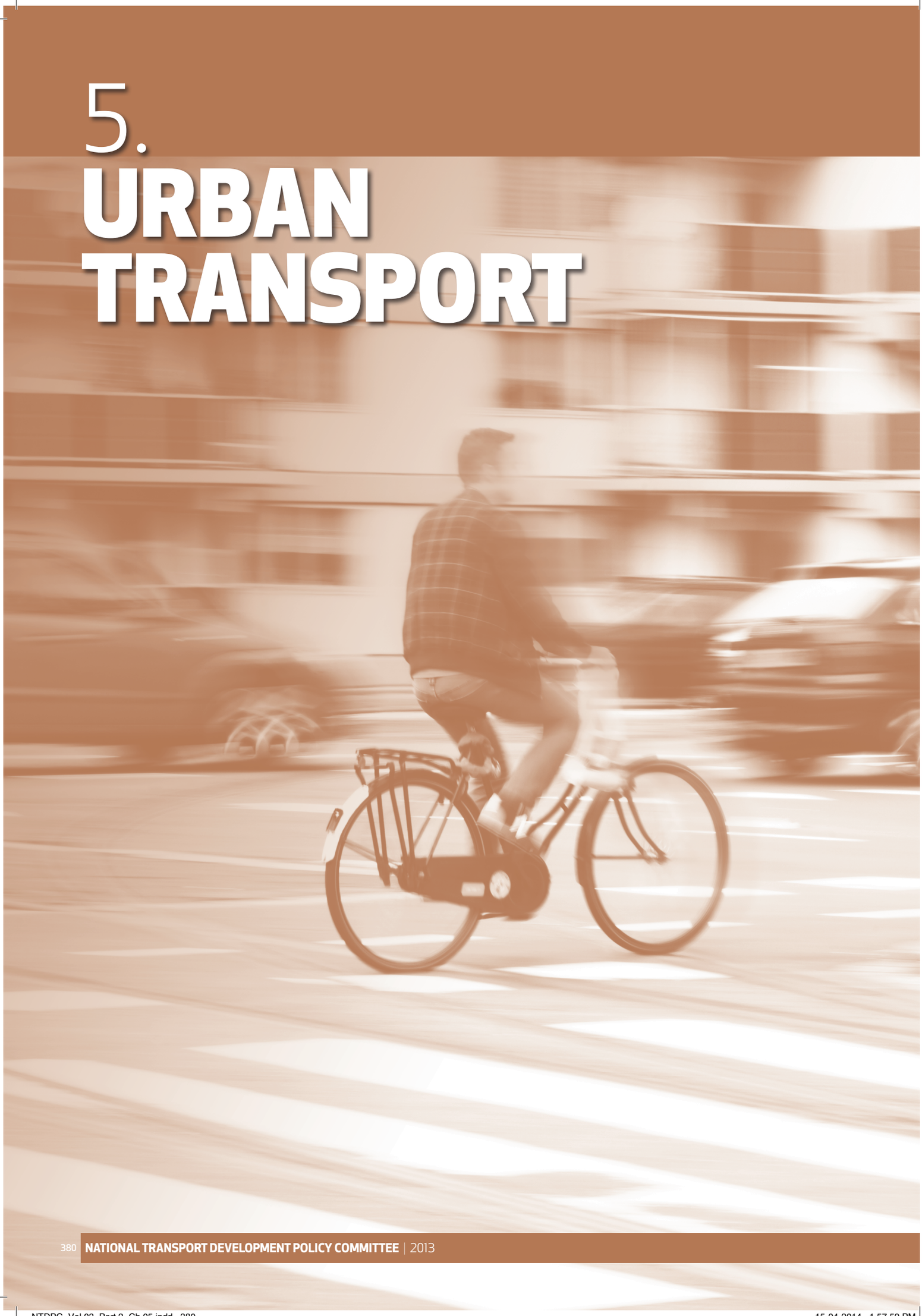
5. URBAN TRANSPORT



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5. URBAN TRANSPORT

India's cities have expanded rapidly over the last few decades and are likely to grow faster in the future. Urban India is expected to contribute 70 per cent of India's GDP by 2030[1].

INTRODUCTION

These are centres of wealth—the per capita income in the largest cities is much higher than the average per capita income of the country as a whole and, in some cases more than double the national average–but they are also intertwined with the national and rural economy through consumption patterns, remittances, and other links.

URBANISATION AND FUTURE URBANISATION PROJECTIONS

According to Census 2001, 27.8 per cent of Indians, i.e., 286 million people or 55 million households lived in urban areas. The provisional data from Census 2011, showed that urban population had gone up to 377 million, which represents 31.2 percent of the population of India. Estimates of urban population growth in India range from 550 to nearly 600 million people by 2030[2].

'Urban India' will be varied. The total urban population living in cities and towns in any particular class has increased consistently due to the stable and balanced pattern of urbanisation throughout the last century. This balanced urban growth pattern has led to increasingly larger proportions of population living in Class I towns. As seen from Table 5.1, over two-thirds of the total urban population now lives in cities that have populations over 100,000 (Class I towns). The continuing increase in the number of large cities, million-plus cities, half-million-plus cities, and 100,000-plus cities does have implications for strategies for urban transport management.

In 2001, there were 5,161 towns in India which increased to 7,935 towns by 2011 (Table 5.2). The total number of Urban Agglomerations, which constitutes the urban frame, is 6166 in the country. Nearly 50 per cent of the urban population lives in small cities (<0.5 million), whereas 15 per cent lives in mega cities.

The fastest growth in the last decade has been of cities with population between 100,000 and 1 million, e.g., Surat, Nashik and Faridabad. Mumbai, Delhi, Kolkata, Chennai, Hyderabad and Bengaluru have grown at a slower rate than the others during the past three decades. The faster growing big metros like Hyderabad and Bangalore have experienced peripheral expansion with smaller municipalities and large villages surrounding the core city becoming part of the larger metropolitan area. This trend is also beginning to emerge in smaller metros like Pune, Indore and Surat.

Although the share of population in cities with more than a million population is high, more than 60 per cent of the urban population is still living in cities of smaller size (Table 5.3). As will be brought out in the following sections, these cities have not received any support on urban transport either from their respective states or the national government. There is a huge responsibility of addressing urban transport needs responsibly in these towns and cities too.

Even by 2031, about 30-40 per cent of the urban population will be living in small and medium towns. This will be a significant population for which mobility services need to be thought through. The demand for urban transport in newly-growing areas and now-smaller cities also will need significant attention so that urban transport in these locations don't reach crisis proportions before they are addressed. The approach to small and medium towns and large rural

1. McKinsey (2010).
2. UN Population division; the High Powered Expert Committee for Estimating the Investment Requirements for Urban Infrastructure Services set up by the Ministry of Urban Development, Government of India which submitted its final report entitled 'Report on Indian Urban Infrastructure and Services' (HPEC 2011) in March 2011 and the McKinsey Global Institute's Report entitled 'India's Urban Awakening : Building Inclusive Cities, Sustaining Economic Growth', April 2010.

Table 5.1
Composition of Class 1 Cities as per Population Size (Census 2011)

CITIES AS PER POPULATION	NO. OF CITIES
More than 10 million	3
5 - 10 million	5
2 - 5 million	10
1 - 2 million	35
Total Million Plus Cities	**53**
0.5 million to 1 million	43
100,000 to 500,000	372
Total Class - I Cities	**468**

Source: Ministry of Home Affairs (2011).

Table 5.2
Category of Urban Agglomerations as per Census 2001 and 2011

CATEGORY	NUMBER OF UAs AS PER CENSUS	
	2001	2011
Class I (more than 100,000)	441	468
Class II (50,000 to 100,000)	496	
Class III (20,000 to 50,000)	1,388	
Class IV (10,000 to 20,000)	**1,563**	
Class V (5,000 to 10,000)	1,041	
Class VI (below 5,000)	232	
	5,161	**7,935**

Source: Ministry of Home Affairs (2011).

areas cannot be the same as for metropolitan cities and while their demands and problems are also significant urban planners should not look at them with the peculiar lens out of their understanding of mega cities alone.

URBAN TRANSPORT IS UNLIKE OTHER TRANSPORT SECTORS

'Urban transport' (UT) is a broad name for a sector that covers a variety of modes of intra-city transport for people and goods, including walking, bicycling, non-motorised transport such as rickshaws etc, private personal transport, i.e., cars and motorbikes; public transport which could be rail- or bus-based; private-public transport such as taxis and para-transit modes among others.

NTDPC's scope has been spread across a range of issues related to development of comprehensive and sustainable policy for meeting the transport requirements of the country through various modes of transport. While looking at the changing nature of demand for transport and the particularities of each mode of transport, UT cannot be neglected since more often than not, it accounts for the last mile in any other inter-city transport trip. In fact it is, cumulatively, a significant percentage of the overall transportation trips in the country. It is often productive, but also contributes significantly to congestion,

Table 5.3
Distribution of Urban Population, 2001 and 2011

CITY SIZE	POPULATION RANGE	NUMBER OF TOWNS		POPULATION IN TOWNS (IN MILLION)		PERCENTAGE OF URBAN POPULATION	
		2001	2011	2001	2011	2001	2011
Class I	> 100,000	441	468	178	265	62.3	70.2
Class II	50,000 -100,000	496		344		12.0	
Class III	20,000 -50,000	1,388		421		14.7	
Class IV	10,000 -20,000	1,563	**7,467**	23	**112**	7.9	**29.8**
Class V	5,000 -10,000	1,041		8		2.8	
Class VI	< 5,000	232		0.8		0.3	
ALL	Total	5,161	7,935	286	377	100	100

Source: Ministry of Home Affairs (2001, 2011).

environmental pollution, energy dependence and other social concerns.

One of the key differentiating factors between UT and other transport sectors like, railways, roads and inland water ways is the complexity of the system given the variety of modes prevalent here. UT solutions not only have to look at the efficiency in terms of time and cost and convenience of each mode but also the inter dependency of one mode on the other. As an example, a highly efficient mass transit system could be made ineffective if links to other parts of transit systems are weak and inefficient.

Unlike other transportation sectors, UT is primarily guided by the nature and future nature of urbanisation. UT system choice decisions are rarely taken on the basis of technology or system performance alone; they also incorporate economic geography, industrial development, distributional, environmental and other goals. Wider urban social, economic and governance issues such as the crime and safety, public sector regulation and management capacity, also play a strong role in determining the mode of transport adopted by a city.

UT could be a facilitator or could pose a burden on the urban contribution to city productivity and the national economy. The defining trait of urban transportation is the ability to support higher densities in urban areas and efficiently, affordably move people and goods through and in the city. Agglomeration economies rely on provision of basic urban infrastructure services in general and UT infrastructure in particular. UT helps connect people and residential areas to education and employment locations, expanding opportunities and choices for people to access alternate education and employment. The efficiency and effectiveness of the UT system also has an important impact on the health and safety of the commuters in specific and urban residents in general. Safety from traffic-related accidents as well as safety from crime, is also related to the way the city and the transport system is planned and managed. In terms of the health-related impacts of transport in urban areas, vehicular pollution has emerged

In the absence of adequate provision of UT infrastructure, including public transport, congestion diseconomies can outweigh the benefits of agglomeration. Well-planned and implemented UT can augment the agglomeration advantages of cities and minimise their congestion diseconomies.

as the top contributor to air pollution. These issues are discussed more at length in other chapters of this report.

In the absence of appropriate infrastructure, diseconomies could set in from traffic congestion, environmental degradation, deterioration in civic services, fatalities and injuries due to road traffic crashes, and air and water pollution. In order for cities to perform their role as engines of economic growth and innovation, while providing an improved quality of life to its residents it is very important to integrate the competing demands of transport, housing, and commercial real estate in their development. In the absence of adequate provision of UT infrastructure including public transport, congestion diseconomies can outweigh the benefits of agglomeration. Well-planned and implemented UT can augment the agglomeration advantages of cities and minimise their congestion diseconomies.

URBAN TRANSPORT IN INDIA TODAY

URBAN TRANSPORT MODAL SHARE ACROSS INDIAN CITIES

Urban transportation enables movement of goods and people from one location to another within an urban area. UT modes related to the transportation of goods in Indian cities commonly include a variety of modes including non-motorised modes such as manual push carts and bicycle carts, and motorised modes such as small and large trucks, pick up vans etc. UT modes related to the transportation of people, for work, education, social activities and shopping include walking, non-motorised transport–bicycling, cycle rickshaws, etc.; alternative mode of flexible passenger transportation commonly termed para-transit modes–such as minibuses and share taxis, that do not follow fixed routes or schedules; public transport such as on-call taxis, chartered taxis and buses; organised bus systems; bus rapid transit systems; trams and electric buses; underground and over-ground rail based mass transit systems; and private motorised modes such as cars and two wheelers. The distribution of travel among these modes varies significantly across cities. At present, there is inadequate understanding of, and inconclusive data on, the modal share distribution between these various transport modes, across city types and sizes in India. The variations in reported modal share from a few studies are reflected in Table 5.4. It is clear that there is no consensus among transport planners about the true modal split of trips in any city. Particularly lacking is information and data on urban freight movement, which is commonly believed to be up to 15 per cent of the traffic.

The different results are due to a range of factors that include, differences in types and the methodologies of the surveys. Most transport studies, have been conducted by consultants who have designed their methodologies and surveys to measure viability of specific projects such as a new road or flyovers or even integrated public transport systems. Project based methodologies are now also used in wider surveys including a study conducted for Ministry of Urban Development (MoUD) in 2008 leading to the report titled 'Study on Traffic and Transportation Policies and strategies in Urban Areas in India'[3]. These kinds of traffic surveys, however, give an incomplete and often biased picture of modal share as they are most often conducted on points/places on roads (such as at petrol pumps, traffic junctions or midway on roads, etc.) that are unrepresentative of broader traffic patterns. Surveys based on household interviews can also miss many trips taken by those not present when the interview was taken, or those not considered as 'trips' by the respondent.

Comprehensive traffic diary surveys are a superior instrument for policy level discussion and decision making, but are not available in India. Accurate comprehensive traffic diary surveys should be undertaken at the start of each Comprehensive Mobility Plan (CMP) revision process. As discussed in Chapter 5, Volume II on Institutions for Transport System Governance, there also is a strong requirement for developing an institutionalised system that would be responsible for conducting its own national travel and urban transportation surveys on a periodic basis and maintain data banks for data generated by other organisations associated with transportation too.

PUBLIC TRANSPORT MODES ACROSS CITIES

Internationally and historically the choice of the mode of public transport has closely followed the developments in transportation technology as well as the city form and the needs of the city's economy. Many large European and many large American cities that have extensive rail-based public transport, were constructed during the 1850–1920s, the period before the diesel engine, good pneumatic tyres (essential for large buses) and availability of mass-produced road vehicles took hold. These cities have important large Central Business Districts (CBD) which were fed by rail/metro systems. Cities like

3. Asian Institute of Development (2011).

Table 5.4
Mode Share in Various Indian Cities

CONSOLIDATED FIGURES FROM VARIOUS REPORTS ON MODAL SPLIT IN INDIAN CITIES										
CITY SIZE CATEGORY (MILLION POPULATION)	CITY NAME	POPULATION IN THE CITY (MILLION)	WALK	NON-MOTORISED TRANSPORT		INTERMEDIATE PUBLIC TRANSPORT		PUBLIC TRANSPORT	MOTORISED PERSONAL TRANSPORT	
				CYCLE	RICKSHAW	AUTO RICKSHAW	OTHERS		CARS	TWO WHEELERS
>8.0****	–	-	22	8		7		44	10	9
>5.0*	-	-	29	8	1	1		47	4	10
	Mumbai**	-	12	10		-		60	18	
	Mumbai***	16.40	28	5		9		44	9	5
	Mumbai****	17.70	27	6		7		45	8	7
	Kolkata**	-	12	4		-		77	5	
	Kolkata***	13.20	18	12		3		57	7	3
	Kolkata****	14.70	19	11		4		54	8	4
	Delhi **	-	35	5		-		40	20	
	Delhi ***	12.90	20	12		6		43	14	5
	Delhi ****	13.80	21	12		6		43	14	5
	Chennai**	-	32	16		-		42	10	
	Chennai***	6.56	22	6		9		32	9	22
	Chennai ****	7.00	22	8		8		31	10	20
	Bengaluru**	-	46	10	-	-		36	8	
	Bengaluru***	5.70	28	5	18	18		26	16	7
	Bengaluru****	8.60	26	7	7	7		35	8	17
	Hyderabad**	-	21	28	-	-		35	16	
	Hyderabad***	6.34	22	6	7	7		49	8	8
	Hyderabad ****	6.30	22	9	7	7		35	9	9
	Ahmedabad**		48	14	-	-		28	10	
	Ahmedabad***	5.41	22	14	5	5		15	20	24
	Ahmedabad ****	5.90	22	14	6	6		16	17	25
'4-8****	-	-	25	11	7	7		21	10	26
'2-5*	-	-	29	13	2	7		33	1	21
	Pune**	-	28	10	-	2		38	24	
	Pune***	3.78	24	8	8	-		12	10	38

CONSOLIDATED FIGURES FROM VARIOUS REPORTS ON MODAL SPLIT IN INDIAN CITIES										
CITY SIZE CATEGORY (MILLION POPULATION)	CITY NAME	POPULATION IN THE CITY (MILLION)	WALK	NON-MOTORISED TRANSPORT		INTERMEDIATE PUBLIC TRANSPORT		PUBLIC TRANSPORT	MOTORISED PERSONAL TRANSPORT	
				CYCLE	RICKSHAW	AUTO RICKSHAW	OTHERS		CARS	TWO WHEELERS
	Pune ****	4.20	22	11		7		12	12	35
	Kanpur **	-	72	21		-		5	2	
	Kanpur ***	2.72	30	18		7		6	7	32
	Kanpur ****	-	29	19		7		9	16	21
	Lucknow**	-	36	36		-		0	28	
	Lucknow***	2.24	38	26		8		0	4	24
'2-4 ****	-	-	25	18		6		10	12	29
'1-2 *	-	-	30	8	5	2		24	1	30
'1-2 ****	-	-	24	19		8		13	1	24
'0.5 -1 *	-	-	32	10	9	3		21	2	23
'0.5 -1 ****	-	-	32	20		3		9	12	24
< 0.5 (category 1a) ****	-	-	34	3		5		5	27	26
< 0.5 (category 1b for hilly towns) ****	-	-	57	1		0		8	28	6
'0.1-0.5 *	-	-	38	15	12	3		13	1	18
'.05-0.1 *	-	-	38	17	13	4		11	1	16

Source: * Tiwari (2011); ** Pendakur 2002 and World Bank 2002; *** Data from various City Development Plans available at http://www.jnnurm.nic.in/ (accessed on 20 January 2014); **** WSA, GoI (2008).
Note: Figures in per cent except where mentioned otherwise.

Tokyo, New York, Paris and London provided exceedingly large CBDs with large number of jobs each[4]. In today's developing world, there are very few cities that have such large CBDs with such high employment densities. India's cities often have several concentrated business districts corresponding to city centres in particular eras.

Very few Indian cities currently, have organised, registered and regulated public transport systems. The coverage of local commuter rail services are available only in the seven metropolitan cities in India Mumbai, Delhi, Chennai, Kolkata, Bengaluru, Hyderabad and Pune. Organised city bus services operate now in about 65 cities, an increase from only 20 cities in 2006. Intermediate public transport modes like three-wheeled auto rickshaws, tempos and cycle rickshaws also provide public transport services. Today, while the share of city buses is very small compared to para-transit modes (registered transport and personalised motorised vehicles (two-wheelers and cars), it must be kept in mind that in most cities, a large number of contract buses also ply especially catering to trip demands for work and for children to go to school. City-wise vehicle registration data when compared to the fleet strength of the formal public transport agency reveal interesting insights on how important other vehicles, contract buses and para transit vehicles must be in those cities for urban transport (Table 5.5).

A general decline in public transport trips is noticeable in cities of all sizes when a RITES study of 1994 is compared to the WSA, Study on Traffic and Transportation Policies and Strategies in Urban Areas in India (Table 5.6). Another analysis of data on vehicles registered in India, presented in Table 5.7, reveals that the share of buses has declined to 1.1 per cent of all registered vehicle in India from 11.1 per cent in 1951, indicating that while cars and two wheelers have seen rapid growth, governments have not invested significantly to increase the quality and availability of public transport, especially through buses, over the decades. However, the rapid growth in personal two-wheelers specifically, and in cars to some extent, is still much less than comparative economies globally as discussed in a later section.

4. Mohan (2008).

Table 5.5
Pattern of Public Transport in Selected Indian Cities
(All figures in numbers)

CITY	MUMBAI	DELHI	CHENNAI	BANGALORE	KOLKATA	PUNE
Public Transport Buses operated by State Road Transport Undertaking (SRTU)	BEST	DTC	MTC	BMTC	CALCUTTA STC	PUNE MPML
	4,652	5,771	3,414	6,111	956	1,549
Other Buses (Registered buses excluding SRTU buses)	8,189	39,986	33,791	22,150	3,293	13,459
Paratransit-registered commercial transport vehicles including taxis and three to six seater passenger vehicles	159,629	253,532	174,314	162,431	49,648	78,778

Source: Adapted from Ministry of Road Transport and Highways (2011, 2012).

Table 5.6
Composition of India's Vehicle Population

YEAR END (MARCH)	TWO WHEELERS	CARS, JEEPS AND TAXIS, ETC.	BUSES	GOODS VEHICLES	OTHERS VEHICLES	TOTAL
	(as percentage of total vehicle population)					(Million)
1951	8.8	52.0	11.1	26.8	1.3	0.3
1961	13.2	46.6	8.6	25.3	6.3	0.6
1971	30.9	36.6	5.0	18.4	9.1	1.8
1981	48.6	21.5	3.0	10.3	16.6	5.4
1991	66.4	13.8	1.5	6.3	11.9	21.4
2001	70.1	12.8	1.2	5.4	10.5	55.0
2011	71.8	13.6	1.1	5.0	8.5	141.8

Source: Ministry of Road Transport and Highways (2012).

While these figures do provide a macro picture of the rapid increase in registration of personal modes of transport, especially two wheelers, a significant caveat is that public transport vehicle numbers are likely to be more accurate than those of personal vehicles. This is due to annual or bi-annual verification of public transport vehicles in all states. The number for personal vehicles registered is likely to be much higher than those being used and those on the road due to the fact that very few of them are de-registered. They pay a one-time road tax at the time of registration and annual monitoring of the registration is not in place. Therefore the number of personal vehicles registered presented in the table reflects a cumulative number of all vehicles registered over many decades. The personal vehicles on the road are only a small percentage of these. A survey conducted in Delhi to support the Auto Policy, demonstrated that only around 60-70 per cent of the personal registered vehicles were in use[5].

5. Expert Committee on Auto Fuel Policy (2002).

Table 5.7
Public Transport Share Comparison, 1994 and 2007

CITY CATEGORY	CITY POPULATION (RANGE IN MILLIONS)	WSA, 2007 (PER CENT)	RITES, 1994 (PER CENT)
1	< 0.5	0–15.6	–22.7
2	0.5-1	0–22.5	22.7–29.1
3	1.09–2	–50.8	28.1–5.6
4	2–4	–22.2	35.6–45.8
5	4–8	32.1	45.8–59.7
6	Above 8	35.2–54.0	59.7–78.7

Source: Urban Transport Working Group, 2012

URBAN TRANSPORT TRIPS AND TRIP LENGTHS

It is generally believed that the demand for transport increases with increasing incomes. The point to be noted however is that work and education trips, which are essential in nature, remain constant even with increasing incomes. All the other trip types (such as shopping, social, personal business, etc.) are flexible and are smaller in number than work trips.

As described in Box 5.1, the total number of trips does not increase dramatically with rising incomes or increasing population, but the number of motorised trips can and the motorised essentially replace walk or non motorised trips. Also as a city grows motorised trips per corridor may increase.

Indian cities have traditionally been developed on mixed land use models that allow neighbourhoods to provide for residences, workplaces, shopping, social and educational facilities. This has resulted in minimising of trip lengths irrespective of city size as the mixed land use prevalent in the cities due to either planned or unplanned market interventions ensure that living and work spaces are as close to each other as possible and the dependence on motorised urban transport is minimised separately by all households. Figure 5.1 shows that 80 per cent of the trips are less than 10 km in length and 70 per cent of the trips are less than 5 km even in big cities like Mumbai and Hyderabad. In cities like Pune 97 per cent of the trips are less than 10 km and 80 per cent are shorter than 5 km. The average trip length in medium and small size cities is less than 5 km, which makes non motorised transport an attractive option for commuting.

Another associated phenomenon is that in large cities such as in Mumbai, Delhi, Hyderabad and Pune, as documented in the Census of 2011, about 41.3 per cent, 16.2 per cent, 32.9 per cent and 20.7 per cent of the urban households, respectively, live in slums. The residents of slums are essentially from lower income groups. They typically find it difficult to afford either motorised private or motorised public transport and hence are primarily dependent on Non Motorised Transport (NMT) even for long distance trips. As documented by Tiwari[6], only a small percentage of people living in slums use public transport for commuting. Development projects or housing projects for the poor displace communities from slums closer to the city to far off locations. This displacement of poor people from areas close to their work, while raising each poor families own transport costs, also pose significant challenges to their mobility, thereby increasing their economic vulnerability.

Whereas in most cities of the world, the majority of trip distances are less than 10 km, in India, they are still less than 5 km as in Mumbai[7].Other cities most likely have shorter average trip lengths. These characteristics of Indian cities are a huge positive, i.e., smaller trip lengths and travel time, for providing sustainable and affordable travel options in the future too. New city development strategies and plans including UT plans need to recognise and strengthen these characteristics to ensure modern, efficient, sustainable UT service provision.

RESIDENTIAL DENSITY AND MIXED LAND USE OF INDIAN CITIES

Population density is a key determinant of the spatial spread of a city and therefore the intensity of travel demand. At the city-wide 'net density'[8] level Bangalore has a density of 5,889 persons/sq. km, Hyderabad has 6,265 persons/sq. km and Ahmedabad has 15,574 persons/sq. km[9].

As presented in the Urban Transport Working Group report[10] and other literature, Indian cities are often described to have low densities that need to be made more dense. This may be misleading. 'Residential urban density' measures how many people live in

6. Tiwari (2011).
7. Baker et al. (2005).
8. Total population of the city divided by the total area of the city.
9. Urban Transport Working Group Report, NTDPC, 2011.
10. Urban Transport Working Group Report, NTDPC, 2012.

Box 5.1

The Limit to Mobility Needs: Each Trip Has a Purpose

'With increasing motorisation mobility increases. The number of trips a person makes a day increases with number of cars per inhabitants. More cars mean more mobility'. This has been the conventional wisdom propagated through the 20th century and has been the traditional definition of mobility. As explained by H. Knoflacher each trip is related to a purpose. This purpose is to compensate the existence of local deficits (i.e., non-availability of services and goods) of the origin at the destination.

In low-density cities like Houston and Melbourne, which are car-dominated and have abundant road space, car owners travel long distances relatively fast, but still have high travel times. It is difficult to establish efficient public transport systems in such low-density cities. In such cities, those who do not have cars, cannot get to work easily and can be excluded from economic activities. On the other hand, cities that have a dense settlement pattern, such as Hong Kong, Singapore and Tokyo, tend to be more public transport friendly and more citizens use non-motorised forms of transport. These world-wide experiences tell us that access needs despite varied mobility patterns, remain similar across cities of different sizes, populations and contexts.

Mobility can therefore only improve if local deficits, such as facilities available in the vicinity/neighbourhood are expanded which are often lacking due to poor urban planning, poor logistics, poor management. Deficits have to be compensated by physical mobility. But the number of purposes for accessing which mobility is needed in society have not changed during increased motorisation . Mobility therefore has nothing to do with car ownership since it is purpose-related. Each trip with the car replaces a trip of another mode.

Increasing car mobility means decreasing mobility for pedestrians, cyclists or public transport. There is no or marginal growth of mobility in the transport system as a whole, when the population is constant. The number of trips remains constant. Knoflacher shows from an example from an Austrian city, that the trend of increasing motorisation was broken by changing the physical structures and land uses around 1990. Since then car traffic has declined; pedestrian, cycling and public transport has increased. These changes did not result in trip numbers changing.

Source : Adapted from Knoflacher (2007); Mohan (2006).

relative proximity in cities, expressed as the number of people living in each square kilometre of a 100 x 100 kilometres urban region[11].A mapping of 'residential urban density, as in Figure 5.2, shows how Hong Kong, Mumbai, Istanbul and Shanghai have more effective 'residential urban density' than New York, Mexico City, Sao Paulo, Johannesburg and London. Residential density is largely driven by topographical constraints, the location of public transport and other infrastructure, but also by each city's inherited traditions of urban culture and development.

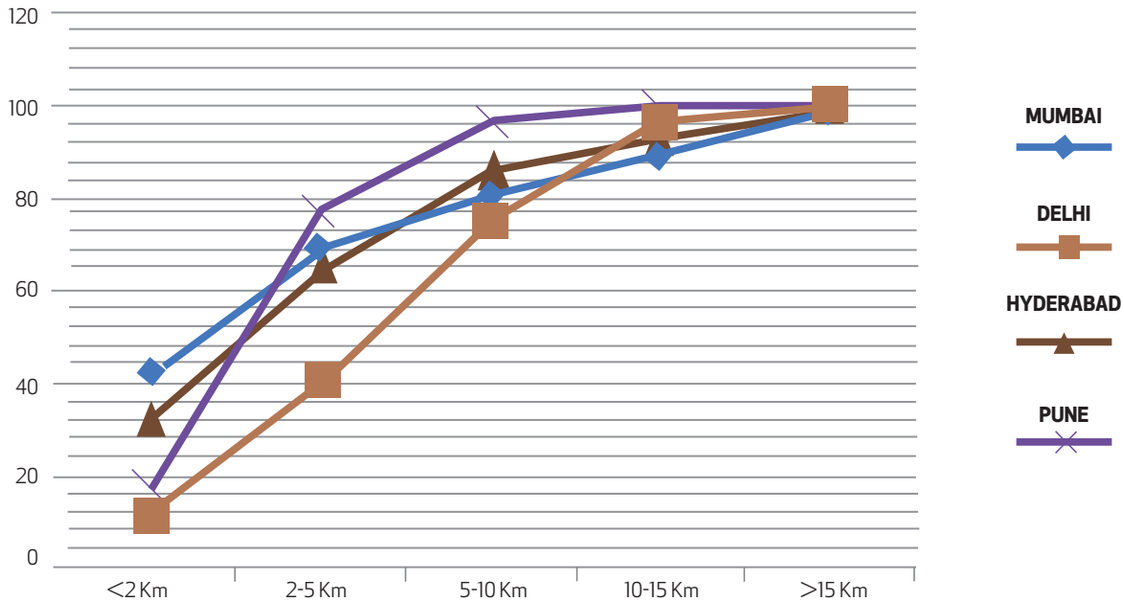
Globally, residential density differs widely. Figure 5.2 shows how topographical constraints drive densities that rise to 'spikes' in Manhattan and parts of the Bronx, Brooklyn and Queens in New York, and in Hong Kong Island and Kowloon in Hong Kong, and Mumbai. São Paulo is multi-centred and similar in its overall density pattern to Mexico City, yet São Paulo's skyline is dominated by high-rise apartment blocks, while Mexico City's is consistently low-rise, demonstrating that high-density can be achieved with different types of built form.

Indian cities, in most instances, have high proportions of mixed land use, which result in high residential densities and ensure smaller trip lengths and maximise non-motorised transport modes for commuting. London and Paris also demonstrate that even with lower density cities can have very good and effective public transport systems. Over the next 20 years, while per capita income in India will increase significantly, it will still be low, and so most areas in most cities will have significantly high densities, other than a few pockets for some very high-income citizens.

The need for effective UT increases with density. With respect to public transport in urban areas it should be noted that cities such as London, Paris,

11. LSE Cities (2011).

Figure 5.1
Trip Lengths in Selected Indian Cities



Source : Tiwari (2011).

Zurich, etc. have much lower built up densities than most Indian cities (Table 5.8) yet have very good public transport systems. Angel et al also conclude that 'average densities in developing-country cities are high enough….to sustain public transport'. Several studies compiled by Holtzclaw[12], for example, suggest that average densities of 30 persons per hectare can sustain local bus service and densities of 50 persons per hectare can sustain high-frequency bus service. Many planners recently have been calling for cities, especially developing country cities, to be made denser, for better benefits from energy savings and the reduced levels of greenhouse gases associated with public transport, but this strategy is not without costs.

RAPID GROWTH OF PERSONAL TRANSPORT AND ITS IMPACT

According to the Motor Transport Statistics[13], the annual rate of growth of motor vehicles in India over the last decade was very high close to 9.9 percent. In 1981 there were only 5.4 million vehicles registered in the country. The figure was 21.4 million in 1991, 54.9 million in 2001 and 141 million in 2011 (Table 5.6 earlier).

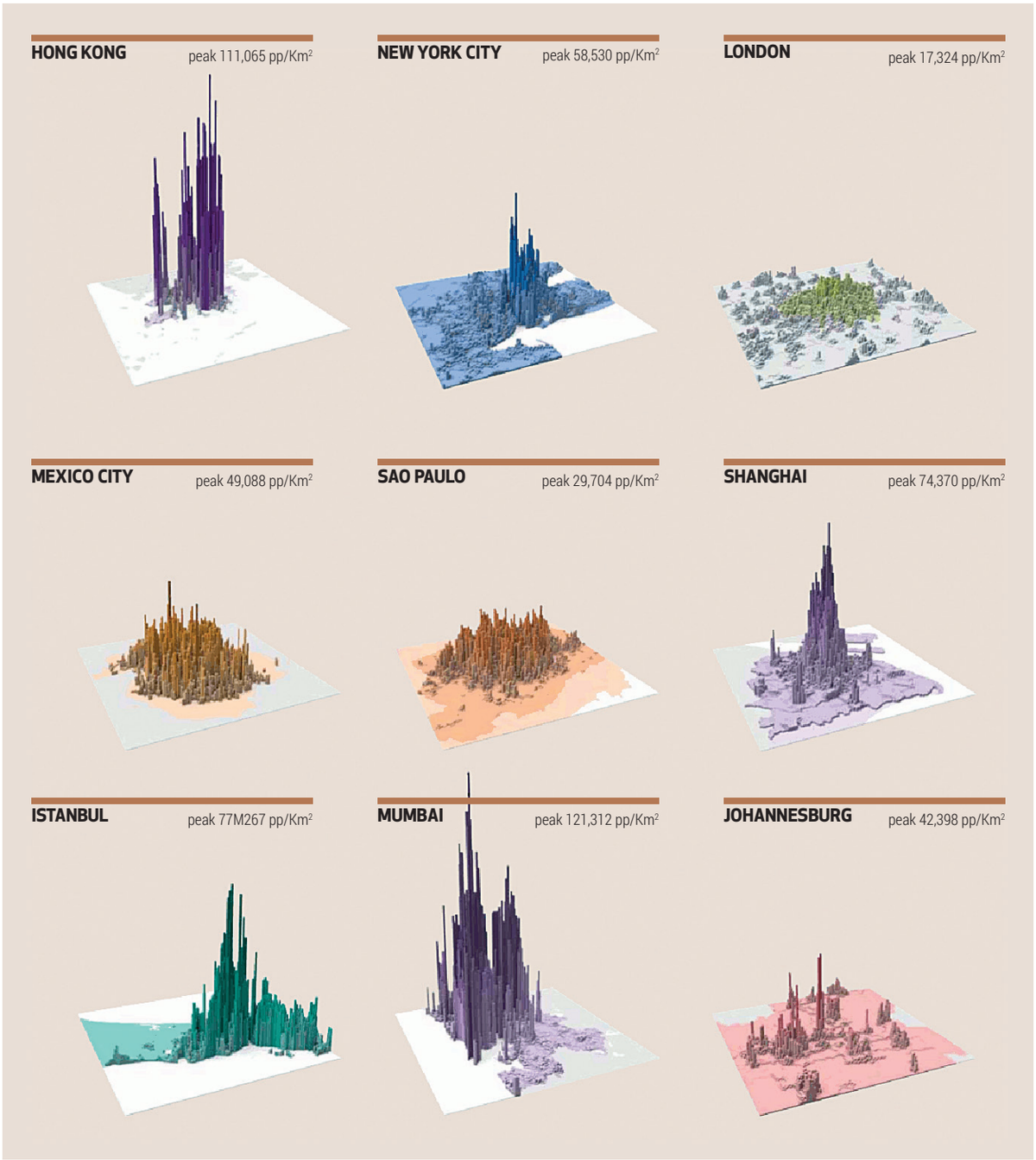
Notwithstanding this rapid growth of motor vehicles in the last three decades, international comparison of vehicle per 1000 population rates across countries, shows that India has low penetration (Table 5.9), but which is consistent with its level of per capita income. The figure is likely to be even lower since registered but unused vehicles figure in the data. International comparison in Figure 5.3 shows the trends in car ownership in countries with per capita incomes less than $40,000 and with increasing car ownership trends. While it shows that increasing trends in car ownership can be witnessed as a phenomenon even in countries with much higher per capita incomes, it also reveals how countries with similar per capita incomes have different car ownership ratios, establishing that while a rapid increase in motorised vehicles can be expected in India, policy can affect car ownership to some extent and car usage to a large extent.

India's most acute UT problems are not because of the number of vehicles but the high concentration of private vehicles in a few selected cities. About 32 per cent of motor vehicles are in metropolitan cities alone, which constitute just around 11 per cent of the total population[14].

Delhi, with around 1.4 per cent of the Indian population, accounts for more than 7 per cent of all motor vehicles in the country. As of 31 March 2011, there were more than 7.23 million registered motor vehicles in Delhi compared to a population of 16.7 million residents and about 600 additional vehicles are being registered every day, even though there has been a downward trend in this over the last couple of years. However, a recent report suggests that the actual number of vehicles in Delhi may be about half this number[15]. This therefore indicates that the issues

12. Holtzclaw (1994).
13 Motor Transport Statistics of India, Various Issues, Transport Research Wing, Ministry of Surface Transport, Government of India, New Delhi.
14. Ministry of Road Transport and Highways (2012).
15 Mohan (2013).

Figure 5.2
Residential Density of International Cities



Source: LSE Cities (2011).

related to cars and private transport need special focus in our metropolitan cities.

The huge increase in the population of two wheelers in India is a unique. From being 8.8 per cent of registered vehicles in 1951, it has crossed the 70 per cent mark. India now has the second highest concentration of two wheelers in the world only after Malaysia and ahead of China.

Personal vehicle demand is going up in an environment where there is the absence of adequate and efficient public transport systems. At the same time rising incomes makes cars and motorcycle ownership increasingly affordable. Cars are available from Rs 150,000 to Rs 300,000 upwards and motorcycles requiring an outlay of around Rs 50,000-60,000 plus are the two major choices for private vehicle ownership and serve two different sections of the market. Level of service (comfort) and travel time are the principal priorities for those in the high income population group, while initial capital investment and operating costs are the major deciding factors for those in the middle-income class. Thus,

Table 5.8

Built Up Area, Urbanised Area and City Footprint Densities in Selected Cities

CITY	COUNTRY	BUILT-UP AREA DENSITY (HECTARES)*		URBANISED AREA DENSITY (HECTARES)**		CITY FOOTPRINT DENSITY (HECTARES)***	
		1990	2000	1990	2000	1990	2000
Beijing	China	164.7	162.7	144.9	138.4	84.1	71.4
Shanghai	China	162.9	125.2	141.4	102.9	78.3	59.5
Hong Kong	China	629.5	543.0	532.7	462.9	399.7	346.8
Bandung	Indonesia	278.3	241.8	219.1	188.9	134.7	127.0
Kuala Lumpur	Malaysia	76.4	68.0	60.2	52.7	40.4	37.6
Manila	Philippines	347.6	284.1	264.4	230.9	154.9	146.4
Singapore	Singapore	170.9	174.8	128.6	130.3	78.7	87.3
Bangkok	Thailand	139.4	100.3	107.5	77.1	47.9	44.4
Hyderabad	India	276.4	189.6	228.7	155.8	128.5	95.0
Jaipur	India	347.9	200.4	282.8	158.6	179.5	127.2
Kanpur	India	159.2	151.7	132.5	128.5	78.4	73.7
Kolkata	India	386.9	276.7	321.4	226.4	172.6	110.4
Mumbai	India	474.5	440.3	407.3	384.5	310.7	286.3
Pune	India	466.9	201.6	362.9	158.1	181.0	124.3
Vijayawada	India	246.9	181.5	199.7	157.2	133.3	98.3
Istanbul	Turkey	190.7	165.9	144.6	129.5	107.1	94.0
Cairo	Egypt	259.7	231.1	221.3	198.2	167.7	143.1
Addis ababa	Ethiopia	204.6	211.3	157.7	164.5	110.8	111.8
Sao Paulo	Brazil	101.7	99.6	87.9	88.1	72.1	71.5
Moscow	Russia	139.1	95.5	109.4	76.9	62.3	47.4
Philadelphia	United States	35.0	34.3	28.3	28.4	24.0	24.5
Chicago	United States	24.7	20.4	19.0	16.4	12.0	10.4
Paris	France	70.2	64.4	55.7	53.1	40.8	39.5
Tokyo	Japan	117.6	115.7	91.5	93.0	80.1	81.7
Madrid	Spain	147.1	124.5	119.7	98.9	74.4	63.7
London	United Kingdom	62.2	54.1	48.6	43.6	35.5	30.8

Source : Shlomo et al. (2010).
Note: * is the ratio of the total population in the smallest administrative districts containing the city and the total area of the built up pixels within these districts.
** is the ratio of the total population to the total urbanised area.
*** is the ratio of the total population and the total city footprint area (sum of the urban and suburban built up areas).

Table 5.9
Vehicular Penetration in Select Developed and Developing Countries

COUNTRY	GROSS NATIONAL INCOME PER CAPITA 2009 (US $)	PER 1,000 PERSON		
DEVELOPED		PASSENGER CARS	TOTAL VEHICLES**	TWO WHEELERS
US	46,360	439	828	26
UK	41,370	460	544	21
Japan	38,080	617	617	28
Germany	42,620	510	610	46
Australia	40,240	550	717	28
France	42,620	496	654	56
DEVELOPING				
Mexico	8,960	191	288	11
Malaysia	7,350	313	675	325
South Africa	5,760	110	170	7
Brazil (*)	8,070	165	275	68
China	3,650	34	119	72
Korea, Rep	19,830	267	393	37
India (##)	1,220	13	117	76

Source: Calculated on the basis of data received from offices of State Transport Commissioners/UT Admns; International Road Federation (2011); Ministry of Road Transport and Highways (2012).
Note: **: India Vehicle include passenger cars, buses + coaches, vans + lorries and Two wheelers
(*): Data relates to 2008, ##: Data relates to 2011

cars and two wheelers address different markets and, in general, they are not competitors. Recent industry trends also indicate that a significant segment of the market is moving out of the small entry-level car segment and is buying larger cars. This could have increased negative impact on city mobility indicators.

One of the most direct impacts of increase in personal motorised transport has been on parking requirements. As most residential or work facilities were not developed with such high private transport ownership in mind personal motorised transport parking often overflows and occupies public land such as road carriageways, footpaths or parks etc. posing other problems of mobility. Simultaneously parking space for public transport and non-motorised transport is not given any priority. It is now well recognised that parking demand is insatiable, in an environment of rapid increase in private vehicles in larger cities. Conventional policies encourage more parking supply.

However it must be noted that despite the high and increasing percentage of cars and two wheeler ownership in relationship to over all vehicles these personalised vehicles still constitute a small portion of overall passenger trips in each city. As in the case of Delhi[16] (Figure 5.5), and in various city-level comprehensive mobility plans in cities where the penetration of personal motorised transport is high, car ownership still constitutes at the most, less than 25 per cent. Personal motorised transport use has had severe negative impacts and the pace of increase of personalised motor vehicles has emerged as the key urban transport and mobility challenge for the country.

EXTERNALITIES, ENERGY ISSUES, ENVIRONMENTAL IMPACT AND SAFETY PERFORMANCE

ENERGY ISSUES

Energy efficiency of UT is important for two reasons. First, energy costs form a significant proportion of transport costs for all modes in urban India,

16. As per RITES (2010) for Delhi, the business as usual scenario will have cars based trips increasing from 19.3 percent to 23.4 percent by 2021 and two wheeler trips from 21.7 to 21.9 percentage of trips by then.

Table 5.10
Registered Motor Vehicles per 1,000 Population in Million-Plus Indian Cities

CITY	MVS/'000 POPULATION
Agra	366
Bangalore	434
Bhopal	401
Chennai	388
Coimbatore	577
Delhi	332
Greater Mumbai	90
Gwalior	408
Hyderabad	391
Indore	560
Jaipur	551
Jodhpur	559
Kanpur	343
Kochi	193
Kolkata**	30
Lucknow	417
Madurai	412
Pune	415
Visakhapatnam	356
Average of 35 Million + cities	293

Source: Ministry of Road Transport and Highways (2012).

so that efficiency in energy use is a central issue in sector efficiency. Second, consumption of energy, particularly that of hydrocarbons, is a critical factor in determining the impact of the UT sector on both the local and the global environment. Figure 5.6 shows the estimated fuel consumption in 23 largest cities which is close to 8-10 per cent of the petroleum used in the country.

Another TERI study[17], indicates that

- There will be an 18 per cent reduction in motor fuel demand, if buses meet 70 per cent of the total passenger travel demand in 2030.
- If fuel efficiency of vehicles can be improved by 5 per cent and 20 per cent in 2015 and 2030, respectively, for the vehicles registered after 2010, a reduction of about 17 per cent is achievable in motor fuel consumption by 2030 as against the BAU scenario.
- Integrated land-use and transport planning can also reduce transport energy demand by 20 per cent by 2030.

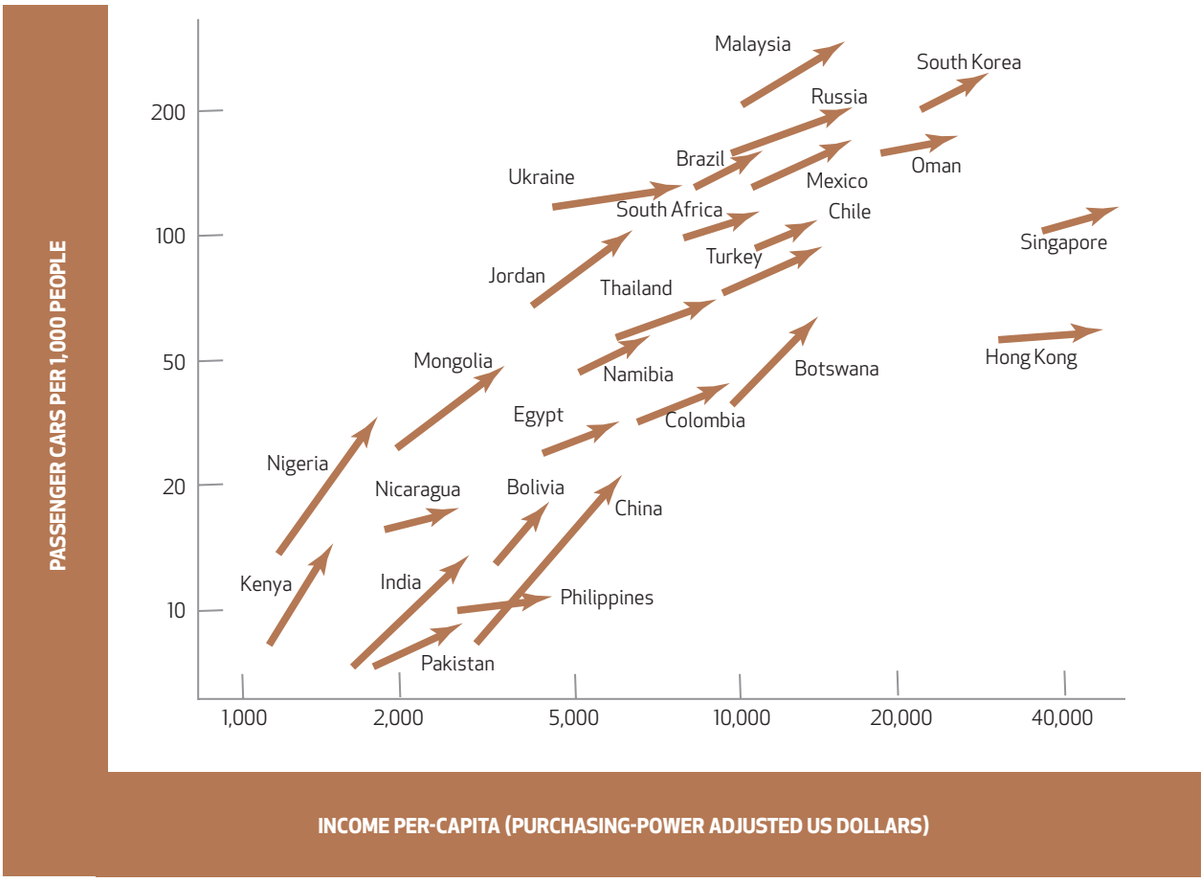
These numbers indicate the impact of different interventions. If these interventions are taken together, the reduction in energy use and CO_2 emissions could be very significant.

The National Mission on Sustainable Habitat of the National Action Plan on Climate Change (NAPCC) also focuses on reducing energy use in UT by emphasising the strengthening of public transport systems through various promotional, regulatory and fiscal measures. The key actions proposed, related to UT are:

- Promoting modal shift towards public transport and better urban planning for reducing the need to travel and to shorten travel distances
- Introducing appropriate transport pricing measures to influence purchase and use of

17. TERI (2007).

Figure 5.3
Projected Growth in Passenger Cars Per 1,000 People, Various Countries



Source: Kutzbach (2010).

vehicles with higher fuel efficiency and alternate fuels

- Tightening regulatory standards such as enforcing fuel economy standards for automobile manufacturers
- Establishing mechanisms to promote investments in development of high capacity public transport systems
- Abandoning of old vehicles to be made illegal and responsibility for handing over the end-of-life vehicle to collection centres fixed on the last owner of the vehicle
- Setting up of a demonstration unit to take up recycling of vehicles, especially two wheelers, which require new techniques
- Setting up a Combustion Research Institute to facilitate R&D in advanced engine design
- Providing tax benefits and investment support for recovery of materials from scrap vehicles.

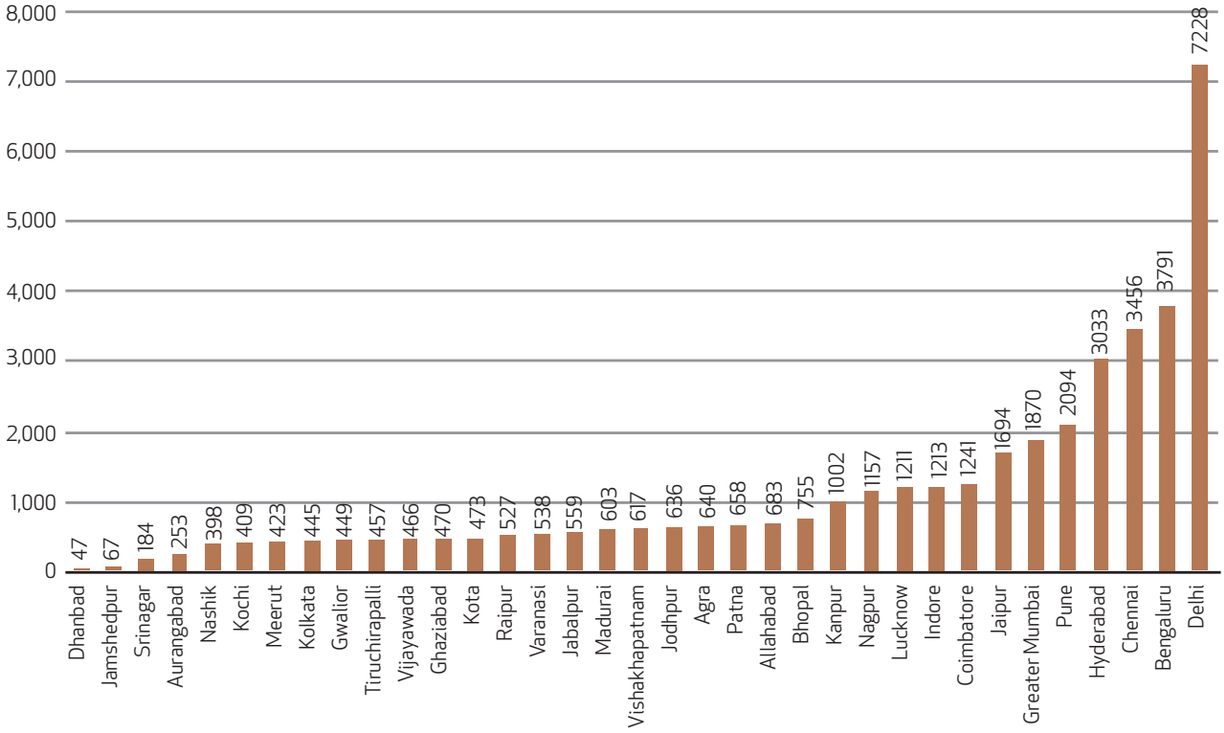
ENVIRONMENT EXTERNALITIES AND PUBLIC HEALTH

On one side, urban transportation activities support increasing mobility demands for passengers and freight, and on the other side, they have resulted in growing levels of motorisation and congestion. This results in the UT sector becoming an increasingly significant contributor to environmental problems. In urban areas the key manifestation has been air pollution and its health effects, which have been discussed in detail in the Chapter 7, Volume II on Energy and Environment. Some anecdotal data which outlines the externalities and environmental impacts of the urban transport sector in India are discussed below to stress the urgent requirement to focus on the need to focus on measure to control the same.

UT externalities are closely linked to environmental pollution and public health outcomes. In India it is clearly evident that increasing vehicular emissions leading to poor air quality are having significant negative impacts on public health. Traffic-related air pollution, especially PM and NO_x, has been shown to lead to premature morbidity and mortality. The World Health Organisation (WHO) estimates that over 700,000 people die each year in South Asia as a result of ambient particulate matter pollution[18]. In 2008, the CPCB identified around 70 cities, representing over 80 per cent of the cities that were being mon-

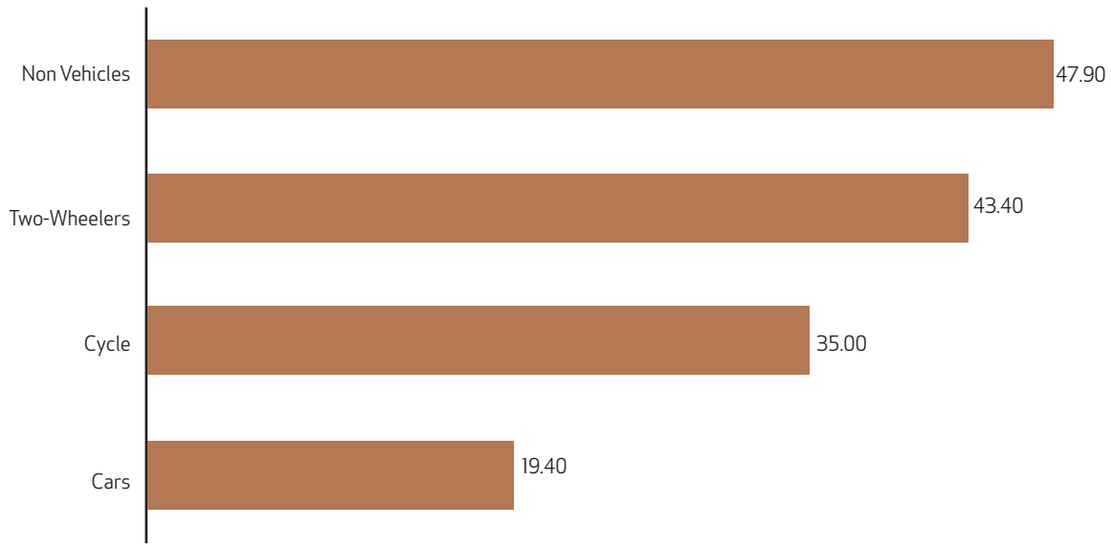
18. Health Effects Institute (2012).

Figure 5.4
Registered Motor Vehicles in Some Large Cities, March 2011
(Figures in '000s)



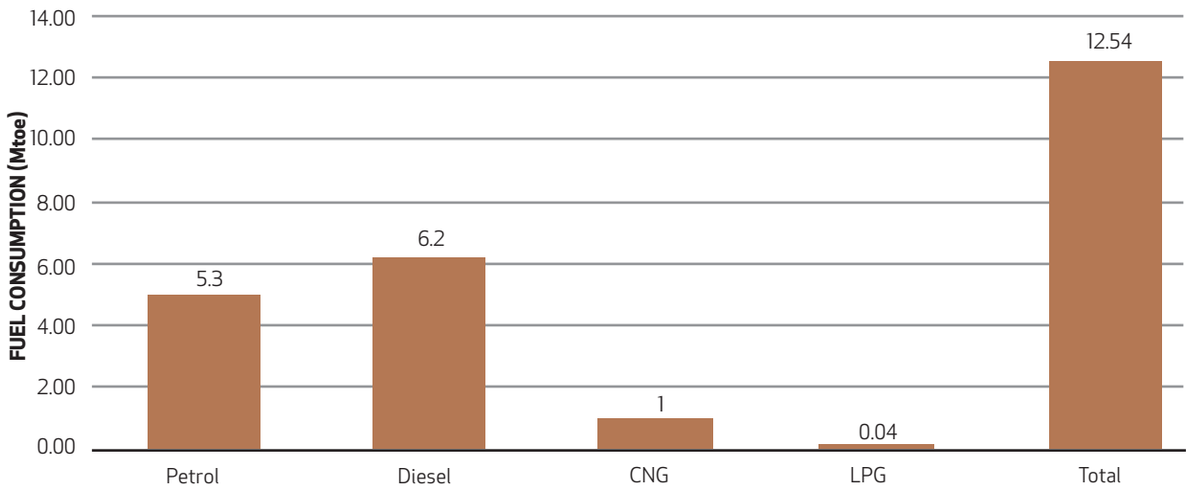
Source : Ministry of Road Transport and Highways (2012).

Figure 5.5
Vehicle Ownership in Delhi, 2010
[Per cent of Households]



Source: RITES (2010); adapted from EMBARQ.

Figure 5.6
Estimated Fuel Consumption of Motorised Transport Activities in 23 Million-plus Cities (2001)



Source: RITES (2010) adapted from CMBARQ.

itored, that were not complying with the NO_x and PM standards. The number has most likely increased since.

The complexities of the problems have led to much debate in environmental policy and in the role of transportation. The transportation sector is often subsidised by the public sector, especially through the construction and maintenance of road and mass transit infrastructure and through subsidies in operation. Total costs incurred due to the increasing use of petroleum-based fuels are generally not fully assumed by the users. The lack of consideration of the full costs of transportation could explain several environmental problems. Yet, a complex hierarchy of environmental costs is involved, ranging from internal (mostly operations), compliance (abiding to regulations), contingent (risk of an event such as a spill) to external (assumed by the society). If environmental costs are not included in costing and pricing, the usage of the car is consequently subsidised by society and costs accumulate as environmental pollution. This requires due consideration as the number of vehicles, especially automobiles using petroleum-based fuels, is steadily increasing.

Most recent reports are unanimous in recommending that cities try to arrest their current pattern of transportation growth in order to bring down their energy consumption by adopting the 'Avoid, Shift and Improve' approach to transport planning and management as articulated by the Bellagio Declaration (May 2009) and advocated by many others.

SAFETY PERFORMANCE

As in other low-income countries, fatalities linked to the transport sector, in India, especially road fatalities are expected to increase by more than 80 per cent over the first two decades of the 21st century, while high-income countries are expected to show continuous fatality reductions. As per a WHO report[19], road traffic injuries caused an estimated 1.24 million deaths worldwide in 2010. The outlook is ominous for India, as road fatalities in the South Asia region are projected to increase by 144 per cent from 2000 to 2021[20]. In 2010 as per the Accidents, Deaths and Suicides in India, National Crime Records Bureau, Ministry of Home Affairs, Government of India, 133,938 people were killed in road traffic accidents crashes[21].

The most recent Government report on this issue[22] states that in 2011 the total number of persons killed was 142,485[23]. As per the 'World report on road traffic injury prevention' by the WHO, road injuries are now among the top three causes of death for those in the 15-44 age group, compared to fifth place worldwide, and among the top 10 causes of death among children in the 0-4 age bracket

19. WHO (2013).
20. Kopits and Cropper (2003).
21. NCRB (2010).
22. MoRTH (2011).
23. GOI (2011b).

Box 5.2
Valuing Reductions in Premature Mortality from Air Pollution

Studies of the air pollution effects on premature mortality predict how many fewer people are likely to die if air pollution is reduced. For example, a 10 percent reduction in PM10 in Delhi, might result in 1,000 fewer deaths each year, though we do not know exactly which thousand people will be the victims.. This is equivalent to reducing the risk of dying by a small amount for all people living in Delhi so that the risk reductions multiplied by the population adds up to 1,000 fewer deaths. Since reducing air pollution reduces risk of death by a small amount for each person in an exposed population, what, in principle, we wish to estimate is what each person in the population would pay for this small risk reduction. If this willingness to pay (WTP) were added across all 10 million residents of Delhi, it would represent the value of saving 1,000 statistical lives. Dividing the total WTP by the number of statistical lives saved yields the average value of a statistical life (VSL)—the sum of WTPs for risk reductions that save one statistical life.

WTP for a reduction in risk of dying is usually estimated from studies on compensating wage differentials in the labor market, or expenditures to reduce risk of death. These studies are usually referred to as revealed preference studies because they are based on actual behaviour.

Transferred values can be compared with the direct estimates of a value of a statistical life in Delhi (Bhattacharya, Alberini and Cropper, 2007). In the study, 1,200 commuters were asked what they would pay to reduce their own risk of dying (a) as a pedestrian, (b) as a driver of a two-wheeler, and (c) as a commuter, regardless of travel mode. The responses to these questions were pooled to estimate the value of a statistical life in a traffic safety context. It was found that mean WTP to reduce one's risk of dying increases with income and education, and also with baseline exposure to risk, measured by commute time, by whether the respondent travels as part of his job and by whether he drives a two-wheeler. Mean (WTP) is three times larger for a respondent who drives a two-wheeler and travels on the job than for one who does not. It was also found that those responses were sensitive to the size of the risk change valued. For all respondents the elasticity of WTP with respect to the size of the risk change is approximately 0.55. For respondents with a high school degree this increases to 0.80, while for respondents with a bachelor's degree the elasticity is not significantly different from one.

The preferred estimate of VSL—approximately Rs 1.3 million or $150,000 Purchasing Power Parity (PPP)—is based on the mean WTP of a commuter with a high school degree who drives a two-wheeler and travels while on the job. This represents the benefits to a person with high exposure to traffic risks of a reduction in risk of death. This number exceeds the VSL currently used in evaluating the benefits of road safety projects by the World Bank (generally, foregone earnings) or in Indian studies (Mohan [2001] uses Rs 535,000). It is, however, smaller than the VSL that would be used if official values were transferred from high income countries to India assuming an income elasticity of one.

comparable to countries with much higher vehicular densities[24].

If one takes into account not just deaths, but injuries, related economic losses and losses due to damage to vehicles, these are large enough to seriously threaten development in many countries. Global losses due to road traffic accidents are estimated at around $518 billion, as per WHO estimates[25], and cost governments between 1 and 3 per cent of their gross national product. An estimate by the Planning Commission in 2002[26] puts the social cost of road accidents in India, at 3 per cent of GDP, more than the government spends on education or health. Affected families often have to bear huge burdens due to loss of life or serious injury to wage-earners, and medical and rehabilitation costs.

But the extent of the problem, the categories of people affected, and many of the reasons behind this modern epidemic, certainly marks India out as an especially bad case. But the problem is yet to receive the highest priority in government[27].While most view road fatalities as a simple 'fact of life,' a perception aided by the very word 'accident', they are nothing of the kind. They are caused by a combination of inadequate road design, unsafe vehicle design, lack of enforcement and lack of expertise dealing with road safety.

While the data presented here can be used to indicate broad-brush trends, it is also important to note that this may reflect only accidents that are registered with the police, which usually happens only with respect to fatalities. Also, much of the information

24. Peden et al. (2004).
25. Ibid.
26. Ministry of Road Transport and Highways (2007).
27. Mohan et al. (2009).

on causes are products of clearly subjective inferences at local levels since it is well known that no serious accident cause analysis is carried out by the police except in rare cases of notoriety attracting public attention. A large number of cases are not properly recorded and reported, hence the figures here may be an understatement[28].

Delhi had the highest number of road accident fatalities in 2010 (2,829) with a rate of 60.3 per million population. The lowest was in Dhanbad (45) and the highest other than Delhi was Bangalore (832). Delhi accounted for 25.1 per cent deaths of bicycle riders, 18.8 per cent deaths of pedestrians, 16.6 per cent deaths of two-wheeler riders and 9.2 per cent deaths of three-wheeler riders in 35 mega cities.

None of the cities in India have safe or adequate facilities for pedestrians and bicyclists. This can be corrected only if road building authorities are forced to design roads by enabling legislation. In addition, it appears that vehicle speeds may be higher than desired especially during non-peak hours along with unchecked driving under the influence of alcohol. This would require the provision of a better trained and adequate traffic police force in every city of India.

Existing institutions are not fully equipped to deal with the increasing traffic on the roads or to adopt the advancements made in the techniques and technology that would promote road safety. The National Road Safety Council (NRSC) does not have adequate statutory backing, budgetary resources or the mandate to be an effective Organisation for executing road safety plans in a mission mode. Therefore to implement the above the institutional arrangements and systems around the improvement of safety aspects of transportation systems need to be strengthened. Responsibility for transportation safety is diffused and there is no single agency to deal with a range of problems associated with safety and there is also no effective mechanism for coordinating the activities of the different agencies dealing with safety. The role of key ministries and public sector agencies in improving road safety is currently seen as peripheral. This will have to change and transportation safety will need to be viewed as a priority area in the county's agenda for development.

The Report of the Committee on Road Safety and Traffic Management, 2007, also known as the Sundar Committee report, by the Ministry of Road Transport and Highways (MoRTH), had compared road safety institutional arrangements in various countries. It further laid out a comprehensive road-map for improving road safety conditions in India, which could have a significant impact on urban transport safety and NTDPC is of the view that the Sundar Committee recommendations should be implemented urgently.

CENTRAL GOVERNMENT INTERVENTIONS

URBAN TRANSPORT THROUGH THE FIVE YEAR PLANS AND THE NATIONAL URBAN TRANSPORT POLICY

The first explicit statement of interest in urban transport came in the 6th Five Year Plan (1982-87), which also mooted the need for a National Urban Transport Policy (NUTP). Despite this early start, a National Urban Transport Policy could be finalised only in 2006, the terminal year of 10th Five Year Plan.

Delhi had the highest number of road accident fatalities in 2010 (2,829) with a rate of 60.3 per million population. The lowest was in Dhanbad (45).

UT was, until recently, covered within the ambit of intercity rail and road travel. It was only in 1986 that the Allocation of Business Rules of the Central Government were modified and the Ministry of Urban Development was made the nodal ministry for policy and planning at the national level for rail-based UT. But all the responsibilities for the technical planning for rail-based UT systems were retained with the Ministry of Railways[29].

The 8th Five Year Plan saw a shift of the 'Urban Transport' subject from 'Transport' chapter of the Plan document to the chapter on 'Urban Development', signifying some sort of ownership of the problem by the Ministry of Urban Development. It also that noted that the traffic had continued to multiply with the result that the UT infrastructure in all large cities is on the verge of a breakdown. In the absence of reliable public transport and convenient and safe walking and bicycling facilities, people are compelled to resort to private vehicles, which have aggravated congestion, pollution and energy intensity. It also pointed out that there is no single agency to plan, coordinate or execute transport policies and programmes in urban areas. It was in this context that the subject of planning and coordination of Urban Transport was entrusted to the Ministry of Urban Development in 1986 and in 1988-89 an Urban Transport Consortium Fund was set up.

The 9th Plan accepted that the UT problem was an institutional orphan and there was critical need to develop UT institutions. It also accepted that there was no escape from upfront investment in the rail-based mass transit in metropolitan cities but that private sector financing was not the answer for the same and metro rail could be financed only with the

28. Mohan (2011).
29. GOI (2011a).

No Indian city has safe or adequate facilities for pedestrians and bicyclists. This can be corrected only if road building authorities are forced to design roads by enabling legislation.

active support of Central and state governments, including direct equity participation and tax incentives. The Plan also mandated financing of metro rail through dedicated levies on both users and nonusers and for the first time mooted the idea of setting up of a 'National Urban Transport Fund'. It emphasised an active co-operation and joint collaborative action by Central, state and city governments as the only solution to combat the deteriorating UT scenario in cities and towns of India.

The National Urban Transport Policy first mooted in 6th Five Year Plan, was finally adopted in 2006, the final year of the 10th Plan. The Policy acknowledges the existence of Central Acts and Rules dealing with the urban transport issues and their being administered by the central government, and for the first time focused on the central principle of investment for moving people not vehicles. It also mentioned that the objective of the policy was to ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of city residents to jobs, education, recreation and such other needs within our cities. It recommended that UT become an important parameter at the urban planning stage itself; and encouraged integrated land use and transport planning in all cities so that travel distances are minimised and access to livelihoods, education, and other social needs, especially for the marginal segments of the urban population is improved.

It promoted the greater use of public transport and non-motorised modes by offering Central financial assistance for this purpose and sort the establishment of institutional mechanisms for enhanced coordination in the planning and management of transport systems. It also focused on the introduction of new Intelligent Transport Systems for traffic management and addressing concerns of road safety and trauma response and reducing pollution levels through changes in traveling practices, better enforcement, stricter norms, technological improvements, etc. The NUTP was quite successful in setting out the broader frame of a sustainable UT system. It also outlined an implementation framework, of which Unified Metropolitan Transport Authorities (UMTA) were the centrepiece.. The policy remains a key statement of the direction that the UT sector needs to traverse in India. Major funding for urban transport was made available under the 10th and 11th Plans through the JNNURM programme discussed in the next segment.

More recently, in 2009, the MoUD, which has been anchoring the National Sustainable Habitat Mission as part of the **National Action Plan on Climate Change,** has produced an mission document which has a strong chapter on UT.

The report lists some broad strategies for reducing GHG emissions in the transport sector include:

- Greater Use of Non-Motorised Mode
- Improving Access and Reducing Passenger and Freight-Kilometres
- Emphasis on Railways for Passenger and Freight Transport
- Implementing Tough Fuel Economy Standards
- Use of Alternate Fuels
- Use of Battery Operated Vehicles (BOV) and Hybrid Vehicles (HV)
- Use of Hydrogen
- Use of Compressed Natural Gas

JNNURM

In December, 2005, the Government of India launched the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) to invest over Rs 1,200 billion in urban infrastructure improvements and basic services to the urban poor. The transport sector has received 11 percent of the total JNNURM investment[30]. Till May 2013, 143 UT projects have been approved, with the majority (80 per cent) in cities with populations of at least 4 million.

Some of the highlights and positive developments under JNNURM :

- Requiring Comprehensive Mobility Plans (CMPs) is a significant reform, which aims at putting local bodies at the centre of urban transport planning, and has encouraged cities to think about mobility in a more holistic way. Although reviewers have found the plans of mixed quality[31], the process has ensured that India's larger cities are now aware of the general principle of 'moving people not cars' embedded in the NUTP.
- Guidelines have been issued and some support for preparation and implementation exist.
- JNNURM has been a significant source of public investment into public transport through its investments in buses and BRT projects

Table 5.11 shows the percentage of JNNURM investment in large cities that have gone into the urban transport sector. This does not include funding for urban buses also made available to certain cities

30. IIHS (2011).
31. TERI (2011).

Box 5.3
JNNURM and Urban Mobility

Funding for the procurement of buses came as a late addition to the JNNURM programme. The JNNURM programme reform conditions related to mobility were embedded in the guidelines that accompanied the procurement of buses for the concerned cities. Much of the issues on which action from state government and urban local bodies was sought was in line with the National Urban Transport Policy. Some of the key commitments sought by the Central government were priority for public transport, dedicated lanes for buses, special purpose financing and PPPs for setting up BRTs, dedicated transport fund to be set up through additional vehicle registration fees, setting up congestion and green tax regimes. Other than this it also called for the setting up of the Unified Metropolitan Transport Authority, setting up of fee-based parking systems and the use of urban specifications for buses.

While JNNURM provided an impetus to thinking and action on urban mobility and pursuing the National Urban Transport Policy, Indian cities are far from achieving any significant success in achieving the NUTP outcomes.

Source: Adapted from Sivaramakrishnan (2011).

under the scheme. Further, analysis of cities' budgets show that, as in Pune, although the CMP sets out goals of achieving 50 per cent mode share from non-motorised transport and 40 per cent from public transport, they allocated 61 per cent of their 2011-12 budget to motor vehicle-related projects[32]. Only 18 per cent of Pune's budget was allocated to public transport projects and 9 per cent to non-motorised transport.

In short, while JNNURM has been quite successful in creating a focus for investments in urban infrastructure in India and the programme is important as the nation's first concentrated effort to try and improve urban infrastructure, there is still much room for improvement in India's urban transport infrastructure. There are a number of lessons to be learnt from the implementation of the programme both in terms of the reforms being pursued as well as the projects funded through the programme.

MOUD'S SERVICE-LEVEL BENCHMARKS

A key initiative undertaken by the Ministry of Urban Development in recent years has been the setting up of service-level standards for various urban services. For UT service-level performance benchmarks have been identified for the following areas of intervention:

a. Public transport facilities
b. Pedestrian infrastructure facilities
c. Non Motorised Transport (NMT) facilities
d. Level of usage of Intelligent Transport System (ITS) facilities
e. Travel speed (Motorised and Mass Transit) along major corridors
f. Availability of parking spaces
g. Road safety
h. Pollution levels
i. Integrated land use transport system
j. Financial sustainability of public transport

The parameters highlight the performance as would be monitored by the Urban Local Bodies (ULB)/ Development Authorities/Parastatal Agencies. These performance measurements will need to be carried out by the service delivery agencies themselves, reported to higher levels of management and also disseminated widely to the public.

The Ministry of Urban Development, will take the lead for disseminating these service level performance benchmarks. Further SLBs will also be institutionalised through the JNNURM and other programmes of the Ministry.

State governments and their nodal agencies in the urban sector have a critical role in driving performance of ULBs. A state government will need to periodically examine the SLBs as an input for its decisions related to policy, resource allocations, providing incentives and penalties, channelising technical and manpower support SLBs will also be an important input to State Finance Commissions.

ULBs/parastatal agencies are the most important stakeholders for institutionalisation of SLBs. As service delivery institutions, ULBs will find it useful to institutionalise systems for performance management using SLBs. Benchmarking with other cities within the state or with similar cities would facilitate a healthy competitive environment for continuous improvement.

32. Parisar (2011).

Table 5.11

Transportation Projects under Urban Infrastructure and Governance Component of JNNURM, March 2013

URBAN TRANSPORT AS PART OF JNNURM SUB-MISSION ON URBAN INFRASTRUCTURE AND GOVERNANCE				
BROAD SECTOR	**SECTOR (JNNURM MIS)**	**NUMBER OF PROJECTS SANCTIONED**	**COST OF PROJECTS SANCTIONED (RS MILLION)**	**ACA COMMITTED (RS MILLION)**
Urban Transport	Roads/Flyovers	100	82,213	33,833
	Mass Rapid Transport System	21	52,110	23,731
	Other Urban Transport	17	7,804	3,655
	Parking	5	8,604	3,372
Sub Total		143	150,732	64,592
Drainage	Storm Water Drainage	73	84,272	34,605
Drinking Water	Water Supply	157	203,409	99,730
Sewerage	Sewerage	113	149,934	71,608
Urban Renewal	Urban Renewal	11	4,865	2,035
Solid Waste Management	Solid Waste Management	45	20,087	10,513
Heritage	Development of Heritage Areas	7	2,254	1,441
Preservation of Water Bodies	Preservation of Water Bodies	4	1,167	686
Total		553	616,723	285,213
Urban Transport as percentage of Total		**26**	**24**	**23**

Source: http://www.JNNURM.nic.in (accessed 14 May 2013).

LARGE URBAN PUBLIC TRANSPORT PROJECTS

In India there has been a tendency to plan large UT projects without adequate analysis of existing transport patterns in cities. What is needed is an understanding of demand patterns in order to take an integrated view which should include, mass rapid transit, BRTs, buses, IPT, NMT, etc. Much of the attention has gone to designing and implementing large standalone expensive projects without much focus of integration with the rest of the UT system or with wider land-use planning.

Kolkata was the first city to develop mega projects with the initiation of metro rail. The Metropolitan Transport Project (MTP) was set up by the Railways in 1973, which recommended a Mass Rapid Transit System. The MTP prepared a master plan envisaging construction of five rapid-transit lines for Kolkata, totaling a route length of 97.5 km. A second line is now under construction and four other lines are being planned.

The proposal for a mass rapid transit for New Delhi first emerged from a traffic and travel characteristics study carried out in 1969. Over the next several years, many official committees were commissioned to examine issues related to technology, route alignment and governmental jurisdiction. In 1984, the Delhi Development Authority and the Urban Arts Commission came up with a proposal for developing a multi-modal transport system, which would consist of constructing three underground mass rapid transit corridors as well as augmenting the city's existing suburban railway and road transport networks. The Government of India and the Government of Delhi jointly set up a company called the Delhi Metro Rail Corporation (DMRC) in 1995. The first line of the Delhi Metro was operationalised in 2005 and it became the second underground rapid transit system in India, after the Kolkata Metro. Recently a number of other rail-based mass transit systems have been initiated in a number of cities such as Bangalore, Chennai, Mumbai, Jaipur, Hyderabad and Kochi. The 12th Plan document outlines a very liberal technical approach to identifying cities and corridors for metro projects, without simultaneously addressing financial and affordability concerns of residents and cities.

Box 5.4

Metros and the Future of Urban Transport: Two Technical and Planning Issues

Other than costing and financing a number of related issues are presently misunderstood, by decision makers. First, the issue of speed and trip/travel time. Contrary to popular impression, high travel speeds of mass transit systems don't necessarily help reduce door-to-door travel time, which is the most relevant indicator for users and should inform the choice of MRT options. As documented (Mohan 2008), elevated and underground public transport systems do not provide time saving compared to car or motorcycle use unless there is congestion on the road or the trip is very long, due to the time lost on escalators and long walking distances inside underground or elevated metro and monorail stations. The metro only becomes efficient for trip distances greater than 12 km, while options including walk, bicycle and Bus rapid transit are efficient for trip lengths of 1-2 kms; 3-4 kms and 6-7 kms respectively .

Ridership capacity is another area where projections and reality have not matched. The original feasibility study for developing a metro system for Delhi justified its economic feasibility by projecting a daily ridership of 3.1 million passengers by 2005 (RITES 1995)[2]. This was later reduced to 2.18 million passengers on the first three corridors (65.8 km) when completed in December 2005 as stated by the DMRC CMD, and then in 2005 further reduced to 1.5 million a day. The system was actually operating at around 0.6 million passengers per day at the end of 2007, (and in 2012 on a festive day it recorded a historic peak of 2.2 million passengers on both the phases together close to 200 kms length) less than 20 percent of projected capacity. Similarly, the Kolkata metro is operating at about 10 percent projected capacity[3] [Singh 2002]. Peak Ridership capacity in a single direction is also often considered during decision making but never realised in everyday use. While metros are most required at 40,000-50,000 passengers per direction, in reality most often peaks achieved in the system are 1/3rd to 1/4th of this. Also aspects such as costing for reduction in pollution and accidents etc, are often over stated and in reality such benefits are not realised (Mohan 2008).

Source: Mohan (2008); RITES (1995); Singh (2002).

While there is a degree of enthusiasm around cities developing and implementing large and costly mass transit projects, we need to note that there are a large number of inherent risks in taking to large fixed infrastructure projects. With the Metro projects themselves, there are a number of concerns that need to be taken into account before decision making and which are not given adequate attention in the current policy context. Questions related to the high construction costs and the availability of modern, alternative, and more cost effective options are not adequately considered. The decision making process on costs is also inadequately informed as often, funds for capital costs are provided by external sources and the full operations and maintenance costs are not factored in and if at all they are, the O&M costs are often paid for by sources other than direct revenue from the project, making them uncertain and often unsustainable in the long run. As discussed in this chapter and earlier in this report, local governments should be the primary decision-making tier of the government regarding large urban public transport projects in their city and should use a life cycle costing methodologies to inform their decision-making process. Furthermore, the project cost should include the cost of feeder systems, public bike sharing and pedestrianisation in the influence zone of metro stations and project plans should include strategies for this complementary infrastructure.

Over the last decade, improvements in computing and communication technologies, and successful demonstration of improved and higher-capacity bus transport projects in a bunch of Latin American cities have led to the implementation of a number of BRT projects globally as well as in India.

With the advent of the JNNURM, a number of new initiatives like BRT systems and procurement of

Box 5.5

Regulating Intermediate Public Transport

There are three main types of arrangement for regulating intermediate public transport (IPT), which consists of privately operated small buses and vans.

The first arrangement is for IPT to be viewed as normal public transport and to be subject to the same regulations as traditional bus services. This is the regime under which IPT became part of the main supply of service in Uzbekistan and the Kyrgyz Republic. In these cases, the fragmented operators were encouraged to form associations to bid for route franchises. While the process was not entirely smooth, it resulted in lower fares on small vehicles, while discipline increased. This approach has also gained currency in Brazil.

The second arrangement is for the regulation of IPT to be undertaken by a separate public authority. In Sri Lanka, a public body was created with powers to issue permits to private companies, and to set fares. The issuance of permits became a form of political patronage and there was a large over-issue of permits. As a result, a proportion of buses were kept off the road each day, leading to underutilisation of vehicles and higher costs per passenger. The legislation was later reversed and regulatory powers were passed back to the original transport commissions.

In Bogota, while the new Transmilenio BRT system was regulated privately, the Transport Ministry was in charge of issuing permits for other modes; licensees were able to sub-contract operations to other operators (taking a fee from each) who could compete with the Transmilenio services. This resulted in over-provision of small vehicles of poor quality, and high levels of road congestion. To improve coordination, the role of issuing permits was transferred to the Transmilenio company. The heart of the problem in both Bogota and Sri Lanka is that the existence of a separate regulatory regime for one part of the sector resulted in the administrators acting as the protector of the sector's private interests rather than as a regulator in the public interest.

The third arrangement is for the IPT sector to be allowed, or encouraged, to regulate itself. In Accra, Ghana, the operation of small vehicles (called 'tro-tros') is left to associations, by far the largest and strongest of which is the Ghana Public Road Transport Union (GPRTU), which is itself a federation of a number of smaller associations which operate specific terminals. To provide service, a supplier must be accepted to operate a route from one of these terminal associations. While operation is disciplined, the route structure is very fragmented and inefficient.

Source: Gwilliam (2011d).

buses have been taken by various state governments. BRT systems already exist in Pune, Delhi, Ahmedabad and Rajkot, with new ones coming up in Kolkata, Vishakapatnam, Vijayawada, Surat, Naya Raipur and Hubli-Dharwad. Modern low-floor buses can be found in many cities like Delhi, Mumbai, Bangalore, Nagpur, Chennai, etc. JNNURM has also funded 15,260 buses in 61 cities.

However, BRTs are not the only way that buses need to be deployed in Indian cities. Buses provide a large number of advantages if a bus system is deployed as the citywide system of choice for public transport. A combination of different energy efficient and clean buses is the most modern, convenient and viable public transport system which provides the backbone to public transport in most cities across the globe. In India too, dense bus-based public transport along with efficient paratransit systems needs to be provided if the public transport system is to become convenient and affordable for commuters to shift from private transport to public.

SUSTAINABLE URBAN TRANSPORT POLICY

Indian cities today suffer from inadequate urban services and environmental degradation. All categories of road users face problems in commuting. Pedestrians do not get a safe, conflict, and obstruction-free path to walk; and both cyclists and pedestrians have to fight for the right of way with fast moving motorised modes of transport, many a times risking their lives. The user of public transport faces long waiting periods, uncertainty in travel time and difficult conditions of travel. Personal motorised modes of transport are slowed down by the slow moving traffic and face significant delays. Road users get restless leading to road rage, rash driving, and accidents.

By 2030, all this should change in cities and urban agglomerations, as well as satellite towns. Public transport should be citywide, safe, seamless, user-friendly, reliable and should provide good ambience

with well-behaved drivers and conductors. Citizens should get access to jobs, education, social services and recreation at affordable costs and within reasonable time. Transport should be more efficient and less polluting.

Clearly, to attain this kind of Vision 2030 for urban transport, policies, planning and investments needs to be directed towards sustainable urban transport with emphasis on making public transport, walking and cycling attractive, cost-effective, efficient options. This shift in emphasis also needs to be supplemented with the rapid uptake of cleaner technologies, a stringent fiscal regime including rigorous analysis of project costs and social benefits as well as strategic use of targeted subsidies, along with the use of intelligent transport systems.

The policy context, in terms of issues, concerns and objectives, has been steadily evolving and effects policies for transport in general and urban transport in specific. The institutional context to support these policies, however, needs to be developed even as overall urban governance and planning processes are evolving. This report's chapter on Institutions for Transport System Governance (Chapter 5, Volume II) lays out a broad framework for UT governance in India's federal context. The next section in this chapter discusses more granular details.

Both policy and the institutional framework will have to take shape in challenging circumstances with new pressures of resource scarcity and a more limited environmental 'budget' for climate-changing and air-polluting emissions. More developed countries, have developed their UT systems under very different circumstances and policy mandates. A decade ago issues such as climate change, safety, security, and fuel efficiency were low on the policy agenda in India. Now, institutions in India, like elsewhere around the world, are responding to these emerging issues and preparing for investing significant resources in an attempt to achieve improvements in these areas. This Committee is of the opinion that these policy concerns should be the key issues around which UT policy and systems are shaped over the next 20 years.

Barcelona, Bogotá, Curitiba, Dublin, Hong Kong, London, Munich, Seoul, Singapore, Stuttgart, Vancouver and Zurich are often quoted as examples of cities that have developed sustainably in important aspects of urban transport. These cities have not reached these goals by accident, but by purposeful action that has been maintained over time. No single best practice project alone can turn a city around; sustained effort toward well-defined goals is required. Indian policy makers must ensure that city governments seek not only technological fixes but also not ignore the fact that real results come from integrated and systematic policy action as a whole.

UT also functions as a nexus between issues of urbanisation, land use, energy use and climate change. Before energy efficiency and climate change became central policy concerns, sustainable cities defined sustainable UT policies as access-based transport planning oriented around planning for proximity of uses. To control traffic congestion, two tools have been used: provision of public transport (the 'carrot') and demand management (the 'stick'). In 2005, Wright and Fulton[33] showed that when economic and planning measures are added to control vehicles and fuels, goals for energy efficiency and climate change mitigation are also met, thereby proving that the new policy paradigms are consistent with the approaches that have been adopted by sustainable cities.

No single best practice project alone can turn a city around. Indian policy makers must ensure that city governments seek not only technological fixes but also not ignore the fact that real results come from integrated and systematic policy action as a whole.

While a number of reports covering urban transport such as the MGI (2010), HPEC 2011, and the Recommendations of Working Group on Urban Transport for 12th Five Year Plan have been published recently, the NTDPC is of the view that UT policy, planning and investment needs to be more responsive to safety, energy, environment and health concerns. It is only by following an integrated view including these policy concerns that urban transport can over the medium term i.e., by 2030, be expected to change towards sustainable transport, that would put peoples mobility issues ahead of access requirements for cars and personal transport modes.

OUTLINE FOR A NATIONAL APPROACH

NTDPC, like the National Urban Transport Policy, recommends three well-recognised and internationally-accepted strands of urban transport policy known as 'avoid, shift, and improve'. To pursue this approach, policy makers will need to focus on (a) the information and metrics basis for planning, design and operating aspects of UT infrastructure, (b) developing and implementing a strong transport demand management regime, and (c) improving implementation of projects and coordination between investments in the urban transport system. The key aspects of the proposed policy approach for sustainable urban transport are discussed in detail in this section. The next section goes on to discuss physical design issues related to developing improved facili-

33. Wright and Fulton (2005).

In recent times, indiscriminate land use planning and the increasing development of peri-urban areas by businesses and households have forced residents to make greater use of motorised transport.

ties for sustainable urban transport and the economic instruments for transport demand management that should be incorporated to incentivise behaviour change in commuters.

Avoid: Sustainable transportation is about moving less. Reduction in the need for travel by promoting city structures and urban densities as well as imaginative use of Information and Communication Technologies, for example, may lead to a reduction in the passenger km and freight-km required to sustain the urban economy.

Shift: Change modal choice to promote lower fuel consumption per passenger-km and/or freight-km and manage traffic and reduce fuel consumption as well as air pollutants.

Improve: Increase the energy efficiency of vehicles and use of efficient and cleaner fuels to decrease impacts of distances travelled and reduce the greenhouse gas footprint per litre of fuel consumed.

There is also an established hierarchy within these three complementary objectives, best explained by a transport emission specialist, who noted in 2011, that 'a gallon of fuel conserved, or a tonne of air emissions avoided due to reduced vehicle travel (the result of mobility management—defined to include improved transport options, efficient incentives, and land-use management) is worth an order of magnitude more than the same energy savings and emissions reductions provided by increased vehicle fuel efficiency or shifts to alternative fuels. This occurs because mileage reductions also reduce traffic congestion, road and parking facility costs, consumer costs, accidents, pollution, and sprawl, and often improve mobility options for non-drivers[34]. Initiatives across all the three elements need to be undertaken based on peculiarities of individual ground realities in different cities. It also therefore implies that single actions without integrated and systematic policy actions often do not result in reaching the desired outcome.

Other than Avoid, Shift, Improve, the other theme that India needs to focus on simultaneously in the short and medium term to develop sustainable urban transport services is the decision making about and financing of mega projects in UT.

AVOID: REDUCING THE NEED FOR TRAVEL

Accessibility requires mixed land uses in dense cities where arteries are not blocked by congestion. Historically, many Asian—including Indian—cities have measured up well to this ideal, with a range of services and amenities located in each neighbourhood and non-motorised transport and para-transit providing good access. In recent times, however, indiscriminate land use planning and the increasing development of peri-urban areas by businesses and households seeking lower-cost land have forced residents to make greater use of motorised transport. The remedy is judicious land-use planning that reduces residents' need to travel and cuts back on urban sprawl, pollution and congestion. Mixed-income neighbourhoods are also very important as lower skilled service industry workers such as electricians, plumbers, house-helps, etc., need to find employment in the vicinity of their own homes, while higher skilled and better paid workers can afford to travel larger distances for work. Mixed land-use policies include integrating residential and commercial neighbourhoods and moving away from concepts of strict zoning by activity. It is recognised, of course, that the efficacy of this approach does have limits as cities grow and people do live at increasing distances from their places of work, schooling and leisure.

SHIFT: CHANGING MODAL CHOICE

Where travel cannot be avoided, policies need to promote the use of public transport over private modes.

Both the 'stick' of traffic restraint and the 'carrot' of attractive public transport are necessary to reduce transportation-related problems. While it is rarely politically feasible to control car ownership, controlling car use meets with less resistance. Indian cities should consider implementation of economic measures to restrain traffic such as parking policies, congestion charging across cordons or within areas, car-sharing schemes and other measures. Where these policies are not possible, cities may consider fuel surcharges along with vehicle license duties that reflect the vehicle's impact on air pollution and other externalities. The net revenues from these measures should be invested in improving the public transport system to secure acceptance for necessary but unpopular policies.

In addition to these measures to prod cities along a sustainable path, competition can be introduced into the supply of funding for public transport services. This is necessary to develop efficient, market facing services. Also an early integration of bus priority ways, busways, BRT, into cities' expansion and development plans would help integrate transport and urban development while maintaining the flexibility to reroute public transport arteries as the city develops. Rail-based metro systems can be considered for some cities with more established patterns of residential and commercial development, after careful examination and attention to the opportunity costs

34. Litman (2011).

of investing in relatively expensive fixed infrastructure.

IMPROVE: INCREASING THE ENERGY EFFICIENCY OF VEHICLES AND FUELS

The agendas for energy efficiency and climate change require controls on vehicles, and fuels used. Transport policy packages that include these controls greatly mitigate the adverse consequences of motorisation by decreasing distances travelled and reducing carbon dioxide emissions per litre of fuel consumed. They also produce co-benefits by reducing local air pollution (nitrogen oxide, sulphur oxide, and particulate matter) (See Chapter 7, Volume II on Energy and Environment).

Achieving these objectives requires inventive technology, measures to encourage the rapid take-up of that technology, and regulation as well as effective enforcement that controls in-use emissions by ensuring that vehicles are properly maintained.

This also requires careful consideration of the close links between vehicle technologies and fuel technologies. New fuels permit new technologies and new technologies perform better as a result of lower vehicle weights, less aerodynamic drag, lower tyre rolling resistance, and lower-friction lubricants. India's emissions standards currently vary among cities and between rural and urban areas, in part due to differential availability of low-sulphur diesel compatible with the latest emissions control technologies. Cars and trucks that pass between emissions zones often end up damaging their emissions filters by refueling with lower-quality fuel. Also, as King[35] emphasised, carbon dioxide emissions must be considered throughout the life cycle of fuels. There is an ever-present danger of unintended consequences when these matters are ignored. When the contrary occurs, however, the possibility arises that 'technology and the right policies will solve environmental problems…by 2050 so that environmental factors need not be restraints on road traffic growth. Some local areas of poor air quality need to be addressed by other means'[36].

Whether India will progress on the paths advocated in these initiatives depends on its openness to latest technology and the replacement rate of the vehicle fleet in response to standards and enforcement. The Bureau of Energy Efficiency has developed the Passenger Car Fuel Economy Labeling & Standards Framework, which needs to be implemented across the country and similar initiatives should also be undertaken for other categories of motorised vehicles, such as two wheelers and heavy vehicles. Policy decisions should also be taken in line with the Corporate Average Fuel Economy (CAFÉ) standards[37], regarding the phased predictable implementation of progressive standards, over the next decade. India currently is five years behind western developed countries in these matters and the government should ensure quicker implementation of improved standards with regard to both vehicle as well as fuel standards[38] (Chapter 7, Volume II on Energy and Environment).

BOON OR BANE? LARGE URBAN TRANSPORT PROJECTS FUNDED WITHOUT CITY CONTROL

Large projects can be agents of change in a city but are also risky by nature. Not all large projects are beneficial; major radial expressways, for example, can increase car usage and undermine sustainable urban transport policy. This simple question (whether a mega transport project [MTP] is required) demands many varied and interrelated responses. In the context of MTP planning, appraisal and delivery, these include taking a view on understanding how well risk, uncertainty and complexity have been treated; and, acknowledging the importance of context in decision-making and, most importantly, in making judgments about 'success'[39].

> Both the 'stick' of traffic restraint and the 'carrot' of attractive public transport are necessary to reduce transportation-related problems. While it is rarely politically feasible to control car ownership, controlling car use meets with less resistance.

Flyvbjerg et al.[40] study a large number of mega projects internationally, highlighting the fact that major risks have shown up consistently in mega projects over time and across nations. They demonstrate that mega transport projects globally have nearly always had cost overruns: these range from 26 percent in the case of Oresund's coast-to-coast link in Scandinavia, to 196 percent in Boston's artery/tunnel project in the US. They conclude that in such projects it is impossible to trust cost projections. With respect to demand projections too, they found that a minimum deviation of +/- 20 per cent and up to 70 per cent should be considered during decision making. The extent and magnitude of actual environmental impact are not well understood and so post project auditing should be a must in all these projects. The wider substantial, regional or national or international benefits commonly claimed in such projects are difficult to ascertain as the links are quite weak. Actual project viability typically does not correspond with forecast viability, where the latter was often found to be brazenly over optimistic. They conclude that due to

35. King (2007).
36. RAC Foundation (2005).
37. http://www.nhtsa.gov/fuel-economy (accessed 23 October 2013).
38. Europe is already into a regime of Euro V and VI standards.
39. OMEGA Centre (2012).
40. Flyvbjerg et al. (2003).

One must approach large projects with caution and ensure that the institutional framework is flexible enough to adjust quickly to inevitable surprises. Large projects, while providing a huge opportunity to cities also have enormous associated opportunity costs.

DMRC PROJECTIONS AND ACHIEVEMENTS			
		Ridership per day (m)	
Phase	Length	Projected	Realised
I	60 km	2.8	0.6
II	180 km	4.5	1.8

these aspects not only does the economic efficiency suffer, but also democratic accountability. Those who bear the brunt of the risks involved in mega-projects must have a commensurate voice in decision-making about the projects.

The lesson is that one must approach large projects with caution and ensure that the institutional framework is flexible enough to adjust quickly to inevitable surprises. Large projects in India too, while providing a huge opportunity to cities also have enormous opportunity costs associated with them. As an example in India, whereas the Delhi Metro rail project (Phase 1 of 65 kms) cost Rs 191 billion, the Golden Quadrilateral highway project connecting the four major mega cities in India by four-lane highways cost approximately Rs 300 billion for 5846 kms[41]. The Delhi Metro, including its three phases will provide for less than 15 per cent of commuter trips in the city. (The average metro trip being longer than other trips will, however, account for a greater proportion of urban travel in terms of passenger kms). Similarly, the Kochi metro represents the largest Government of India investment in the state of Kerala. These examples demonstrate that large urban transport projects have significant opportunity costs especially where a variety of basic infrastructure across sectors needs to be improved, and hence decisions to undertake such projects require careful ex ante cost benefit analysis.

There is an increasingly strong momentum in urban India, to take such decisions on megaprojects in a participatory manner involving affected stakeholders. However to implement, support and inform a structured consultation exercise, there is a strong requirement, especially if megaprojects are being conceived, that technical expertise and institutional capacity is set up in all five million plus cities. As discussed later in this chapter and also in Chapter 5, Volume II on Institutions for Transport System Governance, the nodal agency for transport in such cities should be an independently funded agency with statutory backing and a permanent technical staff. We refer to this proposed body as the Metropolitan Urban Transport Agency (MUTA). The NTDPC has recommended the setting up of an 'Office of Transport Strategy (OTS)' at both the Central and state government levels (see Chapter 5 on Governance). The MUTA would function as a metropolitan-level counterpart for the OTS for all cities with over 5 million population. The OTS should be responsible for analysing alternative project possibilities and technologies and then undertaking a broad based consultation exercise to inform decision makers on the options. The state-level OTS could support similar exercises in other smaller cities across the state. These institutional arrangements should also be backed by improved instruments for appraisal and decision making.

FULL LIFE CYCLE ACCOUNTING OF URBAN TRANSPORT SYSTEMS

Advanced decision-making tools are used by successful cities to solve complex problems and assist in taking difficult decisions. Full life cycle accounting (LCA) for costing of infrastructure and services is increasingly used internationally for decision-making, but is still a relatively new concept. Unlike typical government projects which account for the capital costs alone, life cycle accounting includes costs associated with the operation and maintenance and repair during the life span of the facility created. It also includes costs to the environment: pollution created and energy used during the construction phase as well as the operation phase. This comprehensive way of accounting for the costs of an urban transit systems provides a more accurate basis on which choices between different technologies can be made.

LCA can significantly change the comparison between transport options. TERI's[42] LCA of transport modes, commissioned by the NTDPC and discussed in more depth elsewhere in the report, found that modes which involve greater capital costs in infrastructure have a larger environmental impact. Although the results of this study are discussed in detail elsewhere in this report, the issue related to urban transport is presented in Tables 5.12 and 5.13.

The report also points out that metro rail has a significant cost of infrastructure construction and maintenance due to energy consumed and CO_2 emitted. It also shows that while electric systems are cleaner for the urban areas where they are installed, the process of electricity generation remains polluting and environmentally damaging. Thus, the external costs to the environment are often just passed from one location to the next.

41. http://www.delhimetrorail.com/projectsupdate/project_cost.aspx (accessed 15 January 2014).
42. TERI (2012).

Table 5.12

Comparison of Options for Mass Public Transport Based on Results of LCA Study by TERI for NTDPC: Fixed Infrastructure

LIFE CYCLE ANALYSIS OF EMBODIED ENERGY AND CO_2 IN MASS PUBLIC TRANSPORT MODES: FIXED INFRASTRUCTURE					
BRTS	**Phase**	**Embodied Energy**	**Unit**	**Embodied CO_2**	**Unit**
Fixed Infrastructure Construction	1 Km Bus lane only	12.3	TJ/km	371.7	T/km
	1 bus stop	3.6	TJ/stop	346.8	T/stop
Fixed Infrastructure Maintenance (30 yrs)	1 km Bus lane only	16	TJ/km	446	T/km
Metro Rail	**Phase**	**Embodied Energy**	**Unit**	**Embodied CO_2**	**Unit**
Fixed Infrastructure Construction	1 km metro line and one station	245.1	TJ/km	23,246.1	T/km
Fixed Infrastructure Maintenance (30 yrs)	1 km metro line and one station	8.8	TJ/km	792	T/km

Source: Life cycle analysis of transport modes,TERI (2012).

The study shows that infrastructure-heavy urban transport modes which are 'fixed' in nature, and have large life spans, limit the flexibility of the city to innovate with new more environmentally favourable technologies, as they arrive. Long lock-in periods with chosen modes precludes the implementation of other options as they are developed.

The NTDPC recommends that advanced, international, contemporary instruments such as the LCA framework should be included in the methodology to evaluate and appraise programmes and projects, especially mega projects, before decisions on funding are made. This is particularly important for projects that may be funded by multiple levels of government but concentrate risk on state or metropolitan governments.

ECONOMIC MEASURES FOR TRANSPORT DEMAND MANAGEMENT

It is not enough to improve traffic flows by building more roads and flyovers, and augmenting urban transport facilities alone. There is also substantial room to use existing infrastructure more efficiently through more effective demand management and traffic regulation. Road space requirements in urban and town planning norms currently in use in the country are most often more favorable for motorised vehicles than for other road users and citizens in general. Road right of ways are designed for peak traffic times which could last for very short time spans in the day, but become detrimental to the livability and walkability of the space. Sustainable transport cities have reversed this and provide the least priority to personal transport vis-à-vis other road users, especially for in-city transit.

There is a need to control the growth in transport demand. Otherwise supply of public transport may never be able to catch up with demand and personal vehicles will increase congestion and negative externalities of urban transport. An economic policy regime to strongly support transport demand management (TDM) needs to be put in place in India.

The time has come in India, especially in cities with the higher motorised vehicle populations to consider the implementation of restricted registration programmes and linking ownership to proof of ownership/availability of parking place, and limiting accesses to zones/areas through measures like congestion charges, high parking fees, restriction on availability of parking in areas served by public transport. Programmes restricting private vehicle registration have been quite successful and have demonstrated their use in countries such as Japan, Mexico, Singapore and Hong Kong, and more recently in Beijing too.

These TDM measures offer individual commuters a tangible economic benefit or dis-benefit related to the use of one or more travel modes. Some economic instruments that should be used to control the use of

Table 5.13
Comparison of Options for Mass Public Transport Based on Results of LCA Study by TERI for NTDPC: Rolling Stock

BRTS	Phase	Embodied Energy	Unit	Embodied CO_2	Unit
BRT Rolling Stock - Diesel Buses	Manufacture	1.7	TJ/bus	140	T/bus
	Maintenance (full life)	0.3	TJ/bus	22	T/bus
BRT Rolling Stock - Diesel AC Buses	Operations 2014	458.1	KJ/PKM	36.9	g/PKM
Metro Rail	**Phase**	**Embodied Energy**	**Unit**	**Embodied CO_2**	**Unit**
Rolling Stock	Manufacture	2.2	TJ/coach	130	T/coach
	Maintenance (full life)	1.8	TJ/coach	81	T/coach
	Operations	86.4	KJ/PKM	19.7	g/PKM

Source: Life cycle analysis of transport modes,TERI (2012).

personal vehicles in large Indian cities are presented in Table 5.14.

COMPREHENSIVE MOBILITY PLANNING

The conventional UT planning approach has focused mainly on flow of motor vehicle traffic. Since the National Urban Transport Policy, 2006, some attention is now also being placed on 'moving people not cars'. Increasingly, the focus is shifting to accessibility (the ability to reach desired goods, services and activities) and mobility of people, as against mobility for motor vehicle. Thus, planning should aim at improving accessibility, mobility and traffic flow in that order.

The transport modes to be used and the modal mix will depend on the city population, city form and size, availability of road surface and the trip length. The objective should be to restore balance in the use of road space for walk and non-motorised transport and promotion of the use of public transport, above private motorised vehicle use. Priority in planning for modes should be as follows in descending order:

- Walk and bicycle
- Public transport including para transit
- Personal vehicle transport

Table 5.15 shows desirable modal shares for different city sizes based on trip length distributions in Indian cities.

IMPLEMENTING MIXED LAND USE AND HIGH DENSITY DEVELOPMENTS AND AVOIDING URBAN SPRAWL

Urban Planning for mixed land use, high density and mixed income neighbourhoods, are being recognised all over the world, as the best way to ensure safe and sustainable urban development while minimising the risks and negative effects of transport. Land management is a key element of the Avoid strategy of the 'Avoid, Shift and Improve' approach.

Indian cities have developed over time in a mixed land use format. Only with the segregated design of cantonments under British rule and thereafter new city master plans was this principle first put aside. Thereafter, with the adoption of British town planning parameters, such mixed land use high density development has been discouraged. However, in practice most cities have still developed with considerable mixed land use, high density and mixed income localities, due to the widespread need of poorer people needing to stay closer to work places, which these plans have not provided for. As also discussed in an earlier section, most Indian medium-sized and large cities have higher densities than many cities around the world which have successful public transport systems.

Over the last decade, along with income growth and greater use of private motorised transport, new suburban developments around larger cities are being witnessed. These low density gated communities,

Table 5.14
Economic Measures for Transport Demand Management

TYPE OF INCENTIVE OR DISINCENTIVE	POSSIBLE ECONOMIC INSTRUMENTS	SELECTED ECONOMIC MEASURES
Curb motorised vehicle ownership	Tax/charge on vehicle purchase/ownership/ scrappage	Annual Vehicle Tax Registration Tax/Charge (re)Sales Tax/ Charge Scrappage Tax/Charge
	Restricting the number of vehicles and/or new registrations	Auction schemes/competitive bidding for new licenses Licensing car ownership
Discourage motorised vehicle use and encourage switch to public or non-motorised transport	Tax/charge on vehicle use	Fuel tax Pay-at-the-pump (sur)charges
	Tax/charge on road and/or infrastructure use; Restricting access to urban centres or special areas	Parking fees City tolls Road pricing Bridge tolls Cordon/area pricing Congestion pricing
	Subsidies for public transport and/or multi-modal transport (modal subsidies)	Subsidised public transport fees Subsidies for public transport networks and operation Tax-deductable public transport expenses P&R schemes
Encourage lower emission technology use and innovation	Taxes/Charges on vehicle purchase/ownership/scrappage; Taxes/Charges on vehicle use; Taxes/Charges on road and/or infrastructure use	Tax differentiations based on emissions Carbon/energy taxes Emission fees Emission-based surcharges Subsidies, tax rebates for lower emission vehicles/technologies

Source: NTDPC Research.

do not provide for mixed land use or mixed income neighbourhoods. These suburban outgrowths lead to significant increase in trip lengths while making public and mass transport solutions less viable and effectively promote increased car dependency, which is posing a critical challenge to sustainable transport in the immediate term. *The NTDPC is of the view that future urban development plans over the next 20 years, should be based on principles that create mixed land use, high density and mixed income neighbourhoods, based on norms for persons per hectare and not FSI alone.* This should be addressed through the appropriate changes in the urban planning norms and should be incorporated into planning standards such as the Urban Development Plan Formulation and Implementation Guidelines (UDPFI) which are followed by planning and development agencies in most states.

Also to be kept in mind is the fact that even in our richest cities, over the next 20 years, affordability levels of users of urban transport systems will remain low, inspite of the high economic growth levels expected. This implies that a large number of users will have limited resources to spend on long distance intra-city travel. Mixed land use, high density and mixed income neighbourhoods also provide for the proximity of different economic strata of society which have to rely on one another to be productive, which augurs well for the city, especially given that the skills and human resource intensive service sector contributes the largest share of the city's economy. High-density mixed land use neighbourhood design also has added safety benefits and new research shows that due to mixed use the neighbourhoods are busy throughout the day which help keep away crime and violence (Box 5.6).

INTEGRATED LAND USE AND TRANSPORT PLANNING

Urban transport is a derived demand closely linked to urban growth policies. Therefore integrated land-use and transport planning to minimise transport

Table 5.15
Desirable Modal Shares for Different City Sizes

CITY SIZE IN MILLIONS	0.05-0.1	0.1-0.5	0.5-1	1-2	2-5	>5
Walk	30	30	30	30	25	25
Cycle	25	20	15	12	10	10
Rickshaw	12	10	8	6	1	1
TSR	8	3	5	3	3	1
PT	12	15	15	20	33	38
Cars	1	1	2	4	8	10
MTW	12	21	25	25	20	15

Source : Urban Transport Working Group, NTDPC 2012.
Note: MTW: Motorised two-wheeler; PT: Para-transit; TSR: Three-wheeler scooter rickshaws.

demand is essential. Some types of land use patterns increase the use of car, while others reduce the amount of vehicle travel needed to access goods, services and activities. Some transport policies such as increase in road capacity and speed, generous parking supply, low road user charges and fuel taxes, poor walking and cycling conditions, inferior public transit service, high public transit fares, tend to encourage use of private motorized transport and also support the development of city sprawl.

In the coming years, much of India's population growth will take place in urban areas. At the same time, increasing wealth, declining household size, central area redevelopment, and other factors are causing a rapid drop in urban density even in India/Asia (Figure 5.7). These trends make most developing cities likely to at least double in physical area over the next two decades.

With the exception of cities in the People's Republic of China, few Asian cities are addressing this issue in a concerted or proactive way. Nonetheless, attention to this aspect is also increasing in India. The process of integrating land use and urban transport, should be driven by the principle that lower income workers should be closer to their employment areas while higher income workers, can afford to travel larger distances for work.

In addition to being geographically feasible, land-use plans must also be financially and politically feasible—i.e., they must be possible to implement. This requires stakeholders to accept that development is not allowed in certain areas. It also requires authorities to enforce planning regulations and construction standards. In most developing cities, achieving these conditions will require a considerable change in attitudes, greater technical capacity in planning departments, and institutional modifications that place these departments at the heart of the urban management process. While this may seem challenging, cities that have embraced sustainable transport principles have been through these challenging issues and the impacts are now seen on the ground as in Copenhagen (Figure 5.8).

A few Indian cities are also exploring the concept of Transport oriented Development (TOD), which suggests that there should be commerce and settlements around public transport nodes. This idea was vital for Northern American cities with high incomes and low densities such as Portland, Oregon, which have densities of 15-25 persons/hectare. In our context however, since we have a prevalence of mixed use high density development in most of our cities, it is important to promote high density in newer developments too with smaller block sizes across the whole city and not only at transport nodes. However, the densities in Indian cities need to be further increased along the mass transit corridors through a process of redevelopment with smaller block sizes to promote walking, cycling and easy access to public transport.

Box 5.6

Advantages of High Density Mixed Land Use Planning Though Urban Environmental Design

A number of recent researchers using comparative statistics and victimisation surveys show that environmental design can be used as an urban planning tool to reduce crime and violence in our cities and transport systems. Safety from crime and violence can be ensured through neighbourhood design elements in place of vast emptiness and suburban development, as in older inner city neighbourhoods. Bill Hillier (2010) had analysed how low burglary in dwelling spaces has a direct linkage with the inter-mix of multiple uses in streets. Researchers have developed a bunch of Urban Planning Strategies aimed at increasing the safety taking into account existing social and physical structures; guaranteeing accessibility and avoiding enclaves; creating vitality (blending functions and activities, attractive layout); providing mixed status (blending socio-economic groups, avoiding segregation); creating adequate urban density to allow vitality and natural surveillance; avoiding physical barriers (due to infrastructures etc.) and waste land.

Urban Design Strategies for safety should include layout considerations such as continuity of urban fabric and pedestrian/bicycle routes; specific location of activities; time schedules coordination to guarantee continuous natural surveillance; visibility (overview, sight lines between e.g., dwellings and public space, lighting, etc.); accessibility (orientation, alternatives routes, limiting access for un-authorised people); territoriality-human scale, clear public/private zones, compartmentalisation; attractiveness (colour, material, lighting, noise, smell, street furniture); and robustness (materials e.g., street furniture, fences).

Source: Gronlund (2013).

WALKING AND NON-MOTORISED TRANSPORT

Provision of pedestrian and bicycling facilities which are safe from road accidents and crime by design is the third most important learning from successful cities for the Indian context. Infrastructure for walking and bicycling needs to be improved urgently across urban India to (a) provide for safe and convenient transit for the large number of commuters who currently use this mode and (b) to attract more commuters to use these modes.

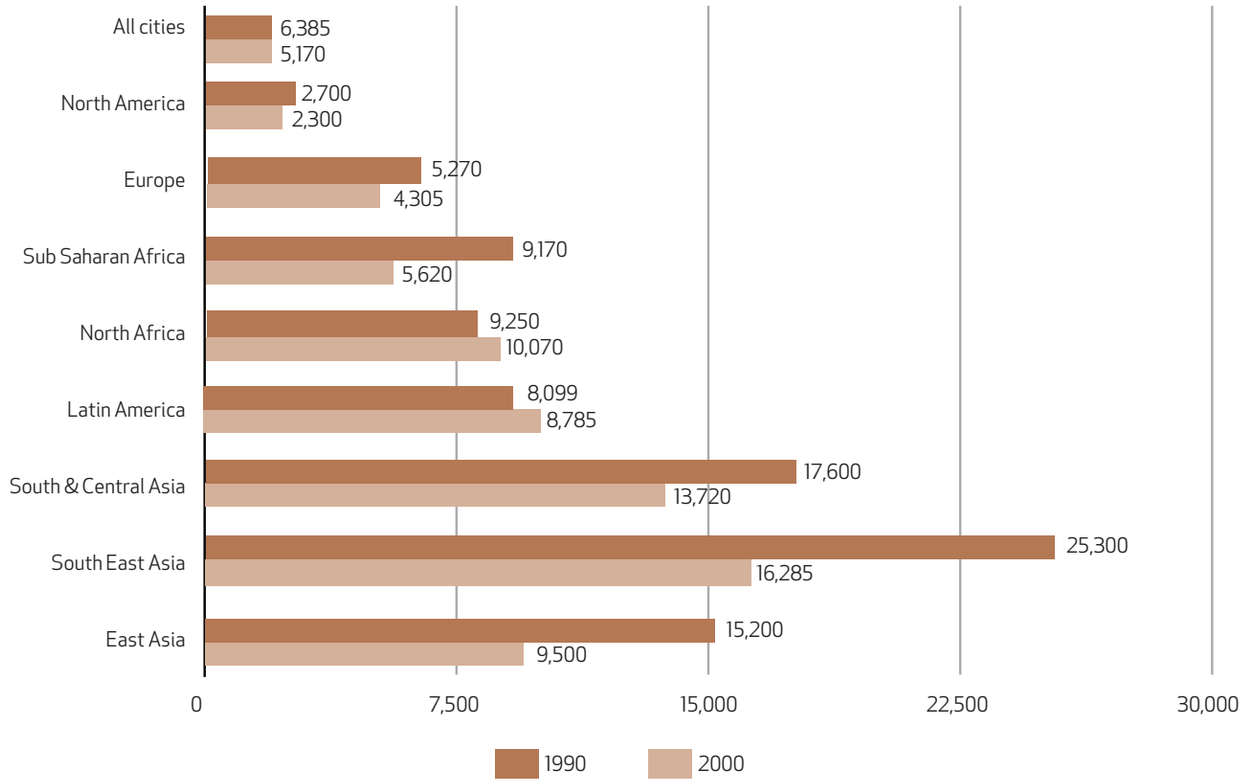
Walking and bicycling represent the largest share of trips in most cities with low affordability and mixed land use. In spite of this, often there is neglect of facilities for safe use of these modes, which needs to be corrected in the short term. Walking and to a large extent bicycling are also inexpensive, emission-free, use no fossil fuel, offers important health benefits and, for those without substantially impaired mobility, is accessible regardless of income. But walking and bicycling in all Indian cities is more challenging due to the poor quality of infrastructure and amenities for pedestrians and bicyclists. Pedestrians are particularly vulnerable, and account for about 35-50 per cent of road traffic fatalities in most Indian cities. Walk facilities should be designed and managed to accommodate a wide range of uses. People walk alone and in groups, walk pets, push strollers and carts, run, skate, bicycle, stop to gaze and talk, play and eat on sidewalks and paths. Footpaths serve as both travel-ways and stopping areas. Walking isn't only a mode of transportation but is also very important to social life in a city. The vitality of a city is closely associated to citizens being outdoors on the streets. However due to risks and perceived safety risks to walking and bicycling, these modes are losing favour among those who have choices (upper and middle income households) quickly and this trend needs to be reversed soon, to achieve sustainability in urban transport.

Lowering motorised traffic speeds is a key to improving pedestrian safety and can be done by introducing traffic calming designs and wider pedestrian paths (see Box 5.7). This also would help those who have impaired mobility, such as mothers negotiating traffic with young children, walkers carrying heavy items or older pedestrians and the differently abled. Special facilities and amenities for universal accessibility for wheelchairs also need to be made part of street design. In India, whenever new urban transport projects such as city roads and mass transit systems are being planned, it is recommended that facilities for pedestrians are integrated suitably in the main project itself. This needs to be ensured by national, regional and local legislation.

Many of the strategic macro-level points raised in a recent report of the International Transport Forum, are also important for Indian cities and need to be adopted as listed below.

(a) Implementation of clear administrative

Figure 5.7
Urban Densities in 1990 and 2000



Source: Angel et al. (2005).

responsibilities, with the urban local body in the centre, but across all levels of government for coordination of initiatives to promote walking.

(b) As mentioned before, the MoUD has come up with Service Level benchmarks, and it is important that the SSLB be implemented for measuring, reporting and monitoring pedestrian accessibility and mobility. A 'system' approach is needed for the design of walking environments, where the 'safe system' recognises that road users make mistakes and requires road design to take account of this to reduce the risk of serious injury.

(c) Implement the pedestrian planning guidance for local administrations. Each local body should develop, notify and implement, their own guidance and controls on street and road, such as in the city of Chicago, and include targets for future levels of walking and cycling.

(d) Encourage employers to create incentives for employees to walk and cycle to work.

(e) Implement traffic-calming zones and designate 30 km/h zones in all residential areas, school and hospital areas and shopping districts, areas with high pedestrian activity and local streets.

(f) Review current traffic codes to strengthen the legal and financial protection of pedestrians.

Safe facilities for NMT i.e., footpaths and dedicated cycle lanes should be developed on priority basis along with accompanying facilities such as parking booths, drinking water kiosks and street furniture. These should be citywide to assure the commuter that he can complete his journey all the way by walk or bicycle if he so chooses. NMT facilities should become a national norm and get first priority in infrastructure development and funding. Funds allocation for major transport infrastructure should be linked to achieving targets for creating facilities for NMT.

A number of guides and resources including from IUT for the MoUD, by the UTTIPEC and more recently from the Chicago Department of Transportation provide theoretical principles and information on best practices for improving non-motorised travel

Figure 5.8

Copenhagen: From Car Domination in the 1970s to Pedestrian-Friendly Streets and Bicycling City

Source: Risom and Mookerjee (2013).

Box 5.7

Complete Communities

'Many communities were not designed to make it easy for residents to walk, bicycle or use public transportation. The streets may be too wide for safe crossing, or a lack of sidewalks may inhibit a walk to the store or transit stop. Now, states are embracing "complete streets", which entails planning, designing, constructing, maintaining and operating transportation projects and systems, keeping in mind the needs of all users—motorists, bicyclists, pedestrians and transit passengers—regardless of age and ability. Twenty-six states, the District of Columbia and Puerto Rico have some form of complete streets policy; in 17 states, policies were enacted by the legislature. In 2011, New York and Washington enacted complete streets legislation, and such measures typically are considered by a number of states and localities each year. The District of Columbia also enacted its Sidewalk Assurance Act, which requires installation of sidewalks to ensure a safe and accessible environment for pedestrians and those with disabilities. The law provides that, for road segments that lack sidewalks on both sides of the street, road reconstruction or curb and gutter replacement must include installation of a sidewalk on at least one side of the street. At the federal level, the U.S. Department of Transportation issued a policy statement on bicycle and pedestrian accommodations in March 2010. It states that, "The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide—including health, safety, environmental, transportation, and quality of life —transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes". It encourages states to adopt similar policies, which many states already have done.'

Source: Shinkle (2012).

In India, whenever new urban transport projects such as city roads and mass transit systems are being planned, it is recommended that facilities for pedestrians are integrated suitably in the main project itself. This needs to be ensured by national, regional and local legislation.

conditions. Some key design elements are as listed below:

- Integrate non-motorised planning into all transport and land use planning activities
- Educate all transportation professionals in non-motorised transport planning principles
- Fund non-motorised transport at a comparable rate as other travel modes
- Ensure that all roads are suitable for walking and cycling unless these modes are specifically prohibited and suitable alternatives are available
- Use current planning practices and design standards, including Universal Design (inclusive design for the differently abled)
- Include non-motorised travel in transport surveys and models
- Create pedestrian-oriented Commercial Centres and neighbourhoods
- Perform user surveys to identify problems and barriers to non-motorised travel
- Improve sidewalks, crosswalks, paths and bike lanes
- Correct specific roadway hazards to non-motorised transport (sometimes called 'spot improvement' programmes)
- Improve Non-motorised Facility Management and Maintenance, including reducing conflicts between users, and maintain cleanliness
- Develop pedestrian oriented land use and building design
- Increase road and path Connectivity, with special non-motorised shortcuts, such as paths between cul-de-sac heads and mid-block pedestrian links
- Street furniture (e.g., benches) and design features (e.g., human-scale street lights)
- Traffic Calming, Streetscape Improvements, Traffic Speed Reductions, Vehicle Restrictions and Road Space Reallocation
- Safety education, law enforcement and encouragement programmes
- Integrate with transit (Bike/Transit Integration and Transit Oriented Development)
- Provide Bicycle Parking
- Address Security Concerns of pedestrians and cyclists
- Public Bike Systems (PBS), which are automated bicycle rental systems designed to provide efficient mobility for short, utilitarian urban trips
- Pedestrian ways, which are indoor urban walking networks that connect buildings and transportation terminals
- Create a Multi-Modal Access Guide, which includes maps and other information on how to walk and cycle to a particular destination
- Provision of multi-storey car parks for residents (paid for by residents) in order to gain public space on the road and gradually reducing parking space on the streets in order to promote cycle and walking
- Monitoring of public parking space with a special control task force
- Additional park and ride facilities at the periphery of the city

The NTDPC recommends that all cities should be responsible for pedestrian ways and facilities, which should be embedded in a law, linked to targets for improving streets and their maintenance within a period of 10 years.

PUBLIC TRANSPORT MODES

Public transport consists of:

- Mass rapid transit;
- Intermediate public transport; and
- Personalised public transport.

Mass rapid transit is the backbone of city transport in large cities as it is the mode that carries a very large number of commuters using minimum space. Intermediate public transport, i.e., tempos and mini buses supplement mass rapid transit in large cities and are the main mode of public transport in nearly all medium and small size cities. Personalised public transport i.e., autos and taxis and cycle rickshaw cater to the demand of commuters seeking a substitute for personal transport.

MASS RAPID TRANSIT

The main modes of mass rapid transit are:

- High capacity: Metro rail, commuter rail, BRT, LRT, monorail, HSST (Mag lev), Linear Metro, Automated guide-way transit (AGT), Automated people mover (APM), inland water transport and several other modes, which are grade-separated from other traffic.
- Lower capacity: Trams and buses of various sizes operating in mixed traffic metro cable in hill cities.

High capacity metro rail and commuter rail (suburban rail) are already in use in India; so are buses of various sizes. BRTs have also started operating in Ahmedabad, Rajkot, Delhi, and Pune. An increasing number of cities in India are constructing/planning facilities to operate BRT. Use of Modern Tram (also called Light Rail Transit) may be possible in many cities. Broadly, the light rail system is similar in design and operation when compared to closed BRT systems. Modern Tram being at grade is very

Box 5.8

Financing Urban Transport : Non-Motorised Transport-Financing Cycle Paths and Cycles

Both segregated cycle paths and sidewalks for pedestrians are generally assumed to be part (or not part, as the case may be) of the normal design and financing process for roads. Finance for them thus comes usually from the road budget. The most extensive segregated network in the developing world is the 340 km cycloruta network constructed in Bogota during the same three years as the initial phase of Transmilenio. The $50 million which this cost was funded from the city investment budget. In such circumstances the critical issue is whether provision for NMT is contained within the national urban road design standards. Bogotá prepared and has available a Design Manual and Good Environmental Construction Practices guidelines for public works on its cycle way system.

There are some recent signs of development of earmarked finance for NMT. In 2008, the South African government published its draft proposals for NMT, which included the obligation for NMT plans to be prepared at both the provincial and local levels, and for an NMT fund to be established from part of the national Road Fund revenues (South Africa Department of Transport 2008). A similar initiative is being pursued in Botswana.

In poorer countries bicycle ownership has been a constraint. An early attempt to provide credit for cycle purchase in Lima, Peru failed because of the problem of collateral with the traditional municipal bank, as did an early lease programme in Tanzania. But group savings programmes in Kenya were more successful, as have been promotional bicycle sales in South Africa. Government support is critical, as in the South African shova kalula programme inaugurated in 2001, which now aims to roll out a million bicycles by 2014, but had only introduced 72,000 bicycles by early 2011. Other interesting recent contributions have been the bicycle recycling project in which old bicycles from the city of Aachen in Germany are recycled to the poor in Cape Town, South Africa; and the development of a short term bicycle rent programme in Hangzhou, China. Security of bicycle property is still a problem satisfactorily tackled in Japan and the Netherlands but not yet overcome in many poor countries.

Source: Gwilliam (2011c).

convenient for commuters. It doesn't cause any local pollution when compared with BRT. It allows for the possibility of operation of both trams and buses on the same tracks, depending on local circumstances.

Monorail, HSST (Mag lev), Linear Metro, (AGT), (APM) and several other modes are currently available internationally but are not in use in most cities as public transport systems. They are mainly used in special lines such as airport connection lines, local entertainment areas, amusement parks etc.

Medium capacity modes such as electric trolley buses or buses can be used for mass transit. These vehicles when used at grade with mixed traffic allow for low capacity but are often more flexible and convenient for commuters, especially over short distances.

Choice of MRT mode depends mainly on urban form, costs and benefits, demand level on a corridor, available ROW and the capacity of the mode. Other considerations are land use along the corridor, the location of building lines, and the potential for increasing the ROW, financing options—including how costs for capital investment and operation and maintenance are to be shared, etc. Other features such as convenience, cost, safety, eco-friendliness, energy and land conservation, aesthetics and local technology maturity from maintaining the system should be given due weight.

An important issue is at-grade or grade-separated construction. At-grade MRT is the most convenient facility for the commuter. Grade-separated modes increase trip time by 10 to 15 minutes to account for the need to go up or down. At-grade construction should therefore be the default priority.

In the metro rail projects undertaken so far, the concern to keep costs within manageable limits has seemingly resulted in a preference towards elevated construction. MRT projects have a very long project life. Elevated structures are often more land-intensive than underground modes. Cost calculations most often do not take into account the long term opportunity cost of the land. Underground metro rail has the advantage in keeping the city landscape more aesthetic. Elevated modes, road or rail have not been laid in the last few decades in any developed country and many important western cities have

Box 5.9
Designing Safe Public Transport

Research now shows clear evidence that the success of Public Transport systems is often dependent on the safety and perceived safety that it provides to commuters. Public transport safety needs to be guaranteed during the whole length of the trip: on the routes of access to stations or stops, during the waiting time and on vehicles. Old people and women are particularly sensitive to the problems of personal safety on public transport networks, and require special consideration in design. Communication and information, is an essential ingredient of a safe public transport system. It is necessary to offer as much information as possible and as clearly as possible so that public transport users are not disoriented or feel vulnerable in unknown areas. The reliability of the service is often seen as a key element in making for a secure experience of travelling. In public transport systems, unexpected failure to deliver punctually creates disorientation and generates anxiety, leading to commuters feeling unsafe. Interventions such as, a reliable night bus service makes an important contribution to safe local transport. Maintenance and design is another key factor in making people feel comfortable and safe. Lighting, good design, visibility at stops and stations are an essential component in creating feelings of safety and security. The immediate surroundings of public transport stops and stations have also to be checked in terms of safety.

Source: Cardia (2013).

also destroyed these structures to rejuvenate cities and street. Therefore the desirability of elevated systems needs to be examined very carefully.

In Indian cities however there is a requirement for affordable, dense and safe MRT networks that should be financially sustainable based on city resources, as far as possible. The MRT services should be designed as an integral part of any new development in urban areas. Dense, integrated public transport is required in our cities. Only such dense MRT (based on buses if they are to be majorly funded by city governments) can support transit in the already dense parts of our cities and can assists a shift towards high-density, mixed-use walking and transit-oriented urban environments. A city as a first step should organise the existing public transport into an integrated network to cover the whole city. These services can be operated by buses of various sizes as appropriate to demand level. Actual ridership will guide adjustments in the capacity needed and to be provided on each route. When the demand level exceeds the capacity of bus services and BRT, other guided MRT modes may be considered.

The safety and safety perception of MRT modes is a key factor in its wide based use and should be a key feature in the design on an MRT network. If the public MRT is not safe or perceived to be unsafe its usage cannot be ensured or improved, as large sections of users would avoid using such systems.

As per a recent analysis, 'the high rate of various taxes are one of the important reasons for the financial unviability of MRT modes, especially buses in India. Besides, as compared to other modes of transport, the levies on the MRT modes are quite inequitable'[43]. An important step that the government needs to take to promote MRT is to reduce/remove all taxes on MRT and taxis and make them more attractive.

PARA-TRANSIT/INTERMEDIATE PUBLIC TRANSPORT MODES

While para-transit modes are not a major mode in most developed country cities, many cities in the developing world including in east Asia have proactively worked out solutions to meet the varied requirements of users at affordable costs.

In India too some cities have been trying to integrate informal para transit with MRT. The informal para-transit systems are often organised in India, and with some Organisation al support from city governments they could be converted into formal public transport modes while improving the quality of service provided by them. New Technologies need to be used to improve service quality and provide more efficient urban transport, such as on-call cycle rickshaws, smart cars/battery-operated taxis and solar motor cycles. Para transit has essentially grown in market segments at price ranges that are not catered to, by the formal sector and therefore offer a very valuable service to users. This mode also has to be supported to develop dense integrated sustainable public transport systems across Indian cities.

These para-transit modes have the flexibility to move from acting as personalised transport to mimicking public transit by operating on fixed route for multi-

43. Knarola and Tiwari (2008).

Box 5.10
Importance of Perception of Safety in Public Transport

Equally important, violence and fear undermine attempts to improve active living, including active transportation, thereby exacerbating existing climate effects and illnesses, and also in multiple ways increasing the risk for onset of disease. The presence of violence also contributes to a diminished community environment and has social and economic costs, including decreased business development and fewer educational and employment opportunities for community members. The perception of violence exerts the same weathering effect as violence itself. Violence in the environment promotes a deep level of community-wide fear, which can lead to pervasive feelings of distrust, suspicion, and isolation and a subsequent drop in social interactions. Compromised social interactions contribute to decreased social cohesion and, consequently, underutilization of local assets, such as community centres walking paths, and parks that would otherwise facilitate healthy behaviors

Source: Cohen et al. (2013).

ple passengers. Radio taxis are increasingly becoming popular in large cities, while para-transit as public transport is expanding its role in small cities and some large cities in areas where the formal public system is not needed for the commuter demand. Improved technology in user interface as well as in vehicle efficiency and the inclusion of road space for locating these para-transit services can go a long way in making the service provided by these modes more convenient and effective for commuters while ensuring sustainability.

As stated earlier, use of intermediate public transport in Indian cities is extensive. Para-transit modes are playing an important role in providing mobility to a large section of the population. They are attractive for commuters as they often provide transit services at a variety of more affordable price points than other modes. While a number of safety and convenience factors in these modes need to be improved, they have a potential of providing clean mobility. Manufacturers should be encouraged to invest in improving the technology of these vehicles by:

- Setting up emission and safety standards under the Motor Vehicles Act.
- Banks and financial institutions providing low interest loans for small scale industry producing these vehicles, and attractive replacement schemes for operators.
- Dedicating 10 per cent of the cess money available with the Ministry of Industry from the transfer of technology for vehicle manufacturing for the improvement of intermediate public transport vehicles.
- Move from a 'closed permit systems' to an 'open permit system', for para-transit/intermediate public transport modes to make public transport more convenient[44]. This regime change should be accompanied by strict training and maintenance norms.

MULTIMODAL INTEGRATED AND CITY WIDE PUBLIC TRANSPORT NETWORK

Transport is inherently multimodal. Transport demand varies from corridor to corridor and so does the capacity of various modes. For an economic public transport network, the mode for a corridor should suit the demand level on that corridor. NUTP requires that a public transport system is coordinated and well integrated with efficient inter-change infrastructure and should offer a seamless journey to the users (NUTP, Para 21). The public transport network should be citywide so that the commuter is assured that he can complete his journey all the way by using public transport.

An essential adjunct of Multimodal Transport is the interchange points where commuters shift from one mode to the other. Efficient interchange points that avoid conflicting movements and impose minimum time penalty have a very important role in providing seamless travel to the commuter. This will make the commuter decide to use the public transport network as a matter of choice.

It is equally important that public transport is made user-friendly so that the commuter uses it voluntarily. The most important aspect is Multimodal integration; Physical integration, network integration, fare integration, Information integration and institutional integration. Besides the passenger information display system, integrated ticketing for all modes (common mobility card) and interchange facilities, use of intelligent transport system, facilities for handicapped, safety and security against hooliganism, vandalism and terrorism, national public transport helpline number are critical to promote public transport and should be a part of planning.

44. CiSTUP (2012).

Box 5.11

Uzbekistan: Mobilising the Informal Sector in Secondary Cities

Uzbekistan has a population of 24 million, with over TWO million living in the capital city Tashkent. No other city is as large; major secondary cities have populations of 500,000 or less. Rigid control of public transport fares in successor companies to the Soviet-era state transport agency Uzavtotrans led to a severe squeeze in operating margins, resulting in a decline in service and maintenance standards. In most urban areas, bus enterprises were only able to provide less than half of the planned capacity. In 2000, with an average age of over 10 years, 30-35 per cent of buses were unavailable for service at any given time and out of the buses that were put on the road on any given day, 25-40 per cent broke down after a few hours of operation. The decline in state urban transport services has been partly compensated by the emergence of private bus operators, which are typically single owner-operators with minibuses of seven or 11 seats. Their growth is fueled by cheap credit available to purchase seven-seater 'Damas' minibuses produced by Uz-Daewoo. Even though the private sector was performing an important role in maintaining an adequate level of service, it was undercapitalised and was deemed to operate in a uncoordinated and undisciplined way.

To introduce discipline and quality into a fragmented informal sector, the government reorganised the road transport sector in 2001, with Uzavtotrans dissolved into 400 Joint Stock Companies (JSCs).

This leveled the playing field by exposing JSCs to competition from private operators through competitive tendering for the allocation of urban passenger routes. By 2006, 941 urban passenger routes operated in Uzbekistan, and over 93 per cent were allocated on a tender basis. Consequently, the share of the private sector increased from 40 per cent in 2000 to about 70 per cent in 2005. Following the success of the franchising experience for urban bus routes, the government allowed open tenders for the allocation of suburban, long distance and international passenger routes.

A fundamental problem concerned the financing of new vehicles. The danger was that direct financing by the IFIs of vehicles for the traditional public transport undertakings would undermine the developments which had been achieved in the shift towards a more competitive sector, and would drive out the existing private sector undertakings. An independent bus leasing arrangement (Uztransleasing-UTL) was introduced in 2004 to overcome this; it would be able to satisfy the IFI requirements for finance without giving an unfair access to cheap funds for the traditional operators. The process was supported by technical assistance to develop financial management and operational procedures, model contracts to be used by UTL for bus leases, provisional agreements for prospective lessees, as well as substantial support for the staffing and training of the company.

The main aspects of this experience which appear to be of relevance to India are:

- The introduction of a competitive tendering system capable of handling both small and large operators in the bidding process
- The necessary restructuring of the public sector bus operation to make competitive tendering work effectively
- The development of leasing institutions that can assist small and medium enterprises to compete

Source: Gwilliam (2011a).

'Door-to-door' planning should be done in terms of time, cost and convenience to the commuter. Improved accessibility and last mile connectivity should be a vital feature of transport planning.

- Regular and dense public transport stops, within close walking distance from homes/office
- Places for bicycle parking at the public transport stops
- Safety and perceptions of safety at bus stops can be enhanced through proper design, maintenance as well as regularity and frequency of the public transport mode itself[45].

REGIONAL AND SUBURBAN TRANSPORT

The influence of urban centres extends to towns both in the immediate neighbourhood and those at some distance. These requirements should be met by suburban and regional services respectively. An important criterion in suburban and regional transport planning is the trip time and the level of comfort during travel.

Once the suburban rail enters the city, it becomes a part of the urban transport system. Regional/suburban transport services should be integrated with the

45. Cardia (2013).

Box 5.12
Modal Integration in Public Transport

To attract customers to public transport, which is necessary to solve congestion and environmental problems, it is essential to deliver a convenient and affordable product. A high level of service integration allows multimodal journeys to be undertaken without significant penalties either in total journey time or total journey cost. The first requires physical integration and the second requires commercial integration between the modes.

Efficient physical integration can be achieved using a hub-and-spoke philosophy, with slower modes or smaller vehicles serving low density residential areas feeding to a trunk network of higher speed modes. The trunk services in this sort of arrangement are not necessarily all conventional metros. For larger cities, such as London, Paris and Munich, suburban rail systems perform major trunk movement functions. In many Latin American cities, such as Bogota, Colombia, and Curitiba, Brazil a segregated BRT system operates.

Without a through ticketing system or an electronic travel card system accepted on all elements of the system, the monetary costs of modal transfer may preclude transfer, however good the arrangements for physical integration. While physical integration requires a long planning horizon for big infrastructure projects, commercial integration is cheaper and faster. Commercial integration can be achieved by a common payment mechanism that allows seamless transfers with automatic transfer rebates. In London the introduction of the electronic 'Oyster Card' made interchange between privately operated buses, private suburban railways and the London Underground carry no greater penalty than a change of line within the underground system itself. While negotiations of sharing of revenues can be difficult, the evidence of London suggests that there is sufficient overall benefit from co-ordination for all modes to benefit.

In many cities this sense of integration has been achieved by the establishment of a 'brand image' so that travelers can feel confident that there really is an integrated system at their disposal. The existence of a single marketing company for integration, sitting above the individual operating companies is often the critical requirement. The system in Curitiba is an example. Curitiba's buses are owned by 10 companies, managed by a quasi-public company that handles marketing.

Source: Gwilliam (2011d).

city network for easy dispersal. Institutional mechanisms need to be put in place to enable this integration. Currently, suburban rail is under the Ministry of Railways and the contribution of the state/city in the development of the stations is nil. There needs to be put in place a corporate institution, with the agreement of both the Railways and the city transport system, which will articulate the integration of the suburban rail services with the city mobility services. The area around the stations can be developed by the corporate entity on the principles of transit oriented development and it could be the platform for enabling common protocols like the common Mobility Card.

URBAN FREIGHT TRAFFIC

Freight traffic and movement of goods within the city and 'passing through' intercity traffic affects overall city mobility. Passenger movements are concentrated in the morning and evening peak hours; freight movements are spread over a 24-hour period. The size, low maneuverability, noisiness, and high pollution output of goods vehicles make their presence particularly objectionable. Goods pick-up and delivery in city centres are also seen as seriously problematic because of limited parking too. At the same time, goods vehicles, which typically are 10-15 per cent (GOI 2010-11) of the registered vehicles in a city, are vital to the economy and well-being of society. Commerce is dominated by goods vehicles, and the logistics industry in particular is dependent on road transport for pick up and delivery. Globally 'in urban areas, freight contributes considerably to both environmental and social challenges: upto 20 per cent of the traffic, 30 per cent of street occupation and 50 per cent of greenhouse gas emissions are generated by freight[46].Garbage pick up and fire protection are among many essential services that are vehicle oriented.

Logistics and freight transport in urban areas are a key input for the productivity and economic vitality of cities. There is a direct relationship between freight and urban jobs. In high-density mixed-use planned neighbourhoods and in western Europe

46. Savy (2012).

Once the suburban rail enters the city, it becomes a part of the urban transport system. Regional/ suburban transport services should be integrated with the city network for easy dispersal. Institutional mechanisms need to be put in place to enable this integration.

and Japan, with the changing demands on freight distribution new designs are being adopted. These new designs include laying out of the street, so as to facilitate deliveries, efficient management of delivery places and harmonising all elements of operation regulation (size of vehicles, time of access, etc.) at the scale of urban areas based on the trade-off between job creation and logistics nuisances.

Urban freight is a complex system, in constant change due to change in demands (decrease in door to door informal traders, more malls, more internet shopping, etc) and has economic, technical, political and social dimensions. It also has to straddle the bridge between these and there is no single decision maker, likely to transform the situation, but a constant effort of comprehensive innovation and cooperation of various stake holders. Several new concepts are being tried out which include delivery relays in commonplace shops, logistics shops, electronic lockers (Germany), drive-in retail shops, reliable home delivery and differentiation according to products (value, size and weight of consignments).

Currently, in most Indian cities the vehicles used are old, polluting vehicles operated with little professionalism, low productivity (direct cost), high nuisances (social cost) and have numerous illegal stops (second lane, middle of the street) and present a worsening congestion, an important hidden social cost. However land prices as well as some larger cities' strategies are driving Logistics exchanges/'mandis' further and further into the urban outskirts. This practice then leads to longer final haulage, potentially contributing to increased pollution, cost, and congestion. This is another area in which choices about land use and transport practices must be jointly considered in order to arrive at the optimal approach.

In urban India, especially in the large cities, over the next 20 years the urban freight sector will be a very important component, either aiding or constraining urban economic development. Currently for local authorities, urban logistics are not yet integrated within their concept of territory and their know-how but their inputs often have a significant impact on the sector and in turn on the productivity of the city's economy. The subject needs to be studied in depth to evolve planning norms that permit goods movement without affecting passenger movement. The current strategic trend of restricting and pushing out logistics and freight vehicles and interchanges to the outskirts of the city needs to be relooked at for better integrating urban freight to support job creating in cities and improve the vitality of cities.

Urban planners and policy makers have now proposed a set of measures to help improve the efficiency of goods vehicle operations. Some measures adopted from Arne Wittlov[47],include:

- Providing space on streets for loading and unloading of goods vehicles
- Supporting urban consolidation centres
- Measures to encourage night delivery services
- Installing shared bus and lorry lanes
- Improving vehicle design and customization
- Integrating planning and not pushing logistic depots into the cities periphery
- Encouraging the use of information systems and telematics applications
- Providing lorry maps in paper form and outline
- Providing information about prevailing traffic conditions and relevant facilities
- Encouraging the use of environmentally friendly goods vehicles

PARKING

It is now well recognised that parking demand is insatiable, in an environment of rapid increase in private vehicles in larger cities. Conventional policies encourage more parking supply to meet ever-increasing demand. The approach should instead shift to modulating supply to maintain a sustainable level of vehicle traffic and space devoted to parking rather than other urban amenities. NUTP, for example, has advocated levy of high parking fee that represents value of land occupied and to allocate parking space to public transport and non-motorised transport on priority.

Under the on-going reform process in India, cities are expected to make the transition from the conventional approach of providing more parking facilities, to using parking as a demand management tool. This is the case in most developing country city contexts as elaborated in Box 5.14. The strategy should be to minimise and avoid serving each building with its own parking. It is more judicious to build parking for the neighbourhood. If the policy can be reoriented to provide parking for each development area instead of each building then the parking requirement will also be modest. Standards can vary from zone to zone or city to sub-urban areas within the city and may be reviewed periodically and revised if necessary. The key message is that parking should be shared, common and not individually owned, and it should be priced. However this of late has led to the propagation of the construction of a number of multi-storied parking facilities, as 'cities are clueless about the ultimate goals of parking policy and how

47. Wittlov (2012).

Box 5.13

Parking as a Restraint Measure in National Urban Transport Policy

It is also time to assess if the new investments in parking are consistent with the policy position of the Government of India. The policy position emerges from the NUTP which is administered by the Union Ministry of Urban Development. It is important to note that the NUTP has taken on board the travel demand management principles very explicitly. It states:
Land is valuable in all urban areas. Parking places occupy a large part of such land. This should be recognised in determining the principle of parking space.

Levy high parking fee that represents value of land occupied.

This should be used as a means to make use of public transport and make it more attractive. Graded parking fee should recover the cost of the land.

Public transport vehicles and non-motorised modes of transport should be given preference in the parking space allocation. This along with easier access of work places to and from such parking spaces, can encourage the use of sustainable transport.

Park and ride facilities for bicycle users with convenient interchange are a useful measure.

In residential areas also, byelaws need changes to free the public carriageway from parked vehicles impeding the smooth flow of traffic. Make provisions in the appropriate legislation to prevent the use of right of way on road systems for parking purposes.

Source: CSE (2012).

the multi-level car parks fit, if at all, into the overall policy paradigm'[48].

Parking standards should vary from zone to zone or city to sub-urban areas within the city and may be reviewed periodically and revised if necessary. The key message is that parking should be shared, common and not individually owned, and it should be priced.

The NUTP has advocated levy of high parking fee that represents value of land occupied and to allocate parking space to public transport and non-motorised transport on priority. It treats parking as an essential infrastructure that must service all buildings and recommends that public infrastructure funding should be tied with it. Some positive principles which need to be followed are:

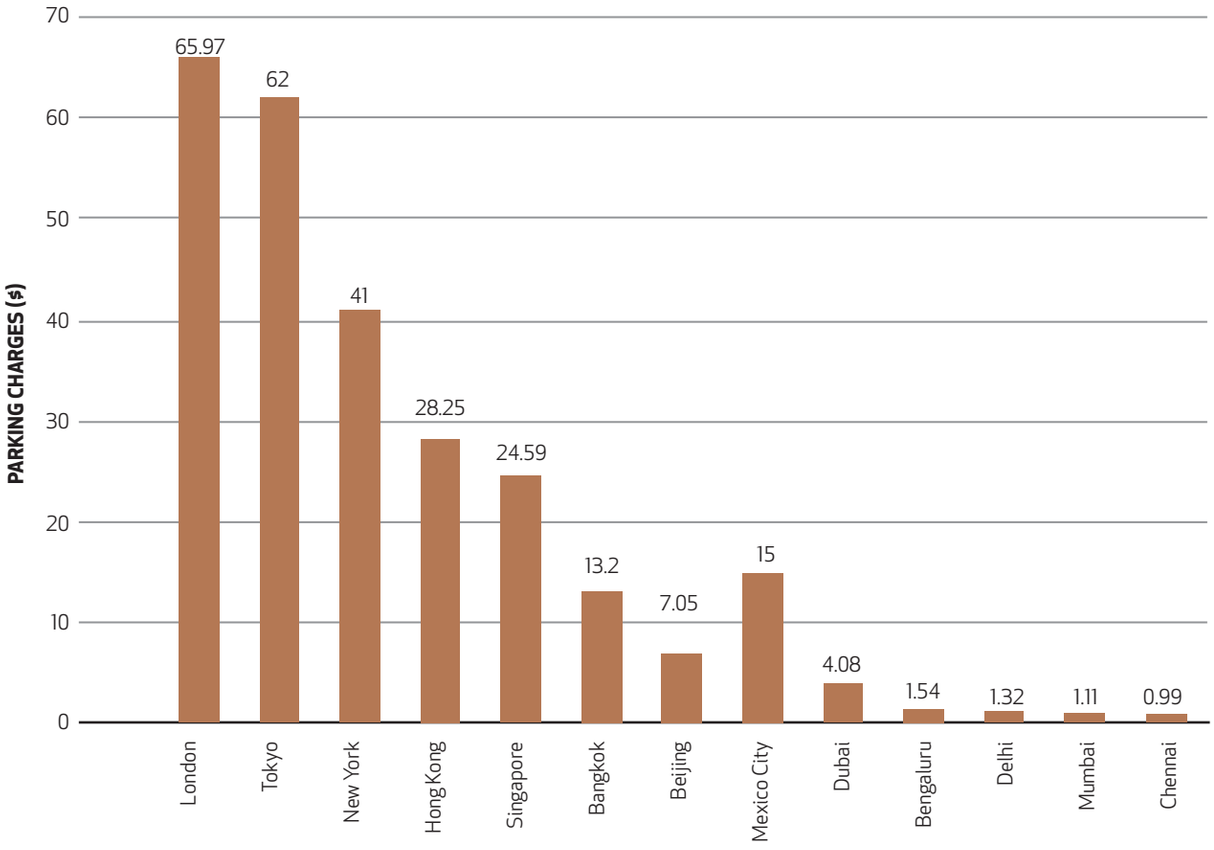
- Parking management is to be used as a demand management tool—to decrease use of private vehicles and thus reduce overall demand of parking, and shift travel to public transport, para-transport and non-motorised modes.
- Parking is a consumer commodity, not a legal right. No subsidised parking is to be provided in public spaces. User must pay full cost of parking facility based on land opportunity cost, capital cost, operation and maintenance (O & M) costs and temporal demand.
- Private vehicle must be parked on 'a fully-paid rented or owned' space. Proof of the same must be furnished before registering a private vehicle.
- Spaces already designated for parking must be utilised to highest efficiency and financial viability.
- In the influence zones of the MRTS stations, a maximum limit on parking spaces should be imposed so as to enable shift to public transport from personal transport.
- On-street parking should be discouraged to the maximum extent possible or should be highly priced as compared to off-street parking.
- Off-street parking must be provided with park and ride facility and the responsibility of keeping the streets, in the vicinity of multistory parking, free from unauthorised parking with the help of traffic police should be with the multistory parking operator.

TRAFFIC MANAGEMENT MEASURES

Smart traffic engineering and management optimisation measures do not carry major costs and are critical to avoid congestion. A traffic management unit is therefore essential in each city. Table 5.16 shows the typical Functions and Responsibilities of a Traffic Management Unit.

48. CSE (2012, p. 1).

Figure 5.9
Comparison of Parking Charges in Various Cities, 2011



Source: Collters International (201)- CBD Daily parking charges (in US $).

SAFETY

The need to improve safety in urban transport in India does not need any justification. Fatalities in India per million of population have steadily increased. The actual situation may be much worse as a number of accidents are not even reported. Within adequacy of the existing road infrastructure to handle the ever increasing traffic, road safety is deteriorating rapidly and requires urgent attention. A MORTH Committee on Road Safety and Traffic Management, also known as the Sundar Committee, estimated about 50 per cent increase in road accidents over a 10-year period (2005-15)[49].

Some of the major concerns regarding road traffic safety are[50]:

- Traffic fatality rates have been increasing in most cities
- Pedestrians, bicyclists and two wheeler riders comprise of 60-90 per cent of the total fatalities
- Motorcyclists represent a large portion of urban fatalities (about 25 per cent)
- Several studies indicate that the involvement of trucks in fatal crashes is high
- Nighttime driving in India is substantially riskier than daytime driving
- Alcohol involvement in road traffic crashes has become a serious concern

All million plus cities should have measureable urban transport safety plans and indicators developed in the short term. There should be a programme that ensures that the plan is implemented over the next 10 years. The measures/strategies for road public transport safety should include specialised facilities for non-motorised transport; should curtail speed of vehicles in arterial roads and in local streets to help enforce all safety aspects as prescribed in the Motor Vehicles Act.

Today no single agency or department is responsible for improving safety in a comprehensive, scientific and a systematic manner in a city. The organizational framework to deal with all road safety related issues should be provided by creating a Safety Board at state level with safety cells in cities with dedicated personnel and budget. Relevant R&D shall be a part of the research programme to minimise injury and the consequences in the event of an accident. Rescue services should be organised to provide relief in the fastest time possible. Also protocols of Road Safety

49. Ministry of Road Transport and Highways (2007).
50. Mohan et al. (2009).

Box 5.14
Controlling Private Vehicle Use: Parking Policies

European cities have reallocated street space in favor of pedestrian, bicycle, and public transport use by reducing available parking spaces. Copenhagen has used parking removal to create a network of pedestrian areas, and Strasbourg, where on-street parking was removed and placed underground to make way for a tram line. In recent years, some larger European countries have instituted maximum limits on the total number of parking spaces (on-street and off-street) that may be provided in congested city areas. European cities deploying these measures include Budapest, Copenhagen, Hamburg, London, Paris, Strasbourg and Zurich. This reform has required changing building codes to freeze the existing supply and ban any future development of parking spaces. For every off-street space created in central area of Zurich an equal number of on-street parking spaces must be eliminated. These maximum limits in European cities have had a positive effect in reducing traffic congestion. Similar to establishing parking quantity by zone, several European cities also regulate parking duration by zone. These zonal designations are developed to better tailor parking pricing and duration to the land uses, densities, and transit characteristics in these zones. This policy is also followed in some Asian cities.

It is now standard practice for all large European cities charge for on-street parking in areas with significant parking demand. However, as city size becomes smaller the application of paid on-street parking becomes less common. For example, all cities in the Netherlands with a population of over 100,000 levy street parking charges. In contrast, only 1/3rd of cities with 20,000 to 50,000 persons have paid street parking, and only about 15 per cent of cities with fewer than 20,000 inhabitants use paid parking systems.

While the primary purpose of charging for parking should be to limit traffic and to better ration the use of available parking spaces, revenues from parking can be substantial. In Amsterdam, a city of approximately 1.4 million population, the city was estimated to collect EUR 130 million (approximately $175 million) in parking fees during 2009 or nearly a quarter of its total tax revenues. London, (population 7.6 million), also collects substantial sums from motorists from on-street parking amounting to 170 pounds sterling (approximately $270) per registered vehicle during the fiscal year 2008/09.

Source: Gwilliam (2011b).

Audit (RSA) by an independent and well qualified auditor who reports on any deficiencies in safety aspects and prepares recommendations on improvements that may be necessary, need to be put in place.

With respect to other aspects regarding improving safety, the recommendations of the Sundar Committee report on road safety and traffic management, should be speedily implemented. A more detailed elaboration of safety issues is presented in Chapter 12 on Safety in this report.

SECURITY

The need for security against vandalism and crime is increasing by the day. Security is needed for commuters, particularly women and children and operators and staff on duty. It needs to be dealt with in a systematic manner. Security is important over all parts of the journey: stations, stops, shelters and on-vehicle. It covers both passengers and operators.

The presence of young people and people who have been drinking tends to make other passengers more uneasy. Young people are more likely to be bullied or intimidated by other young people than by adults. People with learning disabilities are particularly subject to harassment and bullying. Majority of incidents of harassment or intimidation go unreported. Developing an Effective Strategy is the need of the hour and should include:

- Design solutions including the use of robust materials, good lighting, clear sightlines
- Management solutions such as the presence of trained staff, effective surveillance, procedures for reporting incidents
- Partnership initiatives such as effective liaison with the police, work with schools, and sponsoring initiatives which promote public transport to young people
- Planning for security should become a part of urban transport planning
- Use of principles outlined by professionals promoting Crime Prevention Through Environmental design (CPTED)

Table 5.16
Typical Functions and Responsibilities of a Traffic Management Unit

DIVISION	FUNCTIONS AND RESPONSIBILITIES
Traffic Management Policy	Formulate and Implement city wide 'Traffic Management Policy' to comply with objectives defined by the 'city council' which would include, at least such areas as determination of (i) a functional road hierarchy; (ii) the appropriate balance between transport system users (private transport/public transport/NMT/pedestrians; (iv) priority programmes for action; and (iv) a 'five year' investment plan'.
Traffic Research	Assemble/survey, monitor, analyse and evaluate all traffic and accident data to enable trends to be identified, problems quantified and traffic management plans and improvements to be prepared.
Traffic Management Plans and Improvements	Plan, design, implement, monitor, evaluate, fine-tune and continuously up-date traffic schemes and policies to realize the agreed Traffic Management Policy. The programme would cover all motorised road based modes (cars, public transport, trucks, etc.) and all non-motorised modes (pedestrians, cycles). Plans and improvements would range from simple junction improvements or marking and signing programmes through to far reaching city wide strategies such as extensive bus priority or pricing. Safety considerations are part of any scheme planning and design process but specific safety programmes and accident counter measures would be a responsibility.
Traffic Control Devices	Plan, design, install, operate, and maintain all traffic control devices including (i) traffic signal systems including computer-controlled systems; (ii) road markings; (iii) road signs and, (iv) enforcement devices (cameras etc.)
Traffic Regulations	Formulate traffic regulations to realise the proposed Traffic Management Plans and Improvements, for enactment by city government and for enforcement by the traffic police.
Parking Management	Prepare off- and on-street parking policies and programmes including approval for the location of and access to parking areas proposed by others. Parking enforcement and administration (for example, where paid parking applies) would be carried out by a separate parking authority' or equivalent.
Approvals and Co-ordination	Evaluate and advise city government on all schemes (e.g., new roads) and developments (developed both by public and private sector agencies and including major new land or building developments) which have a significant traffic impact to ensure that they are consistent with agreed traffic policy. In effect carry out traffic impact studies for all major development proposals.
Consultation	Consultation with the public and stakeholders on traffic policy and on the impacts of specific schemes and measures.
Budget	Preparation of an annual budget for submission to city government for (i) implementation of Traffic Plans and Improvement Schemes; (ii) traffic operations and maintenance of control devices; and (iii) the continuous work of the traffic management agency.

UNIVERSAL ACCESSIBILITY

The Constitution of India ensures equality, freedom, justice and dignity of all individuals and implicitly mandates an inclusive society for all including persons with disabilities (Box 5.15). In the recent years, there have been vast and positive changes in the perception of the society towards persons with disabilities. It has been realised that a majority of persons with disabilities can lead a better quality of life if they have equal opportunities and effective access to rehabilitation measures.

Universal accessibility needs to be provided, by the UT systems, both at the systemic level and the infrastructure level.

- Accessibility at the systemic level implies that components of public transit systems like trains and buses, their stations and stops, the ticketing and any other user interfaces should be within reach of people with different types of impairments.
- At the infrastructure level, pedestrian paths and crossings, parking facilities and access to public land uses should be inclusive in their design for differently abled persons.

NEW TECHNOLOGY APPLICATIONS

New technologies have the potential to address the key challenges for UT and change the way we commute. New transportation innovations and linking and optimising them could provide convenient, affordable door-to-door trips for users.

Sustainable mobility is not only about private motorised vehicles becoming more smart, which however can contribute to improved environmental outcomes through hybrids engines, plug-in electrics, or even about alternative fuels like ethanol. While many private manufacturers are investing in improving technology to make vehicles safer, more fuel-efficient and environmentally sound, the real contribution would be to improve the performance parameters in Public Transport and para-transit modes. Clear policy directions would encourage mass transit modes to mainstream greener vehicles. Sustainable mobility is a system where public transportation is central and personal vehicles are peripheral, but both operate on improved environmental norms and standards.

Recent efforts of technical innovators aligned with public transport managers has been to rapidly infuse all these disparate modes with Information Technology (IT) and telecom interfaces, thereby creating passenger-information platforms that can tell commuters beforehand, through a mobile phone or any device, when their bus will arrive, or when and which metro train to board for their onward journey. It would also promote common ticketing across modes.

The auto sector is attempting to reduce congestion and grid-locks on roads and in the short term this is expected to give a fillip to vehicle-to-vehicle communication technologies and collaborative consumption like car sharing. While the private car industry is investing heavily into improving technologies, serious attention needs to be paid to improving technologies for public transport and para-transit. Some companies have been improving buses and bus systems. Recent technology allows a person at a base station to monitor if the driver of a bus is accelerating too fast, braking aggressively, or whatever, and much of this data can be gathered. However more effort would be required to improve the efficiency of inter-modal transfers through IT-based methods. Also more emphasis is necessary of using intelligent systems to integrate taxi and auto rickshaws, para-transit, public and personal (dedicated autos/cycle rickshaws, etc.) with the public transport network on a round the clock basis, as this could also go a long way to make public transport more attractive to users.

SECTOR INSTITUTIONS AND GOVERNANCE

INSTITUTIONAL FRAMEWORK

India's ability to meet the ambitious goals for transformation of urban transport as part of a larger urban development strategy requires more than policy commitment. The institutional framework for defining, refining, and implementing policies will also have to be strengthened and integrated with India's larger federal governance structure. The Constitution of India, does not specifically list the urban transport sector, making it to a large extent a constitutional and institutional orphan. The present institutional arrangements to manage urban transport are fragmented and the responsibility is diffused. At the city level, several agencies are involved in the management of various components of UT (see Annex D). At the state level, UT is managed either by the Urban Development, Municipal Administration, or by the Transport Ministry as a subject, though often there are a number of agencies that provide urban transport services that may not report to these departments administratively. At the Central Government level, UT is being managed by three Ministries Urban Development, Railways, and Road Transport and Highways. Other than this the laying down of standards and norms for urban roads is being undertaken by the Indian Roads Congress.

Box 5.15
Long Way Ahead for Disability Access on The Ground

'I have been in a wheelchair for the last five years and in all this time, accessibility has not improved one bit in public spaces, at least not enough to enable me to venture out on my own. People on the road still stare, awareness continues to be limited', reveals a former ace swimmer, who is now on a wheel chair after a swimming accident. Articles 14, 19 and 21 of the Indian Constitution recognises that persons with disabilities shall be provided accessibility on an equal basis with others to the physical environment, transportation, information and communications, and other facilities and services provided to the public, both in urban and in rural areas. Yet, inspite of the estimated number of differently abled people being as high as 70 million in the country, they continue to be an 'invisible minority'.

A new updated disability bill draft is being considered by the government. The new bill aims at updating provisions, while widening the definition of disability. It also envisages the establishment of national and state disability rights authorities.

However many experts and social activist feel that new laws are meaningless and regulations have remained on paper, after decades of neglect and continued stigma, they are not convinced that new laws will see any improvement on the ground. Disability planning needs to be streamlined at all levels. Disability is now being captured in the Census data. The 1995 Disability Law clearly stated that public spaces should be made accessible for persons with disabilities, there still is a long way to go to achieve this goal. Even new buildings that have been constructed post-1995 are yet to be made barrier-free. At a daily level, the barest of daily activity that the 'abled' take for granted in India's big cities are mostly inaccessible: 'None of the traffic lights are audio-enabled. Pavements are not smooth enough for a wheelchair. Even in supposedly inclusive systems like the Delhi Metro, there is only one entry-exit that has an elevator. What if you need to cross the road? The metro feeder buses are inaccessible. At most bus stops, there is no seamless movement from the platform into the bus. The BRT system too is flawed—how will a person with physical disability get to a bus stop planted in the middle of the road? And now there is talk of replicating it, despite protests,' says the founder of non-governmental agency AccessAbility, .

Most government effort to address better accessibility has been sporadic, while what is required is that civic agencies come together to build long-term, large-scale barrier-free infrastructure. Some private companies are now trying to engage differently abled persons and developing offices which are barrier-free. New ways of partnership are required to make disability access a national movement so that all public spaces and relevant private spaces provide equal access opportunity for the differently abled.

Source: Adapted from Bhatt (2012).

This state of affairs is not conducive to the provision and growth of urban transport along a sustainable path. Rectification of this weakness has become all the more urgent in view of the huge investments projected to be made in this sector.

Urban transport institutions also require investment in appropriate expertise, both in terms of human capital as well as data and decision support systems.
Proposed institutional framework

Chapter 5, Volume II on Governance highlights the two overarching priorities for urban transport: (a) building up expertise on urban transport strategy, particularly at the urban and state levels where decisions on responses to varied needs will need to be taken; (b) defining the locus of responsibility and accountability for urban transport in a way that encourages and enables integration across modes and between urban transport and broader urban development efforts. This chapter provides additional detail on how such changes could be initiated.

In order to provide dedicated attention to urban transport to enable it to grow along a sustainable path and to incur the level of expenditure envisaged, the institutional framework to deal with this sector is proposed as follows:

- The primary responsibility for UT should lie with state governments. This report has recommended creation of state-level Offices of Transport Strategy which may be the locus for urban transport, in collaboration with agencies for urban development. Devolution of expertise, formal notification of jurisdiction in keeping with the Constitutional division of powers, and rapid investments in

building state capacity for safe, environmentally sustainable, urban transport must be undertaken. Urban transport is a key component of urban development, which as per the Schedule 6 of the constitution is a state subject, Therefore, the key responsibility for urban transport should explicitly lie with the state government and the Urban Local Body.

- States should also enact comprehensive urban transport laws, with the possibility of model guidance from the Centre. The Centre can set out the roles and responsibilities of the multiple city and state-level entities with regard to public transport, land use and public transport integration, multi-modal integration, safety, facilities for walk and NMT, etc.
- Over time, UT responsibilities should be devolved to metropolitan and city authorities, particularly for cities of more than 1 million. This report has recommended strengthening of the Metropolitan Urban Transport Authorities as a counterpart to state and national OTS. The 74th Constitutional Amendment 1992, which aimed at transferring a number of urban service responsibilities to urban local governments, did not mention urban transport/public transport, but transport responsibilities are integral to the urban planning functions recommended for the Metropolitan Planning Committees to be established in larger cities. This arrangement is also consistent with the principle of subsidiarity guiding recommendations in Chapter 5 on Governance. Box 5.16 on Recife provides an example of this kind of arrangement. The national government will inevitably retain an important role in financing urban infrastructure, given India's fiscal structure. Such funding should be technology-neutral as far as possible, and linked to mobility, access, environmental, and other system outcomes rather than specific approaches to urban transport.
- The national government may also play a role as technical advisor while state expertise is being created. This report proposes creation of a national Office of Transport Strategy which would liaise primarily with the Ministry of Urban Development, and also with Rail, and Road Transport and Highways as needed to generate overarching strategy guidelines.
- The national government would be responsible for creating standards for urban transport performance, including safety, environmental impact, and other national goals.

The Central government cannot be directly responsible for urban transport in each city in a federal set up like India, with a wide diversity of contexts. Central government oversight of urban transport, other than in setting standards for national goals such as safety, efficiency, and environmental impact as well as public investment management, is inconsistent with international experience as well as economic logic.

States are a natural locus for urban transport in India's current circumstances. Larger cities can and should assume the primary responsibility for metropolitan transport as broader urban reforms catch up with constitutional commitments. The arrangement in London, a city with approximately the same population as Bangalore (and less than Bangalore Urban Agglomeration) is elaborated in Box 5.17 as a reference point.

However, states would continue to play a role in ensuring equitable development of urban transport and efficient use of expertise for smaller cities that may not have the economies of scale to develop their own urban transport strategies.

This new institutional framework would redirect lines of accountability from existing agencies engaged in implementation and operation of UT-related projects to ensure that they would continue in their present implementing roles, but guided by more integrated decision-making.

ROLES OF DIFFERENT STAKEHOLDERS

Within this broad framework, the roles and responsibilities need to be clearly defined.

CITY GOVERNMENT

Most of India's cities would work closely with their respective state governments to design transport strategies appropriate for their size and growth. Cities should be expected and empowered to be the locus for data collection on traffic pattern, land use patterns and proposed land use changes, and other factors feeding in to the transport strategy. In this way, urban local governments could 'learn by doing' as they grow.

Cities to which urban transport authority has been devolved must be provided with a strong institutional framework, an effective organisational set up with a dedicated agency to look after planning, coordination and implementation of urban transport services, legislation, a resource generation policy and adequacy of skills. A three-level organisational set up is therefore proposed for the city.

- Metropolitan/District planning committee/ inter-municipal cooperative arrangement.
- Dedicated authority for urban transport (MUTA).
- Other existing city transport agencies.

METROPOLITAN PLANNING COMMITTEE

The constitution and activation of the 'Metropolitan/District planning Committee' (MPC/DPC) as envisaged in the 74th constitutional amendment for

Box 5.16

Voluntary Collaboration in The Recife Metropolitan Region, Brazil

Brazil is a federation of states, with the attribution of responsibilities between the jurisdictions contained in the formal constitution. Each level of government has a democratically elected government to implement the powers attributed to that jurisdiction by the constitution.

The Recife metropolitan region (RMR), in the north east of Brazil, consists of 14 contiguous municipalities with an area of 2,208 km^2 and a total population of 3,337,000, at a density of 1232 per km^2. The state capital, Recife accounts for 1,422,000, and the three central municipalities (including Recife) for 2,370,000 of the total.

Responsibility for urban public transport in RMR is divided between the state of Pernambuco (generally responsible for inter-municipal transport) and the constituent municipalities (generally responsible for intra-municipal transport). However, with the exception of Recife the majority of trips generated in all the municipalities are inter-municipal. For that reason, the governments of the state and the Recife municipalities, committed themselves to work together in a consortium to address the problems of urban transport. It is expected that the other municipalities will join the consortium as it develops. The formal sector bus services and the metro system were brought together in the Estrutural Integrado Sistema - SEI which consists of a network of services, integrated both physically and in terms of a through ticketing system, which allows interchange in closed terminals without payment of a second fare. The SEI is complemented by an open system, with ticket sold for single trips.

The tariff structure in the RMR is zonal, based on a set of semi circular rings around the centre of the metropolis. The number of zones, originally five, has been progressively reduced to two, with the last simplification being the merging of all trips above 32 km into a single zone, which occurred in 2004. There are also special tariffs for the trunk lines of the SEI and for some lines operated by microbuses. The metro system has its own tariff, but is also included in the SEI so that passengers can use the metro lines for trunk movements in multi-modal trips at the integrated tariff rate.

A social survey of April 2004 indicated that public transport is the transport of the relatively poor, with 53 per cent of the public transport users having family incomes less than 2 minimum salaries, and 89 per cent having less than 5 minimum salaries…However, the issue of the affordability of essential transport to the poor is dealt with directly by the 'vale transporte' system. If requested to do so by an employee any employer is obliged to provide a ticket for the journey to work, for which he can deduct a maximum of 6 per cent of the workers' salary As in principle the VT is only sold for use on the formal public transport system the it should tie employees to the formal public transport operators. In practice, however, the VT became a secondary currency, which could be used on informal transport as well as formal. To overcome this the VT has been converted into a personalised, electronically readable ticket.

The executive authority for implementation of policy is the 'Empresa Metropolitana do Transport Urbanos (EMTU). This body establishes the lines, schedules, frequencies, types of vehicle and all other matters pertaining to the control of inter-municipal bus transport in the RMR. The responsibility for control of intra-municipal bus services rests with the individual municipalities, though Recife and Jaboatao have delegated this responsibility to EMTU. In practice, therefore, the bulk of the bus services in RMR are controlled by EMTU, which makes all the effective decisions of a policy nature.

All bus services are provided by private companies. The maintenance of some less unremunerative services (and operators) by internal cross subsidy within the system is facilitated through a clearing house known as the Camara do Compensacao Tarifaria (CCT). Individual operators retain the direct fares that they collect, and the revenues obtained through cashing in of VTs with EMTU. Payments for student concessions go directly to CCT and form a buffer which is then distributed to balance the interests of different operators. The entitlement of each individual operator is calculated by a cost based formula including fixed costs (vehicle depreciation) and variable cost components. The payment is in the form of a price per vehicle kilometer planned, related to the particular fleet operated.

The state and the municipalities will establish a 'Consortium' and will transfer the integrated management and development of all public transport modes to this consortium. 50 per cent plus one of the shares of the consortium will be held by the State, 30 per cent by the municipality of Recife and the rest by the other municipalities in proportion to the magnitude of their participation in the sector. The small vehicles (kombis, VPP) which have operated in a very irregular and uncontrolled way have been driven out of the central municipal area of Recife, while some of the kombis are being integrated into the existing system through regulation and issuing of licenses through a tendering process.

Source: Excerpted from Annex 2 of Gwilliam (2011d).

cities especially with more than a million population is important to address both inter-sectoral coordination as well as geographic jurisdictional coordination, particularly for large regional urban transport projects. While the MPC/DPC has made limited progress so far, it is an important and constitutionally legitimized focal point for resolving inter-jurisdictional and macro regional decisions and coordination issues, which have significant investment impact. UT like other large network investment projects can be a strong beneficiary of such an institutionalised and capacitated system. The MPC would inevitably subsume the current Development Authorities.

DEDICATED AUTHORITY FOR URBAN TRANSPORT (MUTA)

The NTDPC is fully supportive of the National Urban Transport Policy 2006, that large metropolitan cities with population in excess of one million set up the 'Unified Metropolitan Transport Authority' (UMTA). The MUTAs proposed in this report could be thought of as fulfillment of this mandate. This authority should take care of the connectivity with the surrounding suburbs and region as well. As per the NUTP, the MUTA should not report to the Secretary of Urban Transport in the State Government, but to the MPC/DPC. The UMTAs created till date report to Development Authorities and would need to be re-aligned.

As discussed in Chapter 5, Volume II on Institutions for Transport System Governance, the current UMTAs act more like advisory committees and not as empowered technical decision making and coordinating bodies, more often representing state-level interests than local-level ones.

The NTDPC is strongly of the view that this is not a desirable approach and proposes that instead of calling the entity 'Unified', it could be called 'Urban', thereby putting to rest any ambiguity on the reporting/ownership arrangement of this entity. Thereby the 'Metropolitan Urban Transport Authority, (MUTA)' should either report to the MPC/DPC or to an inter-municipal cooperative arrangement created by the urban local bodies involved. Hereafter the mention of the MUTA means the Metropolitan Urban Transport Authority.

The NTDPC, in line with the NUTP 2006, envisages the MUTA primarily as a holistic and integrated decision making and coordinating body to bring about Policy, Planning and Service Co-ordination, to decide on capital financing and long term investments and to monitor implementation. As in the NUTP 2006, the MUTA should be further supported by a professional body that will study and make recommendations on various issues for consideration and decision by MUTA. Rather than have two separate bodies NTDPC proposes that MUTA be made into a full time professional body working under a city council with representation from all city agencies and stakeholders including the surrounding region.

The MUTA should undertake all work related to urban mobility in the city. This will include: strategic and policy functions; regulatory functions; integrated planning; transport demand management; organising services; providing common services; resolution of day-to-day matters and monitoring the work assigned to implementing agencies both for the city and the surrounding region. For MUTA to be effective it should be backed by legislation and the entire funding for urban transport should be routed through MUTA. All one million plus cities should have an MUTA and this should be incorporated in an inter-municipal cooperative manner. In large five million plus cities, the MUTA should host its own counterpart to the Office of Transport Strategy (OTS), which would be a dedicated technical-strategy team looking at future plans and responsible for analysing alternative project possibilities and technologies and then undertaking a broad-based consultation exercise to inform decision makers on the options. This function of the OTS could be centralised at the state level for other million plus and smaller cities in the state.

While inter-municipal bodies are common in many countries there are, very few Indian instances. Some can however be witnessed, as in a couple of municipalities north of Mumbai, when a cluster of smaller towns cooperate to run common facilities such as

Box 5.17
Unified Transport Authority: The Case of London

The Greater London Authority is a unitary authority headed by a directly elected mayor. It is responsible for a number of functions including transport, policing, fire and emergency planning, economic development, land use planning, culture, environment, and health.

Within the transport sector the Mayor is responsible not only for public transport but also for the major road system and for traffic management and parking policy. By combining these functions he is able to formulate transport policy on a comprehensive and strategic basis, integrating the traffic and public transport functions and determining the priorities for expenditure in the sector. The Mayor sets bus, underground and taxi fares, and determines how much money is available for procuring tendered services. He might thus be regarded as a one-man elected Transport Authority.

While key strategic powers rest with the Mayor, operational responsibility lies with Transport for London (TfL), which is accountable to the Mayor and responsible for delivering an integrated and sustainable 'Mayor's Transport Strategy'. The Strategy covers all modes for which TfL has responsibility including buses, metro, roads, walking, cycling, freight and water transport. Although not responsible for sub-urban rail, the Strategy promotes a policy of partnership with the responsible agency.

In addition to the Strategy, Transport for London (TfL) is responsible for:

- Managing the 580 km network of major roads termed the Transport for London Road Network (TLRN)
- Managing/operating/owning all traffic signals (about 4800 installations)
- Managing London Buses through London Bus Services Ltd which regulates the service (provided by over some 3730 kms of bus routes), contracts the routes to the private sector (operating some 7000+ buses); TfL provides and owns infrastructure (stops, terminals) and finances on-road bus priority (currently 1000 bus lanes totalling 240+ kms) on both its own TLRN roads and Borough (2nd tier authority) roads
- Managing London Underground (the metro system)
- Managing/operating/owning some lesser public transport services such as London River Services, Trams (28km), and Docklands Light Rail (26km).

The Mayor obtains funds partly from transfers from the central government, partly from local taxation and partly from the congestion charge road-pricing scheme. The level of subsidy has varied greatly over the last two decades. From covering less than 50 per cent of costs from the farebox in the early 1980s, after the introduction of competitive tendering of services from private sector suppliers the deficit was reduced to nearly zero by 1998. Since then, a political decision to increase the quality of service, while keeping fares down has resulted in the deficit rising to about 40 per cent.

Source: Gwilliam (2011d).

fire stations, joint water source development projects, solid waste management facilities and common urban transport routes/buses.

Operation of bus, rail and other guided transit modes, Bus Priority Schemes, Water transport etc. are often entrusted to specialist agencies. This should continue. Construction of infrastructure, operation and maintenance thereafter will be by the relevant agency. Permits for stage carriage operation including para-transit should be issued only as approved by MUTA.

To enable the proposed institutional framework to deliver, it must be provided with adequate means and authority. The best way of imparting the desired strength to institutional framework essentially MUTA is to give it the authority for allocation of funds to various agencies in the city to undertake various UT-related activities. The performance of MUTA can be measured in terms of parameters such as the travel speed and the level of air pollution in the city. Thus the aim should be to have an authority with full powers, but which should be accountable. The mandating of this format of the MUTA needs to be part of any new model legislation on UT developed by the Central Government.

International experience offers two broad lessons for building strong metropolitan transport authorities: first, funding is necessary to create convening power and the ability to motivate coordination across

stakeholders; and second, other than access to funding, there is no one best answer for institutional form to ensure coordination.

There is no 'best practice' strategy for urban transport planning, in part because it is intertwined with other aspects of urban governance. Institutional frameworks can and do take many forms. The case studies summarised in Boxes throughout this report outline a wide range of institutional possibilities, starting with three levels of metropolitan transport coordination. Transport can be part of the duties of a metropolitan-level government, a special-purpose metropolitan-level transport agency that coordinates the systems for a number of city/suburb-level governments in an urban agglomeration, or a public transport authority focused on a public transport system operating on and alongside the infrastructure for private motorised/non-motorised transportation. The legal forms of institutions also vary, with some created by national law, others by state law, and some by voluntary association between municipalities. The organisational structures also vary from being a committee of the municipal government, independent agencies reporting to political appointees of local and in a few cases national government, or companies managed by a board representing stakeholders. It is difficult to rank the varying arrangements' performance given variation in their purposes, institutional context, and limited data.

THE IMPORTANCE OF MUTA FINANCIAL AUTONOMY AND AUTHORITY

The saga of the United States Metropolitan Planning Organisations (MPOs) (Box 5.18) is a particularly well-documented case of the timeframe for developing metropolitan planning organisations. It took five decades and at least three significant pieces of federal legislation in a context with otherwise strong city governments to get to the point where MPOs appear to be able to fight for their own institutional place as representatives of regional interests rather than subsidiaries of state governments in UT planning. It is useful to discuss the experience of these organisations in some detail.

Australia's efforts to integrate transportation illustrate what can happen when the 'integrating agency' does not have its own financial authority. Well-funded road-building departments were simply renamed and merged with lesser-funded agencies. The result: 'the power imbalance within the public service has tended to bias any attempt at "integration" of transport planning, which invariably came to mean a balance strongly in favour of roads.'

The Lagos Metropolitan Area Transport Authority (LAMATA), an accelerated 'big bang' version of institutional reform for specific metropolitan emergencies, was also centreed on creating a new agency with the power to direct investments. The LAMATA Law was signed in January 2002, and the corporate body charged with overseeing all aspects of metropolitan transport planning, from traffic management to public transport was launched in 2003. The independent 13-member Board of Directors comprises representatives of transport operators, transport unions in Lagos state, the organised private sector, the general public, local government areas, and transport related LSG agencies, with a full time Managing Director/Chief Executive Officer (MD/CEO). It functions as a corporation, with private sector levels of pay and open recruitment. LAMATA has the power to levy and collect user charges as well as tariffs, fees, and road taxes approved by the Governor, but also relies on the World Bank for 40 per cent of its funding (and 80 per cent when started). According to Gwilliam[51], 'LAMATA has already been successful in (a) preparing a strategic long-term plan for the transport sector in Lagos; (b) coordinating activities of the multiple agencies involved in the sector; (c) rationalising motor vehicle tax administration, resulting in a substantial increase in revenues; (d) maintaining, upgrading, and rehabilitating 632 km of the declared road network; (e) implementing a pilot Bus Rapid Transit (BRT) "Lite" system from Mile 12 to Church Missionary Society (CMS); and (f) most important, changing the attitude among users towards bus transport system'. It is not clear how widely applicable or scalable this model would be, nor is there substantial documentation of its successes and failures.

OTHER EXISTING AGENCIES

Existing agencies managing various components of urban transport will continue to be a part of the institutional framework as the third level in the cities for executing works as per the prioritised programme approved by the MUTA. The professional skill with existing agencies in implementation and operation will be much needed. It is important that the large number of agencies presently involved do not feel left out. The respective city agency will be responsible for maintenance of assets as well.

STATE GOVERNMENT

UT is intertwined with urban development which is primarily a state subject and hence the State Government should play a pro-active role in the growth of UT facilities in its cities. It should create a separate department to deal with UT within the urban development or municipal administration departments. The State Government should lay down policies, administer laws, rules and regulations, organise education and enforcement and allot funds to cities on a pre-determined basis. It should assist the cities with guidelines and manuals to plan and provide sustainable urban transport.

The regulatory functions of licensing, vehicle inspection and enforcement may continue with the Transport Commissioner. All other functions relat-

51. Gwilliam (2011d).

Box 5.18
Metropolitan Planning Organisations

The United States' Metropolitan Planning Organisations, today one of the more powerful local-level transport agencies in the world, came about when the Federal Highway Act (1962) required urban areas with population of more than 50,000 to form an MPO. These were advisory bodies in the early years; charged with representing metropolitan concerns in a 'continuous, comprehensive, and cooperative' planning framework but without the financial authority to transform these concerns into investments. They were nominally distinct from state governments, but state governments often sat on the consultative committees and staffed the technical agencies that supported MPO analysis. In some case the MPOs effectively acted as administrative subdivisions of the state departments of transportation (DOT). The MPOs appeared to be an after-thought to put a technocratic gloss on the political decision to include substantial funding for urban highways in the Federal Aid Highways Act of 1956.

Thirty years later, as national focus on the interstate system subsided and the challenges of connecting urban nodes into the national grid became more apparent, the national government passed legislation to strengthen the MPOs. The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) reorganised the legal basis for MPOs to make state agencies stakeholders rather than advisees. The federal government began to provide significant transportation funding directly to MPOs, along with making their function and powers more uniform across metros. A fifth of ISTEA funds, or more than $9 billion of Surface Transport Programme funds, were to be spent by 137 of the larger MPOs covering populations of 200,000 or more. ISTEA also tasked MPOs with new responsibilities: to make sure that the metropolitan transport plans were fiscally consistent (could be paid for with funds that were likely to come in) and to run mandatory participatory processes for public and private stakeholders. Large MPOs were required to include representatives of local and state government as well as heads of transport system on their policy-setting boards. The legislation requires the MPOs' Transport Improvement Plans (TIP) to be included in the state's TIP without modification, though the states do have some discretion about how to allocate some parts of federal transport aid across jurisdictions.

The federal government re-affirmed the MPOs' position in the Transportation Equity Act for the 21st Century (TEA-21), providing more funding and new responsibilities for MPOs. The federal re-affirmation of the strong MPO seemed to help tip the scales toward MPOs, though an 2002 evaluation of six large MPOs found that the relationship between the MPO and state Department of Transport (formerly the dominant sub-national transport entity) varied and that the perceived quality of the relationship was correlated with the perceived extent of the performance on meeting long-run transport needs.

The power to determine how federal funding was spent was clearly a turning point for U.S. MPOs. The 1991 transfer of federal funding to MPOs was not a trivial change; it was the first time that federal gas tax revenues were transferred to any sub-national entity other than state transportation departments. Still, legislative empowerment did not immediately transform MPOs' actual ability to pull stakeholders including state government departments together. While ISTEA placed MPOs in charge of developing transportation plans and gave them new financial powers, it directed them to work 'in cooperation' with their state governments without specifying the details of 'cooperation'. Many states resisted.

Available evidence from the literature and our own research suggest that MPOs and state DOTs are only now beginning to discover how to make their new relationship operate effectively. As recently as 1995, MPOs generally gave poor ratings (an average of 3.07 on a scale of 1 to 10) to their relationships with state DOTs (Gage and McDowell 1995, pp. 148-49). Well into the mid-1990s, some states continued to resist granting MPOs their full statutory role in the transportation planning process, either by refusing to allocate federal funds to them or by dominating voting power within them. In five states, including Virginia and North Carolina, governors delegated veto power over MPO decisions to their state DOTs, effectively undermining MPO authority (Prendergast 1994, p. 41). The New York State DOT directly controlled the staff of the New York Metropolitan Transportation Commission, hampering the regional agency's ability to operate Metropolitan Planning Partnerships independently, reducing the full participation of local officials, and preventing the agency from taking a true leadership role in its region (vanderWilden et al. 1996, pp. 9-11). In several other cases (e.g., Milwaukee), MPOs have been given only partial project selection authority.

Tensions between states and MPOs on procedural matters continue: MPOs are supposed to develop plans to respond to air quality mandates, but the state actually compiles the full investment plans and determines what gets into the plan for meeting attainment goals. This has led to solutions that the MPO sees as ineffective for air quality and bad for transportation, while the air quality agencies feel that the MPO is not open enough about its plans as they are being formed and might be revised.

Today's MPOs, however, are significantly anchored in municipal government, with 42 per cent of the board seats held by municipal elected officials. Nearly all have legal and fiscal powers independent of the state departments of transport, though many are intertwined with regional councils of government or municipal governments. Still, the Association of American MPOs (AMPO) (http://www.ampo.org [accessed 21 January 2014]) continues to argue for more powers and funding to be devolved to MPOs from states. MPOs are responsible for large pools of federal money, but they do not have formal powers to coordinate or obtain information or plans or otherwise link to state agencies in order to fulfill their mandate. They have no taxation powers.

ed to planning and provision of services in the city should be looked after by the department of urban transport.

With respect to traffic safety the establishment of a high level, multi-agency working group, generating comprehensive safety programmes, has led to very significant and rapid improvements in road safety in cities as widely spread as Melbourne, Durban, and Brasilia. A board should be set up in each state to deal with safety issues in a comprehensive manner.

CENTRAL GOVERNMENT

The Ministry of Urban Development is the nodal ministry for urban transport at the centre. Two joint secretary level posts with some support staff are currently functional in the Ministry. NTDPC proposes that this UT department gets strengthened with a strong technical unit and data cell. As and when a new Ministry of Transport is developed, the UT department in the Ministry of Urban Development would focus on advising the Ministry of Transport on urban transport issues and their linkages with broader urban development goals. This integration of UT with broader transport strategy responsibilities is consistent with international practice.

The Central Government should lay down a national policy framework for urban transport; enact laws as required to uphold this framework; draft regulations and lay down planning standards and norms for national common standards (without restricting local operational efforts to achieve these outcomes); prepare guidelines and manuals including those for private sector participation; design, install and maintain standards for a common national database built from state and metropolitan databases; disseminate data; promote research in UT including safety issues; and organise capacity building.

Another important role for the Central Government is to supplement the financial support provided by states to cities on a pre-determined basis to enable them to plan and coordinate the implementation of major infrastructure augmentation schemes including bus and rail transit. Such funding should be designed to focus on incentives on outcomes while remaining technology-neutral for approach to urban mobility. In addition, the Central Government may help with the setting up of an effective institutional framework across states and cities.

LEGISLATION

There is no single legislation at present that covers the requirements of UT comprehensively. Urban transport will inevitably be influenced by a number of Acts, ranging from the Motor Vehicles act addressing vehicle licensing to the Air (Prevention and Control of Pollution) Act addressing ambient air standards and forming the basis for emissions controls, to frameworks for public-private partnerships and Acts governing specific modes of transport.

This poses two challenges: First, reworking of technology-specific Acts to ensure that they are coherent in their treatment of how states and cities approach a particular purpose. The Railway Act, Metro Construction Act, and Tramways Act, for example, should be examined and, if needed, amended to be mutually consistent in their treatment of rail-based urban transport. The second challenge concerns ongoing coherence in the policy framework given the many different goals for which laws are enacted.

The Office of Transport Strategy and the national Ministry of Urban Development could be focal

Too often, decisions are reactive, buffeted by events, and struggling to keep on course. A risk management framework has the potential to quickly transform a city's urban transport management style from reactive to proactive.

points for ongoing research and consultation to identify areas of conflict and suggest resolution.

States may also wish to enact comprehensive Urban Transport Acts addressing system characteristics, liability, pricing, safety, and other aspects. In the current Constitutional setting, however, these would not supercede national policy, so the Ministry of Urban Development would also have to develop an enabling framework for these State Acts.

UT plans have to be implemented over a period of time and hence require continuity. Urban transport however has many characteristics that need to be firmly established and would benefit from a legislation to set aside ambiguity and fragmentation that are negatively impacting the development of the sector in India. Such Acts have been implemented in Eastern Europe and Latin America in the recent past.

IMPROVING IMPLEMENTATION PROCESSES

At the implementation level, there is also a strong need to improve institutional and human capacity. It does not take long for city leaders to run up against challenges of implementation. Implementation currently at the city level is often confined to major roads. In instances where comprehensive plans were actually implemented, the results are not yet available. There is little evidence of effective asset management or performance monitoring.

This poor record can be explained by governments' failure to create processes to translate strategies and plans into operation. These processes are features of sustainable cities. Putting them in place does not require more effort per se but rather more effective effort. To achieve that, authorities need to manage cities and plan transport strategies and projects proactively. To do this, planners must analyse and manage strategic risk.

Too often, the sector decisions are reactive, buffeted by events, and struggling to keep on course. A risk management framework has the potential to quickly transform a city's UT management style from reactive to proactive. To make projects more adaptable, and suitable for the future, planners should create a technically sound strategy that has robust performance in the uncertain future and enjoys stakeholder support. To formulate coherent plans, to identify and develop effective projects and policies, and to manage the transport system proactively, one must employ strategic processes. Along with this, a transport asset and performance management process also needs to be adopted at the city level, wherein processes should facilitate the proactive management of the city's transport system and should create pressure for improvements, due to fair performance assessment and monitoring (e.g., Box 5.19 for the city of London).

Transport systems comprise valuable assets such as roads and equipment, which deteriorate and require investments for their maintenance, upgrading, or replacement. Politicians and city authorities of most cities ignore this responsibility, seeming to find new projects more appealing than the mundane management of the city's asset base. For this reason, asset management is often an 'elephant in the room'. Actors fail to recognise that the good functioning of the public and private transport system depends on well-managed transport assets without which the city would cease to function.

CAPACITY BUILDING

The second important requirement besides institutional clarity and a clear legislative framework, in meeting the challenge of sustainable urban transport, is to improve the skills, knowledge and capacity of decision makers and implementers at the city and state levels. Unfortunately the capability for undertaking a coordinated approach addressing the issues involved is lacking at the State Government- and City-level. There is an urgent need for capacity building; both institutional and individual.

Individual capacity building should be in two parts; city officials and university-educated professionals. The focus of training for existing city officials should be to develop awareness, skills and a deeper understanding of the requisite issues in urban transport. The focus of the education component should be to create a pool of skilled manpower to be available in the country for recruitment by various organisations engaged in UT. Alumni from such training programmes should be potential recruits for State Transport Corporations, State Transport Departments, municipal bodies etc. Simultaneously State Governments should be encouraged to create a cadre of urban transport professionals and create jobs for such professionals.

The Ministry of Urban Development, Government of India has initiated the establishment of centres of excellence, which are expected to create new knowledge and train UT professionals. Based on the success of this initiative the MOUD is keen to set up more such centres. These centres are important precursors to stronger MUTAs, enabling urban areas to build up expert groups with roots in the local context.

Box 5.19
City of London Performance Indicators

Every local authority in the United Kingdom is required to produce an annual monitoring report that charts its progress in achieving the policy objectives of its local plan. Objectives cover business development, housing, air quality, parking, and other aspects of civic life. Quantified performance indicators are identified for monitoring purposes and the results are made public to allow comparison between authorities. This creates pressure for improved performance. The City of London goes to great lengths to market its performance as a way of attracting foreign investment and to help ensure future prosperity.

Source: http://www.cityoflondon.gov.uk/Corporation/LGNL_Services/Council_and_democracyPerformance/Council-performance_indicators. htm (accessed on 21 June 2011).

These should be aided by incentives from the Ministry of Human Resources Development along with financial outlays from the MOUD, for creation of new faculty positions and provision of research scholarships. Alongside this the curriculum in universities should be reviewed from time to time to ensure that the graduating professionals, have imbibed the most modern knowledge base, such as planning and design of BRT, facilities for NMT, etc, in the current context.

A concerted effort is also needed to upgrade skills in the sector. Currently, most planning is done by consulting agencies appointed by cities. It now appears that neither do the consultants always have the desired level of skill in the assigned task nor do the cities have the necessary skills to supervise and monitor the work of the consultant. A compulsory system of certifying experts to handle specific tasks perhaps needs to be introduced. Capacity building is an ongoing need and hence should be institutionalised.

The MOUD has launched a comprehensive scheme for capacity building for UT. It involves the following 10 activities:

- Training
- Education: Development of curriculum and faculty development of academic Institutes
- Dissemination of information–Conferences and Journals
- Development of legal and administrative frameworks
- Development of manuals, codes and standards
- Development and strengthening of Institute of Urban Transport (India), a national level institute for, training, coordinating research and dissemination of information
- Development of a National database
- Promotion of National level consultancy organisations to provide a pool of professional manpower to assist state/city governments
- Setting up of institutions for the Research and Design; and safety certification of externally guided rail-based transit systems and other new systems that may be developed for urban transport
- Setting up of Unified Metropolitan Transport Authority (UMTA) and Urban Transport Cell in various mission cities.

This scheme is consistent with the institutional development outlined here, though the new UMTAs should be created along the lines of the MUTAs discussed here rather than as additional consultative committees.

This scheme should be run for a few years and then pursued based on its effectiveness. Presently UT is not the responsibility of any dedicated organisation in a city or state. UT professionals are generally not employed by transportation agencies which are essentially staffed by administrators. There is a general lack of UT skills amongst city/state officials of other departments involved in urban transport. For the training and skill building programme to be beneficial, states should be mandated to immediately constitute a dedicated agency for UT in each city with a million plus population and at the state level, create a cadre of UT professionals. States should also identify officials to be appointed to these agencies, send them for training and on return post them to these agencies/departments.

RECRUITMENT AND RETENTION OF PROFESSIONAL STAFF

Recruitment and retention of trained UT professionals in various cities is essential. The main reason for lack of professional skill in cities is that the few UT professionals today do not have career growth prospects in states/cities. Institutional framework must therefore be such that the professionals get their due place in the scheme of things in the city and are offered reasonable career prospects.

Recruitment and retention of trained urban transport professionals in various cities is essential. The main reason for lack of professional skill in cities is that the few UT professionals today do not have career growth prospects in states/cities.

It is proposed that the states create a new state cadre of UT professionals to be posted to various cities and managed by the UT group within the Office of Transport Strategy). These professionals would also be eligible to rotate through the UT group at the Ministry of Urban Development and Ministry of Transport (when formed).

KNOWLEDGE MANAGEMENT AND DATABASE

The virtual lack of a database has severely constrained the ability to formulate sound UT policies and plans and reliably assess the impact of different initiatives that have been taken. Action has been initiated by MOUD to set up a 'Knowledge Management and Database Centre' (KMC) with the support of some external funding agencies, but the efforts in this area need to be scaled up. The NUTP has recommended the setting up of a national level institute to build up a database and be a national store house for all UT sector related data and information. Similar database centres should be set up by state governments and large cities as well. These data centres are another precursor to building metropolitan capacity and integrated decision-making–they create a common understanding of the challenge.

This KMC at the national as well as state levels should have a full fledged library and a publishing wing. The library will include not only books but also national and international journals and periodicals, project reports, study reports, manuals, tool kits and all other such material. The library is to provide a single window for accessing relevant text and reference material, particularly by professionals, students, planners and researchers, with an e-catalogue on its website with appropriate linkages. Data from Masters and PhD thesis work will be channeled into the database. Regular collection of data and information, both from primary and secondary sources to keep the data base and the library at the proposed KMC up-to-date should be institutionalised.

RESEARCH AND DEVELOPMENT AND TECHNOLOGY UPGRADE

Research in UT in India is being undertaken mainly as an academic exercise without any coordination and without trying to match it with the need of the users. Over the last 10 years nearly 1,400 research projects on transport have been undertaken by 20 organisations as reported in the CRRI reports. These include 11 research organisations such as CRRI and nine academic institutes. Only about 200 projects relate to urban transport. Research in UT in the country needs to be stepped up urgently in a coordinated manner and its dissemination organised.

INVESTMENT REQUIREMENTS AND FINANCING

The funding requirements for UT is the largest when compared to other urban development and infrastructure services sectors such as water supply, sanitation, waste management, etc., including housing. Given that this sector has received meager funding in the past, it is essential that sufficient funds be available if the vision of sustainable UT is to be realised. However, while the funding made available has to be at the scale and size of the requirements providing for adequate funding isn't the only aspect of the financing challenge. Development of an appropriate financing and a sound funding system is central to ensuring that the high levels of funding that flow into this sector result in sustainable outcomes, across the country.

GOALS TO BE ACHIEVED BY THE YEAR 2032

For augmentation of public transport infrastructure goals as framed by the committee are listed below. The order of priority from a national perspective, in which the investments need to happen are in the order laid out below. The first two are essential and need to be prioritised at a nationwide level for safety and security purposes. However as discussed in the above section, these will essentially have to be choices made by each city and taken at the city government level and not imposed by either the Central or state Governments.

1. Creation of an effective institutional and implementation framework as well as capacity building arrangements to manage urban transport and projected investments
2. Walk and cycle lanes to be provided in all 100,000 plus population cities and state capitals
3. Development of organised dense city bus service as per urban bus specifications i.e. Vehicle tracking Systems (VTS) and Passenger Information Systems (PIS) in all 100,000 plus population cities and state capitals
4. As a thumb rule BRTs of approximately 20 km/1 million population in cities with population >1 million may be needed and investment requirements could be based on this assumption
5. Road network in all 100,000 plus population cities to be completed with missing links and with good surface and drainage
6. Smaller cities starting from 20,000 population should also have organised urban public transport, with the use of para-transit modes

7. Metro rail projects to be planned based on the findings of a comprehensive mobility plan for the city. Initially, to be restricted to cities with 5 million plus population if required. Principle should be the ability of the city to cover all costs through user charges or fiscal costs.
8. Safety, safety audit and security to be upgraded
9. Technology to be used for Multimodal integration, Enforcement and traffic management
10. Suburban rail services to be considered in urban agglomerations with population >4 million.

INVESTMENT REQUIREMENTS

The Working group on Urban Transport constituted under the NTDPC (WGUT) has made investment requirement projections for the urban transport sector till the year 2030. The estimates have been developed for three scenarios as listed below:

- **Scenario 1:** the Business as usual (BAU); which assumes that policies, strategies and trends continue as witnessed currently. The WGUT estimated that if current trends continue an investment of Rs 22.78 trillion, will be required over the next 20 years.
- **Scenario 2:** The intermediate scenario is a scenario which has been estimated by the WGUT to be in between the desired sustainable scenario and the BAU scenario Rs 17 trillion.
- **Scenario 3:** Desired scenario; is the scenario which will be closest to the sustainable urban transport scenario. The estimated investment requirement will be Rs 15 trillion.

Average annual outlays are in the range of **Rs 750 billion to Rs 1 trillion** across scenarios.

Investment of the order envisaged in the future far exceeds what has been achieved so far, though, it is difficult to estimate the total expenditure incurred by cities currently. It is very interesting to note that the investment required in the desirable scenario– which is a more environmentally sustainable scenario, is much lower compared to the BAU scenario. However, which scenario India achieves depends on how fast and how effectively various policy interventions needed to achieve the vision for 2030 are implemented. Given that capacities in the sector are currently weak it will take effort and time to scale up the expenditure to required levels. Assuming the intermediate i.e., scenario 2 is achieved, the investment during every five-year period in the next 20 years will be in the range Rs 2, 4, 5 and 6 trillion for each following plan period.

COMPONENT-WISE REQUIREMENT

As per the WGUT's projections, roads account for the largest share of investments, 70-80 per cent across all scenarios.

- On an average, 10-15,000 km of new streets need to be developed
- Another 10,000 km of road are to be reconstructed
- 20 per cent of estimated expenditure on roads is required for non-motorised vehicles (NMV) and pedestrian facilities

Also, public transport requirements in terms of network and fleet require significant investments (20-30 per cent)

- Although the WGUT has projected that 500 to 700 km of Mass Rapid Transit Network needs to be built every year, this does not appear to be feasible, or even desirable
- To sustain growth 50-60 per cent of trips should be on public transport.
- Buses form the backbone of transport in major cities (30-40 per cent share).
- Tempos/Auto-rickshaws are major modes of public transport especially in many small and medium sized cities. Since about 40 per cent of the urban population will reside in small and medium towns, this mode will continue to play a critical role as public transport provider (5-10 per cent share).
- Rail transit systems are likely to meet about 10-15 per cent of aggregate demand, mainly in mega cities.
- Every year 8-10,000 buses need to be added to take care of replacement needs as well as to accommodate new demand.

Difference in the three scenarios in terms of type of infrastructure and the corresponding investment needs is shown in Table 5.17.

Between the BAU to the desired Sustainable Transport Scenario the use of bus and BRT increases while the use of rail transit decreases. The spending on roads as a percentage of total however seems higher in the sustainable transport scenario, essentially because it also incorporates a range of sub components, aimed at improving the safety and convenience for pedestrians, non-motorised vehicles including cycle-rickshaws.

COMPARISON OF INVESTMENTS REQUIREMENT PROJECTIONS: THREE RECENT STUDIES

Table 5.18 compares the investments projected in Study reports by the McKinsey Global Institute (MGI, 2009), the High Powered Expert Committee (HPEC, 2010) appointed by the MOUD, and the study by the Need Assessment sub-group of the Working group on Urban Transport.

The investments estimated by all three studies/ reports are comparable at the aggregate level. However, the MGI study focuses much more on Mass Rapid Transit while the HPEC report lays much more

emphasis on Urban Roads, both attributing it to the huge backlog. The estimate by the WGUT is more in line with the HPEC projections. Details of the projection methodologies of the two reports are placed in Annex A.

FINANCING FOR NEW INVESTMENTS AND OPERATIONS AND MAINTENANCE

The estimates of investment outlined above need a financing strategy to support them. Given the distribution of taxation powers between the Centre, the states and local Bodies, currently the only viable method of financing the large scale investments required in UT including the establishment of new mass rapid transit infrastructure would be through capital funding support from the Centre (or state) to the cities for new projects, even if such funding can then be serviced over time through user charges and local imports.

The strategy proposed for funding capital cost and operation and maintenance expenses of UT projects is based on a two pronged approach. This consists on developing and promoting a consortium approach in which Centre, state and city, along with various agencies and the private sector participate in co-financing new investments and simultaneously creating robust **urban transport funds at the national, state and city levels.**

The creation of robust national, state and local funds, will ensure that diversity of funding instruments that are used to create sustainable financial structures that can add the requisite level of predictability and confidence to the UT sector. This, alongwith the use of consortium based funding for large mass transit projects or citywise – citywide, public transport improvement programmes, will also ensure (a) high levels of transparency and accountability around project development and implementation, and (b) evolving project/programme specific financial structures which are better tailored to the specific requirement of each project and city circumstance. However other than just raising the financial resources required for this system to function well and improve over time, clear affordability parameters, prioritisation principles and expenditure management responsibility and rules would need to be established. This also implies that institutional accountability and authority for UT have to be firmly entrusted to local government's, which have to be strengthened with adequate resources to shoulder this responsibility.

BASIC SOURCES OF FINANCES

Financing of the investment needed for consortium funding will come from six key sources; (a) user charges, (b) support from national Government, (c) tax concessions and dedicated levies, (d) Land Monetization, (e) recovery from non-user beneficiaries and (f) debt and PPP. These are discussed in detail below.

(a) **User charges:** The main source of direct funds for UT projects are user charges. However, most systems internationally and in India, do not rely on user charges alone. The low levels of affordability of a large section of society in India, alongwith political considerations do not permit full cost recovery through these. However, user charges are the most stable source of revenue for projects and strategies need to be adopted to try and achieve a situation where most of the project costs are met from user charges. User charges are essentially a local government or operator-levied charge and therefore the funds available represent the local contribution in a consortium funding scenario. User charges are often the most predictable revenue source for the project. They should essentially look to at least cover all operation and maintenance expenses related to the project. If this is achieved the quality of services delivered by the system will be free from uncertainties associated with all other financing mechanisms discussed later. However, operating and maintenance losses, when only user charges are taken into account, in public transport services are quite common. This is because user charges cannot be increased indefinitely as there is an optimal limit to them after which the revenue would decrease due to commuters limiting their use of the facility. Also, transportation projects are often planned not as revenue or profit maximising business enterprises, but because of their positive impact on the wider economic, social, environmental and physical landscape, thereby justifying the use of other sources of financing to be used to develop, operate and maintain some elements of the system.

(b) Support from national government is linked with the national budget, hence often unpredictable and inadequate, given the large number of national priorities. Central support can also be designed as schemes funded through the five year plans, such as JNNURM or RAY, though care must be taken to ensure that funding creates strong incentives for UT outcomes rather than approaches. While the JNNURM scheme has been funding urban transport projects in terms of grants, as discussed in an earlier section it is not well-designed for UT projects. Other than this, there is also a strong case that part of the Central Road Fund (CRF) should also become available for UT projects. Given that the CRF has already been used to fund the construction of national highways,

Table 5.17
Percentage Share of Investment Required: Three Scenarios

	SCENARIO-1	SCENARIO-2	SCENARIO-3
Street Infrastructure	70.08	71.90	78.48
Buses	1.19	1.63	2.00
BRTS Network-km	3.37	4.07	3.95
Rail Transit-km	23.74	19.77	12.25
Depot	0.51	0.74	0.86
Terminals	0.29	0.50	0.65
Workshops	0.08	0.13	0.15
ITS &ATC	0.42	0.72	0.95
Parking	0.29	0.50	0.65
Capacity Building	0.03	0.05	0.06
Grand Total	100.00	100.00	100.00

it is recommended that going forward the primary application of this fund could be for UT as the CRF's primary revenue source is a surcharge on petrol and about 80 per cent of petrol is used in urban areas.

Additional funding has to be generated from the last four sources.

(c) **Tax concessions and dedicated levies:** Tax concessions in India potentially reduce the funding requirements by nearly 20 per cent at the project cost level. This would be part of all national, state and local projects on which taxes are being foregone.

Central and state taxes constitute up to 15 per cent of the cost in rail transit projects and up to 19 per cent in the case of buses[52]. Since public transport is a social necessity, it should not be treated as a business venture. In the case of Delhi Metro, remission of taxes was extended for Phase-I and Phase-II of the project. To improve the financial viability of public transport, Central and state taxes concessions should be extended to all public transport systems at least for the next 10 to 15 years, by which time public transport will become the preferred mode of transport. These tax and duty remissions should be extended to projects undertaken by the private sector as well.

Subsidy in the form of cheaper electricity, etc can also be justified if public transport and intermediate public transport are not treated as commercial activities and accordingly, revenue generating activities. The fact is that these are social services and need to be viewed differently with the appreciation that all sections of the population are to be provided with safe, speedy, comfortable modes of public transport at affordable prices.

(d) **Land monetisation:** the value created in the proximity zones can be recovered through land monetisation; i.e., a 'Betterment Levy' or 'Land Value Tax' or enhanced property tax or grant of development rights. This will be a local body contribution in a consortium funding scenario.

(e) **Recovery from non-user beneficiaries:** Dedicated levies can be levied on non-user beneficiaries mainly users of private modes. This revenue source depending on which institution is best placed to capture it could

52. NTDPC, Working Group on Urban Transport, 2012.

Table 5.18
Comparison of Investment Estimates for Urban Transport by Various Committees (2010-30)

ITEM	MGI	HPEC	WGUT	WGUT	WGUT
			SPRAWL	INTERMEDIARY	DESIRED
Urban Roads	8.90	17.29	12.08	9.41	9.17
Transit	17.64	4.49	10.55	7.44	5.56
Others	0.50	0.90	0.15	0.15	0.27
TOTAL	**27.04**	**22.68**	**22.78**	**17.00**	**15.00**

Source: NTDPC Research.
Note: MGI: McKinsey Global Institute; HPEC: High-Power Expert Committee, Government of India; WGUT: Working Group on Urban Transport, NTDPC.

be part of the state or local contribution to a consortium-based funding arrangement.

It is now widely recognised that governments should (for ecological, equity and economic reasons) make a distinction between investments that generate value for public good, and those that generate value for private benefit. The incidental private benefit that accrues to private modes of travel from public investments in infrastructure should be tapped either to recover a portion of the investments or to develop new funds for future investments.

The source of income from private vehicles is through taxes levied on their consumption of fuel. Typically, cities can add taxes or cesses applicable within their jurisdiction, collecting money for use in making improvements to public transport schemes. Congestion pricing, parking fees, fuel taxes and cesses, all have one important feature—they are easy connectors between private use of scarce resources (urban space and fuel) and their application for public use (in transport systems, for pedestrian improvements, bicycle paths, etc). As such, they have considerable acceptance among the public, especially in these days of increasing consciousness about the environmental impacts of human activity.

Another source of funds that has emerged in recent years is carbon credits. However, the overall trading scenario around such credits is full of uncertainty. Effective planning around these trading regimes is complex, and they cannot be counted upon as consistent sources of revenue and funding.

Annual fees in lieu of lifetime taxes should also be considered for all users alongside public transport projects. There needs to be annual validation of driving license as well as registration certificate; and annual road tax instead of life time road tax. This is as per global practices and can be implemented now with the advent of technology and possibility of payment through the internet and other low cost/effort modes. This move will while improving safety and environmental compliance also enhance government revenues which can then be used to fund other public transport projects.

(f) **Commercial debt and raising initial project cost through PPPs:** This is another area which can make available significant resources through institutional credit and capital, in projects, which are well-structured and where the various primary revenue sources are secured and committed. In typical consortium based project finance structures for large projects due to increasing limitations on government funding, the private sector is being involved. Both the government and the private partner contribute equity and raise debt for the balance amount. Bilateral soft loans should be tapped and funding from multi-lateral agencies should not be ruled out.

PUBLIC-PRIVATE PARTNERSHIP

The experience of PPP has been mixed. One consensus view that emerged was that it may be prudent, to divide public-private partnerships in the transport sector into two phases—one, early-stage PPPs during the establishment of a project (say, during the first five to seven years) to bring in specific expertise pertaining to the creation of infrastructure, and two, for long-term operations, the terms for which can be identified after a running stability has been achieved for the project. While the loan life need not match life of assets and should be left to the market, in the case of megaprojects, if longer loan repayment periods can be worked out, it could become more viable.

Box 5.20

Financing Urban Transport: Avenues for Local Authority Borrowing

The most critical avenue for sustained financing of urban infrastructure will be domestic credit markets. In designing local credit initiatives to reduce the private sector's perceived risks of financing urban infrastructure and to mobilize domestic resources through domestic capital markets, a number of countries have adopted innovative measures that are some combination of the municipal bonds models of North America and Western Europe with access to long-term savings deposits and government contributions.

These initiatives to help mobilise domestic commercial debt resources for sub-sovereign infrastructure finance include the creation of:

- Quasi-independent municipal credit institutions—such as the Municipal Development Fund in the Philippines, the Municipal Fund for Infrastructure Finance in the Czech Republic, and the Tamil Nadu Urban Development Fund of India—to channel borrowed and grant funds to local governments
- Credit-enhancement mechanisms such as the Local Government Units Guarantee Corporation in the Philippines and the Infrastructure Credit Guarantee Fund in the Republic of Korea
- Special purpose vehicles such as the Water and Sanitation Pooled Funds in Tamil Nadu and Karnataka in India to raise finance for small municipalities through bonds, the Investment Fund for Urban Development in Vietnam, and the Urban Development Investment Corporations in China) to manage specific sectors of urban infrastructure in each of the major cities. Using special purpose vehicles as pilot issuers of municipal bonds is being actively considered in China.

Source: Gwilliam (2011c).

BOT finds extensive application in transport infrastructure projects. In the BOT framework, a public administration or any institution, which does not have adequate capabilities, resources or inclination to raise resources, execute and manage large projects by itself, delegates to a private sector entity, to design and build infrastructure and to operate and maintain these facilities for a certain period.

In general, a project is financially viable for the private entity if the revenues generated by the project cover its cost and provide sufficient return on investment. On the other hand, the viability of the project for the host government/institution depends on its efficiency in comparison with the economics of financing the project with public funds/borrowings. Other factors like, the expertise and efficiency that the private entity is expected to bring, as well as the risk transfer could warrant a BOT Model.

NATIONAL, STATE AND LOCAL URBAN TRANSPORT FUNDS

The second component of the financing strategy recommended is the creation of urban transport funds at the three tiers of government, which capture resources from the mechanisms described above along with enhancing fund availability though a few suggested sources, as described here.

Since there are huge investment needs for urban transport and competing demands for resources on the budgets of the Central and state Governments, traditional budgetary sources alone will not be adequate. The NTDPC recommends that new innovative financing mechanisms are put in place. Learning from the global examples, dedicated (non-lapsable and non-fungible) Urban Transport Funds (UTFs) should be set up at National, State and City levels. A National Fund has already been envisaged in NUTP, 2006. The UTFs, apart from meeting capital needs, may also be required to cater to certain operational needs of large infrastructure projects. The UTFs should be funded in a robust manner by implementing the following measures[53]:

- **Levy of a Green Cess of Rs 2 per litre on petrol sold across the country:** the rationale here is that petrol is consumed exclusively by personalised vehicles. A Green Cess on diesel is not recommended because of multiple uses of diesel and the problems anticipated in segregating diesel sold for personalised vehicles. However, we may need to reconsider this position if a significant fraction of personal vehicles start using diesel. The estimated

53. This funding mechanism for augmenting the resources for the urban sector has been recommended both by the NTDPC Working Group and by Planning Commission's Working Group on Urban Transport for 12th Five Year Plan.

Box 5.21
Land-Based Financing of Urban Transport : Public Sector Joint Venture

An alternative to the Central government corporation is the creation of a joint venture between Central government and the conurbation or municipal authority which is to be relieved by the overflow. Orestad in Denmark is a good example of this approach. Orestad is a new town outside Copenhagen connected to central Copenhagen by a 22-km automated metro serving 60 million passengers a year, which began operations in 2003. It was planned, developed, and financed through such a joint venture between central and municipal government. The government provided land amounting to 45 per cent of the 310-hectare site. Copenhagen owned and contributed the other 55 per cent of land. The two partners share ownership of the developer, Orestad Corporation, in proportion to their contributions of land. Both the infrastructure development for the new town and construction of the metro line are being financed primarily through land sales.

Orestad's development plan called for early construction of the metro line and phased development of six town centres within the overall development site. As a consequence, infrastructure and metro investment has been financed by commercial rate borrowing. At the end of fiscal 2006, total debt stood at DKr 13.7 billion, or $2.75 billion. The debt is being repaid primarily through land sales, supplemented by property taxes on new construction. While land market development was slower than expected, and metro construction was delayed, both land prices and land sales accelerated rapidly as development proceeded and commercial occupancy began. The Orestad Corporation now projects that all borrowing will be repaid ahead of schedule and that all infrastructure and metro construction will be financed, as planned, without government subsidy beyond the land contributions

Source: Gwilliam (2011c).

Box 5.22
Rail Mass Transit: Operations and Maintenance-Earmarked Local Taxes

Rail mass transit systems are usually loss-making. This is not necessarily a reason not to have them if they generate substantial external benefits in terms of reduced congestion and air pollution. But it does raise problems of finance for the responsible authority.

The grant of taxing powers to local authorities can still be used in a very purposeful way if earmarked and conditional on specified behaviour by the subsidiary bodies. The most striking example of this is the French 'versement transport'. Introduced in July 1971 and only applied as mandatory levy in the Paris region, the 'versement transport' payment of transportation (VT) has been successively extended, at the option of the authorities, to the transport authorities of any urban area of at least 10,000 inhabitants which chooses to identify an urban perimeter and introduce a transport organising authority. The VT must be paid by any employer of more than nine employees, except for foundations and non-profit associations whose activities are of social character. Employers who either house their workers or directly provide transport for the journey to work are also exempt. Ceiling rates are still fixed by the law outside the Ile-de-France, though the transit authority is free to set rates below the ceiling. The highest rates are in the Ile de France, where the tax is as high as 2.6 per cent in Paris and the Hauts de Seine, though lower in the outer departments. In 2008 the VT accounted for 35 per cent of the total revenue of the Ile de France transport authority STIF

Source: Gwilliam (2011c).

collection[54] of green cess from petrol in the base year is Rs 31 billion and over the period of first four years is Rs 140 billion.

- **Levy of a Green Cess on existing Personalised Vehicles:** All vehicles in India are required to be insured every year. There are several public and private sector enterprises in India which provides insurance to the vehicles at the rate of 3 per cent of the annual insured value both for car and two wheelers. It is proposed that an additional 4 percent of the vehicle's insured value shall be collected as Green Cess. It is estimated that during the first year the revenue collection will be Rs 180 billion and the collection over first four years will total to Rs 832 billion. For ease of collection, the annual cess will be collected through insurance companies. Insurance companies would return 4 per cent of insured value to the government to be put in the dedicated fund.
- **Levy of a Transport Cess on Purchase of New Cars and Two Wheelers:** at 7.5 per cent of the total cost of the petrol vehicles and 20 per cent in case personalised diesel cars. In case of diesel cars, the transport cess has been recommended at 20 per cent as diesel is available at substantially subsidised price and will continue to be so in near future. The matter of levy of differential rates of cess on diesel and petrol vehicles[55] can be reconsidered when the control on diesel prices is lifted. The estimated collection from this cess is Rs 180 billion in the first year and Rs 888 billion over the first four years.

A fixed proportion (say, 70 per cent or as presented in Annex B) of the resources generated by the above levies, as decided by the Central Government, should be earmarked for UT, and the remaining may be utilised for developing infrastructure for rural[56] transport. These levies will not only help in generating a dedicated pool of resources for taking up urban transport projects but would also serve as a significant disincentive for use of personalised vehicles, as part of the overall strategy for demand management. This will serve the twin purpose of providing quality public transport infrastructure and services at affordable cost and reducing congestion and curtailing travel demand on account of use of personalised vehicles. All these revenue sources have a high impact and high feasibility in terms of annual accrual to the urban transport funds.

At a time when the exchequer faces the dilemma of meeting ever growing demand from various sectors amidst constrained government sources of finances and in an environment where PPP can only marginally meet the financing needs of urban transport, the proposed UTFs present themselves as an effective means for funding urban transport investments. In fact, the actual potential of these sources is much higher than the present yields. **The total estimated yield from these three sources is Rs 400 billion in the first year; it adds up to Rs 1860 billion in first four years and reaches Rs 22 trillion in 20 years**. Detailed calculations and assumptions made are listed in Annex B. These estimates reflect the total availability of transport funds through these levies. As proposed here, a part of these funds could be earmarked for rural transport, and the rest would then go for urban areas.

This report has argued that responsibility for UT should essentially rest at the state and city levels. In the case of large cities with population of over 1 million, this should essentially be at the city level, whereas state governments would need to be responsible for the policies and organisation of urban transport in other towns and cities within their respective states. Consistent with this general proposition of decentralisation of responsibilities for UT, arrangements would need to be made so that UT funds thus collected devolve appropriately to the state and city levels.

Two components of the cesses proposed here, i.e., the cess on petrol and green cess on existing personalised vehicles, would need to be levied and collected by the Central Government[57]. Adequate provisions would have to be made in the budgetary process for the collection and distribution of these components. Until such time as the unified Ministry of Transport, as recommended by the NTDPC is set up, the Ministry of Urban Development could function as the nodal Ministry.

The third component of the cesses proposed, i.e., the transport cess on purchase of new cars and two wheelers, could be levied by the Central Government and collected by the state governments along with VAT at the time of sale of such vehicles.

The devolution of these resources to the state and city level UTFs should be on an entitlement basis and not at the discretion of the central government. The NTDPC recommends that this proposal may be examined by the Finance Commissions, preferably

54. The number of diesel cars has been assumed to be 30 per cent of the total cars as against 35 per cent of the present annual sales.
55. For example, these funds can help in augmenting the resources available for construction of rural roads.
56. As per news reports, in November 2012 the Supreme Court had asked for Government's response on an application that, on the basis of 'polluter-pays' principle, inter-alia asked for imposition of various taxes/charges on vehicles—including imposition of a levy on purchase of diesel cars, and an annual levy on private vehicles in the National Capital Region.
57. In May 2013, the Goa State enacted 'The Goa cess on Products and Substances Causing Pollution (Green Cess) Act 2013' that allowed a cess of up to 2 per cent to be levied on certain products/substances—including petroleum products—causing pollution. The objective of this legislation is to reduce pollution and the proceeds of the green cess shall be used for undertaking measures to reduce the carbon footprint. Even though a State Act has imposed the 'green cess' in this case, we recommend that Central Government legislate on this matter for the sake of uniformity of taxation structure and for administrative convenience.

beginning with the 14th Finance Commission, with a view to devising a robust framework for (a) division of total pool of available resources from the three levies between the urban sector funds (national, state, and city), and the rural sector (b) division of the available urban sector funds between the one national-level fund, various state-level funds, and various city-level funds, in a manner similar to the provisions for tax devolution to state governments that is normally proposed by the Finance Commission.

As proposed, the UTFs would be maintained at three levels—national, state, and metropolitan areas. The proposed national and state-level Offices of Transport Strategy and MUTA should, in due course, administer these funds respectively. Until such time these offices/agencies are set up, the nodal ministries/departments dealing with the subject of urban development at the National/State levels and the Municipal Corporations could administer these funds.

The nodal ministries/departments at the national and state level should distribute the funds collected in a timely and transparent manner as per a formula prescribed by the Central Government based on the recommendations of the Finance Commission. After ascertaining the actual collection of cess/surcharge/tax, the nodal ministry should release the funds expeditiously (on a quarterly basis) to MUTAs/municipal corporations (and other organisations) as mandated by the distribution formula. However, until the Finance Commission's recommendations on the matter are received, NTDPC recommends that at least 70 per cent of the total resources collected from the three levies be earmarked for the urban sector. Further, at least 50 per cent of the total resources earmarked for the urban sector should be transferred[58] to MUTA/municipal corporations, and at least 30 per cent of the total resources earmarked for the urban sector should be transferred to the state governments.

Resources from UTFs maintained at the state level should primarily be used for the transportation needs of smaller urban areas (sub-metropolitan areas). They can also supplement the resources of MUTAs for undertaking large projects. Resources from UTFs maintained at the national level should primarily be utilised for creating infrastructure for training, capacity building, and research activities, and setting up standards for national goals such as safety, efficiency, and environmental impact.

The UTFs at the State and city level could also be supplemented through other sources, like land monetisation, betterment levy, land value tax, enhanced property tax or grant of development rights, advertisement, employment tax, congestion, a cess on the sales tax, parking charges reflecting the true value of the land, traffic challans etc. A model where the National and State Level Funds also contribute to the city level funds over a period of time would ensure that the urban transport responsibility and accountability is well nested at the city level.

Pimpri-Chinchwad Municipal Corporation has already set up a dedicated UTF through land monetization and advertisement rights. Similarly, Karnataka has set up a dedicated UTF through MRTS cess on petrol and diesel sold in Bangalore which is being used to fund the metro rail projects.

Certain items, like employers' tax, have not been considered here because of their low contribution and difficulties in collection. Similarly, certain demand management measures, like congestion charges, have also not been included because of their small contribution.

AFFORDABILITY, PRIORITISATION AND EXPENDITURE RESPONSIBILITY

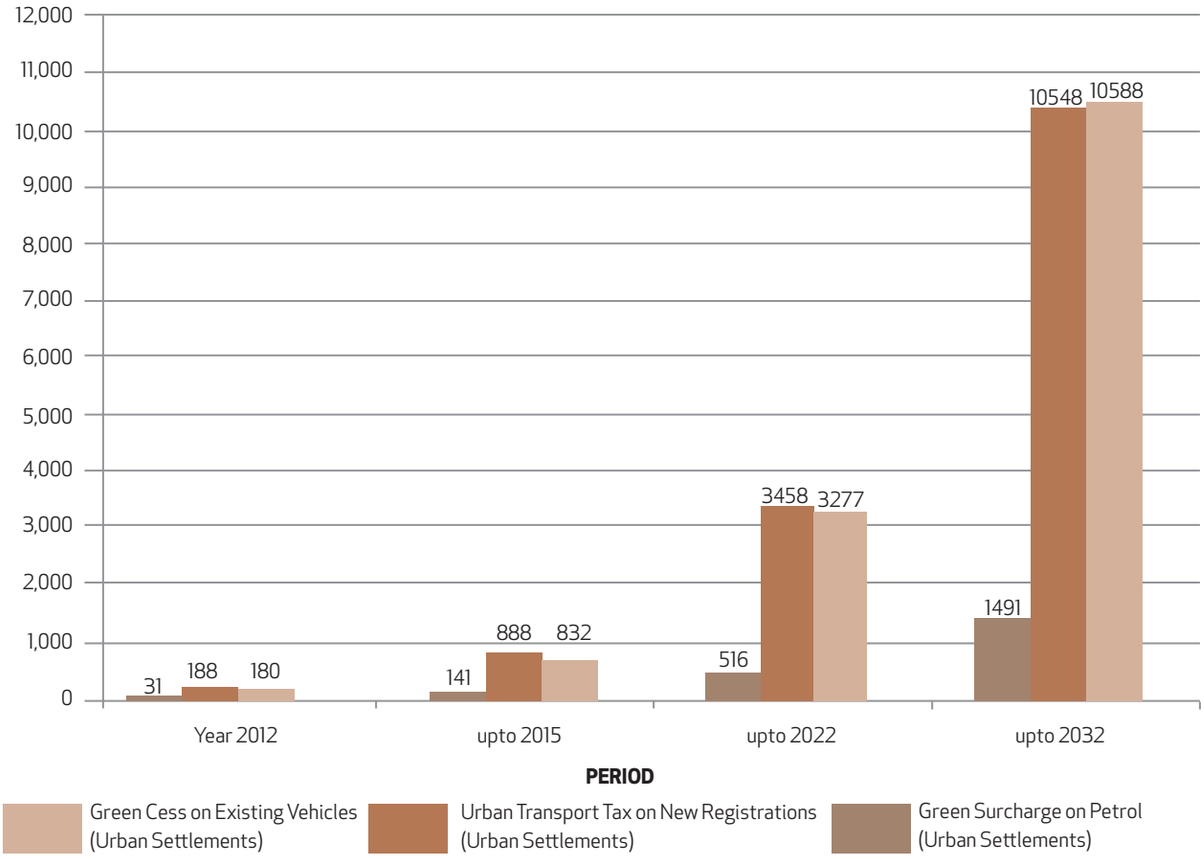
While the funding arrangements and structure recommended here, if implemented, would lead to significant resources for the sector, the full effectiveness and impact of that effort would materialise only if proper policies addressing affordability parameters, prioritisation principles and expenditure management responsibility are established and implemented.

In the current system, a significant portion of funding for mega UT projects comes from the central government. In principle, the municipal corporation and the state government concerned first approve such a project through their own approval systems. It is only after such approvals are obtained that these large projects are posed to the Central Government for funding. In principle, the central government may refuse to fund a project if it is found to be not viable. At present, it insists on an 8 per cent financial internal rate of return (FIRR) for metro projects.

The NTDPC is of the opinion that these procedures need to be strengthened further so that affordability and local prioritisation concerns are adequately addressed. Over time, it is essential that in large cities, the local bodies should be fully responsible for decisions on large UT projects and need to develop institutional capacity and resources to make such transport decisions over the next 20 years. For projects that need financial support at the national level, an improved institutional framework needs to be evolved, which puts the large cities at the centre of decision making. State governments and municipal corporations should not be incentivised to view central funds as being free leading to projects that may not be sustainable in the medium to long term.

58. A natural method of making the inter-se distribution amongst MUTA/municipal corporations is as per their population recorded in the last decennial census.

Figure 5.10
Urban Transport Proposed Sources of Funding
(Rs billion)



The key consideration for approval of such large projects should be their efficacy in providing urban mobility solutions at the local level, and the ability of the local economy to sustain them over the long term.

Core to the development of the investment requirements and the financing strategy, are the way affordability and investment prioritisation is established. In the JNNURM scheme, there are City Development Plans and Comprehensive Mobility Plans which are drawn up at the local government level and are seen as the primary instrument to establish the priority of the investments required. However, this methodology has proved to be inadequate given that the links between these plans and the projects are weak and remain unimportant since the projects grant based financial structure is predetermined, and do not require consortium-based specific tailor-made financial structures. With affordability of users and the city in mind, cities and transport agencies need to develop transparent mechanisms to identify activities and projects which are essential while others could only be considered important or desirable to be taken up in a medium-term horizon. Therefore it is important to define a public sector budget envelope that secures funding for essential activities and projects and only promises funding for other activities and projects.

The expenditure management policies of the UTF at the national level should put in place institutional mechanisms and policies to scrutinise difficult questions before agreeing to fund any proposal. Clear criteria for accepting proposals for funding should be placed transparently upfront. Proposals of funding from the NUTF should have (a) high Impact in terms of actual annual contribution to the NUTF; (b) use Polluters Pay principle; and (c) reduce the use of personal vehicles. Some project-level financing and prioritisation questions could be: Who pays? How are the payments made? How is the spending being prioritised? and Is there a role for the private sector in financing? These are all elements that are linked and need to be considered and structured so that the financing system is sustainable. The expenditure management policies of the UTF should be built to ensure that the following overall principles are fulfilled for stability and sustainability of the financing system.

- Financing for core public transit activities and projects such as must be secured and financing mechanisms must allow for flexibility to address risks emerging from uncertainty.

Box 5.23
Affordability and City Management: Manila

In 1982, Manila created an institutional context that allowed priorities to be determined against available financing. The city developed an investment strategy across all municipal sectors: highways, public transportation, water supply, sewerage and sanitation, garbage disposal, housing, social infrastructure, and others. Working from past expenditures and future prospects, planners identified a set of projects that could and must definitely be financed (the 'core investment' programme) and a second set of projects that could be implemented if additional funds became available (the 'core plus' programme).

Manila used a transparent, comprehensible system to separate unambiguously good from unambiguously bad projects and to classify the remaining projects using objective criteria and different weights for different scenarios. The strategy established the robustness of each project under a range of scenarios and provided a basis for dialogue among government agencies that questioned the rankings. Considerable progress was the result.

Source: Asian Development Bank.

- Lessons from cities that have developed sound financing systems, demonstrate that most funds must be obtained from users directly through tolls, charges, fare boxes, etc.
- According to economic principles too, users, other beneficiaries, and polluters should pay for the benefits they receive or for the costs they impose. Taxpayers should only pay when no other practical mechanism exists.
- Financing must be prudent and cost-efficient and credit ratings can reinforce the essential discipline of long-term financial planning.
- When inter-governmental funds are made available, it should be ensured that responsibility clearly lies with the city authorities and that they have a major stake in the development of the system. This prevents cities from competing for free central government funds that distort strategy and undermine good governance.

ROLLING PROGRAMME

A rolling five-year programme which would lead the sector investments has also been suggested. The rolling programme should be adopted alongside the financing strategy to lay out a macro-national-level trajectory for improvements in urban transport. The rolling programme is based on the 'service level bench marks' developed by MOUD and described in an earlier section. The SLBs provide for four levels of service. It is assumed that all cities are at the starting point (when under implementation, a rapid appraisal to establish the true starting points for each city would be desirable) and will move up one notch every five years up to 2030 through different routes chosen by themselves. Different size cities require different infrastructure. Short and long term actions are required to encourage use of Public Transport and to retain the existing modal share of NMT and walk. The City Mobility Plans are instruments that cities should use to plan to move to the desired and sustainable scenario, in a phased manner. The Rolling Plan is presented in Annex C.

SUMMARY AND CONCLUSIONS

OVERVIEW

The rapid economic growth over the last two decades has entailed a significant structural transformation of the economy away from agriculture and toward more employment in services. At the same time, India's cities have expanded and are likely to grow faster in the future. Urban India has been driving the country's economic growth recently and is expected to contribute 70 per cent of India's GDP by 2030[59]. These are centres of wealth-the per capita income in the largest cities is much higher than the average per capita income of the country as a whole and, in some cases more than double the national average–but they are also intertwined with the national and rural economy through consumption patterns, remittances, and other links. Over the next 20 years, there could be very significant variations in affordability across cities, thereby affecting and shaping the needs and demands for a desirable urban transport system, based on city size, category and income.

NTDPC's scope has been spread across a range of issues related to development of comprehensive and sustainable policy for meeting the transport requirements of the country through various modes of transport. Each of these modes must respond to the changes in demand of the movement of goods and services in the most integrated and cost effective

59. McKinsey (2010).

manner as possible. While looking at the changing nature of demand for transport and the particularities of each mode of transport, urban transport cannot be neglected since more often than not, it accounts for the last mile in any other inter-city transport trip. Urban transport cumulatively, in all country contexts is a significant percentage of the overall transportation trips. It is often productive, but also contributes significantly to congestion, environmental pollution, energy dependence and other social concerns. It is also complex: it is multimodal by definition and the overall performance of the system depends critically not only the individual components but also their interaction.

Urban transport in India is in need of an overhaul. At present, there is inadequate understanding of, and inconclusive data on, the modal share distribution between these various transport modes, across city types and sizes in India. There is also limited information on the extent of urban freight movement. What is clear, however, is that very few Indian cities currently, have organised, registered and regulated public transport systems. More and more urban residents are relying on personal vehicles and traffic congestion, air pollution, accidents, and fuel use are on the rise as a result.

Attention to urban transport in the past has been sporadic and fragmented. The first explicit statement of interest in urban transport came in the 6th Five Year Plan (1982-87), which also mooted the need for a National Urban Transport Policy (NUTP). Despite this early start, a National Urban Transport Policy could be finalised only in 2006, the terminal year of 10th Five Year Plan. The JNNURM has channeled significant investment in transport systems for some of India's largest cities, but much more remains to be done to increase the level and quality of investment. In particular, urban transport policy, planning and investment needs to be more responsive to safety, energy, environment and health concerns. Moreover, attention needs to be focused on the mobility needs of people rather than the facilitation of higher vehicle speeds.

This will require institutional as well as policy change. Authority continues to be divided within and across levels of government. The Ministry of Urban Development is the nodal ministry for policy and planning at the national level for rail-based urban transport whereas all the responsibilities for the technical planning for rail-based UT systems are with the Ministry of Railways[60]. State governments contribute to UT planning as part of their involvement in urban development authorities and departments of transport. Local governments have a limited role in transport planning but are generally responsible for maintenance. Multiple agency control, and diffused attention is not conducive to the provision and growth of urban transport along a sustainable path. Rectification of this weakness has become all the more urgent in view of the huge investments projected to be made in this sector.

AVOID, SHIFT AND IMPROVE

Broadly speaking, the recommendations of NTDPC are to build up on an 'avoid, shift, and improve' framework for urban transport:

Avoid: Sustainable transportation is about moving less. In recent times, indiscriminate land use planning and the increasing development of peri-urban areas by businesses and households seeking lower-cost land has forced residents to make greater use of motorised transport. The remedy is judicious land-use planning that reduces residents' need to travel and cuts back on urban sprawl, pollution, and congestion. Mixed land use policies include integrating residential and commercial neighbourhoods and moving away from concepts of strict zoning by activity.

NTDPC is of the view that urban development plans over the next 20 years, should be based on principles that create mixed land use, high density and mixed income neighbourhoods on the basis of persons per hectare and not FSI alone. Integrating land use and urban transport should be driven with the principal that lower income workers should be closer to their employment areas while higher income workers, could afford to travel larger distances for work. The current strategic trend of restricting and pushing out logistics and freight vehicles and interchanges to the outskirts of the city needs to be relooked at for better integrating urban freight to support job creating in cities and improve the vitality of cities.

These aims should be addressed through the appropriate changes in the urban planning norms and should be incorporated into planning standards such as the Urban Development Plan Formulation and Implementation Guidelines (UDPFI) which are followed by planning and development agencies in most states.

Shift, or change modal choice to promote lower fuel consumption per passenger-km and/or freight-km and manage traffic and reduce fuel consumption as well as air pollutants. Indian cities should consider implementation of economic measures to restrain traffic such as parking policies, congestion charging across cordons or within areas, car-sharing schemes and other measures. Where these policies are not possible, cities may consider fuel surcharges along with vehicle license duties that reflect the vehicle's impact on air pollution and other externalities. The net revenues from these measures should be invested

60. GOI (2011a).

Broadly speaking, the recommendations of NTDPC are to build up on an 'Avoid, Shift, and Improve' framework for urban transport.

in improving the public transport system to secure acceptance for necessary but unpopular policies.

PUBLIC TRANSPORT

Public transport also needs to improve, through an early integration of bus priority ways, busways, bus rapid transit (BRT), into cities' expansion and development plans would help integrate transport and urban development while maintaining the flexibility to reroute public transport arteries as the city develops. Rail-based metro systems should be considered only for some of the largest cities with more established patterns of residential and commercial development, after careful examination and attention to the opportunity costs of investing in relatively expensive fixed infrastructure.

Dense, integrated public transport is required in our cities. Only such dense MRT (based on buses if they are to be majorly funded by city governments) can support transit in the already dense parts of our cities and can support a shift towards high-density, mixed-use walking and transit-oriented urban environments. As a first step, a city should organise the existing public transport into an integrated network to cover the whole city. These services can be operated by buses of various sizes as appropriate to demand level. Actual ridership will guide adjustments in the capacity needed and to be provided on each route. When the demand level exceeds the capacity of bus services and BRT, other guided MRT modes may be considered. The safety and safety perception of MRT modes is a key factor in its wide-based use and should be a key feature in the design MRT network.

It is equally important that public transport is made high-quality and user-friendly so that the commuter uses public transport voluntarily. The most important aspect is multimodal integration: physical integration, network integration, fare integration, information integration and institutional integration. Besides the passenger information display system, integrated ticketing for all modes (common mobility card) and interchange facilities, use of intelligent transport system, facilities for the handicapped, safety and security against hooliganism, vandalism and terrorism, national public transport helpline number are critical to promote public transport and should be a part of planning. It is essential to improve the quality of all types of buses so that they are seen as a high mode of transport.

Improve, or increase the energy efficiency of vehicles and use of efficient and cleaner fuels to decrease impacts of distances travelled and reduce the greenhouse gas footprint per litre of fuel consumed. Achieving these objectives requires inventive technology, measures to encourage the rapid take-up of that technology, and regulation as well as effective enforcement that controls in-use emissions by ensuring that vehicles are properly maintained.

INTERMEDIATE PUBLIC TRANSPORT

This principle also applies to vehicles used for intermediate public transport in Indian cities; these play an important role in providing mobility to a large section of the population. While a number of safety and convenience factors in these modes need to be improved, they have a potential of providing clean mobility through emissions. Manufacturers should be encouraged to invest in improving the technology of these vehicles by:

- Setting up emission and safety standards under the Motor Vehicles Act.
- Banks and financial institutions providing low interest loans for small scale industry producing these vehicles, and attractive replacement schemes for operators.
- Dedicating 10 per cent of the cess money available with the Ministry of Industry from the transfer of technology for vehicle manufacturing for the improvement of intermediate public transport vehicles.
- Move from a 'closed permit systems' to an 'open permit system', for para-transit/intermediate public transport modes to make public transport more convenient[44]. This regime change should be accompanied with strict training and maintenance norms.

NON-MOTORISED TRANSPORT (NMT)

Priority in planning for modes should focus on improving mobility through non-motorised transport, public transport and para transit, and personal vehicles in that order. Safe facilities for non-motorised transport (NMT) i.e., footpaths and dedicated cycle lanes should be developed on priority basis along with accompanying facilities such as parking booths, drinking water kiosks and street furniture. These should be citywide to assure the commuter that he can complete his journey all the way by walk or bicycle if he so chooses. NMT facilities should become a national norm and get first priority in infrastructure development and funding. Funds allocation for major transport infrastructure should be linked to achieving targets for creating facilities for NMT. The NTDPC recommends that all cities should be responsible for pedestrian ways and facilities, which should be embedded in a law, linked to targets for improving streets and their maintenance within a period of 10 years.

INSTITUTIONAL FRAMEWORK FOR URBAN TRANSPORT

To pursue this approach, policy makers will need to focus on

a. The information and metrics basis for

planning, design and operating aspects of urban transport infrastructure, including, especially, a shift to full life cycle accounting,

b. **Developing and implementing a strong transport demand management regime leveraging all available policy and administrative tools, and**
c. **Improving implementation of projects and coordination between investments in the urban transport system.** It is especially important to improve the governance for large projects. The NTDPC recommends that advanced, international, contemporary instruments such as the LCA framework should be included in the methodology to evaluate and appraise programmes and projects, especially mega projects, before decisions on funding are made.

The institutional framework to deal with this sector is proposed as follows:

ROLE OF STATE-AND-CITY-LEVEL GOVERNMENTS

The primary responsibility for urban transport should lie with state governments. This report has recommended creation of state-level Offices of Transport Strategy which may be the locus for urban transport, in collaboration with agencies for urban development.

States should also enact a comprehensive urban transport law, which sets out the roles and responsibilities of the multiple city and state-level entities with regard to public transport, land use and public transport integration, multi-modal integration, safety, facilities for walk and NMT, etc. A model law can be developed by the Central Government to be then adapted by state governments as felt to be necessary. Over time, urban transport responsibilities should be devolved to metropolitan and city authorities, particularly for India's larger cities of more than 1 million. A three-level Organisational set-up is therefore proposed for the city:

- Metropolitan/District planning committee/ inter-municipal cooperative arrangement.
- Dedicated authority for urban transport (MUTA). The NTDPC in line with the NUTP 2006, envisages the MUTA primarily as a holistic and integrated decision making and coordinating body to bring about Policy, Planning and Service Co-ordination, to decide on capital financing and long term investments and to monitor implementation. As per the NUTP 2006, the MUTA should be supported by a professional body that will study and make recommendations on various issues for consideration and decision by MUTA. Rather than have two separate bodies NTDPC proposes that MUTA be made into a full-time professional body working under a city council with representation from all city agencies and stakeholders including the surrounding region.
- Other existing city transport agencies. Existing agencies managing various components of UT will continue to be a part of the institutional framework as the third level in the cities for executing works as per the prioritized programme approved by the MUTA. The professional skill with existing agencies in implementation and operation will be much needed. It is important that the large number of agencies presently involved do not feel left out. The respective city agency will be responsible for maintenance of assets as well.

NTDPC is of the view that urban development plans over the next 20 years should be based on principles that create mixed land use, high density and mixed-income neighbourhoods on the basis of persons per hectare and not FSI alone.

ROLE OF THE CENTRAL GOVERNMENT

The central government will inevitably retain an important role in financing urban infrastructure, given India's fiscal structure. Such funding should be technology-neutral as far as possible, and linked to mobility, access, environmental, and other system outcomes rather than specific approaches to urban transport.

The Central Government may also play a role as technical advisor while state expertise is being created. This report proposes creation of a national Office of Transport Strategy, which would liaise primarily with the Ministry of Urban Development, and also with Rail, and Road Transport and Highways as needed to generate overarching strategy guidelines.

The central government would be responsible for creating standards for urban transport performance, including safety, environmental impact, and other national goals. The Central Government should lay down a national policy framework for UT; enact laws as required to uphold this framework; draft regulations and lay down planning standards and norms for national common standards (without restricting local operational efforts to achieve these outcomes; prepare guidelines and manuals including those for private sector participation; design, install and maintain standards for a common national data base built from state and metropolitan databases; disseminate data; promote research in UT including safety issues; and organise capacity building.

The central government cannot be directly responsible for UT in each city in a federal set up like India, with a wide diversity of contexts. Central government oversight of UT, other than in setting standards for national goals such as safety, efficiency, and

environmental impact as well as public investment management, is inconsistent with international experience as well as economic logic. States are a natural locus for urban transport in India's current circumstances. Larger cities can and should assume the primary responsibility for metropolitan transport as broader urban reforms catch up with constitutional commitments. Cities to which urban transport authority has been devolved must be provided with a strong institutional framework, an effective organisational set-up with a dedicated agency to look after planning, coordination and implementation of UT services, legislation, a resource generation policy and adequacy of skills.

INVESTMENT REQUIREMENT AND FINANCING

The Working Group on Urban Transport[61] constituted under the NTDPC has made investment requirement projections for the urban transport sector till the year 2030. The estimates have been developed for three scenarios as listed below:

- **Scenario 1:** The Business as usual (BAU) scenario; which assumes that the policies strategies and trends continue as witnessed currently. The WGUT estimated that if current trends continue an investment of Rs 22.78 trillion, will be required over the next 20 years.
- **Scenario 2:** The intermediate scenario is a scenario which has been estimated by the WGUT to be in between the desired sustainable scenario and the business as usual scenario. Investment needed will be Rs 17 trillion.
- **Scenario 3:** Desired scenario; is the scenario which will be closest to the sustainable urban transport scenario, the WGUT has worked out that, the estimated investment requirement in this scenario will be Rs 15 trillion.

Average annual outlays are in the range of Rs 750 billion to Rs 1 trillion across scenarios.

Given the distribution of taxation powers between the Centre, states and local bodies, currently the only viable method of financing the large scale investments required in urban transport including the establishment of new mass rapid transit infrastructure would be through capital funding support from the Centre (or state) to the cities for new projects, even if such funding can then be serviced over time through user charges and local imports.

The strategy proposed for funding capital cost and operation and maintenance expenses of urban transport projects is based on a two-pronged approach. It consists on developing and promoting a **consortium approach** in which Centre, state and city, along with various agencies and the private sector, participate in co-financing new investments and simultaneously creating robust **urban transport funds at the national, state and city levels.** This will ensure that a diversity of funding instruments are used to create sustainable financial structures that can add the requisite level of predictability and confidence to the urban transport sector. Financing of the investment needed for consortium funding will come from six key funding sources; (a) user charges, (b) support from national Government, (c) tax concessions and dedicated levies, (d) Land Monetisation, (e) recovery from non-user beneficiaries and (f) Debt and PPP.

The NTDPC recommends that new innovative financing mechanisms are put in place. Learning from the global examples, dedicated (non-lapsable and non-fungible) Urban Transport Funds (UTF) should be set up at the National, State and City levels. The UTFs, apart from meeting capital needs, may also be required to cater support to certain systems during the operations stage. The UTFs should be funded in a robust manner as per the suggestions below:

- **A Green Surcharge of Rs 2 on petrol sold across the country:** The rationale behind the fact that petrol is consumed exclusively by personalised vehicles.
- **A Green Cess on existing Personalised Vehicles:** At the rate of 4 per cent of the annual insured value both for car and two wheelers.
- **Urban Transport Tax on Purchase of New Cars and Two Wheelers:** At 7.5 per cent of the total cost of the petrol vehicles and 20 per cent in case of personalised diesel cars.

A fixed proportion (say, 70 per cent or as presented in Annex B) of the resources generated by the above levies, as decided by the central government, should be earmarked for urban transport, and the remaining may be utilised for developing infrastructure for rural transport. The total estimated yield from these three sources is Rs 400 billion in the first year, Rs 1860 billion in the first four years and reaches Rs 22 trillion in 20 years.

This report has argued that responsibility for urban transport should essentially rest at the state and city levels. Consistent with this general proposition of decentralisation of responsibilities for urban transport, arrangements would need to be made so that urban transport funds thus collected devolve appropriately to state and city levels. This devolution of resources to the state and city level transport funds should be on an entitlement basis and not at the discretion of the central government. This proposal could be examined by the Finance Commission, perhaps beginning with the 14th Finance Commission.

61. NTDPC (2012).

ANNEXES

ANNEX A: EXTRACTS FROM MGI AND HPEC REPORTS

MGI basis for suggesting high investment in Mass Transit are as follows:

- Transportation demand model was developed using a three stage process to estimate total transportation volume, splitting this volume into different modes and consequently forecasting the capacity required to meet the generated demand. The MGI Report also states that target share of public transportation was determined based on global benchmarks or as residual of increase in private transportation (p. 195).
- The report defines three scenarios (p. 196)
  - Private Sprawl (Scenario-1): Mono-centric city structure with FAR values in line with current trends and little investment in PT.
  - Public Sprawl (Scenario-2): Mono-centric city structure with FAR values in line with current trends and high investment in PT.
  - Public Compact (Scenario-3): Poly-centric city structure with high FAR values and high investment in PT.
- In scenario 2 and 3, the report fixed a target for public and NMT transport modal share and treated the private modal share as a residual.
- It has been assumed that rail-based mass transit infrastructure will be provided in each of the top 35 cities in India. For top 13 cities, requirement is immediate, while for the rest, infrastructure may be phased over the next 20 years. The report further assumes that public bus transport is applicable to all cities and that BRTS is provided in all cities above the population of 1 million (p. 198).
- MGI analysis reveals that more than half of the amount needs to be devoted to capital expenditure. Within capital expenditure, almost half the amount is necessary to erase India's existing infrastructure backlog in its cities and to their future needs (p. 63).

Report On Indian Urban Infrastructure And Services By HPEC

Local and sub-local roads are included in the definition of roads for this exercise(Pg.75, Article 3.3.2.) In many other estimates (11th FYP) for roads, only collector and major roads are included.

The large share for urban roads is on account for two factors. First, the service backlog for this sector is higher than those for other sectors' services. The backlog for this sector is very large ranging from 50 to 80 per cent across all Indian cities. Second, unlike sectors such as water where efficiency gains can be quantified, for example, by lowering the proportion of non-revenue water, in urban roads this is difficult. The efficiency gains in roads and transport are more external in nature (like better productivity through greater mobility or reduction in negative externalities of pollution and congestion) and do not necessarily translate into financial gains for the sector itself (p. 76, Article 3.3.3 and 3.3.4.)

A sensitivity analysis with respect to population densities, assuming other variables remain constant, highlights the possibility of reducing investment costs in urban roads and urban transport sectors. For example, an increase in population density by 2,500 per sq. km across all city size classes could reduce the investment requirement for urban roads and urban transport by about Rs 4 trillion, while a decrease in population density by 2500 per sq. km could increase the investment requirement by about Rs 6.5 trillion.

Annex B

Financing Urban Transport: National Urban Transport Fund

[Rs billion]

SOURCES	2012 UPTO 2015		UPTO 2022	UPTO 2032
Green Cess on Existing Vehicles (Urban Settlements)	180	832	3,277	10,588
Urban Transport Tax on New Registration (Urban Settlements)	188	888	3,458	10,548
Green Surcharge on Petrol (Urban Settlements in)	31	141	516	1,491
Total of three sources (Urban Settlements)	399	1,861	7,251	22,626

Detailed calculations are summarised as follows:

Annex B

1 A. Vehicle Population (in '000)

YEAR (AS ON 31 MARCH)	ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
1951	306	27	159	34	82	4
1956	426	41	203	47	119	16
1961	665	88	310	57	168	42
1966	1,099	226	456	73	259	85
1951	306	27	159	34	82	4
1956	426	41	203	47	119	16
1961	665	88	310	57	168	42
1966	1,099	226	456	73	259	85
1971	1,865	576	682	94	343	170
1976	2,700	1,057	779	115	351	398
1981	5,391	2,618	1,160	162	554	897
1986	10,577	6,245	1,780	227	863	1,462
1991	21,374	14,200	2,954	331	1,356	2,533
1996	33,786	23,252	4,204	449	2,031	3,850
2001	54,991	38,556	7,058	634	2,948	5,795
2002	58,924	41,581	7,613	635	2,974	6,121
2003	67,007	47,519	8,599	721	3,492	6,676
2004	72,718	51,922	9,451	768	3,749	6,828
2005	81,501	58,799	10,320	892	4,031	7,459
2006	89,618	64,743	11,526	992	4,436	7,921
2007	96,707	69,129	12,649	1,350	5,119	8,460
2008	105,353	75,336	13,950	1,427	5,601	9,039
2009	114,951	82,402	15,313	1,486	6,041	9,709

Source: Ministry of Road Transport and Highways (2012).

Annex B

1 B. New Vehicle Registration (in '000)

YEAR (AS ON 31 MARCH)	ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
1951						
1956	126	15	47	14	39	12
1961	248	48	111	11	51	26
1966	447	140	152	17	94	44
1971	788	355	235	22	89	87
1976	872	493	111	23	15	231
1981	2,745	1,582	397	49	210	507
1986	5,294	3,679	643	68	320	583
1991	11,009	8,080	1,210	109	510	1,100
1996	12,839	9,336	1,309	125	702	1,368
2001	**21,881**	**15,769**	2,938	194	958	**2,022**

YEAR (AS ON 31 MARCH)	ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
2002	**5,033**	**3,796**	696	14	85	**442**
2003	**9,261**	**6,770**	1,138	99	577	**677**
2004	**7,051**	**5,353**	1,024	61	327	**286**
2005	**10,237**	**7,915**	1,058	139	357	**768**
2006	**9,747**	**7,120**	1,412	118	486	**611**
2007	**8,881**	**5,681**	1,354	378	772	**697**
2008	**10,580**	**7,590**	1,554	104	584	**748**
2009	**11,705**	**8,573**	1,642	88	552	**851**

Source: Figures are derived from Table 1.a; (New Vehicle Registration = Year 2 - Year 1*98% [assuming 2% scrap]).

Annex B

1 C. Vehicle Population Growth (Per cent)

YEAR (AS ON 31 MARCH)		ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
5 Year Growth Rates	1951-56	39	52	28	38	45	300
	1956-61	56	115	53	21	41	163
	1961-66	65	157	47	28	54	102
	1966-71	70	155	50	29	32	100
	1971-76	45	84	14	22	2	134
	1976-81	100	148	49	41	58	125
	1981-86	96	139	53	40	56	63
	1986-91	102	127	66	46	57	73
	1991-96	58	64	42	36	50	52
	1996-01	63	66	68	41	45	51
Annual Growth Rates	2001-06	63	68	63	56	50	37
	2001-02	7	8	8	0	1	6
	2002-03	14	14	13	14	17	9
	2003-04	9	9	10	7	7	2
	2004-05	12	13	9	16	8	9
	2005-06	10	10	12	11	10	6
	2006-07	8	7	10	36	15	7
	2007-08	9	9	10	6	9	7
	2008-09	9	9	10	4	8	7
	Average Last 5 Years	10	10	10	15	10	7

Source: Figures are derived from Table 1.a; Vehicle Population Growth Rate = (Year 2 Vehicles - Year1 Vehicles)/Year 1 Vehicles.

Annex B

1 D. Growth in Registration of New Vehicles (Per cent)

YEAR (AS ON 31 MARCH)		ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
5 Year Growth Rates	1951-56						
	1956-61	96	229	135	-20	33	118
	1961-66	81	192	37	57	84	67
	1966-71	76	154	54	31	-5	98
	1971-76	11	39	-53	2	-83	167
	1976-81	215	221	258	115	1313	119
	1981-86	93	133	62	38	52	15
	1986-91	108	120	88	59	59	89
	1991-96	17	16	8	15	38	24
	1996-01	70	69	124	56	36	48
Annual Growth Rates	2001-06	65	70	65	58	52	39
	2001-02						
	2002-03	**84**	78	64	621	580	**53**
	2003-04	**-24**	-21	-10	-38	-43	**-58**
	2004-05	**45**	48	3	127	9	**169**
	2005-06	**-5**	-10	33	-15	36	**-20**
	2006-07	**-9**	-20	-4	221	59	**14**
	2007-08	**19**	34	15	-72	-24	**7**
	2008-09	**11**	13	6	-16	-6	**14**
	Average Last 5 Years	**12**	13	11	49	15	**37**

Source: Figures are derived from Table 1b; New Vehicles Registration Growth Rate = (Year 2 Registrations-Year1 Registrations)/Year 1 Registrations.
Note: The above table illustrates the year on year incremental growth in the number of vehicles in various categories and not the growth of total vehicle population. The above table is derived based on the year on year registration of new vehicles in various categories.

Annex B

1 E. Vehicular Composition (Per cent)

YEAR (AS ON 31 MARCH)	ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
1956	100.0	9.6	47.7	11.0	27.9	3.8
1961	100.0	13.2	46.6	8.6	25.3	6.3
1966	100.0	20.6	41.5	6.6	23.6	7.7
1971	100.0	30.9	36.6	5.0	18.4	9.1
1976	100.0	39.1	28.9	4.3	13.0	14.7

YEAR (AS ON 31 MARCH)	ALL VEHICLES	TWO WHEELERS	CARS, JEEPS AND TAXIS	BUSES	GOODS VEHICLES	OTHERS
1981	100.0	48.6	21.5	3.0	10.3	16.6
1986	100.0	59.0	16.8	2.1	8.2	13.8
1991	100.0	66.4	13.8	1.5	6.3	11.9
1996	100.0	68.8	12.4	1.3	6.0	11.4
2001	100.0	70.1	12.8	1.2	5.4	**10.5**
2002	100.0	70.6	12.9	1.1	5.0	**10.4**
2003	100.0	70.9	12.8	1.1	5.2	**10.0**
2004	100.0	71.4	13.0	1.1	5.2	**9.4**
2005	100.0	72.1	12.7	1.1	4.9	**9.2**
2006	100.0	72.2	12.9	1.1	4.9	**8.8**
2007	100.0	71.5	13.1	1.4	5.3	**8.7**
2008	100.0	71.5	13.2	1.4	5.3	**8.6**
2009	100.0	71.7	13.3	1.3	5.3	**8.4**
Average Last 5Years	100.0	71.8	13.0	1.2	5.2	8.8

Source: Figures are derived from Table1.a; Composition of Vehicle in Year I = (Total Vehicle in the category/Total Vehicle Population).

Annex B

2. Fuel Consumption

	2004	2005	2006	2007	2008	2009	2010
High Speed Diesel Oil (in '000 tonnes)	37,074	39,651	40,191	42,896	47,669	51,710	55,699
Motor Spirit (in '000 tonnes)	7,897	8,251	8,647	9,285	10,332	11,258	12,731
High Speed Diesel Oil (in million litres)	38,557	41,237	41,799	44,612	49,576	53,778	57,927
Motor Spirit (in million litres)	8,213	8,581	8,993	9,656	10,745	11,708	13,240
Growth Rates (per cent)							
High Speed Diesel Oil		6.95	1.36	6.73	11.13	8.48	7.71
Motor Spirit		4.48	4.80	7.38	11.28	8.96	13.08

Source: Basic Statistics on Indian Petroleum & Natural Gas, MoPNG (http://petroleum.nic.in/petstat.pdf [accessed 12 August 2013]).

Annex B

3. Cess Calculations

a. Green Surcharge on Petrol (Pan India)

YEAR	GROWTH IN MOTOR SPIRIT CONSUMPTION (PER CENT)	CONSUMPTION OF MOTOR SPIRIT (IN LITRES)	GREEN SURCHARGE ON MOTOR SPIRIT (IN RS BILLION) @ RS 2/LITRE	CUMULATIVE GREEN CESS ON PETROL (IN RS BILLION)
2012	8.330	15,538	31	31
2013	8.330	16,832	34	65
2014	8.130	18,200	36	101
2015	8.130	19,680	39	141
2016	7.930	21,241	42	183
2017	7.930	22,925	46	229
2018	7.730	24,697	49	278
2019	7.730	26,606	53	331
2020	7.530	28,610	57	389
2021	7.530	30,764	62	450
2022	7.330	33,019	66	516
2023	7.330	35,439	71	587
2024	7.130	37,966	76	663
2025	7.130	40,673	81	744
2026	6.930	43,492	87	831
2027	6.930	46,506	93	924
2028	6.730	49,635	99	1,024
2029	6.732	52,976	106	1,130
2030	6.530	56,435	113	1,242
2031	6.530	60,121	120	1,363
2032	6.330	63,926	128	1,491

Annex B

3. Cess Calculations

b. Green Cess on Existing Vehicles (Pan India)

YEAR	VEHICULAR GROWTH ASSUMED (PER CENT)	RATIO OF CARS/ JEEPS/TAXIS	RATIO OF TWO WHEELERS	TOTAL VEHICLES ('000)	CARS/JEEPS/ TAXIS ('000)	TWO WHEELERS ('000)
2012	9.60	13.03	71.81	151,336	19,724	108,678
2013	9.60	13.03	71.81	165,863	21,617	119,111
2014	9.40	13.23	71.31	181,454	24,012	129,400
2015	9.40	13.23	71.31	198,510	26,269	141,563
2016	9.20	13.43	70.81	216,772	29,119	153,503
2017	9.20	13.43	70.81	236,715	31,798	167,624
2018	9.00	13.63	70.31	258,019	35,176	181,420
2019	9.00	13.63	70.31	281,239	38,342	197,747
2020	8.80	13.83	69.81	305,988	42,328	213,619
2021	8.80	13.83	69.81	332,914	46,053	232,416
2022	8.60	14.03	69.81	361,543	50,736	250,596
2023	8.60	14.03	69.81	392,635	55,099	272,146
2024	8.40	14.23	68.81	425,615	60,579	292,878
2025	8.40	14.23	68.81	461,365	65,667	317,478
2026	8.20	14.43	68.31	499,196	72,050	341,015
2027	8.20	14.43	68.31	540,129	77,958	368,977
2028	8.00	14.63	67.81	583,337	85,361	395,577
2029	8.00	14.63	67.81	630,003	92,189	427,222
2030	7.80	14.83	67.31	679,141	100,738	457,149
2031	7.80	14.83	67.31	732,112	108,596	492,805
2032	7.60	15.03	66.81	787,750	118,424	526,318

Annex B

3. Cess Calculations

c. Assumptions regarding Life of Vehicle and Its Insured Values

LIFE OF A VEHICLE	NEW & UP TO 1 Y OLD	2 Y OLD	3 Y OLD	4 Y OLD	5 Y OLD	6 Y OLD	7 Y OLD	8 Y OLD	9 Y OLD	10 Y OLD	MORE THAN 10 Y OLD
Value of Vehicle (per cent)	100	95	90	85	80	75	70	65	60	55	50
Percentage of Vehicles (per cent)	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	8.10	19.0
Weighted Average Insured Value of Vehicles	72 per cent										
Leakage in Insurance	50 per cent										

Note: *Y – Year.

Annex B

3. Cess Calculations

d. Calculation of Net Insured Values of Vehicles (Category Wise and Total)

YEAR	BELOW RS 300,000 (AVERAGE RS 250,000)	RS 3-700,000 (AVERAGE RS 500,000)	RS 700,000-1,200,000 (AVERAGE RS 950,000)	RS 1.2-2 MILLION (AVERAGE RS 1.6 MILLION)	ABOVE RS 2 MILLION (AVERAGE RS 3 MILLION)	TOTAL INSURED VALUE OF CAR (RS BILLION)	TOTAL INSURED VALUE OF TWO WHEELERS (RS BILLION)	NET INSURED VALUE OF CAR EXCLUDING LEAKAGE (IN RS BILLION)	NET INSURED VALUE OF TWO WHEELERS EXCLUDING LEAKAGE (IN RS BILLION)
2012	71,277	320,747	270,853	228,086	213,831	11,048	3,927	5,524	1,964
2013	78,119	351,537	296,854	249,982	234,358	12,109	4,304	6,054	2,152
2014	86,774	390,482	329,741	277,676	260,322	13,450	4,676	6,725	2,338
2015	94,930	427,187	360,735	303,777	284,791	14,714	5,116	7,357	2,558
2016	105,230	473,537	399,875	336,737	315,691	16,311	5,547	8,155	2,774
2017	114,911	517,101	436,663	367,716	344,734	17,811	6,058	8,906	3,029
2018	127,118	572,030	483,048	406,777	381,353	19,703	6,556	9,852	3,278
2019	138,558	623,511	526,520	443,386	415,674	21,476	7,146	10,738	3,573
2020	166,422	748,901	632,405	532,552	499,267	25,795	7,720	12,898	4,199
2021	166,422	748,901	632,405	532,552	499,267	25,795	8,399	12,898	4,199
2022	183,347	825,063	696,720	586,711	550,042	28,419	9,056	14,209	4,528
2023	199,115	896,016	756,636	637,167	597,344	30,863	9,835	15,431	4,917
2024	218,916	985,121	831,880	700,531	656,747	33,932	10,584	16,966	5,292
2025	237,304	1,067,868	901,756	759,373	711,912	36,782	11,473	18,391	5,736
2026	260,370	1,171,666	989,407	833,185	781,111	40,357	12,323	20,179	6,162
2027	281,720	1,267,739	1,070,536	901,504	845,160	43,667	13,334	21,833	6,667
2028	308,473	1,388,127	1,172,196	987,113	925,418	47,813	14,295	23,907	7,148
2029	333,150	1,499,173	1,265,969	1,066,079	999,449	51,638	15,439	25,819	7,719
2030	364,043	1,638,193	1,383,363	1,164,937	1,092,128	56,427	16,520	28,213	8,260
2031	392,437	1,765,967	1,491,261	1,255,799	1,177,311	60,828	17,809	30,414	8,904
2032	427,955	1,925,796	1,626,227	1,369,455	1,283,864	66,333	19,020	33,166	9,510

Note: Net Insured Value = Total Insured Value *(1--percentage Leakage).

Annex B

3. Cess Calculations

e. Calculation of Green Cess @4 Per cent of Net Insured Value of Vehicles

YEAR	CARS (IN RS BILLION)	TWO WHEELERS (IN RS BILLION)	TOTAL GREEN CESS (IN RS BILLION)	CUMULATIVE GREEN CESS (IN RS BILLION)
2012	221	79	300	300
2013	242	86	328	628
2014	269	94	363	990
2015	294	102	397	1,387
2016	326	111	437	1,824
2017	356	121	477	2,301
2018	394	131	525	2,827
2019	430	143	572	3,399
2020	474	154	629	4,028
2021	516	168	684	4,712
2022	568	181	749	5,461
2023	617	197	814	6,275
2024	679	212	890	7,165
2025	736	229	965	8,130
2026	807	246	1,054	9,184
2027	873	267	1,140	10,324
2028	956	286	1,242	11,566
2029	1,033	309	1,342	12,908
2030	1,129	330	1,459	14,367
2031	1,217	356	1,573	15,939
2032	1,327	380	1,707	17,646

Annex B

4.Urban Transport Tax on New Registration (Pan India)

a. Calculation of New Vehicle Registration (in '000)

YEAR	CARS ASSUMING 1 PER CENT SCRAP	BELOW RS 300,000 (AVERAGE RS 250,000)	RS 3-700,000 (AVERAGE RS 500,000)	RS 700,000-1,200,000 (AVERAGE RS 950,000)	RS 1.2-2 MILLION (AVERAGE RS 1.6 MILLION)	ABOVE RS 2 MILLION (AVERAGE RS 3 MILLION)	TWO WHEELERS ASSUMING 2 PER CENT SCRAP
2012	1,908	382	859	382	191	95	11,502
2013	2,091	418	941	418	209	105	12,606
2014	2,611	522	1,175	522	261	131	12,671
2015	2,497	499	1,124	499	250	125	14,751
2016	3,113	623	1,401	623	311	156	14,771
2017	2,970	594	1,337	594	297	149	17,192

YEAR	CARS ASSUMING 1 PER CENT SCRAP	BELOW RS 300,000 (AVERAGE RS 250,000)	RS 3-700,000 (AVERAGE RS 500,000)	RS 700,000-1,200,000 (AVERAGE RS 950,000)	RS 1.2-2 MILLION (AVERAGE RS 1.6 MILLION)	ABOVE RS 2 MILLION (AVERAGE RS 3 MILLION)	TWO WHEELERS ASSUMING 2 PER CENT SCRAP
2018	3,696	739	1,663	739	370	185	17,148
2019	3,518	704	1,583	704	352	176	19,956
2020	4,369	874	1,966	874	437	218	19,826
2021	4,148	830	1,867	830	415	207	23,070
2022	5,144	1,029	2,315	1,029	514	257	22,828
2023	4,871	974	2,192	974	487	244	26,562
2024	6,030	1,206	2,714	1,206	603	302	26,174
2025	5,694	1,139	2,562	1,139	569	285	30,458
2026	7,040	1,408	3,168	1,408	704	352	29,886
2027	6,628	1,326	2,983	1,326	663	331	34,783
2028	8,183	1,637	3,682	1,637	818	409	33,980
2029	7,682	1,536	3,457	1,536	768	384	39,557
2030	9,471	1,894	4,262	1,894	947	474	38,471
2031	8,865	1,773	3,989	1,773	887	443	44,799
2032	10,914	2,183	4,911	2,183	1,091	546	43,369

Annex B

4.Urban Transport Tax on New Registration (Pan India)

b. Calculation of Category Wise Newly-Registered Petrol & Diesel Cars (70 per cent Petrol and 30 per cent Diesel Cars) (in '000)

YEAR	PETROL CARS	BELOW 0.3 MN	0.3-0.7 MN	0.7-1.2 MN	1.2-2 MN	ABOVE 2 MN	DIESEL CARS	BELOW 0.3 MN	0.3-0.7 MN	0.7-1.2 MN	1.2-2 MN	ABOVE 2 MN
2012	1,336	267	601	267	134	67	573	115	258	115	57	28
2013	1,465	293	659	293	146	74	626	125	282	125	63	31
2014	1,828	365	823	365	183	92	783	157	352	157	78	39
2015	1,748	349	787	349	175	88	749	150	337	150	75	37
2016	2,180	436	981	436	218	109	934	187	420	187	93	47
2017	2,080	416	936	416	208	104	891	178	401	178	89	45
2018	2,587	517	1,164	517	259	130	1,109	222	499	222	111	55
2019	2,463	493	1,108	493	246	123	1,056	211	475	211	106	53
2020	3,059	612	1,376	612	306	153	1,310	262	590	262	131	65
2021	2,905	581	1,307	581	291	145	1,244	249	560	249	124	62
2022	3,601	720	1,621	720	360	180	1,543	309	694	309	154	77
2023	3,410	682	1,534	682	341	171	1,461	292	658	292	146	73
2024	4,221	844	1,900	844	422	211	1,810	362	814	362	181	91

YEAR	PETROL CARS	BELOW 0.3 MN	0.3-0.7 MN	0.7-1.2 MN	1.2-2 MN	ABOVE 2 MN	DIESEL CARS	BELOW 0.3 MN	0.3-0.7 MN	0.7-1.2 MN	1.2-2 MN	ABOVE 2 MN
2025	3,985	797	1,793	797	398	200	1,709	342	769	342	171	85
2026	4,929	986	2,218	986	493	246	2,111	422	950	422	211	106
2027	4,640	928	2,088	928	464	232	1,989	398	895	398	199	99
2028	5,728	1,146	2,577	1,146	573	286	2,455	491	1,105	491	245	123
2029	5,377	1,075	2,420	1,075	538	269	2,304	461	1,037	461	230	115
2030	6,630	1,326	2,983	1,326	663	332	2,841	568	1,279	568	284	142
2031	6,205	1,241	2,792	1,241	621	310	2,660	532	1,197	532	266	133
2032	7,640	1,528	3,438	1,528	764	382	3,274	655	1,473	655	327	164

Annex B

4.Urban Transport Tax on New Registration (Pan India)

c. Urban Transport Tax Rates and Estimated Collections

YEAR	UT TAX RATE ON PETROL CARS (PER CENT)	UT TAX RATE ON DIESEL CARS (PER CENT)	UT TAX RATE ON TWO WHEELERS (PER CENT)	COLLECTIONS FROM CARS (IN RS BILLION)	COLLECTIONS FROM TWO WHEELERS (IN RS BILLION)	TOTAL URBAN TRANSPORT CESS (IN RS BILLION)	CUMULATIVE URBAN TRANSPORT CESS (IN RS BILLION)
2012	7.5	20	7.5	166	43	209	209
2013	7.5	20	7.5	182	47	229	439
2014	7.5	20	7.5	228	48	275	714
2015	7.5	20	7.5	218	55	273	987
2016	7.5	20	7.5	272	55	327	1,314
2017	7.5	20	7.5	259	64	324	1,637
2018	7.5	20	7.5	322	64	384	2,024
2019	7.5	20	7.5	307	75	382	2,406
2020	7.5	20	7.5	381	74	455	2,861
2021	7.5	20	7.5	361	87	448	3,309
2022	7.5	20	7.5	448	86	534	3,843
2023	7.5	20	7.5	425	100	524	4,367
2024	7.5	20	7.5	526	98	624	4,991
2025	7.5	20	7.5	496	114	611	5,602
2026	7.5	20	7.5	614	112	726	6,328
2027	7.5	20	7.5	578	130	708	7,036
2028	7.5	20	7.5	713	127	841	7,877
2029	7.5	20	7.5	670	148	818	8,695
2030	7.5	20	7.5	826	144	970	9,665
2031	7.5	20	7.5	773	168	974	10,606
2032	7.5	20	7.5	952	163	1,114	11,720

Annex B

5. Summary of Accruals to National Urban Transport Fund (In Rs Billion)

						NATIONAL URBAN TRANSPORT FUND (NUTF)				
YEAR	GREEN SURCHARGE ON PETROL	GREEN CESS ON EXISTING VEHICLES (PAN INDIA)	URBAN TRANSPORT TAX ON NEW REGISTRATION (PAN INDIA)	TOTAL ACCRUALS TO UTF (PAN INDIA)	TOTAL CUMULATIVE ACCRUALS TO UTF (INDIA)	GREEN SURCHARGE ON PETROL (100 PER CENT IN URBAN SETTLEMENTS)	GREEN CESS ON EXISTING VEHICLES (60 PER CENT IN URBAN SETTLEMENTS)	URBAN TRANSPORT TAX ON NEW REGISTRATION (90 PER CENT IN URBAN SETTLEMENTS)	TOTAL ACCRUALS TO UTF	TOTAL CUMULATIVE ACCRUALS TO UTF
2012	31	300	209	509	509	31	180	188	399	**399**
2013	34	328	229	558	1,067	34	197	207	437	**836**
2014	36	363	275	638	1,704	36	218	248	502	**1,338**
2015	39	397	273	670	2,374	39	238	246	523	**1,861**
2016	42	437	327	764	3,138	42	262	294	599	**2,460**
2017	46	477	324	801	3,939	46	286	291	624	**3,083**
2018	49	525	387	912	4,851	49	315	348	712	**3,796**
2019	53	572	382	954	5,805	53	343	344	740	**4,536**
2020	57	629	455	1,084	6,888	57	377	409	844	**5,380**
2021	62	684	448	1,132	8,020	62	410	403	875	**6,255**
2022	66	749	534	1,283	9,304	66	450	481	996	**7,251**
2023	71	814	524	1,338	10,642	71	488	472	1,031	**8,282**
2024	76	890	624	1,515	12,157	76	534	562	1,172	**9,454**
2025	81	965	611	1,576	13,732	81	579	550	1,210	**10,664**
2026	87	1,054	726	1,780	15,512	87	632	653	1,372	**12,037**
2027	93	1,140	708	1,848	17,360	93	684	637	1,414	**13,451**
2028	99	1,242	841	2,083	19,443	99	745	757	1,601	**15,053**
2029	106	1,342	818	2,159	21,602	106	805	736	1,647	**16,700**
2030	113	1,459	970	2,429	24,031	113	875	873	1,861	**18,561**
2031	120	1,573	941	2,514	26,545	120	944	847	1,911	**20,472**
2032	128	1,707	1,114	2,821	29,366	128	1,024	1,003	2,155	**22,626**

Annex C

Rolling Programme Upto 2030

Calculation as Per Service-Level Bench Mark Guidelines

DESCRIPTION	2015	2020	2025	2030
LEVEL OF SERVICE	**4**	**3**	**2**	**1**
PUBLIC TRANSPORT				
Rail Transit, Bus Rapid Transit on Exclusive Row as Per Cent of Total Road Cum Rail Length	<10	10-20	20-30	>=30
No. of Buses/1000 Population	<0.2	0.2-0.4	0.4-0.6	>= 0.6
IPT (Intermediate public transport) In All Cities	Organise	Upgrade		
NMT (NON-MOTORISED TRANSPORT) AND ACCESS				
Footpaths/Road Length as Percentage	< 25	25-50	50-75	>= 75
Street Lighting (Lux Level)	<4	4-6	6-8	>= 8
Bicycle Lanes; Network Length as Percentage of Length of Road Network	<15	25-15	50-25	>= 50
Parking Facilities for NMT as Percentage of Major Terminals	<25	25-50	50-75	>= 75
TRAFFIC MANAGEMENT: TRAVEL SPEED (KMPH)				
Personal Vehicles	<15	15-25	25-30	>= 30
Public Transport	<10	10-15	15-20	>= 20
ROADS AND LINKED INFRASTRUCTURE				
Percentage of Area Under Roads	<10	10-12	12-15	>=15
Parking Spaces Paid as Percentage of Total	<25	25-50	50-75	>= 75
TERMINALS				
Intermodal	Plan	Implement		
Bus	Plan	Implement		
Truck	Plan	Implement		
ITS (INTELLIGENT TRANSPORT SYSTEMS)				
Surveillance; CCTV Provided as Per Cent of Needed	<25	25-50	50-75	>= 75
PIS (Passenger Information System) As Per Cent Of Needed	<25	25-50	50-75	>= 75
GPS/GRPS as Per Cent of Total No. of PT Vehicles	<25	25-50	50-75	>= 75
Signal Synchronisation as Per Cent of Needed	<25	25-50	50-75	>= 75
Modes In Integrated Ticketing as Percentage of Total Modes	<25	25-50	50-75	>= 75
TDM (TRANSPORT DEMAND MANAGEMENT)				
INTEGRATED LAND USE TRANSPORT PLAN				
Persons Per Hectare	<125	125-150	150-175	> = 175

DESCRIPTION	2015	2020	2025	2030
LEVEL OF SERVICE	**4**	**3**	**2**	**1**
Mixed Land Use On Major Transit Corridors (Percentage Area Under Non-Residential Use	<5	5-15	15-30	<=30
Intensity Of Development City Wide	<1	1.0-1.5	1.5-2.0	<=2.0
Intensity of Development Along Transit Corridor- Ratio of FSI on Transit Corridor To City FSI	<1-5	1.5-2.0	2.0-3.0	<=3.0
SAFETY				
Fatality Rate Per Million Population	>0.6 Persons	0.4-0.6 Persons	0.2-0.4 Persons	<=0.2 Persons
Fatality Rate For NMT as Per Cent of Total	>60	40-60	20-40	<=20
Security	Ongoing			
Safety Audit	Ongoing			
INSTITUTIONAL FRAMEWORK				
Legislation	Enact			
ENVIRONMENT				
Energy Efficiency	Implement			
Low Carbon Path	Implement			
Pollution	14-16	10-13	6-9	<=5
GHG (Greenhouse Gases) Emissions	Implement			
Capacity Building (As Percentage of Present Planning)				
Training	60 per cent	40 per cent	Ongoing	Ongoing
Education	60 per cent	40 per cent	Ongoing	Ongoing
R&D	60 per cent	40 per cent	Ongoing	Ongoing
Database	60 per cent	40 per cent	Ongoing	Ongoing
INVESTMENT NEED FINANCIAL SUSTAINABILITY OF BUS TRANSPORT				
Extent of Non Fare Revenue as Percentage of Total Revenue	<=10	10-20	20-40	>40
Staff Per Bus Ratio	<10	8-10	5.5-8	<=5.5
Operating Ratio	>=1.5	1-0-1.5	0.7-1.0	<0.7
Investment (Scenario 2)	**Rs 2 Trillion**	**Rs 4 Trillion**	**Rs 5 Trillion**	**Rs 6 Trillion**

Note: FSI: Floor Space Index; GPS: Global Positioning System; GPRS: General Packet Radio Service; PT: Private.

ANNEX D: URBAN TRANSPORT PLANNING IN SELECT INDIAN METROS

BANGALORE

Bangalore's urban transport system is a joint product of a number of agencies. The Municipal Corporation (Bruhat Bangalore Mahanagara Palike–BBMP), Bangalore Metrorail Corporation (a joint venture between national and state government departments), two agencies accountable to the state government (Bangalore Development Authority (BDA) and the Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC), and South Western zone of the national Indian Railways contribute to the physical network. The Bangalore International Airport Limited (BIAL), a joint venture between the Ministry of Civil Aviation, Karnataka Industrial Investment and Development Corporation (a state agency), and private promoters, developed the city's airport. The Bangalore Metropolitan Transport Corporation (BMTC), Bangalore Metrorail Corporation (BMRC) supply services on this network, competing

with private cars, taxis, rickshaws, and other means of transport. Traffic laws, environmental regulations determined by the national and state Pollution Control Boards (PCB), 'road furniture' according to guidelines established by the Indian Roads Congress (IRC), and licenses issued by the Regional Transport Offices (RTO) influence the operating environment for transport services and vehicle owners.

The state has setup the Bangalore Metropolitan Land Transport Authority (BMLTA) through an executive order, which is primarily a high-powered committee involving most of the senior bureaucracy and two experts. This is anchored by the Directorate of Urban Land Transport, a state-level agency under the Urban Development Department that was technically setup also through an executive order one day prior to setting up of BMLTA. The DULT is supposed to be the coordinating agency for most aspects concerning urban transport in all cities of Karnataka.

Bangalore is also home to several prominent citizen initiatives to provide citizens with more information about transport options and thus (probably) influencing ridership, usage, and public pressure for transport investment and service provision. Mapunity's Transport Information System[62], for example, helps consumers plan multimodal trips, creating an observable demand for further integration of ticketing, physical connections, and other parts of the system[63] for moving people.

The city and metropolitan region's transport system is effectively determined by decisions taken at the state level, with limited institutionalised input from city elected or civic leaders. The Directorate of Urban Land Transport (DULT) under the Urban Development Department is institutionally positioned as a coordinating body for most of the system. It, and especially its parent Organisation (the State Urban Development Department–UDD) have some levers with which to execute this role: the UDD role in allocation of state funding as well as direction of national funds from programmes like JNNURM, convening of meetings, and oversight of departments' functioning.

Decision-making about land use and transport infrastructure across modes intersect also intersect in the KUIDFC, particularly in projects such as the proposed cluster cities development around Bangalore. KUIDFC had commissioned the preparation of Comprehensive Traffic and Transportation Plan (CTTP) for Bangalore in 2007, a report that considerably influenced transport infrastructure development projects taken up by BBMP, BDA, BMRCL, BMTC, KSRTC and Traffic Police including the road widening projects by BBMP, next phases of Metro lines including High Speed Rail to Airport, Monorail/light rail corridors, construction of numerous underpasses and flyovers by BBMP and BDA, and TTMCs by BMTC. Although the KUIDFC is not integrated as a subordinate agency of UDD[63] (or its sub-agencies DULT and BMLTA), a sub-committee under BMLTA was constituted to ensure timely implementation of the projects identified under CTTP. However, during late 2008, owing to a jurisdictional issue, BMLTA directed BMRDA to prepare a revised CTTP for Bangalore Metropolitan Region (comprising about 8,000 sq. km) that should take the CTTP prepared by KUIDFC into account. As it stands, the revised CTTP has been prepared for Bangalore Metropolitan Region.

There are many regular, repeated circumstances in which the various agencies must interact in Bangalore and other evolving cities—decisions about land use, for example, or planning points of interchange and intermodal connection services, ensuring that new developments are adequately connected to the rest of the city, or assessing the impact of new developments and transport infrastructure on air quality via anticipated traffic—but there are few institutionalised channels through which this can take place.

Horizontal coordination between the various agencies takes place on a project basis and generally by specific MOU. Informal coordination amongst different agencies can work well. It worked well just before the inauguration of the new International Airport at Devanahalli, for example, when the State Government constituted a High Level Task Force to Airport Connectivity chaired under an officer of Additional Chief Secretary to the Government with members from heads of various line departments including BBMP, BDA, NHAI, BIAL, Traffic Police, PWD, BMRDA, and others during January-June 2008. In this case, all agencies met almost once a fortnight to take stock of various aspects to ensure there was better connectivity to the new international airport from city centre. It also happens at lower levels: the Bangalore Metrorail Corporation and the Bangalore Metropolitan Transport Corporation, for example, signed an MoU for Common Day Metro-Bus transit passes in February 2011, and BMTC introduced a metro feeder bus service in October 2011, when the first line of the Metro was inaugurated.

Nevertheless, coordination by MOU does not resolve all of the challenges, particularly coordination problems that extend across state and national governments. The BMRCL and Indian Railways have sparred over land use for points where the two rail networks converge. The Metro's North-South Corridor is stalled because the South West Railways is asking for additional compensation for Railways land to

62. http://www.btis.in (accessed 15 January 2014).
63. The South Western Railway reports directly to national railways, complicating efforts to take advantage of rail infrastructure and rail lands for the public transport network. Although there are a number of cooperative agreements between BIAL and state/national agencies, disputes between BIAL and other agencies sometimes require the intervention of the Chief Secretary to resolve.

be used by Metro .There have been extended delays over transfer of land to Metro by KSRTC and vice-versa for construction of Central Station at Majestic by Metro and Intermodal Bus Terminal at Peenya by KSRTC respectively. The matter had appeared in at least two meetings of the BMLTA and has been finally resolved. In the current state of affairs, the State Government has resorted to SPVs to ensure various projects proposed under CTTP[65].

The Bangalore Metropolitan Land Transport Agency (BMLTA), Bangalore's answer to the national mandate to establish Metropolitan Transport Authorities to coordinate urban transport planning and investment, is currently a convening body consisting of the heads of all agencies relevant for transport infrastructure, land use planning, and transport services and chaired by the Commissioner of DULT. It met regularly in the first three years after establishment to discuss coordination, but this frequency has reduced in 2012. It does not have any formal powers to influence investment or expenditure. At the time of writing, the DULT had commissioned a consultant report on the statutory aspects of empowering the body and was reportedly considering a new Bill that would strengthen the BMLTA.

CHENNAI[66]

Responsibility for managing the various components of transportation in Chennai falls under various agencies and departments of central, state and city government. The suburban train, the operations of Mass Rapid Transit System (MRTS) and the ownership of the rolling stock comes under the Indian Railways. The rest of MRTS including air-rights—the right to build, operate and commercialise areas above the metro if necessary—is owned by Chennai Metropolitan Development Authority (CMDA).

Land use and transportation planning is under the purview of CMDA, an agency under the Housing and Urban Development Department of the Government of Tamil Nadu (GoTN). Certain key roads in the city are the responsibility of Highways Department (HD). Legally, only Metropolitan Transport Corporation (MTC) under the Department of Transport of GoTN is allowed to operate stage carriages—buses, share autos and the like – for public purposes. Private parties are allowed only usage of 'tourist' vehicles—auto, taxis, maxicabs—which offer point to point journeys to ferry passengers. The regulation of all of these vehicles is the responsibility of the Commissionerate of Transport under the Home Department and its Regional Transport Offices (RTOs). Chennai Metro Rail Limited (CMRL) was created by GoTN as a Special Purpose Vehicle (SPV) to build and manage the upcoming metro rail system. CMRL is partly funded by the Central Government and GoTN.

The Corporation of Chennai (CoC) manages many of the bus routes and residential roads, parking and other road infrastructure. The Mayor of Chennai is elected by popular vote and the head of the city bureaucracy—the Commissioner and his team—is appointed by GoTN and reports to the Department of Municipal Administration and Water Supply (MAWS). Traffic is managed by Chennai Traffic Police, which also reports to the Home Department.

Some civil society organisations including the Institute for Transportation and Development Policy (ITDP), Embarq, Chennai City Connect (CCC), Transparent Chennai, SUSTAIN and various passenger associations have been engaging with government agencies to advise and improve planning and transportation infrastructure and services.

GoTN has formed the Chennai Unified Metropolitan Transport Authority (CUMTA), headed by the Minister for Transport as Chair, Chief Secretary (CS) as Vice-Chair and all relevant departments and agencies as members. The bill was modeled on the Hyderabad and Mumbai MTAs and gives the UMTA the authority to 'recommends' and 'advise' city and state governments on transport as well as the civil powers to initiate a suit.

While awaiting notification of the bill, the state government has also appointed a 14-member executive committee various working groups on Intermodal Integration (IMI) headed by the MD of CMRL; Finance headed by Secretary of Finance; Non-motorised Transport headed by the Commissioner of CoC. These working groups have senior engineering and planning staff from CMDA, HD, CoC, CTP, MTC, MRTS and other relevant departments. Civil society organisations and experts from CCC, ITDP, Anna University are members of these working groups. The CUMTA Executive Committee, chaired by the CS, and the working groups have the authority to engage experts and relevant organisations as they see fit.

CUMTA has been meeting and discussing complex projects that require a fair degree of cooperation among the members. Most of the projects and policy initiatives are in the early stages. For example the policy on parking management mentioned here is a new initiative. While area planning of CMRL stations is an ongoing project, area planning for MRTS was initiated and is being monitored in the IMI working group. Similarly Common Ticketing is being coordinated and monitored by the IMI working group and involves staff from CMRL and MTC.

CMRL initiated area planning and generation of related projects for various agencies. It has created

64. http://articles.timesofindia.indiatimes.com/2012-04-18/Bengaluru/31361004_1_railway-land-swr-metro-workers (accessed 2 May 2012).
65. The Bengaluru Airport Rail Link Limited, another SPV under the Infrastructure Development Department was set to study the feasibility for high speed rail to airport, monorail/light rail as proposed in CTTP and then take on its construction similar to the relationship between BMRCL and the Metro. In a more recent move, the state government has established Hubli-Dharwad BRTS Company Limited (registered during first week of May 2012) for taking up the BRTS between Hubli-Dharwad in northern Karnataka.
66. This text box was contributed by Raj Cherubal, Director-Projects, Chennai City Connect.

projects for Corporation of Chennai (CoC), HD, MTC, and the CMDA. This project could have profound impact in not only planning orderly and accessible Metro Rail stations by providing safe pedestrian crossing around stations, proper footpaths; pick up and drop off area for private and para-transit; proper bus stops for easy and safe interchange; feeder service with a radius of a few kilometres to avoid use of private vehicles to access Metro Rail; safe public space around stations with vending, public amenities like public toilets, etc.

Joint studies were done by CMRL and other agencies and budgets are being prepared by the agencies for implementation. CoC and HD have also taken up re-designing of roads with modern planning and designs due to this process. CMDA is preparing similar areas plans for the MRTS.

CUMTA is playing a vital role in coordination among these agencies. Since CUMTA does not yet have its own secretariat and planning staff much of this is done by its member agencies. Also, for example, since CMRL is an older and already functional agency and has a strong interest in implementing a vibrant area plan, CMRL officials have taken the initiatives in CUMTA working group to coordinate plans with other agencies. As mentioned earlier, regarding some new issues like city-wide parking management and common ticketing policy and technical specifications CUMTA is helping coordinate among the various agencies. The exact nature and responsibility of planning is expected to evolve as CUMTA is staffed with managerial and engineering personnel.

Important transport hubs like the airport and its vicinities are being reconsidered from IMI perspective—integration of various modes; providing due space and design for public transportation; physical and IT integration; evolving a common plan and physical design across various agencies. This reconsideration is being initiated by agencies like CMRL and organisations like CCC and ITDP.

Currently agencies including the Airport Authority of India (AAI), which owns and operates the airport, do not consider the impact of other modes of transportation on the airport. No specific provision is made to integrate the suburban train, future Metro Rail, buses, para-transit, etc. with the airport to make public transport friendlier for airport passengers. Using the same IMI principles and opportunity, vicinity of the airport is being relooked and redesigned by AAI. But this process gets complicated since various public spaces belong to different agencies. For example, while the airport is owned and operated by AAI, the road in front of the airport belongs to the HD, suburban station to Indian Railways, metro stations to CMRL and so on. Issues of budgets for improvements and integration, payment for competent consultants and so on become a matter of protracted discussions. Ideally, CUMTA should initiate and fund the studies and prepare common plans, while its member agencies raise funds to improve their respective infrastructure and services. Since CUMTA does not yet have funds and staff of its own these activities are being initiated by the Department of Transportation, CMRL, ITDP, CCC and others on their own initiative.

CUMTA is preparing initiatives to establish its secretariat, employ professional staff and has already begun to develop various policies for adoption. It developed a parking policy based on market based pricing, with SPV to manage city parking, for example, which the Corporation of Chennai has agreed to implement via a SPV with Chennai Traffic Police (CTP) and others as co-owners. This model is based on cities like Budapest where they have implemented highly effective parking management systems.

CUMTA has also engaged organisations like ITDP to advise and help implement benchmarks, standards, processes and other tools to make transportation in Chennai more sustainable and modern. CUMTA is also exploring formal and informal tie-ups with international sister organisations who have considerable expertise and experience in managing urban, citywide transport systems.

The CoC via the NMT working group is studying creation of semi or fully pedestrianised areas in important locations in the city. Modelled along Time Squares (NY) and other successful efforts, this could not only create vibrant and safe public spaces but also improve shopping, cultural and leisure experience of visitors.

As part of their efforts to improve pedestrian facilities on roads, CoC and HD have initiated re-design studies of all major roads—which add up to hundreds of kilometre of roads in the city. Here some fundamental decision such as rethinking of carriage way size are being made. Additionally facilities for easy access to all citizens, including disabled, elderly, are being incorporated into the design. The city is now rethinking the standards being used currently along with beginning to undertake more serious coordination with other agencies to ensure trouble free pedestrian flow and smoother traffic flow.

City agencies including CUMTA has enlisted various organisations like Chennai City Connect, Transparent Chennai, SUSTAIN, Care Earth and so on to help in these discussions and rethink. Additionally, MTC and other organisations have initiated studies and pilots to make the system more public transport and citizens friendly. For example, MTC is studying its routes and existing infrastructure and processes to optimise its routes; increase frequency; improve fuel efficiency; improve communication with passengers and so on.

While considerable progress has been made by the city, considerable hurdles still remain and needs to be dealt with. One of the many hurdles is that planning in many areas, like road improvement for dealing with congestion, is dealt by HD and CoC with very little input from MTC and other public transport agencies.

This means that while the GoTN has set ambitious and progressive goals to shift 70 per cent of motorised trips in Chennai to public transport by 2026, agencies like HD and CoC still see flyovers, road widening and elevated roads as solutions to easing congestion. This would be counter to plans in an advanced city, with superior planning and coordination capabilities, where emphasis would be on increasing the public transportation infrastructure and services while at the same time restricting ownership and usage of private vehicles. Such complex plans requires sophisticated coordination of vision, goals, policy, plans, designs, standards and so on among various agencies—which is what CUMTA is expected to do when fully functional.

Many more governance initiatives, tools and processes need to be adopted. There is still a huge dearth of IT and communication systems to engage public participation; ensuring adherence to proper standards and designs; transparent contracting and monitoring; active maintenance and upgrade. All these will require substantial work by CUMTA and all its agencies.

MUMBAI[67]

Mumbai's transport system is overseen by a combination of municipal/metropolitan authorities, state agencies, and national government entities. The road system is planned and developed by Municipal Corporation of Greater Mumbai (MCGM), the Mumbai Metropolitan Development Authority (MMRDA), and the Maharashtra State Road Development Corporation (MSRDC). Local and neighbourhood roads tend to be the responsibility of the Municipal Corporation, while the MMRDA and MSRDC invest in the larger urban arteries such as the proposed elevated coast road from Sewri to Worli (MMRDA) and the Mumbai Trans Harbor Link (MSRDC). Sidewalks, footpaths and skyways are similarly shared across the corporation and metropolitan agencies, with MCGM responsible for much of the legacy network while MMRDA has developed the system of skywalks more recently.

Several national highways developed by the National Highways Authority of India also run through the city and connect it to other urban areas in its economic catchment area (e.g., Pune and Nashik). Construction of roads in coastal areas also come under the purview of the Government of India Ministry of Environment and Forests' national regulations on coastal zones.

The MCGM, also known as the Brihanmumbai Municipal Corporation (BMC) also has primary responsibility for streetlights, clearing encroachments, and maintaining utilities under roads. It is also responsible for traffic management, in keeping with national guidelines for road standards and traffic furniture. An independent Traffic Management Unit was set up under the MCGM in 1999 as part of an effort to strengthen overall urban transport planning. It has the authority to coordinate traffic signals and routing, but its ability to coordinate investments in the road system and public bus services and, even more broadly, investments in alternatives to road transport are not clear.

The bus system comprises three municipal-level services: the largest, the Brihanmumbai Electric Supply & Transport Undertaking (BEST), an autonomous agency formed when the BEST Company was 'municipalised' under the MCGM, operates buses through the metropolitan area including Navi Mumbai. The Navi Mumbai Municipal Transport (NMMT) also operates buses within Navi Mumbai as well as on routes connecting Navi Mumbai and Mumbai. The Thane Municipal Transport (TMT) operates its buses from Thane to outlying areas.

The suburban rail system is owned by Indian Railways and operated jointly by two zones (Western and Central). The Mumbai Railway Vikas Corporation Ltd (MRVC), a joint venture of Ministry of Railways and the Government of Maharashtra, was also formed in 1999 as part of the Mumbai Urban Transport Project for implementation of rail related projects to reduce congestion.

The MMRDA, chaired by the Urban Development Minister of Maharashtra, is the planning and nodal agency for Mumbai Metro project, although some aspects of development such as dispute resolution or cancellation of PPP contracts are under the purview of the Maharashtra State Government. The Metro is being developed in part as public-private partnership—the Mumbai Metro Transport Private Ltd (MMTPL), though more recent expansions may be under the engineering-procurement-construction (EPC) route. The metro will be operated by Mumbai Metro One Pvt Ltd (MMOPL), a joint venture company formed by Reliance Infrastructure, Veolia Transport and the Mumbai Metropolitan Region Development Authority (MMRDA).

Mumbai also has a number of NGOs and international non-profits working on transport-related issues that work with the government and citizen groups to provide expertise for particular projects, advocate

67. Rishi Aggarwal, Observer Research Foundation, contributed significantly to this text box.

integration in neighbourhoods and across modes, develop passenger information tools, and otherwise contribute to Mumbai's transport planning. The World Bank has also provided technical assistance on several projects and integrated transport plans.

In principle, the MMRDA has been the central point for coordination of Mumbai's transport strategy for the last decade. The 2002 Mumbai Urban Transport Project (MUTP) was led by MMRDA with support from the World Bank. The Comprehensive Transport Strategy (CTS) developed under this project envisioned multi-modal coordination for the Mumbai region, so the UMTA was created by Executive Order in 2008 to be the nodal agency for coordination. It operates as a department of the MMRDA and relies on the Development Authority as its administrative and technical Secretariat. As of January 2013, a law was being drafted to establish the UMTA as a separate agency with its own staff.

There UMTA does not appear to have the powers to coordinate with other regional development agencies involved in transport. It is a state-level agency, while the BMC and other bus operators report to the Municipal Corporations. The Additional Chief, UMTA of MMRDA (K. Vijaylakshmi) described some of the challenges in detail at a November 2011 public meeting[68]: The metro- and mono-rail projects have been planned keeping in mind links to the suburban railways, but the project has grown significantly. Plans for a multi-modal corridor from Alibag to Virar, have also been generated. However, implementation of the BRTS for the Western and Eastern Express Highways had been deadlocked due to problems with inter-agency coordination: 'MMRDA has already completed the Detailed Engineering Report (DER), but as the BRTS is under the jurisdiction of MSRDC, BEST and BMC, MMRDA is unable to work on it', she said[69]. Traffic management, a part of the overall transport strategy, is meant to be undertaken by the BMC and other Municipal Corporations. There are also challenges in coordination with other state agencies such as the RDC and the state-national joint venture MVRC concerned with suburban rail.

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