequate and the relevant technical skills are in short supply in the state and local institutions.

E. The allocation of road space

3.19. The subject of road space is a frequently visited one in the Indian urban transport context. It is most often argued that the available street space is much too low in all large cities except Delhi. This position is then used to argue not only for widening and building more (elevated) roads, but also for the construction of off-road public transport systems, be these metros, sky buses, etc. Other authors argue that the road space is not a problem, but its management is.²⁶ In all likelihood, both parties are right. The street space needs to be managed much better, and building new roads and exclusive-track public transport system is warranted in cities which are coping with traffic loads for which their networks certainly were not designed. The essential questions are, of course, who is going to get the street space available at present, how much new road space is to be provided and which off-street systems are going to be built.

3.20. The way this subject is approached in both Bangalore and Chennai has been to: widen the existing roads to a maximum possible, leaving a meager sidewalk width for pedestrians; and apply a laissez-faire attitude to what happens in traffic lanes. What happens is of course that (a) motor vehicles push off the bicycles, and (b) public transport vehicles lose the battle with more nimble 2-wheelers and cars. In addition, parked vehicles generally are allowed to obstruct the moving lanes. Save for some prohibitions against the use of goods vehicles in certain hours, there is no policy of traffic restraint. This omission is deleterious from both fairness and efficiency point of view.

3.21. A special case of traffic restraint has to do with public transport services. No matter how excellent the supply side of public transport operations may be, the service

²⁶ Most recently Geetam Tiwari, “Urban Transport Priorities – Meeting the Challenge of Socio-Economic Diversity in Cities, a Case Study of Delhi, India”, *Cities*, Vol. 19. No. 2, pp. 95-103, 2002; see also A. Bertaud, “Land Management in Bangalore” (2003).

will only have as much quality as the traffic conditions will allow. In both Chennai and Bangalore, this is truly a strategic issue. Neither city has introduced public transport priority measures on city streets, not to mention the creation of at-grade, exclusive-use corridors and networks for bus services. This is not for the want of trying by planners. In Chennai, a busway on Anna Salai was designed and made ready for inclusion under one of Bank-funded urban development projects, but was withdrawn. Only a short exclusive bus lane remains from this scheme. The 10-year investment plan for Chennai contains an elevated highway along Anna Salai, but not an elevated busway. In Bangalore, BMTC commissioned a feasibility study for a bus-based mass rapid transit system. The study, completed in 1999, identified a promising network of 20 bus routes, composed of a Syamese-twin central rings intersected by 8 radial routes. A pilot 12-km line from Jayanagar in the south to Shivajinagar in the north, was estimated to cost Rs 394.9 million (US\$ 8.6 million). This includes the corridor and depot infrastructure and 35 special-purpose buses.²⁷ So far, there is no move from the authorities.

3.22. The consequences of this approach are negative for both street-based bus operations and for chances to acquire an off-street public transport system. When low-cost options for the latter are neglected or rejected, only the expensive ones stay on the table. At the very least, this means that fewer corridors can be provided with off-street public transport modes. The best available advice, based on comparative studies of strategic responses to motorization in many Asian countries, is that the provision of separate space for public transport vehicles and private vehicle restraint are crucial at an early stage of motorization.²⁸

F. Metros

3.23. The neglect of bus-based rapid transit modes in Chennai and Bangalore, indeed in India generally, is proportional to the affection for rail-based modes, especially metros. Rare is an account of urban transport in India which does not mention the Kolkata Metro and the Chennai MRTS, or more recently the Delhi Metro.²⁹ This may have to do with the larger-than-life role that railways played in Indian history and a common association of metros with great cities of the world.³⁰ The resulting bias has an operational form in the view that railways belong to the exclusive tracks and buses belong on the street, or to connect villages.

²⁷ Source: Bangalore Metropolitan Transport Corporation, Annual Administrative Report 2002-2002. The feasibility study was partially funded by Swedish International Development Cooperation Agency. It was carried out by Contrans (Sweden) and Central Institute of Road Transport (Pune). An executive summary is on www.sida.se/articles.

²⁸ See Barter et al., "Lessons from Asia on Sustainable Urban Transport" (2003).

²⁹ It is noted that it took 23 years to build 16.5 km of metro in Kolkata. Its current traffic is 55.8 million per annum (compare to the forecast of 630.1 million made in 1971) and the cost recovery is 38% of working expenses. Source: Y.P. Singh, "Performance of the Kolkata Metro" 2002). Similarly, it took 15 years to build the first 8.6 km of the MRTS in Chennai and that it carries 9,000 passengers per day (3.3 million annually) with very low cost recovery.

³⁰ It may also have to do with the importance of Indian Railways and the fact that their consulting wing (RITES) has a leading role in city studies. This is also true of bus rapid transit. The Bangalore study cited above was commissioned by BMTC (a bus company) and linked to Swedish bus industry. This is said without any reference to the technical quality of these studies.

3.24. The history and the present of transport planning in both Chennai and Bangalore is replete with plans to build a metro or some kin form of urban rail. Chennai actually went ahead and built the first short section of the MRTS and is about to complete the second (a combined length of about 20 km). In addition, the city plans to continue the MRTS (in the circumferential direction), and place a rapid railway line in the middle of the Outer Ring Road. A metro in Bangalore was recommended as early as 1982, then again in 1983 when Southern Railway produced a comprehensive commuter rail development plan. Another study in 1988 (funded by the World Bank) focused on the commuter rail, whereas the next one in 1993 returned the focus to a 2-line metro. In 1994, the attention shifted to a light-rail-based, 6-route, partially elevated network. This was to be developed as a private-public partnership, and operated on a concession basis. This project proceeded beyond a mere proposal, but stopped when the private partner (after more detailed demand studies) asked for a much higher public participation than initially proposed.³¹ Finally, in 2003, a new feasibility study proposed a 2-line metro (18 and 15 km), a cross-shaped system designed to connect all major rail and bus terminals, and most activity centers. It is estimated to cost Rs.49.89 billion (roughly \$1 billion) in 2003 terms. The financial engineering would follow a successful approach used to build the Delhi metro, i.e. 33% the state of Karnataka, 22% national government, the rest to be borrowed long term from both domestic and external sources. In the fall of 2003, a feasibility study for another metro in Chennai, using the Delhi and Bangalore approach, was being considered by the Government of Tamil Nadu.

3.25. Without prejudice to any of the past or current metro proposals, two general issues are involved here. The first is that the attention to metros may be an obstacle to doing something tangible to improve the position of street-based bus lines, i.e. some combination of exclusive lanes with priority of passage at signals, and constructing bus-based rapid transit lines in one of many candidate corridors. The second is the approach to doing feasibility studies. Investments estimated to cost billions of rupees tend to be put forward with single-valued outcomes of major items, i.e. construction and operating costs, passenger volumes and revenues. The notion of risk is absent.³² This is troublesome, especially given the abysmal record on cost, construction period length and traffic forecasts in Kolkata and Chennai urban rail projects. Also, the studies do not focus on alternatives to the proposed system. This may have to do with a trend that all feasibility studies for large rapid transit investments (rail or bus) are done by promoters of various systems, rather than commissioned by the transport planning authorities from independent consultants, with safeguards written into the terms of reference.

Painful decisions to be faced:

- allocation of street space between pedestrians, NMT modes, PT vehicles and individual vehicles
- fare/quality and subsidy policy: social protection vs. modal split
- maintaining the monopoly in the provision of public transport services
- type of mass rapid transit systems: which combination of bus and rail

³¹ The private group was headed by United Breweries. Studies related to this proposal have not been made public.

³² There are exceptions, including the Bangalore LRT study cited here. See Anantharamaiah and Raman “A probabilistic revenue estimation model for providing a mass rapid transit system” (2002).

G. The underlying strategy

3.26. Neither city has formalized a comprehensive urban transport strategy, linked to an urban development strategy.³³ What underlies the ensemble of actions, plans and proposals cited in this report appears to be: negligent of pedestrians, non-motorized and local area travel; (engineering) supply-driven; overly accommodating to individual motor vehicles; conservative in public transport regulation; non-protective of street-based public transport modes; and overly focused on large-scale investments, rail-based public transport investments and primary roads, in apparent belief that these visible structures will increase the image of competitiveness of their city.

A supply-driven approach is focused on input features of infrastructure and services. For roads, these are: road lengths, cross-section, network structure, volume/capacity ratios; spot speeds, etc. For public transport, the common ones are ratios between fleet in service and total fleet, vehicle-km and passenger-km per vehicle, commercial speed, etc.

A demand-driven approach focuses on the passenger and community point of view, in total and disaggregated by income, location, age, gender, transport mode, etc. Typical measures are time and cost of access to public transport lines, employment, and various services, travel speed, safety, comfort, pollution, etc. It

4. THE WAY FORWARD

4.1. The two cities need a demand-segmented, service-oriented urban transport strategy, which would balance growth with equity concerns, with a strong but cost-conscious orientation in favor of public transport modes. The demand segmentation is meant to re-direct the attention to low-income groups and sub-areas, but it is equally warranted in public transport regulatory matters because of the increasing size of the “choice” market. Practically, this strategy would involve making the following progression of steps, from simple to the more difficult:

1. *Measure and evaluate the performance of the transport system, regularly, from the point of view of different groups. This would require a primary effort by the lead urban transport agency, to design the data requirements for different sub-sectors and agencies, commission an initial data collection effort, and maintain a data bank in perpetuity.*
2. *Introduce road and street design standards and practices that are walk-and bicycle-friendly. This should start by including detailed instructions in the terms of reference for planning and design studies.*
3. *Re-allocate the existing road space to provide substantial exclusivity and priority of use to public transport vehicles on arterial streets. The corollary of this is that general traffic would be restrained and parking would be controlled/priced. This would start by a pilot study focusing on selected corridors and/or areas, to be followed by implementation and scaling up of the effort. Both design and implementing stages would involve the local government, traffic police, the*

³³ CMDA has at least attempted to do so, though the result is far from comprehensive. In Bangalore, the severe fragmentation of institutions is a formidable obstacle to both developing a strategy and implementing it.

- transport operators, and the metropolitan planning agency. A substantial intensification of traffic and parking management activities would be required, which may lead to a re-allocation of traffic management functions between the traffic police and municipal administrations. The formation of strong traffic management units in the latter group will be necessary.*
4. *Shift attention and resources to repairing and/or constructing anew secondary and tertiary urban road networks within low-income and poor areas, and connecting them to the arterial network. This requires a policy shift, to be reflected in the normal budgeting process. A link to items 2 and 3 above is needed.*
 5. *Address squarely the issue of public transport fares, subsidies and service levels, balancing social protection and modal split concerns, for all transport modes. This is a major lacuna in the present strategy. Corrective actions will require the setting up of a metropolitan transport regulatory authority, with a small professional support group, aided by external consultants.*
 6. *Implement a regulatory reform aimed at getting substantially higher-quality services and/or lower production costs (internal incentives for MTCs, a gradual move to competition; new organizational form for commuter rail and MRTS in Chennai). The cited regulatory group is a pre-requisite for considering options and implementing changes.*
 7. *Develop a market for public transport modes suitable to serve travel demands at the low end of the income distribution (this also may involve breaking the monopoly of MTCs). The cited regulatory authority is essential for this task.*
 8. *Introduce rigorous project evaluation for large projects, inclusive of mandatory options and risk-conscious analysis. This can start by carefully designed terms of reference and short-listing criteria requiring a much greater involvement of independent consultants.*
 9. *Focus on at-grade, bus-based rapid transit lines, with publicly-owned infrastructure and competitively awarded service concessions, (inclusive of feeder/distributor networks). A pilot project will be necessary to break through the long-held biases.*
 10. *Ensure that new primary roads include a provision for rapid public transport modes (no reference to a specific vehicle technology). This is already a part of some road projects (in Chennai), but so far has been biased in favor of rail-based systems.*

4.2. How to move in this direction? The transition from a narrow, supply-oriented approach to a demand-oriented one is a formidable task. Three ingredients are essential. First is the political agreement with the strategy, difficult because the proposals run counter to pro-growth forces, unions, motor-vehicle owners and the formidable urban rail lobby. Second is a streamlined and strengthened institutional setting. For a start, this would involve the appointment of a lead urban transport institution in Bangalore and strengthening of the Chennai Metropolitan Development Authority. Next, it would involve the creation of a public transport regulatory authority, a policy making body whose technical support can be provided by a separate unit (as in Step #5 above), or by the lead transport planning institution. Also, as noted in Step #3 above, creating a strong

traffic management focus group in the municipal engineering structure will be needed, with some realignment of functions of the Traffic Police.

4.3. The third ingredient is financial. In addition to current efforts to improve funding, budgeting and expenditure management of local governments, there is a systemic problem that transcends Chennai and Bangalore, indeed their states also. It has to do with the national approach to road user pricing and revenue allocation. The problem is to reduce the overlong agency chain between what is paid by local road users (a growth sector in two well-off cities) and the funds brought back to bear on the local transport system. There are several ways to do this. The most common way is to escape funding from general (national, state or city) budgets, by creating a closed loop from road user fees via dedicated funds to cities. A less common way, highly successful where it has been implemented, is to introduce local road charging systems, aiming for both revenue generation as well as demand management. Either way, the challenge is to create not merely urban road funds, but urban transport funds, open to all modes. Private sector funding has a potential as a complement, but the prime source of funds should be user-based and locally linked. This subject is currently beyond the decision making reach of cities, but it needs to enter the discussion agendas at all levels of government.

5. THE POTENTIAL ROLE OF THE WORLD BANK

5.1. The involvement of the World Bank may increase the chances for the development, formal adoption and implementation of the above strategy. First, its direct engagement in the politically difficult growth-equity rebalancing will provide an added weight to the equity camp, much needed in these growth-dominated cities. Second, Bank loans can fund the whole sequence from the design of new type of planning and investment studies, through project selection using stringent engagement and selection criteria, all the way to implementation and evaluation. The Bank's presence would ensure that some of the more difficult policy and investment shifts are tried, evaluated and refined. The implementation of thus selected projects would re-direct immediate benefits to social sectors hitherto neglected in the current transport strategy, which is one of the Bank's primary objectives. Fourth, given the Bank's long history of involvement and its continuing urban and transport projects in the two states, a program approach is feasible.

5.2. The tables below shows a hierarchy of 8 project types defining an exhaustive agenda of policy initiatives and investments, based on the preceding list of strategic moves. Lower-rung options represent small-scale departures from the current practice in the Bank-funded urban and transport projects in both Tamil Nadu and Karnataka. The follow-up projects, now under preparation, with their adaptive design and stress on local institutions and finance, provide ready vehicles to introduce and test policy "turns" in favor of pedestrians, NMTs, public transport modes, and low-income areas. If these policies take root, free-standing urban transport projects in Chennai and Bangalore could aim at one of the higher-rung operations. The highest-rung options are provided to illustrate what may be doable (and will become necessary) in the longer term.

5.3. A project to finance a rapid busway corridor (even a network) is deemed to be of highest strategic priority in either city, as a vehicle to tackle and resolve the underlying conceptual, funding, and regulatory issues.³⁴ Proposals for bus-based rapid transit, in the form of feasibility or at least pre-feasibility-level sketch plans and outline cost estimates, have existed for some time in both Chennai and Bangalore. These require capital investments of under \$10 million for pilot projects in single corridors. Such proposals could be developed and implemented readily and rapidly.³⁵

5.4. The next three rungs (primary roads, commuter rail upgrading, and a metro line or metro access facilities) are project possibilities for the medium-to-long term, to be considered only if the strategic change has occurred.

5.5. The table does not show any policy/investment couplings that would address the funding constraint cited above (the investment box in the last row is left blank). The introduction of a national system of road user charges with an urban transport provision could only be leveraged through a national transport project or a structural adjustment operation. The Bank is working with the Government of India on the reform of road user charges. This effort should take into account the urban transport dimension before some other arrangement is firmed up. Regarding a possible system of locally based user charges, it is premature to think of an urban transport investment in either city which would have the scale sufficient to leverage such a major policy innovation. Keeping the subject on the agenda, however, is not premature, and could be further advanced through technical assistance.

FIRST LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Sidewalk networks • Traffic control (intersections, corridors, areas) • Intersection improvements (at-grade) • Corridor improvements • Pedestrian-only areas • Parking control • Traffic police equipment • Training • Studies 	<ul style="list-style-type: none"> • Setting up of traffic management cells in municipalities, complementing Traffic Police; may require re-alignment • Design& implement a program of transport studies • Improve traffic fine structure • Introduction of parking charges on corridor/area basis • Adoption of road design standards to ensure ample space for sidewalks, crosswalks • reserved lanes for bikes and buses • traffic restraint 	<ul style="list-style-type: none"> • Within current urban projects, e.g. Tamil Nadu UDIII or Karnataka Urban Reform Project • Free-standing UT project

³⁴ The term “funding” refers to the techno-political process in which investment options are generated and evaluated as an input to decision making.

³⁵ The existing proposals are based on operation by MTCs. The strategy proposed in this report would involve a public-private partnership, with a service concession. The project would include a feeder distributor systems. The model for this approach is Transmilenio in Bogota (Colombia).

SECOND LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Road improvements in low-income urban and peri-urban areas (both internal and access roads) • Area-wide road maintenance 	<ul style="list-style-type: none"> • Introduction of design standards to serve pedestrians, bikers • Introduction of road inventory and pavement management system • Linkage of road maintenance with social surveys 	<ul style="list-style-type: none"> • Within current urban projects, e.g. Tamil Nadu UDIII or Karnataka Urban Reform Project • Within the current state road projects • Free-standing urban transport project

THIRD LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Multi-grade intersections • Rail-bus interchange facilities 	<ul style="list-style-type: none"> • Re-allocation of at-grade street space to serve NMT and UPT transport modes 	<ul style="list-style-type: none"> • Within current urban projects, e.g. Tamil Nadu UDIII or Karnataka Urban Reform Project • Free-standing UT project

FOURTH LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Infrastructure for bus rapid transit line(s) • Technical assistance for introducing regulatory arrangement 	<ul style="list-style-type: none"> • Service provision by concession on gross-cost basis (low-floor, low-emission vehicles) • Concessions on feeder/distributor networks • Setting up of an UT Regulatory Authority • Turning some MTC depots into separate companies and allowing them to bid for service 	<ul style="list-style-type: none"> • Free-standing UT Project

FIFTH LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Major new roads 	<ul style="list-style-type: none"> • Re-allocation of street space on existing, parallel streets to serve NMT and UPT modes • Provision of space for rapid transit lines 	<ul style="list-style-type: none"> • Free-standing UT project

SIXTH LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Upgrading commuter rail infrastructure, rolling stock and interchange facilities (Chennai) 	<ul style="list-style-type: none"> • Setting up of an independent Chennai MA Rail Corporation (as in Mumbai) • Creation of UT regulatory authority 	<ul style="list-style-type: none"> • Free-standing UT project

SEVENTH LEVEL		
Investments	Policy/institutional goals	Type of project
<ul style="list-style-type: none"> • Co-finance a metro line in Bangalore 	<ul style="list-style-type: none"> • Tandem operation with a bus-based rapid transit line • Introduction of a risk-oriented project evaluation and alternatives analysis 	<ul style="list-style-type: none"> • Free-standing UT project

EIGHTH LEVEL		
Investments	Policy/institutional goals	Type of project
None (state/city based project not appropriate)	Introduce city-friendly road use charging system	National transport project or structural adjustment loan

ATTACHMENT I-A: URBAN TRANSPORT IN CHENNAI

A. The State³⁶

1. The State of Tamil Nadu, with a population of 62 million, growing at 1.1% per annum, is among the leading Indian states in terms of human development and poverty reduction. It is also among the most urbanized (55%), educated, and industrialized states. Gross Domestic Product rose from Rs.14,520 per capita in 1993 to Rs.36,138 per capita in 1998.³⁷ Economic growth has slowed down somewhat since the mid-1990s, falling to 3-4%, and unemployment rates are second-highest in India. Also in the late 1990s, the financial position of the Tamil Nadu government deteriorated, due to a sharp rises in wages and benefits to its civil service, interest payments on loans, and payments for food subsidies. The fiscal deficit for 2002-3 was forecast at 5.7% of the Gross Domestic Product.³⁸ This has had a negative impact on the ability of the state to invest in infrastructure and basic services, and to improve the social safety net. Priority directions seen on the critical path to accelerating economic growth include the reform of the state administration (reduce its scope and improve performance, especially on the revenue generation and budget expenditure practices), improving the overall investment climate, and attracting private capital into infrastructure and services. A reform program along these lines is underway.

B. The City, Its People and Economy

2. The City of Chennai (until 1996 referred to as Madras) has an estimated 2001 population of about 4.2 million on an area of 172 sq km.³⁹ The wider metropolitan area has a population of 7.5 million on 1,167 sq km.⁴⁰ In the 1990s, the area growth rate averaged 0.9% per annum.⁴¹ The forecast for 2011 is for 6 million people in the city and 9.5 million in the metropolitan area, but the growth appears to have slowed down since this forecast was made.

³⁶ Data on Tamil Nadu are drawn from an internal Bank paper, Tamil Nadu Policy Notes – Concept Paper April 10, 2003

³⁷ Source: Wilbur Smith, Study on Parking Requirements for Chennai Metropolitan Area, Interim Report, August 2003.

³⁸ Source: Tamil Nadu Road Sector Project, Project Appraisal Document, Report 25056-IN, The World Bank, May 20, 2003

³⁹ This refers to the area within the boundary of Chennai Municipal Corporation. Most population and area citations are from Master Plan for Madras Metropolitan Area – 2011, Madras Metropolitan Development Authority, July 1995, with newer numbers culled from diverse documents. The sources often confuse estimates from various censuses and sample surveys with forecasts made at different times from these estimates. An update of travel information is currently underway.

⁴⁰ The web site (<http://urbanindia.nic.in/mud-final-site/urbscene/index.htm>) maintained by the Ministry of Urban Development and Poverty Alleviation, cites a population of 6.42 million, based on the 2001 census, but it does not say exactly which boundary this number refers to.

⁴¹ This is based on the decade growth rate of 9.76% (1991-2001) reported in SBI report on Bangalore.

3. The city is located on level terrain on the Bay of Bengal, traversed in the west-east direction by several rivers and in the north-south direction by the man-made Buckingham Canal. It started in the early 17th century as a trading post on the Bay of Bengal, rising during the British rule to become a regional capital and an important export outlet. The construction of the port at the end of the 19th century and later on railways gave a strong push to shipping, insurance, banking and other trade related services. This pattern has been sustained ever since and the 23-berth port is now the third largest port in the country, with some 2,500 vessels calling annually. On the industry side, the city had textile mills, tanneries and leather processing, locomotive and coach manufacture, and some machine works. After independence, the industrial base was strengthened, especially in rail and automotive vehicle manufacture and complementary activities, while adding petrochemicals, power, electrical machinery and, more recently, electronics. Major industrial estates are located in the north, e.g. petrochemicals in the vicinity of the port, and along the west and south-west railway corridors (automotive industry). In the past decade, the growth has been more in small-scale industries, engineering, wholesale and retail services, banking, and diverse personal services. A “cyber-corridor” is emerging in the south (Adyar).

4. The settlement structure of Chennai is common to many large South-Asian conurbations, reflecting various economic and political eras (Tiwari, 2003; Misra and Misra, 1998). The oldest areas are the closest to the port – Georgetown, the traditional commercial center, and the Fort area, once housing the British administrative and military headquarters. The modern business and commercial developments are farther south-west, e.g., T. Nagar and Nungambakkam, along major streets such as Anna Salai, and in the south (Adyar). There are other identifiable patches of higher density throughout the area: some correspond to the original townships, gradually absorbed by the city, and others have developed around large industrial estates. The city has large slum areas, especially but not only in peri-urban locations, in the south, and in the vicinity of industrial estates. The slums are the way stations for the rural poor seeking or holding informal jobs, but not just that; some of the slum dwellers have been there for several generations.

5. The average gross residential density in the city is high, about 250 people per hectare in the city.⁴² Peak densities reach twice that high in Georgetown, and somewhat less in Purasawakkam and Triplicane. The density pattern is poly-nuclear, but differing sharply from poly-nuclear cities with well-developed land markets. Urban planners in Chennai followed a practice common in Indian cities since independence whereby relatively low floor space indices were applied in central areas and more relaxed indices were applied in the outer areas. This also meant that the municipal infrastructure in place was designed for the perpetuation of these densities. The construction of higher-rise buildings, allowed since the mid-1980s, placed a considerable pressure on roads and other utilities, to which the rise of motorization added pollution and accidents.

⁴² Compare this to Bangalore at 113 people/ha, Moscow at 169, Paris at 85 and Shanghai at 303. The last three use consistent measurement criteria, which is not the case with Chennai and Bangalore data. Source: Alain Bertaud, “Metropolis: A Measure of the Spatial Organization of 7 Large Cities”, unpublished manuscript, 21 April 2001

6. The city has been plagued by a low overall employment rate and a slow growth of employment in the formal sector. Informal employment is estimated to account for as much as 58% of all jobs. This includes such low-wage jobs as self-employed traders, street vendors, rickshaw pullers, and bicycle repairmen but also somewhat better paid jobs in construction, manufacture and repair. The household income distribution in 1998 was reported as follows:

<u>Annual Income (Rs)</u>	<u>No.of hh (000)</u>	<u>%</u>
Less than 37,500	565	37.4
Rs 37,500-50,000	187	12.4
Rs 50,000-62,500	143	9.5
Rs 62,500-75,000	143	9.5
Rs 75,000-87,500	120	8.0
Rs 87,500-100,000	79	5.2
Rs 100,000-112,500	78	5.2
Rs 112,500-125,000	79	5.2
Above 125,000	115	7.6
Total number of households	1,509,000 ⁴³	

7. These data show that the majority of the residents of Chennai (60%) have low incomes, less than (roughly) Rs.5,000 a month. Close to 40% of the population have very low incomes, less than (roughly) Rs.3,000 a month. About 24% of the population is estimated to fall under the poverty line and most (about 1 million) live in slums.⁴⁴ Even recognizing that the survey is more than 5 years old, and incomes have moved upwards since, these numbers are sobering. This state of affairs is in sharp contrast to the visible signs of new wealth – the high-rise buildings and motor vehicles.

C. Transport Demand: Modal Split and Motorization

8. The Chennai Metropolitan Area (CMA) is served by both road and rail networks.⁴⁵ The road system is based on 3-4 major radial roads, and an inner ring road. Secondary and tertiary networks are not well developed. Radial roads converge on the traditional center around Georgetown, roughly in the same corridors as the rail lines of the Indian Railways. Vehicular traffic is quite heterogeneous, with non-motorized modes (bicycles and bicycle rickshaws) being squeezed out by motorized 2-wheelers and motorized 3-wheeler rickshaws. Main public transport services are provided by Chennai Metropolitan Transport Corporation (CMTC), a public-sector monopoly. CMTC operates a fleet of about 2,800 buses in street traffic, employs some 18,400 staff, and carries about 3.5 million passenger trips a day. The Indian Railways (specifically the Southern Railway, the zonal department of the IR) operates commuter rail services on 3 lines, all electrified.

⁴³ Source: www.BombayFirst.org. Lall et al in “Diversity Matters“ (2003) cite a nationwide average annual wage of Rs.60,000, but Rs.74,000 for urban areas in 1998-99. The range was from Rs.41,000 in the leather industry to Rs.110,000 in electronics and computers.

⁴⁴ The poverty rate of 24.4% is an aggregate estimate for all urban areas in Tamil Nadu, and is used here as an approximation for Chennai.

⁴⁵ A more detailed description is given below. This paragraph provides only the bare essentials needed to understand the demand (modal split and motorization) aspects covered in this section.

They converge on Georgetown, carrying about 645,000 passengers a day. An 8.6 km urban railway, the Mass Rapid Transit System (MRTS) has been in operation since 1997. MRTS was constructed on a mostly elevated right-of-way due south from Georgetown, and represents Phase I of a larger project (Phase II is under construction). It carries an insignificant number of passengers, about 9,000 per day.

9. Daily per capita trip rates in Chennai increased from 0.87 in 1971 to 1.28 in 1991 (0.73 for motorized trips), with an average trip length of 10.1 km. Trip rates are forecast to increase to about 1.50 in 2011 (0.93 for motorized trips).⁴⁶ Over the same period, the overall modal split (in %) changed as follows:

	1970	1984	1992
walk	20.70	28.07	29.50
bicycle	21.30	10.70	14.20
public bus	41.50	45.53	37.90
commuter rail	11.50	9.03	4.10
2-wheel motorized	1.70	3.24	7.00
car	3.20	1.45	2.50
other	0.10	1.98	4.80

10. These numbers are likely to have changed since the mid-1990s in favor of individual motor vehicles, especially motorized 2-wheelers.⁴⁷

11. Since economic growth picked up in the last decade, the city has been under the onslaught of increased individual motorization. Motor vehicles in total have been growing at about 10-12% per annum in the past decade, with the highest rates recorded for 2-wheelers and motorized rickshaws. In 2003, there were about 1.5 million motor vehicles registered in the City of Chennai, and 1.8 million in the metropolitan area.⁴⁸ There also some 1.4 million bicycles. Of the motorized vehicles, more than a million are 2-wheelers and a quarter million are passenger cars. The breakdown by vehicle categories is as follows:

	<u>Private use vehicles</u>
2-wheelers	1,099,950
tricycle autos	2,559
3-wheelers	4,781

⁴⁶ Source: "Comprehensive Traffic and Transportation Study for Madras Metropolitan Area" RITES, Pallavan and Kirloskar Consultants for Madras Metropolitan Development Authority, September 1995. Household survey data appear to have been collected in 1992. See also Rajan et al, "Joint Venture of State and National Governments in Developing Rail Facilities: a Case Study of Chennai, India", 1998

⁴⁷ In addition, modal splits in Chennai are distorted by both MTC and commuter rail lines having to operate under strong capacity constraints and non-existent coordination in terms of fare and access arrangements. CMDA sources cite the modal share of "private modes" as being 58% in 2002, without stating the source or providing the definition of private modes.

⁴⁸ Source of data for Chennai City and the state: courtesy Transport Department, Government of Tamil Nadu. In the same year (2003), there were 6.2 million vehicles registered in the state, of which about 5.1 million 2-wheelers and 0.6 million passenger cars. A full time series 1995-2003 is available for the state.

cars, station wagons and jeeps	262,023
other	8,695
sub-total	1,378,008
<u>For hire vehicles</u>	
CMTC buses	3,673
Schoolbuses	740
autorickshaws	39,782
taxis, cabs omni buses	12,007
freight vehicles	28,726
other	1,399
sub-total	86,327
Total	1,464,335 ⁴⁹

12. The corresponding motorization rates are 62 cars per 1,000 population, but 324 cars and motorized 2-wheelers per 1,000 population. This is a high rate, exceeding that of many cities in Western Europe.

13. Notwithstanding rapid motorization, the above data on modal split show that walking and biking accounted for about 44% of all trips. Already this simple information is important for policy making, since the lowest-income groups and school children and students tend to be captives of walking and biking modes. Bus transport, though in apparent decline, still accounted for 38% of all trips. Together, non-motorized and public transport modes accounted for nearly 82% of all trips.

14. Bus passengers tend to come from the lower income strata. A survey of CMTC bus passengers in 1997 disclosed the following income distribution for households.⁵⁰

Monthly income Rs/HH	% of sample
No inc. reported	3.0
less than 1,000	10.4
1001-2500	32.0
2501-5000	34.5
5001-7500	16.0
more than 7,500	4.0

When this information is cross-referenced with the income distribution data cited above (acknowledging one-year difference in survey dates), it would appear that about 80% of CMTC passengers belong to low-income category and about 45% of these are in a very low income category. It would be of essence to know also how many bus passengers are

⁴⁹ The web site of India Petroleum Institute cites the following motorization levels in Chennai, drawn from a study by the Central Road Research Institute 238,000 cars, 949,000 motorized 2-wheelers, and 5,000 buses. The year is not given.

⁵⁰ Source: Annex 6B, Route Rationalization Study for Metropolitan Transport Corporation, Chennai Metropolitan Area, Draft Final Report, Pallavan Consultancy Services, September 2001. The survey covered 18,300 passengers, but only 2,033 answered the income-related questions.

“captives” and how many have access to a motorized 2-wheelers. Data from 1993 surveys in major Indian cities disclosed that households across all income groups owned motorized 2-wheelers, though in varying proportions.⁵¹

15. Service schedules and fares for bus and commuter rail services are decided by different authorities, state and federal government, respectively. Altogether, there is no coordination between bus and rail services. This is best seen in the existence of bus lines parallel to commuter rail and MRTS lines (both running losses) and in different fare structures. Basic bus fares and 2nd class rail fares are shown in the box below. The average fare paid on the bus system is Rs 3.4/trip. The sharp decline of fares per km of distance reflects the State policy of helping distant regional populations get jobs in the city. Limited-stop, express and de luxe services cost more, up to Rs 500 for a 4-km trip to Rs 1,500 for a 46-km trip. Monthly passes are offered at a 30% discount and school children have a 50% discount. For occasional users, bus travel is significantly cheaper, with the difference increasing as trips become longer. Monthly tickets for buses, however, are much more expensive than for the commuter rail.

PUBLIC TRANSPORT FARES IN CHENNAI - 2003				
Distance (km)	Single journey (Rs)		Monthly ticket (Rs)	
	Bus	Train	Bus	Train
2	2.00	5.00	140.00	70.00
5	3.00	5.00	140.00	70.00
10	3.50	5.00	140.00	70.00
15	4.50	6.00	200.00	85.00
20	5.00	7.00	220.00	100.00
25	5.50	8.00	240.00	115.00
30	6.00	8.00	260.00	115.00
35	6.50	9.00	280.00	130.00
40	7.00	10.00	300.00	145.00

Train fares are for 2nd class commuter rail. Fares for MRTS are higher due to a surcharge of Rs 1.00 for a single journey and Rs 20.00 for monthly tickets for all distances.

Sources: the bus fares, courtesy K. Kumar, CMDA; the commuter rail fares, courtesy Neenu Ittyerah, Southern Railway

16. How large are public transport fares relative to low incomes? At Rs 140, a monthly bus pass for one person for a 10-km trip (roughly the average trip length)

⁵¹ Source: Impact of road transportation systems on energy and environment – an analysis of metropolitan cities of India, Tata Energy Research Group, 1993. For Bangalore, this study gives the following data: households with monthly incomes up to Rs.500, 29% owned motorized 2-wheelers, and 71% owned bicycles; for incomes between 500 and 1,500 Rs. 47% owned a bike, another 47% owned a motorized 2-wheeler and 7% owned a car; in the group earning Rs.1,500-3,000, 31% owned a bike only, 60% owned a motorized 2-wheeler, and 9% owned a car. Over Rs.3,000, 37% owned a car, 45% owned a motorized 2-wheeler, and 18% owned a bike only. Given rapid growth of the economy of Bangalore, the absolute values of these income brackets are not comparable with those cited in the text.

represents 14% of a Rs.1,000 household income; this becomes 26% for a 30-km trip. A commuter rail monthly pass for a 10-km trip or less represents 7% of the income, and a pass for a 30-km trip would take 12%. For a monthly income of Rs.2,500, these percentages would be 6% and 10% for a 10-km and 35-km trips by bus, respectively. Equivalent monthly passes for the commuter rail would take 3% and 5%, respectively. In 1997, 13% of the surveyed CMTC bus passengers had household incomes of Rs.1,000 or less, and about 45% had household incomes of Rs.2,500 or less. Incomes are likely to have risen since 1997, so these percentages will be smaller. The conclusion is that for very low-income people, these fares may be onerous.

D. Roads, Traffic and Parking

17. The road network is a patchwork reflecting the city's development along national roads and railways, well before the advent of individual motor vehicles. The network between the high-density corridors is poorly developed, since in-fill construction has often been done illegally. Even major roads exhibit variable widths, different cross-section design standards, and are rarely protected from adjacent land uses. Only short segments, constructed and/or improved over the last 10-15 years introduce a functional specialization and use different road design standards, suitable for urban traffic stream with a great heterogeneity of vehicle types. There are about 2,500 km of roads, of which about 1,000 are said to matter for motor vehicle traffic. Of these, 300 km carry bus lines, which can be taken as an indicator of importance.

18. The network is dominated by three major roads, all radial, really urban sections of state roads leading to the traditional city center in Georgetown: the south-westerly Anna Salai (Mount Road, 128,000 vehicles per day) continuing as Grand Southern Trunk Road (NH45 towards Trichy); the westerly Perlyar E.V.R. High Road (144,000 vehicles per day), becoming NH4 going toward Bangalore; and the north-westerly Erukkancheri High Road becoming the Northern Trunk Road (NH5 toward Calcutta). Other important roads include the westerly Thiruvallur Road (#205) and Kamarajar Salai (South Beach Road) from Georgetown southwards. The Inner Ring Road (Jawaharlal Nehru Salai) Road is located some 8-10 km west of the Bay, at the city limits, and carries about 110,000 vehicles per day.⁵²

19. The traffic control system in Chennai is rudimentary as regards traffic signs, road markings and intersection channelization. Fixed-time traffic signals exist at 115 intersections, without any interconnection. Another 20-30 will come on line soon. Video cameras were installed at 8 intersections. Other intersections are managed by traffic policemen.

20. Traffic safety has been a sore point, with accidents peaking in 2001 at 5,280, of which 708 deaths and 3,800 injuries.⁵³ The corresponding rates are 40 accidents and 5.3 deaths per 10,000 registered vehicles. Most of the people killed were 2-wheeler

⁵² Source of vehicles per day cited in this paragraph is the CMDA document entitled "Investment Plan for Transport Infrastructure in CMA" (undated, circa March 2003).

⁵³ Source: Chennai Traffic Police, "Steps taken ...", July 2003.

riders/passengers (208), pedestrians (190), and cyclists (126). Galvanized into action, the Chennai Traffic Police spearheaded in 2002 a multi-faceted Project Safe Roads. It combined classic law enforcement actions (control and ticketing) with corrective engineering measures, and a large-scale public campaign based on networking with schools, media, civic associations and neighbourhood groups. The accident trend has been reversed, the total reducing to about 3,700 in 2002-2003, with about 400 fatalities and 2,800 injured. The Chennai City Traffic Police, with its 47 traffic police stations and 2,000 staff, are becoming a strong institution. They are continuing their activist stand, their thinking going well beyond traffic safety and traffic management concerns into the domain of medium-to-long term transport (infrastructure) investment program.

21. Parking provision and management are in infancy, but the subject has made it to the political agenda.⁵⁴ Most vehicles park without any control, on pavements and/or sidewalks. In Chennai City, there are some 160 street “stretches” with authorized parking, with fees charged at 69 of them. There are no meters. The Chennai Municipal Corporation leases the collection of parking fees to the private sector, with an annual revenue of about Rs 30 million (US\$0.63 million). Cars pay Rs 2 for short-term parking and Rs 20 for the whole day. Two-wheelers pay about half that, and bikes are free. This initiative suffers from numerous problems: poor markings and information boards, encroachment by street traders, and overcharging and pilferage by fee collectors. Off street parking for general public use is available only at the railway stations, the airport and in the beach area.

E. Chennai Metropolitan Transport Corporation (CMTC)

22. CMTC was created in 1972, under Companies Act of 1956, in a wave of nationalization of the then private operators, whose performance had become unacceptable. It is owned by the State of Tamil Nadu, which appoints all members of its Board of Directors. CMTC operates conventional, scheduled bus services, with a staff of about 18,000 and a fleet of about 2,780 buses (2,200-2,400 in peak service).⁵⁵ Most buses are single-deck Ashok-Leylands built on a truck chassis. The average fleet age as of the end-2003 is 6.2 years; 950 buses are older than 8 years and would be replaced if the company’s finances allowed it. The two tables on the following page provide the main operating and financial statistics of the company for the last two years, including performance indicators.

⁵⁴ A comprehensive study of parking in Chennai Metropolitan Area, including the development of standards, policies and regulative framework, is being carried out by Wilbur Smith Associates. Numbers cited in this paragraph come from early reports from the study team.

⁵⁵ This is comparable to 2,103 buses that CMTC had in 1982-83, and about twice the fleet at the founding. The population of Chennai increased 29% between 1981 and 2001. Source: Pallavan Transport Consultants, Route Rationalization Study, MTC Chennai, 2001.

Metropolitan Transport Corporation LTD – Chennai
Selected operational and financial statistics

	2001-02	2002-03
Staff	18859	18391
Operable fleet (vehicles)	2834	2773
Fleet in service (vehicles)	2213	2248
Average fleet age (years)	5.8	6.14
Gross bus-km (million)	205.8	213.5
Passengers (million)	1311.4	1280.7
Passengers per day (million)	3.6	3.5
Costs (Rs million)		
Wages	2093.4	2249.6
Fuel	1040.7	1190.5
Materials	287.1	269.4
Taxes	49.1	50.8
Other	146.5	207.1
Financial charges	170.9	166.3
Depreciation	180.4	134.2
sub-total costs	3968.2	4267.8
Revenues (Rs million)		
fare sales	3223.7	3830.5
other income	135.3	72.4
profit on sale of assets	0.7	4.1
Compensation	512.7	738.9
sub-total revenues	3872.3	4645.9
Result (Rs million) before tax	-95.8	378.2

Metropolitan Transport Corporation LTD – Chennai
Selected performance indicators

	2001-02	2002-03
Fleet utilization (%)	78.1	81.1
Average daily km per bus	248	250
Staff per bus	6.7	6.6
Average monthly wage (Rs)	9250	10193
Wage bill (% of total costs)	53	53
Breakdowns per 10,000 km	2.34	2.05
Accidents per 100,000 km	0.18	0.14
Cost recovery from fares		
% of direct op. costs	89	97
% of total costs	81	90

23. In addition to ordinary services (60% of bus-km), CMTC operates, limited-stop and express services (30% of total bus-km) and de luxe services (10%). It carries an estimated 3.5-3.8 million passenger trips per day, which is in decline in spite of the population growth and increasing mobility rates. Buses run in mixed traffic, with exception of Anna Salai, where there is an exclusive bus lane provided along about 2.5 km on each side of the road.⁵⁶ Average peak service headways are 15 min on arterial roads and 30 min on less important roads. The average commercial speed is 16 km/h.

24. CMTC has always been considered as one of the best-run urban public transport companies in India (together with BEST-Mumbai and Bangalore MTC in recent years). Performance indicators show reasonable levels of fleet utilization, maintenance and safety, though with much room for improvement. The weakest part of the performance profile is staffing which, at 6.6 staff per bus, is twice the efficient European levels and approaches that of Chinese, public-owned urban bus companies. In addition, the average expenditure of Rs.9,000-10,000 places CMTC employees in a significantly higher income category than the majority of its passengers. The wage bill is a high proportion of total costs for a country with high levels of unemployment and informal employment.

25. The financial situation of CMTC, as reflected in its balance sheet, is not good: its working capital is negative, accounts payable are high and growing, and more than half of the company's debt is short-term. The finances of CMTC have been subject to vagaries of fare policies dictated by the state government, the scale and timing of compensation payments for discount tickets and uneconomical routes, as well as the relations between the state and the organized labor. The state policy generally has been to keep the fares low on the account of low incomes of the population, make up the gap in the operating income through compensation payments, and the capital budget through subsidies. This has ensured that the services remained at a very basic level, acceptable to the majority of passengers while the level of motorization was low. This position of course is in the process of rapid change. In the last two years, following some much-needed fare increases, CMTC has come close to breaking even with revenue derived from fares at traditional levels of service. The gap of 10% could be closed even within the present regulatory arrangement with twin actions on the cost side and revenue side. If, however, CMTC tried to raise its level of service, a major restructuring effort would be necessary in several dimensions.

26. The CMTC has had a monopoly position, which is now under question. A wave to bring the private sector back into public transport services started in 2002 and was immediately opposed by the unions, who are arguing for an increased public investment in the sector. The specific proposal in this instance is the introduction of out-sourcing bus services to private operators using a "kilometer scheme" (gross cost contract) as in Bangalore. The matter is now in courts, with a State High Court ruling expected within

⁵⁶ This is a residual of a Rs.1,540 million (about US\$40 million at that time) project for a 6.5 km rapid busway on the same street, which was developed to the stage of detailed design in the late 1990s, but was stopped before tendering because the funding agreement broke down. See V. Thamizh Arasan (2000) for additional details.

months (early in 2004). As an interim relief measure, some 250 minibuses have been licensed to provide services in peripheral areas of the CMA.

F. Commuter Rail Services

27. The Indian Railways enters the city along three lines, all converging on the Georgetown area. Their combined corridor length is 117.8 km. The broad-gauge north-bound line from Chennai Central to Ennore and Gummidipoondi (46.8 km, 13 stations) has double tracks dedicated to suburban operations. The west-bound line, also broad-gauge, from Chennai central to Tiruvallur (42 km away, 17 stations), has 4 lines for about 15 km and 3 lines thence to Tiruvallur. The third line, in the south-western alignment, from Chennai Beach to Tambaram is 29 km long (18 stations) and has a mixture of meter-gauge and broad-gauge lines, two dedicated to suburban operations and one for all trains. The process of conversion to broad gauge is underway. In the outer parts of the metropolitan area, some rail stations have become industrial and/or residential sub-centers, demonstrating the potential of this mode to become a backbone of the regional and urban transport network. At present, however, rail lines carry only an estimated 643,000 passengers per day.⁵⁷ This passenger density (1.9 million passengers/km/annum) is comparable to that of the Kolkata Metro, but it could be much higher. It is being held back by the competition from parallel bus lines; unsuitability of services and fares for urban travel patterns, fleet size constraints (themselves imposed by poor financial results) and absence of complementary land use developments.⁵⁸

28. The following table shows partial financial results of these services. The rubric “expenditures” consists of direct operating costs only. Cost recovery has hovered between 50 and 60% of direct operating costs.⁵⁹

⁵⁷ Source for this number is direct communication with Southern Railway. Their web site cites a 2002-2003 traffic of 223.6 million per year, which is the number used to calculate the passenger density/km.

⁵⁸ The fact that two transport organizations, both public-owned and both subsidized, compete for passengers, is indicative of weak metropolitan-level transport institutions.

⁵⁹ Direct operating costs include all wages, energy, parts and services, but do not include depreciation and financial costs. Cost recovery of total operating costs could be of the order of 30% or less.

SOUTHERN RAILWAY					
EXPENDITURES AND REVENUES OF COMMUTER RAIL LINES IN CHENNAI					
	1997-98	1998-99	1999-00	2000-01	2001-02
	(in Rs million)				
Broad gauge lines					
Expenditures	635.6	721.2	791.5	976.5	998.4
Earnings	348.6	370.8	410.3	419.3	482.8
Meter gauge line					
Expenditures	482.4	567.3	641.7	671.7	694.9
Earnings	321.3	341.6	379.9	366.6	376.8
All lines					
Expenditures	1118	1288.5	1433.2	1648.2	1693.3
Earnings	669.9	712.4	790.2	785.9	859.6
Cost recovery (%)	59.9	55.3	55.1	47.7	50.8
Earnings gap (Rs mn)	448.1	576.1	643	862.3	833.7

Source: Southern Railway, 5 Dec 2003

Because of the strong pressure to keep monthly fares low, especially for long-distance commuting, to assist workers seeking jobs in the informal sector but unable to move residence, the Railway tried increasing tickets for single fares only to see its traffic erode to cheaper bus lines. Over years, the Railway subsidized these losses, and made direct investments in electrification, gauge conversion, double-tracking, extension, rolling stock replacement, and other improvements on these lines. This policy has been discontinued in part; new co-financing arrangements with the State of Tamil Nadu are sought for all extensions as it is being done with the Phase II of the MRTS in Chennai (see below).

G. The Mass Rapid Transit System (MRTS)

29. The MRTS as it is today is considered to be Phase I of a larger, 4-phase project. If and when completed, the line would make a ring around the city, with interchanges with south-west and west bound commuter rail lines.

30. The present 8.6 km, 1,676 mm gauge, double-track line, was conceived in 1970's, when Chennai's population grew at exceptionally high rates. It was approved by the Planning Commission and the Railway Board in 1983-84, as a fully-funded investment of the Government of India, to be implemented and eventually operated by the Southern Railway department of Indian Railways. The Ministry of Railways provided all technical support. The cars were constructed by Integral Coach Factory (Chennai based). The construction (including rolling stock) cost was forecast at Rs.535 million (in 1980 terms). When Phase I was completed in 1997, 20 years after its conception, the total cost came to

Rs.2,690 million⁶⁰. Government of Tamil Nadu contributed about 20 hectares of land, including 0.5 ha of private land. Land acquisition problems were formidable though the alignment was chosen to minimize this.⁶¹ About 3,500 families were affected by the project and received a total Rs.60 million in compensation.

31. The line is partly elevated (5.8 km out of 8.6 km total) and has 8 stations, 5 of which are elevated. It starts at the Chennai beach, near Fort St. George and Chennai Central stations (without a direct interchange), and goes straight south till Thirumylai, literally perched on the banks of the Buckingham Canal, and in the walking distance from the Bay. MRTS runs 90 trains per day, with 15 min headways in the peak and 30 min off peak. It was designed for a maximum load of 600,000 passengers per day, but carries only about 9,000.⁶² This is due to its poor location relative to sources and destinations of passengers, especially the low-density area between the line and the Bay, the proximity of parallel and fare-competitive bus lines, and poor feeder/interchange facilities.⁶³

32. Separate financial data for the MRTS could not be obtained for this report. Fares (cited above) are marginally higher than for other commuter rail lines. The fare revenue is said to cover the cost of energy and materials. The cost recovery is likely to be significantly lower than that shown above for the aggregate rail operation.

33. Phase II, to the industrial estate at Velacheri in the south-west, has been under construction since 1998. It will be elevated along 7.9 km, out of its 11.2 km total and have 7 elevated and 2 at-grade stations. Its construction costs are forecast at Rs.6.05 billion rupees (about US\$126 million at end-2003 exchange rates), of which the Government of India will contribute one-third and Tamil Nadu two-thirds.⁶⁴ The latter will also contribute 100 ha of state-owned land and about 9 ha of private land. The compensation, expected to involve about 2,500 households, will be about Rs.250 million (US\$5.2 million). Expectations are that the complete Phase I and II sections will carry 29,600 passengers per hour per direction (during peak periods) in 122 trains, and carry an average daily total of 424,000 passengers. This corresponds to a passenger density of 6.4 million per line km per year, close to that of the Beijing Metro and somewhat higher than that of the Paris Metro (network-wide). This appears less than likely.

34. Phase III, just 5 km long, would connect the MRTS with the south-west commuter rail line at St. Thomas Mount station. This is expected to cost Rs.3.78 billion

⁶⁰ Source: Chennai Metropolitan Development Authority, Draft Annual Report 2000-2001, p. 36-37. The source states only the aggregate nominal construction cost. Since exchange rates varied significantly over this long construction period, it is necessary to have the exact expenditure pattern (e.g. semi-annual or annual payments) to recalculate the total in constant 1980 terms.

⁶¹ Source: Rajan et al, Joint Venture of State and National Governments ...” p. 326

⁶² These are 2002-2003 data obtained directly from the Southern Railway. Other sources cited 7,000 passengers per day in 2001, with subsequent increases of as much as 50% on monthly basis, in late 2002, due to bus strikes and fare hikes, reflecting a high price elasticity of demand.

⁶³ Source: “On the wrong track”, The Hindu, 28 September 2003. In 2002, CMDA commissioned a study addressing the potential for densification of the MRTS Phase I corridor: L&T Ramboll Consulting Engineers, Final Report for the Densification Study, July 2003.

⁶⁴ Another CMDA brochure cites a higher construction cost forecast for Phase II, Rs.6.89 billion (US\$143.5 million; \$12.82 million per route-km).

(US\$78.8 million). The Government of Tamil Nadu is seeking a participation from the Government of India for this phase, using the same formula as for Phase II.

H. Institutions

35. The key state-level transport institutions active in Chennai, and their subordinate city institutions, are as follows:

- Department of Highways and Rural Works, responsible for state roads located in Chennai, essentially the three main radial roads plus the Inner Ring;
- Municipal Administration and Water Supply, responsible for Chennai Municipal Corporation (CMC), including the activities of its Commissioner related to roads, waste collection, etc. (and for corresponding departments in municipalities and town panchayats outside Chennai City). CMC is responsible for all non-state roads in the city. In addition, through an agreement with the State Department of Highways, CMC takes care of maintenance of state roads.
- Transport Department, responsible for Chennai Metropolitan Transport Corporation, and for setting government policy in the urban public transport sector;
- Home Department, responsible (through Commissioner, Transport) for transport regulation and motor vehicle regulation, and (through Traffic Police) for traffic control, traffic management and law enforcement; Chennai City Traffic Police works within the Corporation boundary, while District Police work in the metropolitan area;
- Housing and Urban Development Department, through Chennai Metropolitan Development Authority (CMDA), responsible for all transport planning and programming; also, through Town and Country Planning Department, responsible for urban and transport planning outside Chennai Metropolitan Area;
- Tamil Nadu Urban Finance and Infrastructure Development Corporation, a parastatal owned by the state government, functions as a transitional bank for local governments, with funds drawn from various national funds (see below), international financial institutions (including the World Bank), and private sources.

36. The key planning institution is CMDA, the statutory planning body for the entire metropolitan area, acting under the authority of Town and Country Planning Act 1971. It is responsible for: (i) preparing the master plan (land use and supporting infrastructure) (ii) preparing detailed plans and investment projects in housing, sites and services, transport and other urban sectors; (iii) project implementation and/or coordination; (iv) overseeing private investments to ensure consistency with the master plan; (v) commissioning diverse studies; and (vi) acting as nodal agency for national funding institutions, such as Housing and Urban Development Corporation (HUDCO) and Megacities Scheme. CMDA has a staff of about 900 arranged into units according to broad planning and development functions. Some units are spatially defined (e.g. area plans), others by sector (e.g. infrastructure planning unit, covering roads and public transport), or by output (e.g. a master planning unit). Committees are used to deal with

focus subjects, e.g. Traffic Improvement Committee, set up in 1996 to deal with the acute traffic congestion. The first Master Plan was completed in 1975 (horizon 1991) and approved by the state government. The Second Master Plan (horizon 2011) was completed and approved by CMDA in 1994-95, and released in printed form, but the subsequent debate involving all levels of government, NGOs and others has lasted years, delaying the final state government approval.

37. CMDA has been the most active local institution in the field of urban transport. In 1991 it commissioned what would prove to be the most important transport planning study, Chennai Comprehensive Transport and Traffic Study (finished in 1995, see below). Later on, it produced a Traffic Action Plan for Chennai, which has been the basis for much of the work done with the World Bank and proposed for the future.

38. Major urban transport projects in which CMDA was involved with World Bank finance (through a sequence of 2 Madras Urban Development Projects, then 2 Tamil Nadu Urban Development Projects) include:

- the 11.7 km Inner Ring Road;
- at-grade and multi-grade interchanges between state roads such as Anna Salai with non-state roads and railways;
- pedestrian subways;
- widening 21 km of national highways (inclusive of separate bike lanes and pedestrian platforms);
- 3 major and 7 smaller river bridges;
- fleet augmentation for MTC, involving 1,170 buses.

39. In addition, CMDA contributed to planning and executing the MRTS project Phase I, and the bus-and-truck terminal at Madhavaram. Its work on MRTS is continuing during Phase II and III, including also efforts to increase the land use density in the Phase I and II corridors so as to increase the patronage of the system (study completed in 2003). CMDA also pilots the effort to construct an Outer Ring Road in Chennai, apparently including a provision for a rail rapid transit line (see below).

40. The most important national institution active in CMA's transport matters is Southern Railway, a zonal department of India Railways, under the jurisdiction of the Ministry of Railways.⁶⁵ Southern Railway operates the commuter rail lines as well as Chennai MRTS, including decisions on service parameters and fares, and all maintenance. It is also responsible for replacement and expansion investments for the entire rail system.

41. The Government of India has set up several instruments to participate in funding urban projects, including urban transport projects. The longest-established approach has been to provide funding for large individual projects through the Planning Commission.

⁶⁵ Ministry of Railways is by law responsible for all rail based systems, national and metropolitan. The budget for the MRTS in Chennai was not processed as a separate project but as a part of the Ministry of Railway's budget. See Rajan et al (1998), p. 323.

Chennai MRTS Phase I was funded in this manner. A more recent approach, conceived in the wake of adopting the 74th CA, has been to finance urban expenditures by state or local governments through a plethora of funds, such as Megacity Scheme, Urban Reform Incentive Fund, and City Challenge Fund and Pool Financing. All of these are active in Chennai.

I. Transport Planning and Strategy

42. The first Comprehensive Transport and Traffic Study for the city was done in 1970-74 (by MATSU Consultants). This was the era when motorization levels were low and public transport modes were predominant. Its most visible recommendations therefore included improvements of the three suburban rail lines, and the construction of the MRTS, this last meant to grow into an orbital railway, plus an augmentation of the bus fleet. The MATSU study's road recommendations included an Inner Ring Road and a package of (road) corridor improvements. These propositions were afterward taken up in greater detail and implemented to the degree allowed by the available funds. The Inner Ring road was constructed with part-financing from the World Bank, the commuter rail lines were upgraded, but only a fragment of the MRTS (Phase I) could be built.

43. The next and the latest transport development (master) plan was produced during 1991-1995 under the Chennai Comprehensive Transport and Traffic Study (CTTS), by RITES, Pallavan and Kirloskar Consultants (CTTS Final Report, September 1995). The study combined investment, policy and institutional recommendations at varying levels of detail. Its key tangible output was a 10-year program of 25 schemes consisting of road and intersections improvements, costing about Rs 1.01 billion in 1995 terms (US\$ 32.2 at the then exchange rate). The program was divided into 6 groups: flyovers; rail crossings; pedestrian subways; road widening; traffic management schemes; and parking schemes. Pre-feasibility analyses were carried out for most large items from this list. Since many, if not most, of these investment have not been implemented, due to a lack of funds, an effort is underway to update demand and modal split estimates from the CTTS and re-check the attractiveness of the recommended investments.

44. The CTTS also tested some longer-term investment scenarios, essentially large-scale road, busway and rail projects. The recommended variant included the following: (i) extension of the MRTS (Phase II), to Taramani (or Velacheri); (ii) an exclusive busway on Anna Salai; (iii) a third commuter rail track on the North line up to Minjur; (iv) a National Highway Bypass (Outer Ring Road); and (v) rail ring road from Vilivakkam (on the Western line) to Taramani.⁶⁶ The package was to be implemented by 2011 and estimated to cost Rs 9.3 billion (US\$297 million), excluding rail vehicles.⁶⁷ Of these, MRTS Phase II is under construction. The Outer Ring Road, 62 km long, from

⁶⁶ Elsewhere in recommendations (CTTS, Final Report, p. 171), busways were proposed not only on Anna Salai, but also on Inner Ring Road between St. Thomas Mount and Koyambedu/Anna Nagar, and on EVR Periyar Salai. For reasons not explained in the text, only Anna Salai busway was tested as part of five alternative long-term packages.

⁶⁷ MRTS Phase I had not yet been completed when these recommendations were made. The Final Report does not cite any standard economic indicators.

Valadur in the south to Minjur in the north, is now estimated to cost Rs.4.5 billion (about US\$ 94 million).⁶⁸ Phase I, from Vandalur on the Grand Southern Trunk to Tiruvallur Road (29.2 km), is being designed and works are expected commence in the nearest future. Anna Salai Busway and the rail ring were not done, and appear abandoned.⁶⁹

45. In 2003, CMDA produced an update of the investment program put forward in the CTTS and stated the underlying transport strategy.⁷⁰ The strategy first makes references to a continuing urban planning approach to decongest the city-core, directing urban development along main transport corridors, and moving certain traffic intensive activities away from the central business district. A more flexible zoning regulation is aimed to bring residences, jobs and educational institutions closer. Turning to transport matters, the strategy expresses a preference for: (i) moving people rather than vehicles (with a 70% public transport modal share as a target); and (ii) maximizing the use of the present transport infrastructure. The tangible orientations include the following:

- urban rail network will be strengthened and expanded;
- on the three major radial roads (Anna Salai, Periyar, and Nehru Salai), capacity will be expanded using area traffic control, promoting bus lanes, and constructing elevated highways in their median;
- city roads will be concreted;
- road density in peri-urban areas will be increased “to match the spatial strategy pursued”;
- major bottlenecks in road and rail corridors, such as narrow bridges and at-grade rail crossings, will be removed;
- the role of bus routes as feeders to rail stations, and generally inter-modal facilities, will be strengthened; and
- new public transport options (LRT, skybus) will be considered in selected corridors.

46. A few comments on this strategy are in order:

- except for the exclusive bus lanes, there is no mention of traffic restraint, e.g. by using parking charges; this may be an omission by chance, since CMDA has commissioned a comprehensive parking study and there appears much interest in intensifying parking management and charging program;
- in spite of the declaration of preference for people (not vehicles) and for non-motorized modes, there are no specific provisions for these modes;

⁶⁸ The conversion of current rupees into US\$ is done uniformly using an exchange rate of Rs.48 per dollar.

⁶⁹ The most recent development, not a part of CTTS recommendations, is a proposal to construct a metro roughly in the Anna Salai corridor. This is a part of the forward wave spreading from an apparently successful financial arrangement to construct the Delhi metro. The same venture produced a proposal for a metro in Bangalore, and is now reported to be in negotiations with the state government to carry out a feasibility study for Chennai.

⁷⁰ CMDA’s document **Investment Plan for Transport Infrastructure in CMA** is unpublished and undated.

- bus lanes and the role of buses as feeders are the only mentions of the street-bus mode: is there nothing to be done to improve street-bus services, which carry on the order of 90% of all public transport trips in Chennai;
- bus rapid transit, a major urban public transport mode in many mega-cities, is not included as a possibility.

47. A summary of the investment program is shown on the table below. It is recognized that the first-year (2003-04) element is largely committed, the three year program (2004-07) is also reasonably firm, while the longer-term element is still in sketch-plan stage. Also, it is noted that the program does not include any investments for the Chennai Metropolitan Transport Corporation. With these qualifications in mind, the following observations can be made:

- the underlying strategic preference is for major rail projects: of the total amount of US\$1,976 million, \$762 million (39%) is for the MRTS and \$168 million (9%) is for commuter rail lines; combined, this is 48%; if \$112.5 million (6%) for the LRT/skybus (both rail-based) is included, the sum is just above one billion dollars (54% of the total);
- the next preference is for large-scale road projects: US\$875 (44%) million is for radial and ring corridors and major interchanges;
- everything else gets 4%; roads in peri-urban areas get US\$ 4.7 million (compare to \$16.7 million for 2 truck terminals);
- since it is not likely that Chennai Metropolitan Area would be able to mobilize the resources for a US\$2 billion program over the next 10 years, it would be prudent to attach some measure of “attraction” to each element, an economic rate of return or present worth. An investment for which an evaluation was not done, even at a sketch-planning level, should not be included on the list.

48. In sum, the strategy appears to rest on two poles. The first is accommodation with the current and expected motorization in the classic “predict and provide” mode. This is counterbalanced by major capital funds for urban rail -- the most capital-intensive and most risky form of urban public transport. The risk is high enough for the construction cost side of these projects, but is even higher for the operational stage. Both of these should be of particular relevance in Chennai, given the history of long construction periods and relatively low passenger traffic on the commuter rail lines and practically zero traffic on the MRTS Phase I.

SHORT-TO-MEDIUM INVESTMENT PROGRAM FOR CHENNAI METROPOLITAN AREA

	Length (km)	Rs (crore)	US\$ mn	MRTS	Comm R	Prim Rds
A. One-year program (2003)						
A.1 Urban rail						
Construction Phase II MRTS	11	85.00	17.71	17.71		
Gauge conversion of suburban rail lines	56	100.00	20.83		20.83	
A.2 River bridges						
Bridge widening across Cooum on P. EVR Salai		3.00	0.63			
A.3 Traffic management program	39	11.94	2.49			
A.4 Widening & strengthening major city roads	32	42.00	8.75			8.75
A.5 Strengthening roads in peri-urban areas	57	4.54	0.95			
A.6 Detailed design for elevated roads on Anna Salai, Periyar EVR Salai and Nehru Salai		0.20	0.04			
Total for 1-year program		246.68	51.39	17.71	20.83	8.75
B. Three-year program (2004-2007)						
B.1 Urban rail projects						
Completion of Phase II MRTS	11	144.00	30.00	30.00		
Gauge conversion of suburban rail lines	56	355.24	74.01		74.01	
B.2 Traffic management program	27	3.00	0.63			
B.3 Strengthening roads in peri-urban areas	171	13.62	2.84			
B.4 Outer Ring Road						
Constructing 4-lane rd between NH45 and NH205	29	250.00	52.08			52.08
B.5 Widening and strengthening primary roads	901	1711.68	356.60			356.60
B.6 Cement concreting of Anna Salai	12	101.32	21.11			
B.7 Over and underpasses (37 of them)		817.93	170.40			170.40
B.8 River bridges (2 of them)		7.00	1.46			
B.9 Bus terminal at Tambaram		6.00	1.25			
B.10 Multistorey garage at T. Nagar (BOT)		48.00	10.00			
B.11 Study for 2-level elevated roads (A.6 cont'd)		2.80	0.58			
Total for the 3-year program	1207	3460.59	720.96	30.00	74.01	579.08
C. Long-term measures (5-10 years from 2007)						
C.1 Strengthen roads in peri-urban areas	56	4.56	0.95			
C.2 Urban rail projects						
Phase II MRTS ext (Velachery to St. Thomas Mount)	5	378.00	78.75	78.75		
3rd and 4th line between Beach and Ennore		100.00	20.83		20.83	
Quadrupling between Patabiram & Tiruvalur		250.00	52.08		52.08	
Phase III MRTS (St. Thomas to Villivakkam)	20	1200.00	250.00	250.00		
Phase IV MRTS from Villivakkam to Ennore	20	1800.00	375.00	375.00		
Phase II MRTS station area development		50.00	10.42	10.42		
C.3 Elevated urban road projects	44	1126.00	234.58			234.58
C.4 Outer Ring Road (4-lane betw NH205 and TPP Road)	33	250.00	52.08			52.08
C.5 LRT/Skybus along Periyar EVR Salai	12	540.00	112.50			
C.6 Truck terminals (1 in Western, 1 in Eastern corridor)		80.00	16.67			
Total for the 5-10 year program	183	5778.56	1203.87	714.17	72.91	286.66
GRAND TOTAL		9485.83	1976.21	761.88	167.75	874.49

Source: CMDA, Investment Plan for Transport Infrastructure in CMA, March 2003

ATTACHMENT II-B: URBAN TRANSPORT IN BANGALORE

A. The State

1. The State of Karnataka has a population of 53 million, 33% urban, growing at 1.59% per annum (1991-2001). Its economy grew at 7.5% per annum in the 1990s and is expected to continue at that pace.⁷¹ Services as percent of Karnataka's GDP grew from 40.1% in 1990-91 to 47% in 2000-01.⁷² The state was ranked second out of a sample of 10 Indian states with regard to the investment climate. In late 1990s, it experienced a fiscal crunch, due to a combination of a recession in the economy, large losses in the power sector (leakage, theft, subsidies to agriculture), a generous settlement of civil service wages; and a peak in debt servicing. A reform program was undertaken aiming to gradually reduce energy subsidies, improve budgetary processes, and a restructuring program for the public administration.

2. Karnataka has a pioneering program to improve the delivery of services to the public, based on public dissemination of charters for public agencies, adopting service standards and targets, and grievance procedures, and arranging for citizen surveys published as "report cards" for agencies.

B. The City, Its People and Economy

3. Bangalore is the capital of the State of Karnataka. The city itself has 4.1 million people and 930,000 households (2001 data), on an area of 224 square km.⁷³ The corresponding average residential density is 183 people per sq km. The agglomeration has 5.7 million people on 530 sq km.⁷⁴ Another million people visit the area on daily basis. The population growth rate was the highest in the 1970s (7.6% per annum), but it is still quite high, 4.9% per annum, the fastest in India. The growth is due to a combination of high fertility and massive in-migration. The latter is linked to Bangalore's rise as the center of India's electronics and information technology, but also engineering, defense, higher education, consumer goods, and silk weaving. Migrants are a combination of highly skilled workers drawn from all over India and abroad, but also job-seeking rural poor from inside the state as well as the neighbor states. The forecast population for the year 2011 is 10 million.

⁷¹ Source for this growth rate: Karnataka Economic Restructuring Loan, Aide-Mémoire of the Appraisal Mission, The World Bank, April 23, 2001 (p.5).

⁷² Source: Mathew Joseph, "Performance of the Southern States – A Comparative Study", Economic and Political Weekly, September 13, 2003.

⁷³ A report from Karnataka road Development Corporation cites 4.3 million.

⁷⁴ The web site (<http://urbanindia.nic.in/mud-final-site/urbscene/index.htm>) maintained by the Ministry of Urban Development and Poverty Alleviation, cites a population of 5.7 million, based on the 2001 census, but it does not say exactly which boundary this number refers to. Another source (unpublished SBI report Sept 2002) cites 6.5 million taken from the site censusindia.net. The implication is that this is the population within BMDA's jurisdiction.

4. City spatial structure is polycentric, growing at the fringes more in the inner areas. This is due in part to low floor area ratios enforced by BMC in the city center, therefore also higher prices.⁷⁵ Vacant land and structures needing re-development are leapfrogged. The resulting “many-to-many” travel pattern tends to increase trip lengths, while reducing volumes on major corridors. When this is coupled by transfer avoidance by passengers, the public transport system tends to evolve in the direction of increasing the number of direct routes, while decreasing frequency. High corridor volumes represent the sum of many lower-volume lines.

5. The city has a large and growing middle class, the tops of which live in planned residential layouts. Most households live in rental housing (74% in the mid-1990s). There is also considerable poverty, including both those whom economic growth has left behind and fresh migrants from the countryside. Bangalore’s income groups are generally mixed throughout the area, but there is some clustering of low-income groups at west, south-west and north-east peri-urban areas. During the peak of the growth boom (late 1980’s, early 1990’s), rising land prices pushed a lot of low-income people to farther-out locations.⁷⁶ According to a 1999 survey, 2.2 million people live in about 750 slums, sharply up from 1991.⁷⁷

6. The following household income data are for 1998, when the median annual income was Rs 62,500 (Rs 5,208/month):

<u>Annual Income (Rs)</u>	<u>No.of hh (000)</u>	<u>%</u>
Less than 37,500	308	28.1
Rs 37,500-50,000	121	11.0
Rs 50,000-62,500	122	11.1
Rs 62,500-75,000	104	9.5
Rs 75,000-87,500	105	9.6
Rs 87,500-100,000	88	8.0
Rs 100,000-112,500	64	5.8
Rs 112,500-125,000	63	5.7
Above 125,000	122	11.1
Total number of households	1,097,000 ⁷⁸	

⁷⁵ Alain Bertaud, “Bangalore Land Management”, 1993. Still, the last traffic study estimated that the central area attracted 50% of all trips in 1998 (CRRRI et al, 1999).

⁷⁶ Source: Benjamin, “Governance, economic settings and poverty in Bangalore”, p. 36.

⁷⁷ Source: Suprya Roy Chowdhury, Old Classes and New Spaces: Urban Poverty, Unorganised Labour and New Unions”, Economic and Political Weekly, December 13, 2003. Another source cites an older estimate by Karnataka Slum Clearance Board of about 400 slums and 0.5 million slum dwellers. See Vagale “Bangalore: A Garden City in Distress” (1998).

⁷⁸ Source: www.bombayfirst.org. Compare to the 2002 average annual consumption of Rs 30,735 (about US\$640 per capita) cited in: Somik Lall et al (2002) and Uwe Deichmann et al (2003). The median annual consumption was lower, 20,867 rupees (\$435) per capita. The tails of the distribution were at 4,000 rupees and 140,000 rupees. Bertaud and Brueckner (April 2003) report a 1999 per capita income in Bangalore of Rs 28,300. They also cite an average household consumption level of Rs 46,400 for urban India in 1999-2000.

C. Transport Demand: Modal Split and Motorization

7. Urban transport in Bangalore is essentially road based, since the national rail lines were neither designed nor operated with regard to urban and regional traffic (infrequent stations, no pass-through lines, low service frequency). Traffic is dominated by motorized 2-wheelers and 3-wheel rickshaws. Conventional public transport services are provided by Bangalore Metropolitan Corporation (BMTc). Its 2,200 buses operate in mixed traffic, without any privileges like exclusive lanes or priority of passage at signalized intersections. In addition, many companies arrange for transport of their employees, using own minibus fleets or contracting out. BMTc network is diffuse, trying to connect the maximum number of origins and destinations, to avoid transfers (implies low frequency of service on individual lines). The intercity bus terminal was recently re-located to the city fringe, but most freight terminals are still in the central city.

8. The most recent available estimate of modal split, in Bangalore, for all trips, for early 2000's, is as follows:⁷⁹

walk and bike	17%
BMTc buses	38%
other buses	3%
cars & 2-wheelers	38%
3-wheelers	4%

9. About 1.6 million motor vehicles ply the roads and streets of Bangalore, and about 2 million in the metropolitan area. The breakdown by main vehicle categories is as follows:

Private use motor vehicles	
2-wheelers	1,220,000
cars, station wagons and jeeps	279,000
sub-total	1,499,000
For hire motor vehicles	
MTC buses	2,200
private buses	675
other buses and vans	16,000
auto-rickshaws	74,000
taxis, cabs	27,000
freight vehicles	42,000
other	17,125
sub-total	179,000
Total	1,678,000 ⁸⁰

⁷⁹ Source: Bangalore Mass Rapid Transit Ltd, presentation to the World Bank, November 2003. The total estimated number of daily trips was 5,852,000 indicating very low mobility. Some other sources cite the bus share to be 55-60% of all trips longer than 1 km. There have been no large-scale household travel surveys in Bangalore for many years, so all demand estimates are weak.

10. The motorization rates are 68 (=279000/4100) passenger cars per 1,000 population and, when 2-wheelers are added to cars, 298 (=1220000/4100) passenger vehicles per 1,000 population. The forecast for year 2011 is 4.2 million vehicles, of which 2.9 million 2-wheelers and 610,000 cars.

11. Traffic composition in 1999 was 50% 2-wheelers, 20% auto-rickshaws and 20% cars. This is very different from the mid-1960s, when bicycles accounted for 70% of traffic.⁸¹

D. Roads, Traffic and Parking Control

12. The primary network, 500-600 km out of the total road length of 3,000 km, includes 10 state and/or national roads, most of them radial. An Outer Ring Road (62 km, completed in 2002) plays little role in urban transport, carrying mainly the long-distance through traffic. An Intermediate Ring has been constructed in fragments (e.g. south-east between Koramangala and Airport Road). Generally, the road network is underdeveloped in terms of size, structure, continuity and connectivity. The city roads were laid out in the 1940s, when Bangalore had a population of less than half a million. The land development process preceded motorization, and in fact inhibited it later on. The primary roads (Outer Ring Road and Bangalore-Mysore Toll Road excepted) are merely 25 m wide, or less. Traffic control is by about 110 fixed-time signals and/or manual. Traffic Police estimate that 35% of the road network is in poor condition. Traffic safety situation in Bangalore is dismal. In 2002, there were 8,320 accidents, and about 800 deaths, a fatality rate of about 5.3 per 10,000 vehicles. Pedestrians account for 40% of fatalities.⁸²

13. A traffic study carried out in 1999 proposed a large and varied road improvements program, including 45 multi-grade intersections (mainly flyovers), 25 pedestrian underpasses, and various corridor improvements, including widening, at-grade intersection improvements, one-way schemes, and traffic signals. In the next step of the

⁸⁰ Sources disagree on those numbers and use different categories. This table is based mostly on numbers provided by Bangalore Mass Rapid Transit Ltd., dated November 2003. The web site of India Petroleum Institute cites the following motorization levels in Bangalore, drawn from a study by the Central Road Research Institute 234,000 cars, 1,162,000 motorized 2-wheelers, and 35,000 buses. The year is not given. Bangalore City Traffic Police cites a number of 1,750,000 motor vehicles in 2002. They forecast that this will double by year 2011. Karnataka Road Development Corporation cites 993,250 vehicles in 1996 and 1,438,057 vehicles in 2000, implying a growth rate of 9.7% per annum.

⁸¹ Source: CRRRI et al, Traffic and Transportation Improvement Priorities for Road Corridors of Bangalore, 1999

⁸² Source: presentation by Bangalore Rapid Transit LTD, November 2003. The number of fatalities, cited elsewhere, is a coarse estimate. The proportion of pedestrians as victims of fatal accidents is from Reddy and Ramakrishna "Individual modes: efficiency or illusion, A Case of Bangalore City" (2002). For the State of Karnataka, the number of fatalities is about 18 people per 10,000 vehicles registered, which is very high (compare US at 3.2; Malaysia at 5.5; Lao PDR at 15). Source: PAD, Karnataka State Highway Improvement Project, Project Appraisal Document, Report No. 21850-IN, The World Bank, April 23, 2001.

planning process, the number of multi-grade intersections was reduced to 19, with 9 to be done in the first phase. Some of these were undertaken in the intervening years.⁸³

14. Street stretches designated for on-street parking by the Bangalore Municipal Corporation are rented out to private persons who collect fees and enforce compliance with time limits and other regulations. Fees are set by BMC and the revenue goes to BMC. In 2003, fees for cars were Rs for first 2 hours, Rs 10 for up to 6 hours, and Rs 15 beyond 6 hours. Equivalent fees for 2-wheelers were Rs 1.5, 4.0 and 8.0, respectively. A rudimentary program of meter-based charges has started on Brigade Road. BMC has constructed 2-3 multi-storey parking structure “where it had land available” so some unusual locations (e.g. t an intersection. There are also some private at-grade car parks.

E. Institutions

15. Bangalore has a more fragmented institutional network for urban transport than is found in most places. The following institutions are, or could be, the most important for urban transport matters (state ministries excepted):

- Bangalore Municipal Corporation (BMC), specifically its Department of Public Works is responsible for the maintenance and rehabilitation (including widening) of local roads (secondary and tertiary network); in addition, the national/state roads on the territory of the City are handed over to BMC for maintenance, traffic and parking management, and law enforcement.
- Bangalore City Traffic Police:
- Bangalore Development Authority (BDA), set up in 1976, to do both planning and development functions focused on real estate. Its jurisdiction is 1,279 sq km, including the Bangalore City, the surrounding urbanized area plus rural area, . It is responsible for: (i) preparation of comprehensive land use plans, including zoning and major infrastructure plans (updated every 10 years by Karnataka’s Town and Country Planning Act); (ii) layout planning; (iii) approval of development plans and building proposals (including land use changes) for private residential and commercial clients; and (iv) issuing trade licenses. It is also authorized to develop land, i.e. it buys and develops land for residential layouts and infrastructure schemes. BDA does not do sectoral project and policy planning, nor does it have an integrating role for these (no other agency does). It therefore has no capacity for traffic& transport planning, much less public transport regulation. Still, the BDA’s brief has a reference to being responsible for “specific scheme plans.” In this last capacity, apparently, BDA has had a hand in several large road construction projects (flyovers, elevated sections). It is in effect a land development agency. In recent years, it has become self-financing; its revenues include the vacant land tax (but not the property tax) and tax on land sales (\$88 million in 2001-2002).

⁸³ In the course of writing this report, no document was found which summarizes what has been done since 1999. In one unpublished source dated 2002, it was reported that HUDCO was planning to lend to Bangalore for another 28 flyovers. Bangalore Municipal Corporation was planning in 1999 to float a bond to finance road improvements. No mention of this bond was found in later years.

- Bangalore Region Development Authority has jurisdiction over the next ring beyond that under BDA's jurisdiction. Its initial *raison d'être* was to be an overarching agency for coordinating planning and development, but it never took off. Its current functions are not clear, and its staff of a few people is too small to count.
- Karnataka Road Development Corporation Ltd., founded in 1999, registered under the Companies Act, fully owned by the Government of Karnataka. Its original mission is to mobilize private sector funds for the construction and operation of roads and bridges where tolls can be charged. As of May 2001, it has been given the task of developing and implementing (road) traffic infrastructure schemes in Bangalore.
- Bangalore Mass Rapid Transit Ltd (BMRTL) was set up in 1994 to play a role for rapid transit projects equivalent to KRDC plays for roads.
- Karnataka Urban Infrastructure and Development Finance Corporation (KUIDFC), registered under the Companies Act, fully owned by the Government of Karnataka. The role: interaction with the private sector; nodal agency for Megacities Fund, also for implementing WB and ADB loans.
- Agenda for Bangalore, a high-level, high-visibility body set up by the Prime Minister to
- Other ad hoc bodies like the Transport Advisory Forum and Task Force on Traffic and Transport (for operational matters)

F. Bangalore Metropolitan Transport Corporation (BMTc)

16. BMTc is an independent company, registered under the Companies act, fully owned by the State of Karnataka, and governed by a Board of Directors, all appointed by the State. It consists of a central corporate body, 19 depots and 1 workshop. It operates conventional, street-based, scheduled bus services on 1,212 routes, with a fleet of 2,200 buses and a staff of 13,830. Average daily passengers carried amount to 2.6 million. The tables below provide the basic operational and financial statistics, performance indicators, and the fare structure. The company recovers its costs and makes a profit, with only a small-scale contractual compensation.

17. The story of BMTc is that of a resurrection. It was formed in 1997, when the Bangalore depots of the troubled Karnataka State Road Transport Corporation (KSRTC) were separated from the mother company. Like other state transport undertakings in India, KSRTC had been buffeted from all sides:

- The state had loaded gradually more and more social obligations on the company without corresponding compensation (e.g. passengers who had a right to some type of discount fare, or a lightly traveled route);
- Taxation policy of the state were harsher on buses than on private vehicles;
- Passenger demand was falling, especially in the wake of the 1988 Motor Vehicle Act, which opened the sector to a variety of informal transport arrangements;
- Requests for fare increases in line with inflation were approved sporadically and unsystematically; revenues were always chasing costs;

- Staff discipline had broken down, with revenue pilferage estimated at 10% of total fare revenue.
- The management yielded to union pressures for increased wages in spite of fallen productivity.

18. In addition to creating BMTC, the state also gave it a right to adjust fares based on an agreed formula and input cost tracking. A full scale internal restructuring program was conceived and implemented. It focused on staff and management conduct, work procedures, uses of IT in various functions like ticketing, stores, accounting, scheduling and schedule monitoring. The last but not the least is that BMTC opened the door to the private sector through outsourcing, even in its main business line – transport services. This consists of a “kilometer scheme” whereby private operators compete on gross cost basis to serve specific routes. In 2001-2002, close to 300 private buses were in operation, equivalent to about 13% of the BMTC’s fleet. The sum of these efforts is evident in its financial performance: the loss of Rs 78.2 million (about US\$ 2 million) in 1997-98 turned to a small surplus of Rs 39.6 million in 1998-99, rising to Rs 267 million (US\$ 5.6 million) in 2001-2002. It also shows in all technical performance indicators, which place BMTC among the top 2-3 urban transport companies in India:

- Cancellation rate decreased from 14.8% in 1996-97 to 2.6% in 2001-02;
- Distance covered increased from 193.9 km per bus per day in 1996-97 to 227.2 km in 2001-02;
- The rate of breakdowns decreased from 0.55 per 10,000 km in 1996-97 to 0.19 in 2001-02;
- Accidents per 100,000 decreased from 0.26 per 100,000 km in 1996-97 to 0.22 in 2001-02.

Bangalore Metropolitan Transport Corporation LTD
Selected operational and financial statistics

	2000-01	2001-02
Staff	13657	13832
Operable fleet (vehicles)	2287	2376
Outsourced fleet	186	282
Own fleet in service (vehicles)	2190	2253
Private fleet in service (vehicles)	186	282
Average fleet age (in 100,000km)	4.34	4.02
Gross bus-km (million)	180.8	205.5
Passengers (million)	939.9	958.1
Passengers per day (million)	2.6	2.6
Costs (Rs million)		
Wages	1203.8	1270.8
Fuel	740.1	803.7
Materials	177.9	158.7
Taxes	77.8	92.4
payments to private contr.	87.1	243.4
Other	127.3	136.2
financial charges	52.8	61.0
Depreciation	163.3	189.9
sub-total costs	2630.1	2956.2
Revenues (Rs million)		
fare sales	2567.8	3012.0
Other income	26.4	53.3
profit on sale of assets	23.1	16.8
Compensation	144.0	141.1
sub-total revenues	2761.3	3223.2
Result (Rs million) before tax	131.2	267.0

Bangalore Metropolitan Transport Corporation LTD
Selected performance indicators

	2002-03	2001-02
Fleet utilization (%)	96	95
Average daily km per bus	220.1	227.2
Staff per bus in service	6.24	6.14
Average monthly wage (Rs)	7345	7656
Wage bill (% of total costs)	0.46	0.43
Breakdowns per 10,000 km	0.36	0.19
Accidents per 100,000 km	0.26	0.22
Cost recovery from fares		
% of direct op. costs	108	114
% of total costs	100	104

2003 FARE SCHEDULE OF BMTC - BANGALORE	
Distance (km)	Single ticket Rs.
2	2.00
5	4.00
10	5.00
15	5.00
20	6.00
25	7.00
30	7.00
35	8.00
40	8.00
Monthly pass (Rs)	
City Service (Black Board) : Rs.200/- per month	
City Sub-urban Service (Red Board) : Rs.385/- per month	
City Sub-urban / Pushpak / Janpriya : Rs.425/- per month	

G. Land Use and Transport Planning

19. The statutory Comprehensive (Land Use) Development Plan was made and approved in 1984, then revised 10 years later and approved in 1995. This plan is merely a zoning document with rough location of the road network. It is currently being updated by the BDA and its consultants, for the first time using satellites to create digital area maps. It has no bearing on transport matters.

20. What emerges from the review of literature is a sequence of studies, but relatively little action. The first comprehensive traffic and transport planning study was carried out in 1963-64 by the Central Road Research Institute (New Delhi). In spite of the term “comprehensive” the study apparently focused on the road system, proposing the construction of 138 km of ring roads, 77.5 km arterial roads and various grade separators, pedestrian subways and truck terminals. An effort to refresh the data and update the proposals was made by the State Department of Town Planning in 1977. One of its recommendations was to look into a mass rapid transit project, i.e. a metro for Bangalore. The recommendations of this work were taken up by the high-level Lynne Committee in 1981. The Lynne Committee agreed that a metro study was warranted, and a team from Southern Railway (Chennai) was commissioned to do this. The Southern Railway team recommended a 2-corridor metro (24 km, estimated at Rs. 3,300 million in 1983 terms, about US\$320 million at that time), but also investments in 3 commuter rail lines, and a 58-km ring railway (echoes of the Chennai case). The whole package was estimated to cost Rs.6,500 million in 1983 terms (US\$628.6 million) and scheduled over a 25-year period. No action followed this proposal. In 1988, in the course of preparing a project to be proposed for World Bank funding, RITES was commissioned to do another transport study, with a broad coverage of roads, traffic and mass transit. The study was completed, proposing various road and traffic improvements, and also improvements on commuter

rail lines, but again without much follow-up (no Bank project was agreed). In 1993, the State of Karnataka established another committee to look into mass rapid transit. This committee recommended essentially the same metro project put forward by Southern Railway in 1983 and the same circular railway. Again, no follow up action.

21. In 1994, the state created Bangalore Mass Rapid Transit Ltd., with terms of reference to seek a public/private partnership for a mass rapid transit project, on a 25/75 funding formula. The government immediately introduced a special city cess, with proceeds expected at Rs 550 million (US\$ 11.5 million) per annum, dedicated to the anticipated mass rapid transit project.⁸⁴ BMRTL commissioned a feasibility study, which pointed in the direction of an elevated, LRT-based, 96-km long network on 6 routes. The alignment was on major radial roads. The design capacity was about 25,000 passengers per hour per direction. When the full system was built over a 7.5 year period, the forecast was that it would attract 40% of road based traffic in its corridors, half of this coming from street buses. For once, action followed. A private consortium led by United Breweries Group undertook further development of the project on a BOT basis. After more detailed studies of costs and demand were made by the consortium, they asked for a 94/6 funding formula, reflecting an increase in realism gained in the second stage of studies.⁸⁵ The matter stopped there.

22. In 1999, BMTC commissioned a feasibility study for a bus-based mass rapid transit system. The study, completed in 1999, identified a network of 20 bus routes, composed of a Siamese-twin central rings intersected by 8 radial routes. A pilot 12-km line from Jayanagar in the south to Shivajinagar in the north, was estimated to cost Rs 394.9 million (US\$ 8.6 million). This includes the corridor and depot infrastructure and 35 special-purpose buses. This proposal has not been rejected, nor has it been accepted.

23. In 2003, the Government of Karnataka commissioned the Delhi Metro Rail Corporation, which had developed successfully the Delhi Metro (one section in operation, others under construction), to carry out a detailed preparation study for a metro in Bangalore, to be done emulating the technical and financial aspects of the approach used in Delhi. This entails a 25/25 contribution from the State and the City of Bangalore, the rest to be borrowed from domestic and international sources (specifically Japan bank for International Cooperation). The study was a combination of feasibility with an environmental impact analysis. The study came out with a 2-line metro, 18 km and 15 km in length, cross shaped. The middle of the cross is at the Central Railway Station in Bangalore. Station spacing would be 1 km on average (32 stations of which 7 underground). The alignment will be 20% underground (in the central zone), the rest being elevated. Total costs were forecast at Rs. 39.7 billion (US\$0.83 billion) in 2003 terms. With escalation and interest during a 5-year construction period, the total outlay was estimated at Rs. 49.9 billion (US\$ 1.04 billion). In the opening year (assumed to be 2008), the system would carry 820,000 passengers per day, and 1.02 million per day by 2011, at fares ranging from Rs. 4 for up to 2 km to Rs 9 for an 18 km trip (compare to BMTC fares of Rs. 2 for a 2-km trip and Rs. 6 for a 20-km trip; the metro fare is about

⁸⁴ The amount accumulated by the end of 2002-2003 fiscal year was about Rs 4 billion (US\$ 83 million).

⁸⁵ See footnote re inclusion of risk in the section on metros in the main report.

50% higher). The economic rate-of-return was forecast at 22.3% against a “business as usual” reference option. The financial forecast assumes a government subsidy for interest payments and some depreciation, i.e. fare revenue will cover somewhat more than direct operating costs.⁸⁶ The Government is said to have accepted this option and is involved in discussion with the national government. If an agreement is struck, BMRTL will cease to exist, to be replaced by a Bangalore Metro Rail Corporation Ltd, as was done in Delhi,

⁸⁶ The financial report was not available for this report, so the degree of coverage of depreciation by fare revenue is not available.

ATTACHMENT III: URBAN TRANSPORT IN INDIA – BIBLIOGRAPHY

A. Published Sources

K.M. Anantharamaiah and Vijay Raman, “A probabilistic revenue estimation model for providing a mass rapid transit system”, in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

Paul Barter et al., “Lessons from Asia on Sustainable Urban Transport”, in Nicholas Low and Brendan Gleeson, ed., **Making Urban Transport Sustainable**, Palgrave, Macmillan, Houndmills (UK) and New York, 2003.

Solomon Benjamin, “Governance, economic settings and poverty in Bangalore.” **Environment & Urbanization**, Vol. 12, No. 1, April 2000.

Alain Bertaud, “Land Management in Bangalore” get EXACT SITE ADDRESS!!!!

Alain Bertaud and Jan Brueckner, “Analyzing Building-Height Restrictions: Predicted Impacts, Welfare Costs, and a Case Study of Bangalore, India”, (forthcoming), April 2003.

Alain Bertaud, **Urban Planning and Air Quality**, South Asia Urban Air Quality Management Briefing Note No. 6, The World Bank, April 2002.

Suprya Roy Chowdhury, “Old Classes and New Spaces: Urban Poverty, Unorganised Labour and New Unions”, **Economic and Political Weekly**, December 13, 2003.

Michael Cohen, “Urban assistance and the material world: learning by doing at the World Bank”, **Environment & Urbanization**, Vol. 13, No. 1, April 2001.

Evangeline Cuenco, **Lending for Urban Development in India 1974-1995: Lessons from Bank Experience**, processed, Country Operations, Industry and Finance Division, South Asia Country Department II, The World Bank, Washington, D.C., September 16, 1996.

Dattatri, “Madras: A Rural Metropolis”, in R.P. Misra, **Million Cities of India**, Vikas Publishing House PVT LTD, New Delhi 1978.

Uwe Deichmann et al, **Information-Based Instruments for Improved Urban Management**, Policy Research Working Paper #3002, Development Research Group, The World Bank, Washington, D.C., March 2003.

Ralph Gakenheimer, “Comparing Mumbai and Shanghai, Wuhan and Chennai”, paper presented at the 2nd Workshop on Transportation, Land Use and the Environment at ASCI The Administrative Staff College of India, Hyderabad, January 2004.

Ralph Gakenheimer, “Planning Transportation and Land Use for Cities in India”, paper presented at the 1st Workshop on Transportation, Land Use and the Environment at ASCI The Administrative Staff College of India, Hyderabad, December 2-4, 2002.

Gakenheimer, R. and Zegras, C. "Travel Demand Drivers: Chennai, India." Geneva, Switzerland: World Business Council for Sustainable Development, June 2003.

S. George, R. Jha and H.K. Nagarajan, "The Evolution and structure of the two-wheeler industry in India", **International Journal of Transport Economics**, Vol. XXIX, No. 1, February 2002.

A.G. Hathway and P.N. Dongre, **Travel requirements of the urban poor – A study of ten low income settlements in Delhi**, Town and Country Planning, Working Paper No. 13, Bristol Polytechnic, Bristol (UK), 1989.

R. Jha and S.K. Singh, "Small is efficient: a frontier approach to cost inefficiency in Indian state road transport undertakings", **International Journal of Transport Economics**, Vol. XXVIII, No. 1, February 2001.

Mathew Joseph, "Performance of the Southern States – A Comparative Study", **Economic and Political Weekly**, September 13, 2003.

Pradeep Singh Kharola, "Reforms in the public transport – a systems approach", in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

Amitabh Kundu, "Institutional innovations for urban infrastructural development: an Indian scenario", in David Westendorff and Deborah Eade, ed's, **Development and Cities**, Oxfam, Oxford (UK), 2002.

Somik Lall, Jun Koo and Sanjay Chakravorty, **Diversity Matters – The Economic Geography of Industry Location in India**, Policy Research Working Paper #3072, Development Research Group, The World Bank, Washington, D.C., June 2003.

Somik Lall et al, **Tenure, Diversity, and Commitment – Community Participation for Urban service Provision**, Policy Research Working Paper #2862, Development Research Group, The World Bank, Washington, D.C., June 2002.

P.D. Mahadev, "Bangalore: A Garden City of Metropolitan Dimensions", in R.P. Misra, **Million Cities of India**, Vikas Publishing House PVT LTD, New Delhi 1978.

Dinesh Mehta and Pushpa Pathak, "Country Report of India," in Royston A.C. Brockman and Allen Williams, ed., **Urban Infrastructure Finance**, Proceedings of a Seminar held in Manilla, 16-18 April 1996, Asian Development Bank, Manilla (Philippines), 1996.

Dinesh Mehta and Pushpa Pathak, "**Financing of Urban Services in India: A Case for Appropriate Pricing and Cost Recovery**," *Habitat International* 22 (4): 487-502, 1998.

R.P. Misra, "Million Cities in the Context of World Urbanization," in R.P. Misra, ed.: **Million Cities of India**, Vikas Publishing House PVT, New Delhi, 1978.

Sudarsanam Padam, "Transport and Urban Governance in India", in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

S. Padam and S.K. Singh, 2001. "An Urban Transport Policy for India". Paper presented at the 1st Workshop on Transportation, Land Use, and Environment, Pune, India.

S. Ponnuswamy and M. Imtiyaz Ahmed, "Public Transportation Systems – a Case Study of Chennai", **Urban Transport Journal** (India), Vol. 2, No. 2, December 2001, pp. 76-95.

A.V. Poulouse, Financing metro rails and metropolitan commuter networks; Logistics of financing Delhi and Calcutta Metros and Growth and Enhancement of Mumbai, Chennai and Calcutta Suburban Rail Complexes", **Asian Transport Journal**, December 1998, pp. 8.1-8.24.

T.A. Rajan, Y. Shanmuga Sundaram, S. Ponnu Swamy, and K. Kumar. "Joint Venture of State and National Governments in Developing Rail Facilities: A Case Study of Chennai in India", in Andrea Czarnecki, ed., **Urban Infrastructure Development. Proceedings of the Second International Expert Panel Meeting on Urban Infrastructure Development, 8-9 December 1997, Bangkok, Thailand:** 303-345. UNCRD Proceedings Series, No. 26. Nagoya, Japan: United Nations Centre for Regional Development, 1998.

T. Anantha Rajan, **Travel Behavior of Slum Dwellers in Madras**, Indian Institute of Technology, Madras, 1980.

C. Ramachandran, "Case Study of Partnerships in Infrastructure Financing: A Study of India's Megacity Scheme" in Jeffrey Stubbs and Giles Clarke, ed., **Megacity Management in the Asian and Pacific Region**, Proceedings of the Regional Seminar, Asian Development Bank and United Nations World Bank Urban Management Program, Manila, 24-30 October 1995.

C. Ravikumar Reddy and S. Ramakrishna, "Individual modes: efficiency or illusion. A case of Bangalore City", in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

V.G. Rengaraju and R. Sivaraman, "Socioeconomic Characteristics, Land Use and Travel Patterns of Chennai (Madras)", in Murthy V.A. Bondada, ed., **Urban public transportation systems: implementing efficient urban transit systems and enhancing transit usage**. Proceedings of the First International Conference, March 21-25, 1999, Miami, Florida, American Society of Civil Engineers, Reston, VA. 2000 (held in Sect Library HE 305 .U684 2000).

J. Shah and T. Nagpal, ed., Urban Air Quality Management Strategy in Asia – Greater Mumbai Report, The World Bank Technical Paper No. 381, 1997.

Bharat Singal, "Urban mobility for all – institutional issues", in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

Y.P. Singh, "Performance of the Kolkata (Calcutta) Metro Railway: A case study", in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

Sumeeta Srinivasan, "Travel behavior of low-income residents: studying two contrasting locations in the city of Chennai, India" edited version of a paper presented at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 2003.

S. Sriraman, "State road transport undertakings in India: critical issues, constraints and emerging options," **Journal of Indian School of Political Economy (India)**; Vol. 13, No. 3:385-399, July-September 2001.

V. Thamizh Arasan and S.B. Pattnaik, "Notable Features of the Public Transit Systems in Chennai City", in Murthy V.A. Bondada, ed., **Urban public transportation systems : implementing efficient urban transit systems and enhancing transit usage**. Proceedings of the First International Conference. March 21-25, 1999, Miami, Florida, American Society of Civil Engineers, Reston, VA. 2000.

G. Thimmaiah, "Federal India – Burning Issues in Union-State Relations", **Journal of Indian School of Political Economy (India)**; Vol. 9, No. 4:609-625, October-December 1997.

Geetam Tiwari, "Urban Transport Priorities – Meeting the Challenge of Socio-Economic Diversity in Cities, a Case Study of Delhi, India", **Cities**, Vol. 19. No. 2, pp. 95-103, 2002.

Geetam Tiwari, "Low cost means of transport in cities: the critical elements in city transport system in low income countries", in X. Godard and I. Fatonzoun, ed., **Urban Mobility for All**, Proceedings of CODATU X Conference, Lomé (Togo), 12-15 November 2002, A.A. Balkema Publishers, Lisse, 2002.

Geetam Tiwari, "Urban Traffic Management – a Case Study of Delhi", **Urban Transport Journal (India)**, Vol. 2, No. 2, December 2001, pp. 12-30.

L.R. Vagale, "Bangalore: A Garden City in Distress", in R.P. Misra and K. Misra, ed., **Million Cities of India**, Sustainable Development Foundation, New Delhi, 1998.

The World Bank, **India's Transport Sector: The Challenges Ahead**, Vol. 1 Main report, Vol.2 Background Papers, Washington, D.C. May 10, 2002.

The World Bank, **India – Reducing Poverty, Accelerating Development**, Oxford University Press, New Delhi, 2000.

The World Bank, **India – Urban Infrastructure Services Review**, Report No. 16178-IN, Country Operations, Industry and Finance Division, South Asia Regional Department (Robert Burns and Evangeline Cuenco, principal authors), The World Bank, Washington, D.C., May 5, 1997.

B. Government Publications and Consultants' Reports

_____, **National Urban Transport Policy** (undated draft), Ministry of Urban Development and Poverty Alleviation, New Delhi (<http://urbanindia.nic.in/mud-final-site/w-new> accessed February 12, 2004).

_____, **Densification Study for MRTS Corridor Development – Chennai**, Draft Final Report (several volumes) submitted by L&T – Ramboll Consulting Engineers Ltd and Operations Research Group to Chennai Metropolitan Development Authority, July 2003.

_____, **Investment Plan for Transport Infrastructure in CMA**, undated document produced by CMDA, circa March 2003.

_____, **Steps taken to improve traffic and reduce accidents**, Chennai City Traffic Police, July 2003.

* _____, **Bangalore Metrobus Feasibility Study – Executive Summary**, Contrans (Sweden) and Central Institute of Road Transport (Pune), September 1999.

_____, **Traffic and Transportation Improvement Priorities for Road Corridors in Bangalore**, Draft Final Report submitted to Karnataka Urban Infrastructure Development and Finance Corporation by Central Road Research Institute New Delhi, Transport Operations, Planning and Informatics Centre, Bangalore and Centre for Transportation Engineering, Bangalore University, March 1999.

_____, **Comprehensive Traffic and Transportation Study for Madras Metropolitan Area**, Final Report by Rail India Technical and Economic Services Ltd., Pallavan Transport Consultancy Services Ltd., and Kirloskar Consultants Ltd. prepared for Madras Metropolitan Authority, Madras, September 1995.

_____, **Impact of road transportation systems on energy and environment – an analysis of metropolitan cities of India**, Final report submitted to Ministry of Urban Development, Energy Policy Group, Tata Energy Research Institute, New Delhi, May 1993.

ATTACHMENT IV: CITIES ON THE MOVE – EXECUTIVE SUMMARY

A previous World Bank urban transport strategy paper concentrated on economic and financial viability. “Urban Transport” (World Bank 1986) emphasized efficient management of existing transport capacity, good traffic management, and efficient pricing. It discouraged subsidies, recommended competition and minimal regulation, and questioned the value to the urban poor of capital intensive projects that might not be cost effective in countries with limited resources.

Subsequent sector strategy papers have taken a broader view. The transport sector strategy paper “Sustainable Transport” (World Bank 1996) emphasized the integrity of economic, social, and environmental dimensions of a sustainable transport policy. The urban development strategy paper “Cities in Transition” (World Bank 2000a) stressed that the livability of cities depends on their being economically competitive, financially sustainable, well governed, and well managed.

This volume links the urban development and transport sector strategies with a strong poverty focus. Its objectives are (a) to develop a better understanding of urban transport problems in developing and transitional economies, (b) to articulate an urban transport strategy framework for national and city governments, and (c) to identify the role of the World Bank in supporting governments. It concentrates on the problems of people who are very poor, not only in terms of income but also in terms of the broader dimensions of social exclusion associated with inaccessibility: inaccessibility to jobs, schools, health facilities, and social activities.

Some well-established urban trends continue. Urban population continues to expand at more than 6 percent per year in many developing countries. The number of megacities—cities with over 10 million inhabitants—is expected to double within a generation. More than one-half of the developing world’s population, and between one-third and one-half of its poor, will then live in cities. Per capita motor vehicle ownership and use continue to grow by up to 15 to 20 percent per year in some countries. Traffic congestion and air pollution continue to increase. Pedestrian and other nonmotorized transport (NMT) continue to be poorly served. Increased use of private vehicles has resulted in falling demand for public transport and a consequent decline in service levels. Sprawling cities are making the journey to work excessively long and costly for some of the very poor.

The context has changed in some significant respects since 1986. Cities are increasingly involved in trading patterns on a global scale, which makes the efficiency of their transport systems more critical. At the same time, responsibility for urban transport is being decentralized to the cities, which are often strapped for cash and are institutionally ill prepared for the new challenges. Under these conditions the financial state of public transport has deteriorated drastically in many countries. The safety and security of urban travelers are emerging problems, particularly in Latin America.

THE FUNDAMENTAL PARADOX OF URBAN TRANSPORT STRATEGY

Urban transport can contribute to poverty reduction both indirectly, through its impact on the city economy and hence on economic growth, and directly, through its impact on the daily needs of poor people. However, urban transport exhibits a fundamental paradox. How can a sector with such an obvious excess of demand over supply and with such a heavy involvement of private suppliers of service fail so completely to meet the aspirations of both politicians and citizens? Why has it not been possible to mobilize commercial initiative to yield the kind of revolution in service quality and cost that has been achieved in the telecommunications, water, and energy sectors? Finally, why does increasing affluence seem to have the effect of reducing the quality of travel, at least for poor people?

Urban growth increases transport costs. From the viewpoint of efficiency and growth, it is not too difficult to characterize the central problem. Economies of agglomeration generate the growth of cities. As cities grow and become richer, vehicle ownership and use grow more rapidly than the available road space, resulting in increased congestion and traffic-generated air pollution.

Urban growth often has perverse distributional effects. As cities expand, the price of more accessible land increases. Poor people are forced to live on less-expensive land, either in inner-city slums or on city peripheries. As average incomes grow and car ownership increases, the patronage, financial viability, and eventually quality and quantity of public transport diminishes. Motorization, which is permitted by the growth process, may thus also make some poor people even poorer. In particular, in the absence of efficient congestion pricing for road use, piecemeal investment to eliminate bottlenecks will almost certainly benefit the relatively wealthy at the expense of the poor.

An eclectic strategy is proposed. The strategy includes four main ways to address these problems: (a) structural change, (b) improved operational efficiency of the transport modes, (c) better focusing of interventions to assist the poor, and (d) policy and institutional reform.

STRUCTURAL CHANGE

Deconcentration has a limited role to play. The most fundamental structural response is to try to shift activity away from megacities, concentrating new development in medium-size cities. Unfortunately, it is not clear at what city size the economies of agglomeration run out or how a policy of deconcentration can be effectively implemented. Nevertheless, central governments can encourage the development of smaller regional hubs by eliminating fiscal and public expenditure distortions, including elimination of price distortions in land and transport markets, such as the underpricing of congested road space and the absence of full-cost connection charges and impact fees for land development. They can also lead by the location of their own activities.

Improved structure within cities can contribute greatly. A less-radical approach emphasizes coordination of land use and transport infrastructure and service planning, to ensure provision of adequate and well-structured road space as the city grows. This requires improved development control skills and practices at the city level. Critics of this approach argue that such an emphasis on road capacity fosters a level of motorization that will create dependence on the automobile, and will eventually overtake space availability. In any case, it is unlikely to be socially or environmentally acceptable to balance supply and demand solely by increasing road capacity in larger cities.

Good road infrastructure does not necessarily mean total auto dependence. Indeed, it is the combination of land-use and transport planning that has made it possible for some cities to reconcile high mobility with high quality of urban life. In order to achieve that reconciliation, traffic has been restrained (as in Singapore, by road pricing) and has been managed to maintain safe, efficient, and environmentally acceptable movement of people, not just of vehicles. This implies prioritization of infrastructure to protect movements of public transport and NMT against unrestricted expansion of private motorized trips (as in Bogotá, Colombia, and Curitiba, Brazil, through busway systems). In these more constrained circumstances, rigorous appraisal of investments in road capacity needs to take into account (a) the effects of induced traffic on benefits; (b) the benefits to, and disbenefits of, NMT; and (c) the environmental impacts.

IMPROVING THE OPERATIONAL EFFICIENCY OF TRANSPORT

To improve the efficiency of transport, the needs of each mode must be addressed—the road system, NMT, public passenger transport, and mass transit. In addition, the role of the private sector as a means of promoting efficiency deserves special attention.

THE ROAD SYSTEM

Even in highly congested cities, urban road transport efficiency can be improved through better system management. Although rapid development of technology has reduced the cost—as well as the maintenance and operational skill requirements—of modern traffic management techniques, many cities are still too poorly organized and inadequately staffed to make effective use of this development. Both technical assistance and investment are capable of yielding high returns in this field, as long as fundamental institutional and human resource problems are addressed.

Urban road decay is a serious problem in many countries. Road decay contributes to congestion and increasing operating costs. It often arises from jurisdictional conflicts—such as conflicts over which authority is responsible for which roads, lack of clear ownership of neighborhood roads, or inadequate allocation for urban roads from the national road funds through which road funding is channeled.

NONMOTORIZED TRANSPORT

NMT is systematically underrecognized. Walking still accounts for the largest proportion of trips taken, although not of distance traveled, in most low- and middle-income countries. All income groups are involved. Despite this fact the welfare of pedestrians,

and particularly the welfare of mobility-impaired pedestrians, is frequently sacrificed in planning to increase the speed of the flow of vehicles. Cycling is similarly disadvantaged. Without a continuous network of secure infrastructure, people will not risk bicycle travel. Without users, investment in infrastructure for cycling may appear wasteful.

A comprehensive vision and action plan for NMT is required. In the planning and management of infrastructure, the excessive emphasis on motorized transport may be redressed by (a) clear provision for the rights as well as responsibilities of pedestrians and bicyclists in traffic law; (b) formulation of a national strategy for NMT as a facilitating framework for local plans; (c) explicit formulation of a local plan for NMT as part of the planning procedures of municipal authorities; (d) provision of separate infrastructure where appropriate (such as for safe movement and secure parking of vehicles); and (e) incorporation of standards of provision for bicyclists and pedestrians in new road infrastructure design. Incorporation of responsibilities for provision for NMT should also be included in road fund statutes and procedures.

Traffic management should be focused on improving the movement of people rather than on improving the movement of motorized vehicles. In order to achieve that goal, police need to be trained to enforce the rights of NMT in traffic priorities as well as in recording and preventing accidents. Furthermore, the development in poor countries of small-scale credit mechanisms to finance bicycles, credit mechanisms that are increasingly successful in rural areas, might also be developed in urban areas.

PUBLIC PASSENGER TRANSPORT

Public transport is for all. Concentrating on the transport modes of poor people in middle-income countries essentially means the provision of affordable forms of public transport, both formal and informal. But it should not be viewed as only for the poor, as the importance of public transport to all income groups in many rich European cities demonstrates. Improving efficiency in public transport must be concerned not only with keeping costs down but also with providing a flexible framework within which the less poor as well as the very poor can use public transport with confidence and comfort.

Most urban public transport is road based. Bus lanes and automatic priority at intersections can improve public transport performance significantly, but these solutions tend to suffer from inadequate enforcement by police, who are untrained in traffic planning and management. In contrast, exclusive busways in developing countries have proved to be capable, except in very high traffic volume corridors, of performance nearly equivalent to rail-based systems but at much lower cost.

Pricing and financing issues are at the heart of public transport problems. Formal bus operations face financial collapse in many countries, partly as an unintended consequence of goodhearted but wrong-headed fare and service controls. Some prescriptions can easily be made to forestall this. General fare controls should be determined as part of a comprehensive city transport financing plan, and their effect on the expected quality and quantity of service carefully considered. Fare reductions or exemptions should be

financed on the budget of the relevant line agency responsible for the categories (health, social sector, education, interior, and so on) of the affected person. Modally integrated fare schemes should be assessed for their impacts on poor people. It is in the interests of poor people for sustainable financing and efficient targeting of public transport subsidies to be paramount.

There is a rich agenda of urban public transport policies that is both pro-growth and propoor. The recent decline in both the quality and quantity of public transport has resulted partly from the absence or disappearance of a secure fiscal basis for support. Public transport, however, can be improved in many ways that are consistent with the fiscal capabilities of even the poorest countries. Giving priority to public transport in the use of road space makes public transport faster and more financially viable.

Competition is pro-poor. Supply costs can be reduced through competition between private sector suppliers. In Buenos Aires the urban rail system has been revolutionized through concessioning. Regulated competition in the bus market has also worked well in cities such as Buenos Aires and Santiago—but care is needed in system design. Total deregulation in Lima, although it has increased supply, has worsened road congestion, the urban environment, and user safety and security. The lesson is that it is not privatization or deregulation per se that improves public transport, but rather the introduction of carefully managed competition, in which the role of the public sector as regulator complements that of the private sector as service supplier.

Cities should strive to mobilize the potential of the informal sector. Informally supplied small vehicle paratransit (publicly available passenger transport service that is outside the traditional public transport regulatory system) is often dominant in providing for dispersed trip patterns and in flexibly addressing the demands of poor people, particularly in low-income countries, but it is typically viewed as part of the problem of public transport and not part of the solution. Certainly, anticompetitive or antisocial behavior should be controlled through quality controls and enforcement, but its potential can be better mobilized through legalizing associations and through structuring franchising arrangements to give the small operator an opportunity to participate in competitive processes.

MASS TRANSIT

Rail-based mass transit systems have a role to play in very large cities. Rail-based mass transit systems are less congesting than are road-based systems and can be very important for those who are peripherally located and have long journeys to access employment in the cities. In Latin America, in particular, rail-based systems carry significant numbers of very poor people. The Bank has financed several major urban rail developments in the past decade, typically in metros and existing suburban railway refurbishment but occasionally in new construction. Often the restructuring of bus services, which eliminates direct competition and can harm the interests of poor bus-users unless skillfully planned, supports the rail-based systems. The position that has been adopted is that such developments must be integrated into a comprehensive urban transport strategy

and that arrangements should include physical and fare integration between modes, to ensure that the poor are not excluded from or disadvantaged by the Bank's investments.

Urban rail-based systems should be cautiously appraised. Urban rail-based systems are costly to build and operate, are more expensive for the passenger to use than road-based modes, and can impose a large burden on the city budget. It remains appropriate, therefore, to advise cautious examination of the fiscal sustainability of rail investments and their impact on poor people before making expensive commitments. The most critical lesson the Bank has learned is that mass transit investment decisions should be driven by a thorough examination of strategic objectives of technological alternatives, and financial implications, and not by short-term political or commercial opportunism.

THE ROLE OF THE PRIVATE SECTOR

Private financing of urban transport infrastructure is possible. Recognizing the burden of investments in major roads and metros on municipal budgets, cities such as Bangkok, Buenos Aires, and Kuala Lumpur have already managed to secure private capital finance for them. Experience so far has shown that this requires very high demand for faster movement in the affected corridor and a realistic stance by government on the relationship between price controls and commercial profitability. Experience has also shown opportunistic development on an ad hoc basis to be damaging, and usually costly to the public purse. Mass transit systems, in particular, appear to yield greatest benefit when they are incorporated into a citywide price-level and structure plan in which the full cost of new mass transit investments on the municipal budgets, on fares, and on poor people has been estimated in advance.

Planning and regulatory arrangements for private participation in urban transport are fundamental. The interaction of transport with land use requires its careful integration into the planning of metropolitan structure and finance within a comprehensive long-term plan for the city. The public sector must set a strategy; identify infrastructure projects and describe them in some detail; and confirm the acceptability of environmental consequences, tariffs, and any contingent changes to the existing transport system. It must acquire the necessary land and rights-of-way, ensure development permissions, commit funding, and provide some necessary guarantees. Physical coordination (to achieve convenient modal interchange) and fares coordination (to keep public transport attractive and to protect poor people) need to be embodied in a comprehensive transport strategy plan that recognizes the relationships between modes of transport.

BETTER FOCUSING OF INTERVENTIONS TO ASSIST THE POOR

There are two possible approaches when designing poverty-targeted transport interventions—directly serving the locations where poor people live and work, and targeting disadvantaged groups. In addition, institutions must address two issues that have a particular impact on the poor—the polluted urban environment, and safety and security.

SERVING THE LOCATIONS WHERE POOR PEOPLE LIVE AND WORK

Transport improvements can be focused on where poor people live and work. These improvements may involve concentrated efforts to improve access to slum areas or to improve public transport to peripheral locations. The Bank-supported Pavement Program in Low-Income Areas (Programa de Pavimentacao de Baixo Custo em Areas de Baixa Renda—PROPAV) in Brazil proved highly successful, and was extended throughout the country, as well as to other Latin American countries.

Leakage through land rent changes must be taken into account. Transport investments or service improvements change the structure of land values. If there is strong competition for the use of land and highly concentrated ownership of land, rents increase in improved areas and the benefits of transport improvements accrue to rich landowners rather than to poor land occupants. Some investments—such as improvements in bus or NMT systems—are less likely to drive poor people out to more distant, less-expensive locations than are others—such as primary roads or more highly priced, mass transit systems. This finding further emphasizes the need for transport to be part of a comprehensive urban development strategy.

TARGETING DISADVANTAGED GROUPS

Transport provision can be part of a social safety net. A complementary approach is to focus on the specific categories of disadvantaged people. Given the overwhelming importance of the ability to access employment, the work journeys of poor people may be a prime target for support. The cost of ensuring that these trips are affordable may be shifted to the employer (as with the “vale-transporte” in Brazil) or the state (as with the commuter subsidy system of South Africa). Although they may be less-than-perfectly targeted (for example, the vale-transporte misses very poor informal workers), may distort residential location incentives, and are inferior to direct income transfers, targeted transport subsidy arrangements may be the best practicable safety net for poor workers.

Low income is not the only form of deprivation. Gender confers some particular disadvantages in terms of diffused trip patterns and timings, as well as particular vulnerability to safety and security problems. Age and infirmity pose rather different problems, calling for sensitive “inclusive” design of physical facilities. Both locational resettlement and occupational redeployment impinge in a particularly harsh way on poor people, requiring adequate safety nets.

Fare controls can do more harm than good. Experience teaches two important lessons about what not to do with respect to fare controls. First, controlling fares in the absence of realistic analysis of, and provision for, the resource needs of that social strategy actually destroys public transport service and may cause serious harm to some poor people. Second, cross-subsidy within public sector monopolies does not eliminate the fundamental resource problem, and instead adds some extra burden of inefficiencies in supply.

POVERTY OF “LIFE QUALITY”: TRANSPORT AND THE URBAN ENVIRONMENT

Poor people tend also to be the most vulnerable to environmental pollution. The most damaging pollutants are lead, small suspended particulate matter, and in some cities, ozone. Local air pollution from transport in developing countries contributes to the premature deaths of over 500,000 people per year, and imposes an economic cost of up to 2 percent of gross domestic product (GDP) in many countries. A strategy for improvement of the effects that urban transport has on the environment is thus not a luxury to be afforded at the expense of poor people, but an important element of an urban transport strategy. The Intergovernmental Panel on Climate Change (IPCC) also forecast that developing countries will suffer disproportionate costs of from 5 to 9 percent of their GDP should the global level of carbon dioxide double (IPCC 1996).

Understanding of the environmental impacts of urban transport remains deficient. There are some clear technological priorities. While it is generally preferable to concentrate on performance standards, rather than on specific technology preference, there are also some relatively clear technological priorities for the sector. These include the elimination of lead from gasoline, the replacement of two-stroke motorcycles with four-stroke motorcycles, and the elimination or cleaning up of high-mileage, heavily polluting vehicles. The Bank can help with technical assistance in these fields and, in some cases, with the financing of infrastructure and incentive mechanisms to stimulate change.

There is no quick technological fix for developing countries. Local air quality can be improved in the long run by new fuel and vehicle technologies. In the short run, however, the vehicle stock is dominated by an older generation of technology, which is often badly maintained. In some countries the emphasis on identifying and acting to improve the worst, highest-mileage polluters—often buses, taxis, and some trucks—has helped. Inspection and maintenance programs, if undertaken by technologically efficient instruments in a corruption free context, can have great impacts. At the extreme there are assisted, or forced, scrappage schemes.

Some robust “win-win” environmental strategies exist for the urban transport sector. Good traffic management can reduce environmental impact as well as congestion. Tax structure reform can encourage the use of cleaner fuels and stimulate better vehicle maintenance. This reform, however, requires the design of fiscal measures to handle problems associated with the use of fuels (for example, kerosene, which is used in several sectors), and to handle the associated conflicting policy objectives, such as those associated with the taxation of diesel fuel (see the more detailed discussion in the main text of the report). The integration of transport interventions in general municipal development packages may offer better leverage in this respect than the integration of transport-specific projects.

SAFETY AND SECURITY

Road accidents are a global pandemic. Nearly 0.5 million people die and up to 15 million people are injured in urban road accidents in developing countries each year, at a

direct economic cost of between 1 and 2 percent of GDP in many countries. Accidents occur widely on roads between intersections rather than being concentrated at intersections, as is the case in industrialized countries, and the majority of victims are poor pedestrians and bicyclists.

Adequate data are the basis for policy formulation and implementation. The first steps to improve traffic safety are the development of national road accident data collection and analysis capability, and the formation of institutional arrangements to ensure that the data are transmitted to those who need them for policy purposes. Accident frequency and severity can be reduced by improved road design and traffic management policies. While some infrastructure investment is specifically safety oriented (such as infrastructure for NMT in Lima, or grade-separated railway crossings in Buenos Aires), there is a strong case for mandatory safety audits in the design process for all transport infrastructure. Improved medical response can be achieved by some relatively inexpensive and simple institutional innovations. Increasing safety awareness to change traffic patterns and pedestrian behavior requires development and training of staff for specific road-safety coordinating agencies or councils, at both the national and municipal levels.

Personal security is a growing social problem in many countries. While this problem encompasses much more than the transport sector, it is important to analyze the nature and significance of insecurity in the urban transport sector and to devise policy instruments to counter it. That might include collection and analysis of data on personal security in the transport sector to enhance official awareness of the problem, and might include commitment of police authorities to arrest and the courts to appropriately penalize offenders. Strengthening public participation in projects, particularly at the neighborhood level, is important. Some transport policy initiatives can contribute directly to better personal security. For example, street lighting—designed to improve pedestrian security—can be included in street improvement, and particularly in slum-upgrading, projects. Franchise conditions for public transport can give incentives for improved attention to security by public transport operators.

POLICY AND INSTITUTIONAL REFORMS

Technical measures alone are unlikely to resolve the fundamental paradox of a sector's combining excess demand with inadequately financed supply. Improvements in the efficiency of roads, vehicles, public transport operations, and traffic management can undoubtedly improve the efficiency of urban transport. This will not be enough, however, because of three structural characteristics that distinguish urban transport from most other urban service sectors. These characteristics are (a) the separation of infrastructure from operations, (b) the separation of interacting modes of transport, and (c) the separation of infrastructure finance from infrastructure pricing. What is required, therefore, is an integrated package of strategies for infrastructure pricing, service pricing, and urban transport system financing, founded in well designed institutions within an appropriate political framework.

SEPARATION OF INFRASTRUCTURE FROM OPERATIONS

Charging for road infrastructure is the core of a strategy for both efficient allocation of resources and sustainable finance. Congestion increases private transport costs and contributes to the decline of public transport service. While these two phenomena are logically connected, in most cities they are institutionally and financially separated. In principle, vehicular users of congested urban road space should be charged a price at least equal to the short-run marginal cost of use, including congestion, road wear and tear, and environmental impacts.

In the absence of direct charging, fuel taxation should be structured concurrent with vehicle license duties to give a proxy charge for road use and its external impacts. In practice, a range of direct and indirect mechanisms is used to charge for road use. The most common of these mechanisms—the fuel tax—reflects global warming impacts well, but is a poor surrogate for either congestion or road-maintenance impact pricing. Nevertheless, if it is the best proxy there is, the fuel tax should be structured to reflect its relative contributions to urban air pollution, again in conjunction with the structuring of vehicle license duties.

Parking charges should be related to an overall infrastructure pricing strategy. Although they are also a poor proxy for congestion charges, parking charges should, in any case, always cover the full opportunity-cost of land used for parking. Where parking policy is the only available proxy for congestion, pricing controls need to cover all forms of parking space (including that provided privately by employers for their employees).

Direct charging for roads requires careful political and administrative preparation. Although cordon pricing and tolling of specific roads is a step in the right direction, the long term solution lies in more systematic congestion charges. Of course, it is not easy to raise prices or taxes, particularly for goods that have traditionally been viewed as free. For instance, resistance to increased fuel prices in the República Bolivariana de Venezuela in the late-1980s was very violent. Riots following an increase in public transport fares in Guatemala in 2000 cost five lives. This suggests that such increases in charges must be linked with a perceptible improvement in provision of services. There would remain a large education requirement to explain the link between the increased cost and the improvement of services, and to offer realistic choices of alternatives. The second part of the integrated solution thus refers to service provision and pricing.

SERVICE PROVISION AND PRICING

Pricing principles for public transport modes should be determined within an integrated urban strategy. This means that they should reflect the extent to which road infrastructure is adequately charged. Given the high level of interaction among modes, and the prevalent undercharging of road use, financial transfers between roads and public transport services—and between modes of public transport—are potentially consistent with optimal pricing strategy.

Subsidies or compensation payments do not mean that there should be a monopoly supplier of transport services. In the interests of efficient service supply, transport

operators should operate competitively, with purely commercial objectives, and with financial transfers achieved through contracts between municipal authorities and operators for the supply of services. Any noncommercial objectives imposed on operators should be compensated directly and transparently, where appropriate, by the non-transport line agencies in whose interests they are imposed. Above all, in the absence of appropriate contracting or other support mechanisms, the sustainability of public transport service should be paramount, and should generally have precedence over traditional price regulation arrangements. The completion of an integrated policy thus requires an integrated urban transport financing system.

URBAN TRANSPORT SYSTEM FINANCING

Urban transport financing should be fungible. Given the interaction among modes, there is a strong case for treating the urban transport system as an integrated whole. Because neither congestion nor environmental impacts are currently subject to direct charges in many countries, optimizing the performance of the sector as a whole might justify using revenues raised from private automobile users to fund improvements in public transport. Private sector financing for transport infrastructure, raised through competitive tendering of concessions, may be supported by public contributions as long as these have been subject to proper cost-benefit analysis.

There are different ways of securing fungibility of funding. In a well-managed unitary authority, such as in Singapore, this occurs through the normal budgetary process. In more complex, multitiered administrative systems, achieving this flexibility may require the pooling of urban transport financial resources within an urban transport fund administered by a strategic transport authority at the municipal or metropolitan level. Under such an organization, all local transport-user charges, including congestion charges and any allocations of local taxes or intergovernmental transfers for transport, should normally be made to the fund.

Urban transport funds do not imply earmarking of taxes. Earmarked taxes, such as the payroll tax on employers, that supports the public transport agency Régie Autonome des Transport Parisiens (RATP) in Paris, have the advantage of a secure legal and budgetary foundation, and are often the basis on which sound long-term service planning can be undertaken. However, the value of having an integrated urban transport fund does not depend on any specific tax source being earmarked for transport. Moreover, in order to develop the credibility of the fund, and particularly to gain political and popular support for the payment of congestion charges, it is essential that the objectives and scope of an urban transport fund be clearly defined, that allocations be subject to rigorous appraisal, and that the operations of the fund be transparent.

INSTITUTIONS

Policy integration has significant institutional implications. In the interests of urban transport integration and sustainability, developing countries could therefore profitably move toward prices reflecting full social costs for all modes, to a targeted approach to subsidization reflecting strategic objectives, and to an integration of urban transport funding, while still retaining supply arrangements for individual modes that give an

important incentive to operational efficiency and cost-effectiveness. The implementation of such a policy package has significant institutional implications, requiring close coordination both between jurisdictions and between functions, as well as between private and public sector planning and operating agencies.

The basis for institutional coordination is often very weak. Few cities have a strategic agency for land-use and transportation planning, or a competent traffic management unit. Traffic police are therefore often involved with traffic management planning, for which they are ill equipped and untrained. Public transport planning and regulation is also often tied to operations. The few institutions that do exist tend to be understaffed and their staff poorly trained.

Urban transport institutions need both restructuring and strengthening. Action is required on two levels. First, authorities need to recognize what kind of technical organization is necessary to address urban transport issues. Second, the organizations need adequate human, as well as physical, resources to perform their functions. While no single institutional blueprint for public transport is appropriate for all countries, there is enough experience to establish some general principles for the reduction of institutional impediments to effective policy integration.

Jurisdictional coordination may be facilitated through the clear establishment in law of the allocation of responsibility between levels of government. Formal institutional arrangements can be made for collaboration where multiple municipalities exist within a continuous conurbation. The process of decentralization in developing countries may offer an excellent opportunity to address the problems. In particular, intergovernmental transfers need to be carefully planned to be consistent with the allocation of responsibility, but structured to avoid distorting local priority setting. Central governments might also encourage coordination at the metropolitan level; in France, for example, the central government made both local taxation powers and intergovernmental transfers conditional on appropriate jurisdictional and functional collaboration.

Functional coordination should be based on a strategic land-use and transport plan. Detailed planning, both of transport and land use, should be aligned with a municipal or metropolitan structure plan. Coordinated operation is further enhanced by the clear allocation of functions among agencies, with the more strategic functions being retained at the metropolitan level. Obligations statutorily imposed on local authorities should be linked to specific channels of finance (such as direct line agency funding of reduced public transport fares). Responsibility for traffic safety should also be explicitly allocated, with an institutional responsibility at the highest level of the local administration. Traffic police should be trained in traffic management and safety administration, and involved in transport and safety policy planning.

Responsibility for planning and operating public transport should be institutionally separated. For effective involvement of the private sector, technical regulation should be separated from procurement and economic regulation. A clear legal framework should be established for competition in public transport supply, either in the market or for the

market. Operations should be fully commercialized or privatized, and the development of new competitive private suppliers of service encouraged through legal recognition of associations, and so on. The public sector should develop strong service procurement and contract enforcement skills.

POLITICS, PARTICIPATION, AND PERFORMANCE

Decentralized democratic process must be complemented by high technical competence. Ultimately, transport policy formulation involves an element of tradeoff between conflicting interests. It is therefore bound to be a political process. Too often (not least in Latin America) bad investments have been made, and serious urban transport issues trivialized, by the political process. Cities that have exhibited good transport planning and management, such as Curitiba and Singapore, have often developed under strong leadership and have been founded on a high level of technical and professional competence in the planning function. The question is how to reconcile coherent technical vision with more decentralized and fragmented democratic processes.

Public participation and technically strong planning can be complementary. The development of public participation and consultation, in parallel to the local democratic process, is an important means of improving local policy design. This may occur through advance exposure of plans to a free press and other media, as well as through more formal processes of public consultation or public inquiry. For small scale, very localized, infrastructure projects it may be possible to incorporate local preferences in the design process itself. Public transport users may also be involved in service franchising arrangements by complaints and consultation processes and by linking bonus payments for franchised operators to public or media appraisal. At a more strategic level, and for larger, more complex projects, consultation often functions more as a means of trying to reconcile inherently competing or conflicting interests; it is nevertheless central to the development of consensus-based city development strategies.

Public participation must be timely and well structured. Developing strategic involvement requires action at two levels. First, the public processes must be organized to facilitate timely but well-informed consultation. Second, particularly where formal local political processes are weak, the existence of effective local community groups is extremely important. In developing countries, such groups are often well developed in rural areas but much less so in cities. As both policy and financial responsibility for urban development is decentralized to the cities, it is thus possible to create institutional and financial arrangements that better reflect the complex interactions both within the urban transport sector and between urban transport and the rest of urban development strategy. It is only on such a carefully considered institutional and financial basis that the fundamental paradox of urban transport can be resolved.

wb88623

P:\INDIA\INFRSTR\TRANSPORT\Urban Transport\Urb Transport in India 03-11-05.doc
04/18/2005 6:26:00 PM