Draft 2.3

Sustainable Urban Transport

Principles and Implementation Guidelines for Indian Cities





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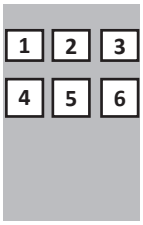

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Preface

The existing pattern of growth of population and physical form of Indian cities threatens to lead us to an unsustainable future of private vehicle oriented development. Many developed nations, which took such a path earlier during their phase of rapid urbanization, are now struggling to retrofit their auto-centric urban environments to more people friendly urban design supported by public transportation, walking, and cycling. Given our rapid growth of urbanization, and the fact that we have an opportunity to learn from the mistakes and good practices of other cities, we are uniquely positioned to develop our cities into economically thriving and socially vibrant places. In order to do this, Indian cities will need to proactively change their growth patterns and improve transportation choices for all. This will lead to myriad benefits. Fewer cars and two-wheelers on urban streets will effectively abate carbon emissions as well, compared to a business-as-usual scenario.

Compact, well-designed pedestrian and cycle oriented developments not only improve quality of life and urban health outcomes for users, but also contribute to a significantly reduced particulate emmission. Increased availability of cheap and accessible public transportation also has significant social benefits and leads to an enhanced quality of life for all.

Starting in 2006, with the National Urban Transport Policy, the Ministry of Urban Development has taken a number of steps to help cities along the path of sustainable urban transport. More recently, the Service Level Benchmarking prepared by MoUD, the twelfth five year plan committee and national transport development policy committee (NTDPC) have both recommended a public transport led development of cities. This report aims to assimilate the principles and concepts introduced in these documents and to make them implementable by the cities and urban local bodies.

Purpose

The aim of this report is to help cities and local governments implement goals of sustainable planning and urban transport. In order to do this, it is important to identify guidelines and standards and establish an evaluation mechanism through which the existing conditions can be assessed and progress can be evaluated and monitored. Also in order to successfully implement this it is critical to identify institutional framework and equip them with appropriate tools for implementation.

Who is it for

This document can serve as a useful resource for city governments and local agencies working on issues related to urban transport at the

city level. This includes agencies engaged in defining standards and guidelines for urban transport, agencies taking investment decisions and those concerned with implementation. This report also provides a framework to citizens and other professionals to advocate for a sustainable urban transport planning and implementation, through the principles, recommendations, relevant case studies and implementation tools.

Structure

The report is structured in three parts. Part One outlines the definition and key benefits sustainable urban transport followed by a summary of existing issues related to urban transport. Part Two provides the key recommendations based on 10 principles of Sustainable Transport. Each principle is supported by recommendations, associated benchmarks, agencies responsible for implementation and case studies. Part Three includes implementation tools and notes in institutional framework.

While there is a attempt to provide concrete guidance for making the urban transport sustainable, this report by no means claims to be all-encompassing nor is it expected to be implemented directly. The purpose of the document is also to help coordinate and unify the efforts made by various government and non-government agencies across the cities / urban areas for improving urban transport. The recommendations in this report are accompanied by benchmarks that serve as reference for improvements. Also, the benchmarks are expected to be reviewed by the cities and to be updated based on local conditions. Wherever urban specifications already exist, attempts have been made to reference them within the principles and guidelines.

If cities are able to use this guide to create their own vision and road map towards a sustainable future, the report would have accomplished its mission.

Acknowledgements

At the outset, we are grateful to Shakti Sustainable Energy Foundation for supporting and funding this project. This document integrates and assimilates efforts of various government and non-government agencies to provide a holistic picture of the improvement needs for urban transport. This could not have been possible without the support and advice from Shreya Gadepalli (ITDP), Chris Kost (ITDP), Mr. V K Phatak (Former Chief of Planning, MMRDA), Romi Roy (UTTIPEC) and Anumita Roy Chowdhary (CSE).

After the version 1.0 of the document was published, it was reviewed by a number of experts and practitioners associated with urban transport without whose inputs it would not have been complete. For this, we would like to thank Todd Litman (VTPI), Prof. Geetam Tiwari (TRIPP, IITD), Prof. K. T. Ravindran (SPA) Dr. Ashish Verma(IISc), Ms Sujaya Rathi(Cstep),

Akshima Ghate(TERI), G Raghuram (IMU), Dr. Darshini Mahadevia and Rutul Joshi(Center For Urban Equity), Anuj Malhotra (Center for Green Mobility), Avanish Pendharkar (CH2mHILL), Pradeep Sachdeva (Pradeep Sachdeva Design Associates), Rajendra Ravi (Institute for Democracy and Sustainability), B I Singal (IUT), Sonia Kapoor (IUT), Ashok Bhattacharjee(UTTIPEC) and Mriganka (UTTIPEC). The current version incorporates many of the comments and inputs of the above experts. We are thankful to Institute for Urban Transport (IUT) for their graciousness in allowing us to use their facilities for the technical working session on Urban Transport. Finally, we would like to thank Himani Jain (SSEF) and Aakriti Chaudhari (SSEF) for their continued support throughout the process.

While we have had the opportunity to discuss and review the contents of this document with various experts from India and abroad, any mistakes and/or errors in this document remain ours.

Contents

Part 1: Overview

Chapter 1. Sustainable Urban Transport

1.1 Why Sustainable Urban Transport?

Since the past decade India has been growing at a rapid pace, both as an economy as well as in urban population living its in ever expanding cities. This growth has led to significant and rapid increase in vehicular ownership especially in the urban areas, resulting in unprecedented levels of traffic congestion, severely hampering mobility, deterioration of environment and quality of life in Indian cities.

Historically, increasing economic prosperity is observed to be associated with higher ownership (and use of private vehicles (see figure below). However, many of the developed countries are seeing harmful effects of car-oriented growth, in terms of congestion and its impact on an individual's social and family life, health and productivity. India is in facing a similar situation. Increasing incomes and expanding cities have had similar effect on increasing vehicle ownership and usage, deteriorating overall urban mobility and quality of life. Therefore it is crucial for Indian cities to look at more sustainable solutions for urban transport that improves mobility along with ensuring environmental, social and economic sustainability.

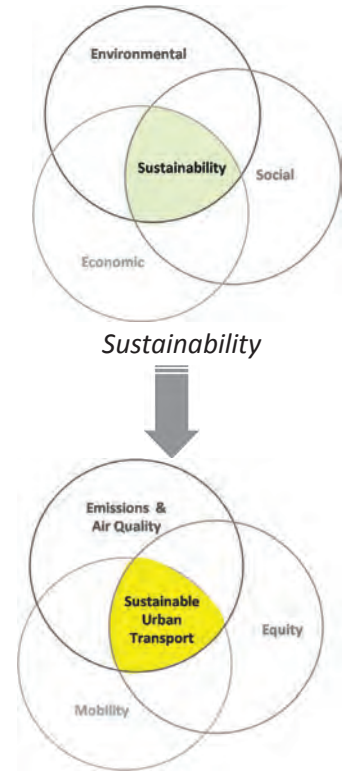


Figure 1.a: Sustainable urban transport aspects

1.2 Concept of Sustainable Urban transport

Sustainability means meeting the needs of the present without compromising the ability of future generations to meet their own reconciliation of environmental, social and economic demands - the "three pillars" of sustainability. In relation to urban transport, "environment" can be addressed as emissions and air quality, "social" can be addressed as equity and "economic" can be addressed as mobility of the city dwellers.

Sustainable approach to urban transport will improve mobility and accessibility in urban areas. Such an approach balances the need to address environmental concerns with the need to provide affordable mobility choices to rapidly growing urban areas. Thus, Sustainable Urban Transport aims to provide affordable, accessible, equitable, comfortable, secure environment-friendly transport services.

Urban transport systems have direct economic impact on cities. Availability of good and efficient transportation services at affordable costs also enhances the quality of life of residents. Importance of public transportation has also come under increased focus due to the contribution of vehicular pollution to climate change and deteriorating

air quality and its impact on health (PricewaterhouseCoopers Pvt. Ltd., 2008). Hence, a need is felt for a sustainable approach to urban transport.

A sustainable transportation system is one that:

- "allows individuals, companies and societies to meet their basic mobility needs in a way that preserves human and ecosystem health, and promotes equity within and between successive generations;
- is affordable, efficient, offers a choice of transport mode, and supports a competitive economy, as well as balanced regional development; and
- limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation , and uses non-renewable resources at or below the rates of development of renewable substitutes, while minimising the impact on the use of land and the generation of noise" (ECMT, 2004).

1.3 Benefits of Sustainable Urban Transport

Sustainable approach towards the urban transport and current transport trends will have number of comprehensive benefits in environmental, social and economic aspects. Emphasizing the proposed approach towards the reforms will increase efficiency, support economic development and create more livable, healthier and equitable cities. It is important because it can help build support from people concerned about other issues besides environmental risks.

S pecific
M easurable
A chievable
R elevant
T ime bound

SMART Goals

These benefits include:

- Reduced traffic and parking congestion
- Road and parking facility cost savings
- Consumer savings and affordability
- Improved mobility and improved economic opportunity for non-drivers
- Increased traffic safety
- Energy conservation
- Air and noise emission reductions
- Improved public fitness and health (from more walking and cycling)
- Reduced chauffeuring burdens for drivers
- Support for strategic development objectives (more redevelopment of existing urban areas, reduced sprawl)
- More attractive and livable urban areas, which increases property values, development opportunities and business activity within existing urban areas

- Support for various industries including tourism, intermediate transport and public transit providers, and economic development benefits from reduced dependency on imported vehicles and fuel.

1.4 Overall goals for Sustainable Urban Transport

Each city is varied in terms of its development, population and hence the needs. These needs help to evaluate what actually is missing and what is to be provided. Before setting up any goal it is very important for the city to conclude the objectives for any reform needed.

Considering the set of goal in the context of Sustainable Urban transport, other than considering the social, economic and environmental aspects it is necessary to understand the pre-requisite goal would be to move people- not just cars. (as per NUTP 2006)

SMART goals are the key to the success of any efforts made, as they are specific, measurable, achievable, relevant and time bound. SMART goals can ensure a holistic betterment of the urban transport systems and services in India. SMART goals for urban transport need to be implementation oriented.

Since each city is little different than the other city, every city will need to create its own goals and performance standards in order to provide the most appropriate solutions to its transport challenges. These goals could be in the form of those mentioned below, or maybe completely different Ensure the per capita Vehicle Kilometers Travelled (VKT) in each of the major cities (Population $>$ 0.5 million) should be below base year levels (year to be decided by the city/metro)

- Ensure income distribution of potential riders on public transport is within 10% of actual income distribution of the urban area.
- Ensure per capita travel time is not adversely impacted by increasing urbanization and shift in travel mode.
- Ensure complete streets all over the city, in all cities.

The key is for each city to understand its unique challenges within its context and then try to frame goals in a manner that will allow appropriate and timely implementation. Adopting goals or solutions that have been successful in other cities may not be a wise strategy.

1.5 Components of Sustainable Urban Transport

In order to accomplish the goals, specific actions need to be undertaken which will help the cities overcome their unique challenges. The following principles (also discussed in detail in part 2) provide a framework for understanding the existing issues and preparing an action plan for

implementing the goals of sustainable transport in each city.

1. *Walk*: Develop neighbourhoods that promote walking

2. *Cycle*: Prioritize cycling and other non-motorized transport modes

3. *Public Transport*: Support access to high-quality public transport

4. *Connect and Complete*: Create well-connected network of complete streets

5. *Integrate*: Integrate land use and transport to create high density, mixed use transit oriented developments

6. *Compact*: Encourage compact regions with short commutes

7. *Parking*: Influence private vehicle usage through parking

8. *Shift*: Shift from unsustainable mobility to sustainable modes by regulating road use and other fiscal measures

9. *Safety*: Ensure safety and security in urban transport

10. *Freight*: Integrate freight planning with urban transport

Depending on the specific needs, each city can put together a plan that outlines a comprehensive approach to address their issues and lead them on a path to sustainable future.

1.5 Approach

The approach adopted for this report helps identify clear implementation oriented recommendation which will help cities solve their urban transport issues.

The overall implementation oriented goals help to assess and evaluate sustainability of improvement efforts for urban transport. The principles outlined above help address the urban transport issues and to help achieve the implementation oriented goals (further details in Part 2). For each of the principles and sub-principles, recommendations and guidelines are proposed which can be monitored and evaluated using the indicators and benchmarks. Each principle is also accompanied by relevant case studies. These are supplemented with recommendations on appropriate implementation strategies & institutional framework.

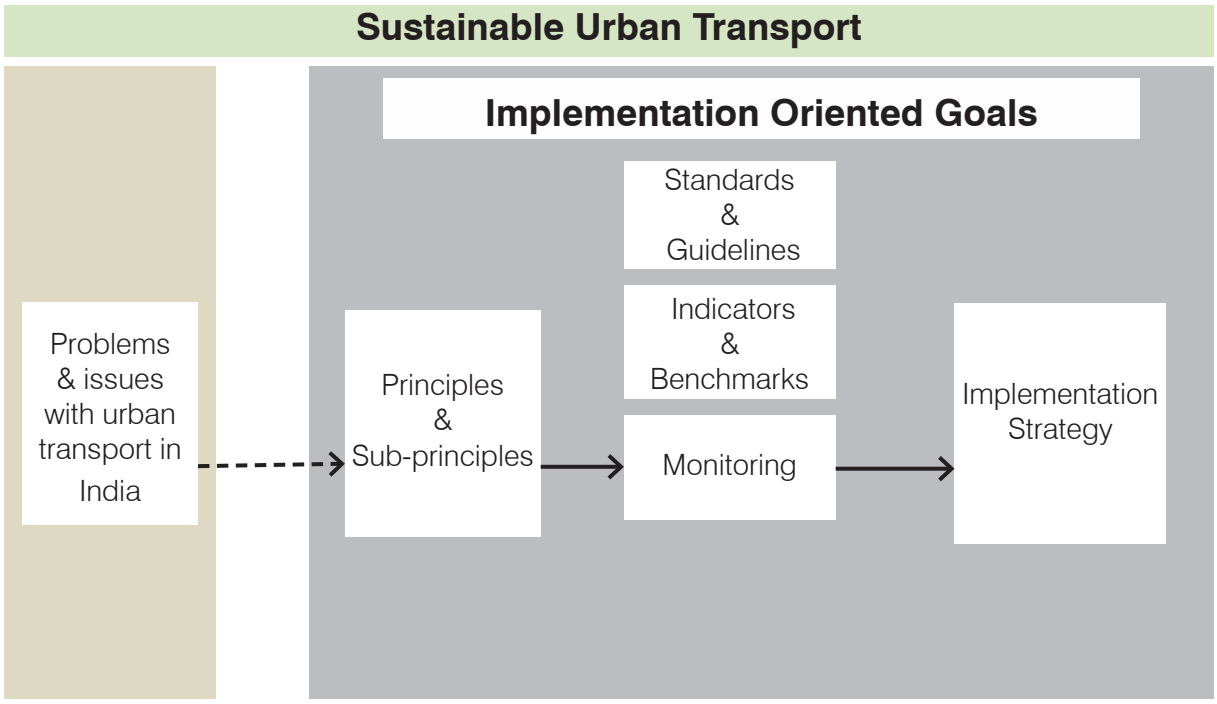


Figure 1.b: Approach for Sustainable Urban Transport

Chapter 2. Overview of existing conditions

2.1 Existing urban transport scenario

Figure 2.a: Increase in private vehicle ownership and usage

This sections highlights the key issues and problems with existing urban transport services and conditions. Several documents and reports at the national level, such as the *National Urban Transport Policy, Study on Traffic and Transportation Policies and Strategies in Urban areas in India, Twelfth five year plan,* etc. have also identified similar issues and highlighted the urgent need for addressing the same.

2.1.1 Heavy traffic congestion

Private vehicle population and mode share has grown exponentially over the last two decades. Share of two-wheelers in the total fleet was 72 per cent in 2006 (Ministry of Road Transport & Highways, Government of India, 2009). City governments have attempted to solve transport crises as isolated projects of road widening and grade separated junctions. This has led to an induced demand for new private motor vehicles. Hence, despite these road improvement projects, which have dominated government expenditure, congestion is on the increase. (Tiwari, 2007). Moreover, the rise in traffic congestion leads to more demand for road

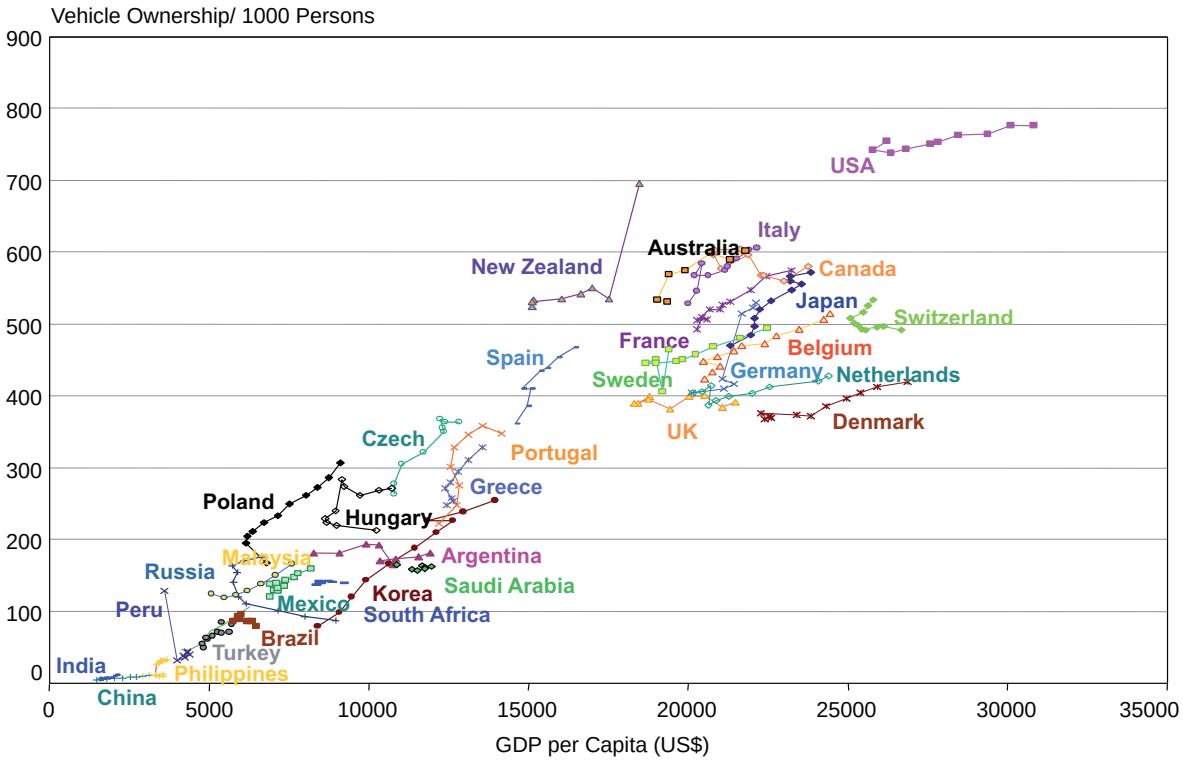


Figure 2.b: Vehicle ownership as a function of per capta income

space for vehicles and parking and thereby leads to reduction of space for pedestrians and cyclists. Congestion leads to increase in noise and pollution, thereby causing reduction in quality of street environment. One response to congestion is grade separated access way, but this leads to fast moving vehicular traffic and causes unsafe environment for pedestrians. Hence it is necessary for cities to manage congestion by managing street space and parking.

2.1.2 High air pollution and Greenhouse Gas (GHG) emissions

Per capita emission levels in India's seven largest cities are at least three times higher than the World Health Organization standard (Palanivel, 2002). Of a total of 127 cities/towns monitored under the National Air Quality Monitoring Program, only 3 have low air pollution, and 101 cities report at least one pollutant exceeding the annual average air quality standard (Central Pollution Control Board, 2009). At least 40% of ambient air pollution in cities can be attributed to transportation and related causes. It is important to understand that this high ambient air pollution is despite having fewer cars per capita than many countries. As income rises and India develops this situation could become worse.

Motorized two wheelers (MTWs) and cars (including jeeps, MPVs etc.) contribute between 60% and 90% of the total GHG emissions (produced by all modes of transport) in our cities while supporting about 29% of trips. Bus-based public transport supports about 27% of trips and contributes between 3% and 21% of GHG emissions depending on the city size. Non-motorized modes (i.e. pedestrians, cyclists and cycle-rickshaws) contribute to no emissions at all and support 39% of trips (Ministry of Urban Development and Wilbur Smith Associates, 2008). A recent study by CAI-Asia indicated that due to rapid motorization, the CO2 emissions from road transport is expected to increase at 7.75% per year, which is higher than many other Asian countries.

2.1.3 Reduced cycling and walking

With population growth cities have tended to sprawl and increased travel distances have made non-motorized modes impossible to use (NUTP, 2006). Alongside, congestion, increase in purchasing power of people and totally inadequate facilities combined with deteriorating state of existing infrastructure for cycling have all contributed to reducing cycling to less than 11% of the mode share which is down from nearly 30% in 1994 (MouD-WSA, 2008). 40% of today's trips in the cities are by Non-motorized transport and 25% of all fatal accidents involve Non-motorized transport. Similarly, poorly designed footpaths have less acceptance from the pedestrians whereas encroachment by hawkers make it difficult for the pedestrians to use the footpaths constructed.

Figure 2.c: Private vehicles have maximum share of on Indian roads

2.1.4 Increased travel time and reduced quality of life

Figure 2.d: The average time spent in commuting by an employee in Mumbai is 47.26 minutes

Historically Indian cities are relatively high density and mixed land use cities which are conducive for high public transit use. In addition, most of the cities have small trip lengths. However, due and lopsided industrial location poilicies and land markets that are primarily speculative, cities are beginning to experience rampant urban sprawl greatly increasing trip lengths for some and in turn forcing excessive reliance on personalized vehicles, mainly cars. Also, increase in car ownership has resulted in people shifting to far off places having affordable housing thereby further leading to sprawl. There is a need to retain the existing compact form of Indian cities, else if the trend continues, cities will double in size within the next 2-3 decades. It will be extremely difficult to retrofit this low density growth with a viable public transport infrastructure in the future. A MoUD study in 2010 based on sample of 87 cities estimated than under a business-as-usual scenario, in about 20 years time, the expected average journey speeds on major corridors in many cities would fall from 26–17 kmph to 8–6 kmph. This could result in travel time by upto three times and hence significantly impact quality of life..

2.1.5 Inadequate public transport

Figure 2.e: Worsening public transport, Mumbai

Public transport mode share is generally less than 20% (except in the mega cities) (Agarwal, 2009). A substantial part of the population relies on private vehicles to meet their daily transport needs. Out of 85 cities (population greater than 0.5 million) 65 cities (including 6 metro cities) do not have an organized city bus service (Agarwal, 2009). Public transport accounts for only 27 per cent of urban transport in India. Share of the public transport fleet has decreased from 11 per cent in 1951 to 1.1 per cent in 2001(Source: Motor Transport Statistics of India, 2001-02, Ministry of Shipping, Road Transport & Highways). While the number of personal vehicles per 1000 population has expanded about three times(between 1981 and 2001), the number of buses per 1000 population has increased only 2.3 times. The preliminary findings of a study commissioned by the urban development ministry at the Centre has found that the availability of public transport (buses and Metro) in Delhi per 1,000 people is only 0.504). Despite large push by JNNURM phase 1 for bus procurement in various cities, most of the cities have not been able to put them to use in order to improve public transport.

With more than 90 percent of public transport passengers in Indian cities relying on buses, it is especially important to upgrade bus services through modern, safe vehicles and priority on the congested roadways. The heavy, high-floor buses currently in service in most cities are noisy, polluting, fuel-inefficient, and unsafe. They are built on truck chassis with such high floors that boarding is slow and difficult. Moreover, they have

slow acceleration as well as poor fuel economy due to their weight, and are inappropriate to urban use. Many buses do not even have closable windows and doors to protect passengers from the weather and from falling out of the vehicle. It is essential to replace these outdated buses with modern, safe, clean, and fuel-efficient vehicles. In addition, public transport users are faced with problems of poor frequency of buses as well.

In 2009, only 20 out of 85 Indian cities with a population of 0.5 million had bus services. (Source: As compiled in Isher Ahluwalia HPEC report (2011) and Census of India and MoUD. For cities, having no or very less public transport, IPT is the most widely used mode for transportation.

2.1.6 Unregulated & expensive Intermediate Public Transport

Para transit or Intermediate Public Transport (IPT) modes like rickshaws, shared tempos, shared cars, taxis and cycle rickshaws are prominent in India. The lack of Investments and innovative business plans in the public transport over the years affects the service levels of existing fleet of public transport and their reliability.. Smaller cities in India are mostly dependent on IPT ; however, the routes are not found to be regulated leading to problem of non availability of IPT modes in fringe areas where public transport too is less frequent. Also, many of the cities do not have meters and regulated fares. Moreover, the city authorities are responsible for regulation and fixation of fares which are not linked with the fuel thereby causing conflicts with the operator. A number of these vehicles have minimal regulations in terms of road worthiness certifications issued by the transport authorities. Their operations have been left to the private operator. Often they have been found to cause serious emission and safety violations. Currently, there is no policy or program that can improve the operation of Intermediate Public Transport modes. Often the fare policy stipulated by the government (which may or may not be aligned with market rates) is not honored by the operators, and the road infrastructure also does not include facilities for these modes. As a result, the operators have to violate legal policies to survive (Tiwari, 2007).

Figure 2.f: Delhi, Operations of IPT has been left to the private operators

2.1.7 Inequity in transport and housing options

With urban expansion, city dwellers are faced with the prospect of choosing between cheaper housing on the periphery of the city combined with high transport costs or to live within the city where accommodation is more expensive. This inequity places the most burdens on people of the lower income group. For the urban poor this second option often translates into living in crammed conditions without urban services in a slum within the city to stay closer to their work places. And the ones that live on a city's

fringe where land or housing is cheaper are exposed to high travel costs (ADB, 2009).

2.1.8 Unsafe travel conditions

Figure 2.g: No distinction for motorized and non-motorized modes

Currently, the focus is on moving vehicles instead of moving people. People travelling via non-motorized modes like cycling and walking have to share the same right of way as cars and two-wheelers (National Urban Transport Policy, 2006) leading to unsafe conditions for all. The number of fatalities has gone up from 28,400 in 1981 to 81,000 in 2001.(Op Agarwal, 2006). Studies show that the number of fatalities are also increasing in relation to the increasing motorization. One study indicates that cities with higher slow moving vehicles in the traffic stream such levels where pedestrian involvement on road accidents average 20%. This highlights the absolute lack of pedestrian facilities in our country.

While progress has been made towards protecting people in cars, the needs of these vulnerable groups of road users are not being met". Pedestrians constitute a significant share of total fatalities and the magnitude is in fact much higher in cities where the facilities do not do meet the demand. For example, although the cities like New Delhi, Bangalore and Kolkata have a pedestrian fatality share greater than 40%. The problem becomes more severe when we try to access the impact on most vulnerable section of society. For example, in the case of Bangalore, every two days, three pedestrians are killed on roads and annually more than 10,000 are hospitalized. Elderly people and school children carry a large share of the burden with 23% fatalities and 25% injuries.

The percentage of streets with pedestrian pathways is hardly 30% in most cities. The main reason behind this is inequitable distribution of road space that streets are not well-designed and implemented in India to accommodate all the functions of a street..And furthermore, in most cases, only part of the right of way is developed (rest being undeveloped) leading to unorganized and unregulated traffic which is unsafe for pedestrians and cyclists. Security is also a major problem on public transport services and within the public realm. Without adequate security, public transport is vulnerable to vandalism and theft which affects the quality of service and ridership.

2.1.9 Inadequate investments and allocation issues

Since transport is a state subject in the Indian constitution, central government did not have a policy or investment plan for urban transport infrastructure until 2006. City governments attempted to solve transport crises through isolated road improvement projects. This has resulted into

fragmented and irregular network updates.

Investments in road-widening schemes and grade-separated junctions which primarily benefit personal vehicle users (cars and two wheelers) in the short term, have dominated government expenditure (Tiwari, 2007). Attention to public transport has been inadequate. In India, most city bus services make losses and do not have the resources to renew their fleets. (Tiwari, 2011).

In the name of promoting public transport, demand for rail-based systems (metro, light rail (LRTS), monorail) has been pursued by several cities. Metro systems are capital-intensive systems (Rs.2,000-3,000 million/km, or US$51–76 million/km). While this may be feasible for large dense cities, it is not suitable to meet the mobility requirements of majority of the cities. The cost of a single metro trip is at least Rs.45 (US$1.14) compared to Rs.15 (US$0.38) for a bus trip. Tickets have to be subsidized at least 10 to 15 times more heavily than a bus ticket for the same journey. Yet they are being pursued by the city authorities and promoted as investment projects in which the private sector can participate (Tiwari, 2007) where as bus based initiatives are not provided enough subsidy in capital cost of projects.

Figure 2.h: Over-loaded public transport

2.2 Overview of existing institutional framework

Under the Constitution of India, responsibility for urban development, and therefore, urban transport, rests with the state government.

City level - At the city level, several agencies are involved in the management of various components of urban transport. Urban local bodies, under the Ministry of Urban Development, are responsible for a range of functions. Construction and repair of smaller streets, street signage, traffic lights, licensing and control of non-motorized vehicles and clearing of encroachments come under Urban Local Body's purview. The PWD is responsible for state roads. Town and Country Planning Organization and Housing Board at city or state level (under the Ministry of Housing and Poverty Alleviation) handle land use related decisions. In some cities like Mumbai, Ahmedabad, Pune, Kolhapur, Solapur etc, .bus-based public transport is also in the form of Municipal Transport Undertakings. In some cases, operations are franchised to private operators by the city. In Chennai; Panaji, Pondicherry etc private companies run services. In recent years, urban local bodies have been asked to set up dedicated agencies to implement and operate 'bus rapid transit' and ordinary bus services.

In some cases even one component may be managed by several different agencies. For example, Streets and the associated infrastructure, the main infrastructure for urban transport in a city, could be developed and maintained by at least 6 agencies, namely the urban development

authority, the urban local body, State PWD, the Central PWD, the National Highways Authority and the Central Ministry of Surface Transport.

The Regional or Urban Development Authority handles land use planning. The existing legal enactments that directly affect planning for urban transport are the 'Town and Country Planning acts' enacted by various States. The 'Town and Country planning acts' enacted by Maharashtra and Tamil Nadu are required to prepare regional plans including transport requirements. Karnataka Town Planning Act-1961specifies planned growth of land use and development and for the making and executing of town planning schemes. There is no mention of including transport planning in it. Similarly four UD Authority acts i.e. Delhi Development Authority, Lucknow development Authority,, Indore Development Authority and Bangalore Development Authority and

The Karnataka Municipal Act does not mention specifically both land use planning and transport as its functions. DDA act requires preparation of land use plan based upon such survey of the present use of land as may be necessary for estimated future needs and includes transportation. However, it is essential to achieve integration of land use and urban transport as well. For this, it is essential to improve the institutional setup with necessary skills such that both functions become the responsibility of the same city agency. Going forward, the cities should be empowered to take care of their needs including urban transport.

State level – At this level, components of urban transport are managed by various departments and ministries. Urban Development department and State Transport Department handle significant part of the decisions. State level departments cascade into three significant agencies at the regional level – Urban Development Authorities under MoUD, the State Road Transport Corporations (SRTCs) and Regional Transport Office (RTOs) under Ministry of Roads, Transport and Highways. RTOs are entrusted with licensing of motorized vehicles, monitoring of quality of services, implementation of safety regulations and regulation of private bus services and Intermediate Public Transport. Urban rail-based public transport comes under the purview of the Ministry of Railways. Metro rail services are being planned, designed, implemented and operated by dedicated companies. Traffic Police, under Home Ministry, is the enforcement agency for traffic laws and managing traffic at signalized intersections. Railways have their own police for rail-based modes.

State Road Transport Corporations, are responsible for planning services and setting fares of bus-based public transport. For bus-based public transport services, the roles of planning, provisioning, design and franchising are not clearly defined in any one place, and are being done by different authorities in various cities (Ministry of Urban Development & Wilbur Smith, 2008). Some cities including Delhi, Bangalore, Kolkata, Hyderabad; Jaipur, etc have organizations under Road Transport Corporation Act of 1950. In these cities, urban and regional services are both handled by the SRTC.

Bus-based public transport in Chandigarh, Punjab & Haryana and some cities like Delhi, Bangalore, Kolkata, Hyderabad, Jaipur etc. is done by Government Departmental Undertakings. Regulations for health and safety are set by the Ministry of Road Transport and Highways, CPCB (Central Pollution Control Board) and SPCBs (State Pollution Control Board). While responsibility of implementation of safety regulations is under the Ministry of Road Transport and Highways, environmental regulations are under purview of the CPCB and SPCBs. (Report on Indian Urban Infrastructure and Services, 2011). Department of Environment, State government is entrusted with monitoring of air quality.

Central Government level - Three Ministries i.e. urban development, Railways and the Road Transport and Highways are involved at this level. Ministry of Urban Development is the nodal ministry for urban transport. It handles strategic planning and policy formulation. The Ministries of Railways and Road transport and Highways, do not have any dedicated cells to deal with urban transport issues. Ministry of Road transport and Highways partakes in strategic planning for the urban transport sector. Along with the Indian Roads Congress (IRC), this ministry is also responsible for laying down standards and norms for various components of urban transport. Ministry of Petroleum and Natural Gas regulates prices and quality of transportation fuels.

2.2.1 Problems related to current institutional framework

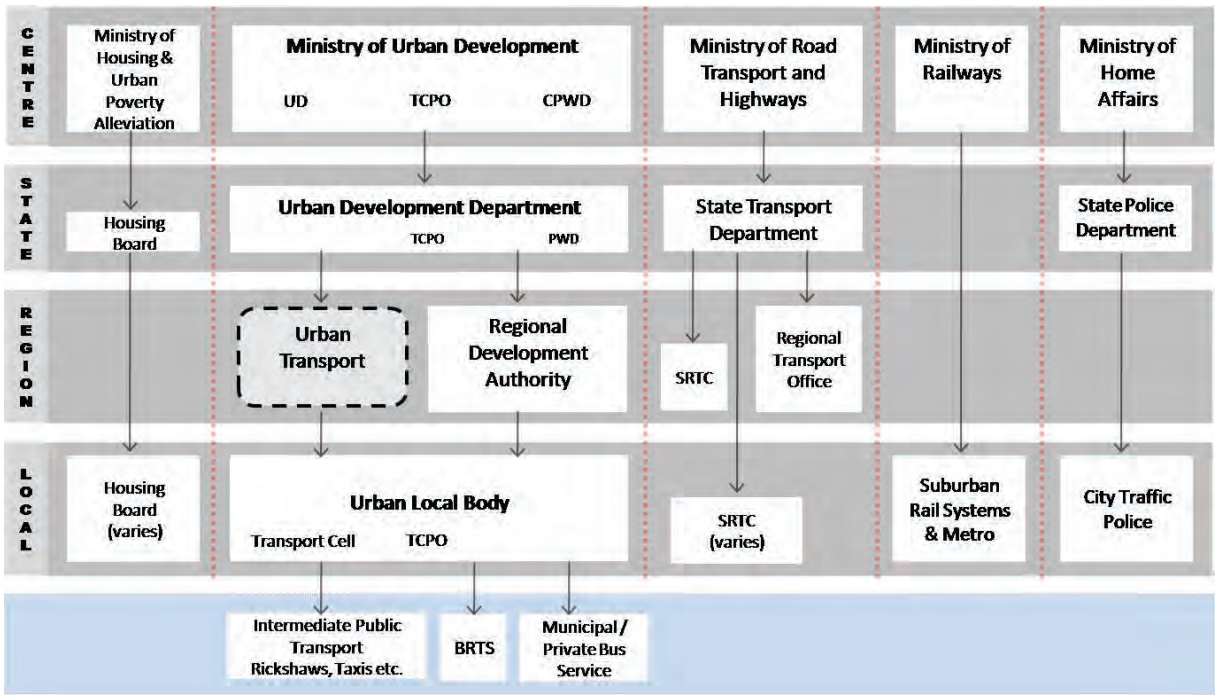


Figure 2.i: Representative Institutional Framework

Abbreviations used in the figure: UD – Urban Development; TCPO – Town and Country Planning Organization; CPWD – Central Public Works epartment; PWD – Public Works Department; SRTC- State Road Transport Corporation

The existing institutional framework is seen to be inadequate at addressing many of the issues of urban transport in the Indian context. Some of these are highlighted below:

1. Urban Transport is controlled by multiple institutions. This multiplicity of institutions (Ministry of Urban Development & Wilbur Smith, 2008) has resulted in no unity of command and fragmentation of functional responsibilities. There is also no accountability in ownership, performance, and maintenance transportation infrastructure and system operations.
2. Urban transport affects almost all and each agency reports to a separate ministry at the state and center level from whom it derives its power. Urban Transport is reduced to a secondary responsibility for each agency. Each agency has its own primary role in the scheme of things. These agencies merely carry a component of urban transport as a secondary function. (National Transport Development Policy Committee (Planning Commission), 2010).
3. There is no single apex agency for regulation & coordination between institutions. The current structure of Governance in the transport sector does not provide for the right Co-ordination mechanism to deal with urban transport problem (National Urban Transport Policy 2006).
4. There is also no co-ordinating agency for integrating operations of different modes.
5. Lack of transport planning departments in planning or development organizations at state and city level.
6. Lack of traffic management expertise, funds and automation in traffic management under the Traffic police.
7. Weak decision-making power with local governments even two decades since the 74th Constitution amendment.
8. The recent initiatives by the Unified Metropolitan Transport Authority (UMTA) serve as a platform for coordinating transport management. UMTAs have not been formed in all states. Where they exist, there is no consistency in the role assigned to them. Different states have assigned different roles and power to the UMTAs.
9. Inconsistent and fragmented data constrains the reliable assessment of existing systems and future initiatives
10. There is no legislation at present that covers the requirements of urban transport comprehensively. The Motor Vehicles Act deals with the licensing of vehicles, Railway Act covers intercity traffic, Metro Construction Act deals with the specific issues related to construction of the metro rail, Tramways Act deals with tramways within the road surface with free access across it. Other modes of mass rapid transit such as the bus rapid transit, the light rail transit the mono rail and several other guided modes of transport and issues of transport

planning, multi -modal integration, safety, tariff and financing are not covered under any act

11. Urban local governments in India are among the weakest in the world both in terms of capacity to raise resources and financial autonomy. While transfers from state governments and the Government of India have increased in recent years, the tax bases of ULBs are narrow and inflexible and lack buoyancy, and they have also not been able to levy rational user charges for the services they deliver.

2.2.2 Summary findings

The following is a summary of the various issues faced in urban transport in terms of institutional framework, current trends and future requirements.

1. Land use planning - based on horizontal, low density expansion of urbanized areas rather than densification of inner areas near public transport.
2. Priority of users - Motorized modes given priority over non-motorized modes and pedestrians.
3. Missing single agency - No single agency responsible and empowered to address issues of Urban Transport
4. Lack of coordination among various agencies - related to urban transport
5. Lack of reliable and adequate information - for evaluating, monitoring and planning of transport infrastructure
6. Lack of integration of transportation with land use
7. Restrictive regulations - Current planning approach relies on restrictive regulations to influence demand and supply rather than creating market based mechanisms.
8. Lack of Integration with Urban Transport - Freight and Regional transport planned in isolation with no integration with Urban Transport.
9. Need stronger role of media and voluntary sector - No role for voluntary sector, media in influencing behavior of end-users.
10. Lack of information and adequate safety and security around use of public transport.
11. Lack of efficient parking regulations and management

Urbanization is only going to increase in Indian cities and existing urban conditions will worsen in the coming years unless steps are undertaken to address the above mentioned issues. The current approach to urban transport is unsustainable at multiple levels. There is an urgent need to develop guidelines for sustainable urban transport that can help mitigate these issues and can be implementable and in the long term, help strengthen the process of urbanization.

Part 2: Principles, Recommendations and Case Studies

Principles for Sustainable Urban Transport

The following 10 principles have been derived to address the issues related to urban transport highlighted in the previous section. This builds on the efforts of the Ministry of Urban Development outlined in the National Urban Transport Policy (2006) and the Service Level Benchmarking Study (ongoing). Recent reports of the sub-committees on Urban Transport for National Mission on Sustainable Habitat (NMSH), Twelfth Five Year Plan, and National Transport Development Policy Committee (NTDPC) have also been perused and their recommendations have been integrated with these principles. Efforts made by other organizations such as the recent 8 principles proposed by the Institute for Transport and Development Policy (ITDP), and work done by Unified Traffic and Transport Infrastructure (Planning and Engineering) Center (UTTIPEC) and Centre for Science and Environment (CSE) have also been considered and assimilated appropriately.

Walk	Develop neighbourhoods that promote walking
Cycle	Prioritize cycling and other non-motorized transport modes
Public transport	Support access to high-quality public transport
Connect and Complete	Create well-connected network of complete streets
Integrate	Integrate land use and transport to create high density, mixed use transit oriented developments
Compact	Encourage compact regions with short commutes
Parking	Influence private vehicle usage through parking
Shift	Shift from unsustainable mobility to sustainable modes by regulating road use and other fiscal measures
Safety	Ensure safety and security in urban transport
Freight	Integrate freight planning with urban transport

While the above principles have been identified to a certain extent even in earlier studies, including NUTP, this document identifies clear implementable recommendations aligned with the above principles. It will be possible for cities and local governments to identify a city specific approach to their issues of urban transport with the help of this document. Further, preparation of a detailed Comprehensive Mobility Plan, which considers all these principles, recommendations, and impacts of alternative solutions for sustainable urban transport, can be the next step

in the move towards a more sustainable future for urban transport for each city.

The first few principles are organized in the sequence of priority. Before anything else, it would be important to improve quality of pedestrian infrastructure as identified in WALK. Next comes improvement of cycling facilities and amenities. Together these constitute a large proportion of users in our cities and these improvements are also less capital intensive compared to the larger projects (like flyovers and underpasses). A number of smaller cities (with population less than 5 lakhs) would be able to bring about significant improvement in the quality of life of their citizens even if they implement and apply only the first two principles.

Next is the aspect of PUBLIC TRANSPORT in the 3rd principle. This is increasingly important for small, medium and large cities. However, with the current focus and emphasis on heavy rail projects by larger cities, even smaller cities are trying to implement such projects in their cities. It is important to understand that the demand in small and medium cities (up-to 40 Lakh Population) may even be met by a good quality BRTS at less than one tenth the cost of a metro system. Regardless, as cities grow in size and population, it is important to proactively put in place an appropriate public transport system which will minimize the future growth of private motorized vehicles and improve the quality of life of citizens.

Parking policies and other measures to help people adopt more sustainable modes of transport are important as without them the public transport systems cannot realize their full potential. Freight transport and Safety are some of the most undervalued aspects of urban transport. As cities grow and become larger, conflicts between freight and passenger transport will need to be mitigated. Safety is even more critical as this is one of the key factors affecting mode choice for discretionary users of public transport.

Together the above principles will provide a framework to help cities identify existing issues of urban transport and subsequently address them with appropriate recommendations and implementation tools.

Principle 1. Walk

"Develop neighbourhoods that promote walking"

Sub-principles:

- *Ensure provision of* ***high quality*** *pedestrian infrastructure*
- *Ensure* ***safety*** *and* ***comfort*** *of pedestrians*
- *Encourage pedestrian friendly* ***building access, frontage****, and* ***street level uses***

Principle 1. Walk

"Develop neighbourhoods that promote walking"

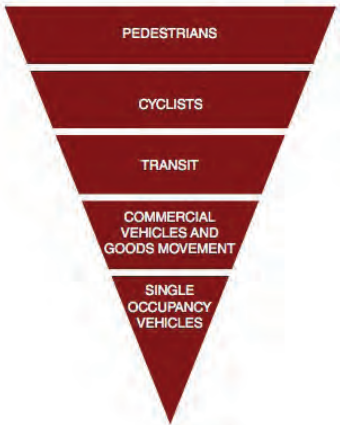


Figure 1.1: The transportation and mobility priorities pyramid

Walking is a nearly universal human activity that provides mobility, exercise and pleasure.

Walking is the most energy efficient, healthy and sustainable mode of transport. It is also the most universal mode. Everyone is a pedestrian for part of their trip even if they are driving or using a bus or rail transit. Hence, walking needs to be the primary focus of any plan or policy related to urban transport.

In Indian cities, poor street conditions discourage people from walking, even for short trips. Currently, the share of public transport trips in major urban areas in India is between 25%-30% Since every public transport user is also a pedestrian at the time of access and egress, walking trips may constitute 50-60% of total trips (Tiwari, 2007). Despite high share of walk trips, there is a lack of pedestrian infrastructure and walkable street networks. Majority of our roads (more than 70%) do not have footpaths (MoUD, WSA, 2008). And where they do exist they rarely meet the clear minimum width (1.5m) required. Some guidelines for provision of pedestrian infrastructure and safety of pedestrians do exist in India, although in a fragmented manner. However, there is not adequate awareness and guidance regarding these regulations and standards for the implementing and enforcing agencies.

List of existing regulations for protecting the rights of pedestrians:

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

(Source: www.transparentchennai.com)

In the absence of adequate pedestrian & cycle infrastructure, the use of non-motorised modes like cycling and walking has become extremely unsafe, as these modes have to share the same right of way with fast moving motorized modes.(NUTP, 2006). If our cities are to sustain walking as a viable mode of transport (even for short / medium trips between 1-3 km), provision of pedestrian infrastructure needs to be made an immediate priority. Safety and comfort of pedestrians is just as critical. People will not walk in unsafe environments which are often the after effects of automobile oriented street designs. Hence, designing streets where walking is prioritised is important along with building regulations that also prioritises access and egress for pedestrians.

Figure 1.2: Pedestrians as the primary focus

Sub-principles:

1A. Ensure provision of high quality pedestrian infrastructure

Figure 1.3: High quality pedestrian infrastructure

Walking and cycling are the two most basic modes of transport and also the most sustainable. Together these represent a major portion (30 - 50%) of the mode share for cities of varying sizes(MoUD, WSA, 2008). However, at present road space gets allocated to whichever vehicle occupies it first. The focus is, therefore, the vehicle and not people. The result is that a car carrying only one or two persons is allocated disproportionately high space compared to a bus carrying 40 people. In this process, the lower income groups have, effectively, ended up paying, in terms of higher travel time and higher travel costs, for this disproportionate space allocation to personal vehicles. Users of nonmotorized modes have tended to be squeezed out of the roads on account of serious threats to their safety (NUTP, 2006).

Provision of adequate street space and high quality pedestrian infrastructure can help encourage more people to walk as a mode of transport and for leisure. In order to encourage pedestrians, it is important to design and implement 'complete streets' which provide a safe and comfortable environment for walking. Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and make it safe for people to walk to and from train stations. (smartgrowthamerica)

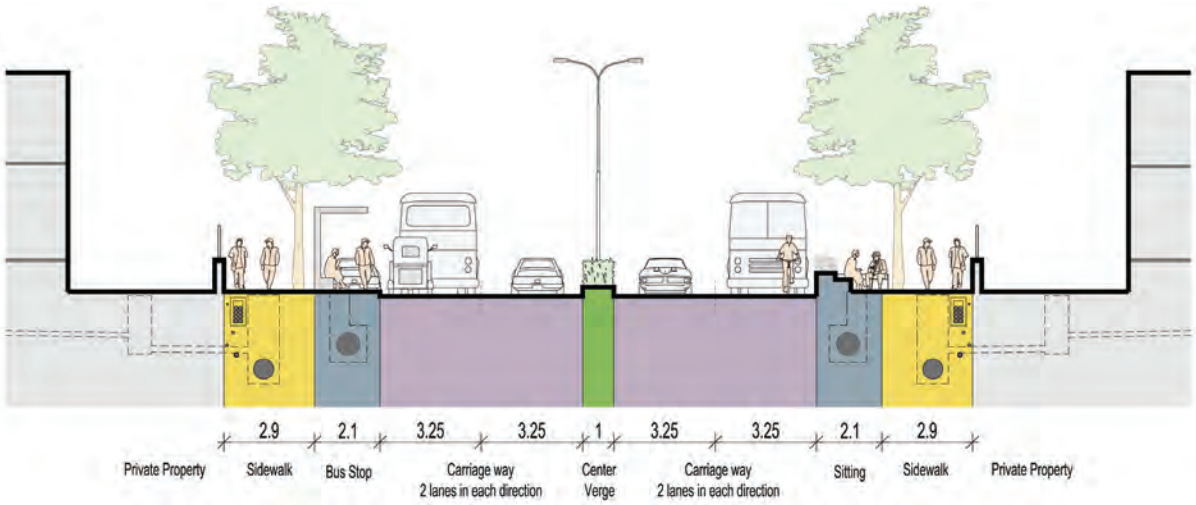


Figure 1.4: *Complete Streets* - Streets for all

Figure 1.5: Pedestrian safety signage

1B. Ensure safety and comfort of pedestrians

Streets and urban environments must be safe and comfortable for pedestrians to walk freely. One of the key issues for many Indian cities today is the increasing challenge of ensuring safe street space for pedestrians. Frequent conflicts with motorized modes, illegally parked vehicles, vendor encroachment etc., drives pedestrians to either shift to other modes and / or to risk their lives and walk frustratingly within the carriageway. Occupants of private cars account for only 5.5% of the total number of traffic fatalities (of the 35 cities with million-plus population studied). People outside the car constitute the vast majority of traffic fatalities in all cities irrespective of size. Pedestrians, cyclists & other NMT users form the single major group of users that account for traffic fatalities in India. (Mohan, 2009)

Hence, one of the first and most important improvement needed on Indian streets is the availability of wide and smooth footpaths with appropriate curb-cuts and ramps for universal access. Well-designed crosswalks are necessary to ensure safety while crossing the street. Painted crosswalks often do not work until the notion of safety for pedestrians is instilled in the mindset of vehicle users. At least initially, this will have to be instilled through strict enforcement and where needed, through intentional traffic calming measures such as raised cross walks, differentiation in paving materials, signalized at-grade crossings etc.

Encroachment of pedestrian space by commercial establishments and parking is another major hurdle in the way of improving safety and comfort for people who walk. Enforcement is key and so far has been poor due to various reasons. One way to improve enforcement is to partner with the people whom this affects the most. With today's technology, where smart phones are increasingly becoming ubiquitous, allowing common public to report encroachments may go a long way in discouraging

encroachers. On another front, there are also issues of encroachment of footpaths by the homeless and this is a more difficult issue to address. It needs to be resolved differently where the rights of the homeless people do not conflict with the rights of the pedestrians. In short, there has to be a zero tolerance policy for encroachment on streets, if we are to adequately address the needs of pedestrians.

Another important factor for pedestrians in the Indian context is the need for thermal comfort. Shade provided by trees and adjoining buildings help pedestrians walk comfortably in hot environment. Hence, shade needs to be considered in the design of streets. 'Continuous shade' on the walkway should be ensured – through presence of tall building at the property edge or by providing trees close enough to each other so as to achieve adequate shade condition.

Certain streets should be considered for full-time / part-time pedestrianization in order to promote safe walkable environments. This may be especially relevant in the case of older / inner core areas of the city where walking is threatened by growth of vehicular traffic. Minor streets / local streets should be designated as pedestrian priority streets.

A key issue that hampers a number of efforts identified above is the issue of resurfacing of streets in Indian cities. More often than not, during resurfacing of streets, the final street level is raised due to the thickness of asphalt added to the previous road. This, in turn, requires the footpaths to be raised and so on. This creates difficulty in fixing levels of footpaths, and creating a universal access environment. It is absolutely critical that the final levels of all major streets and arterials be fixed with respect to local datum based on a proper survey. This will allow people to provide better access for pedestrians (including universal access to the disabled – which is mandatory according to Persons With Disabilities Act 1995).

1C. Encourage pedestrian friendly building access, frontage, and street level uses

Buildings often have entrances and exits that can only be reached from their parking lots or driveways. These entrances are difficult and dangerous for pedestrians to find and access. Encouraging developments that front the street leads to a natural monitoring of pedestrian activities and helps enhance safety. Primary building entrance should be oriented toward the street or public right-of-way. Vehicular entrance (if any) should be located separate and away from the primary street entrance.

Figure 1.6: Active frontages

Minimal front setback between the street and the edge of the building helps define the street edges, and create a sense of enclosure by forming a "street wall" that encourages pedestrian activity.. Deep front (and side) setbacks lead to a lesser sense of "street wall" which in turn may lead to unsafe pedestrian environments. The front setback and the frontage of any development on major streets should contribute in a positive manner

Figure 1.7: Market encroaching on ROW of major street, Ahmedabad

Figure 1.8: Vending kiosk, Delhi

to urban environment by allowing adequate visibility from the street. This increases "eyes on the street" which lead to safer streets with lesser crime. Uses that do not contribute positively to the urban environment such as long term parking should be relocated away from the primary entrance of the development.

Certain types of informal activities on street can help contribute to the urban environment for pedestrians, cyclists and other users. However, it is important to understand and distinguish between the kind and size of informal activities that currently take place on Indian streets. Some informal activities are in reality full fledged informal markets. While it is necessary to retain and organise these, they cannot be accommodated within the ROW of any major street and should placed some place off-street. There are certain other informal activities that provide support services to perdestrians, cyclists and other users. Provisions for such activities should be made within the ROW of major streets so that these do not encroach on the other areas of the street. Wherever possible, these should be aligned with public transport nodes, important public buildings, parks etc.

Recommendations

1A. Ensure provision of high quality pedestrian infrastructure

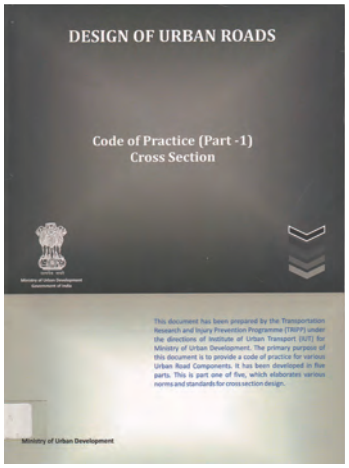


Figure 1.9: Design of Urban Roads published by MOUD

1. Cities should ensure that all streets are designed and implemented according to i) city / state specific street design guidelines OR ii) national street standards for urban roads prepared by IRC / MOUD.

   Indicator - Percentage of streets (categories minor street and above) in the city that are designed and developed as per city/ state street design guidelines OR national street standards by IRC / MOUD

   Benchmark - 90%

   Implementation - ULB / UDA through Street Redevelopment Program

   Monitoring - Streets Audit

   "Street Classification Table" on pg. 106 outlines an approach to street design that may help cities prepare their own street design guidelines if needed. An example of city / state specific street design guidelines is the one prepared by UTTIPEC for implementation within Delhi.

   Note – It is understandable that certain streets within historic areas and/or within slums etc. may not be able to meet the design standards outlined for the state / city. However, it is possible to account for such areas within the street design guidelines and hence design/implement these streets according to the guidelines. Thus, there is no reason for any street within the city to be built at standards different from what the guidelines recommend.

Figure 1.10: Continuous unobstructed pedestrian pathway, Ontario.

2. Provide continuous, clear & unobstructed pedestrian pathway minimum 1.8m wide in each direction on streets wider than 10m and minimum 1.5m on streets narrower than 10m. (Complies with IRC code 103:2012)

   Indicator - Percentage of streets having unobstructed pedestrian pathway of minimum standards

   Benchmark - Minimum 100%

   Monitoring - Streets Audit

   Implementation - ULB / UDA / UMTA will implement through Street Design or Street Redevelopment.

   Refer - "Street Classification Table" for further details

   Note – Minimum widths of footpaths is the first essential step to providing "equitable space" to pedestrians as outlined in the National Urban Transport Policy. The earlier version of this document outlined this standard as applicable to minor streets and higher in the hierarchy of streets. However, after discussions with various experts and

stakeholders, it was felt that this standard is fundamental and it needs to be applied to all streets. The only case where an exception may be made is in the rare case of pedestrian only streets within historic / core areas & other areas of the city and/or in case of local street where the vehicular traffic speed has been calmed to under 20km/hr.

Figure 1.11: Segregated footpath and utility zone, Islington. UK

	Minimum Width of Clear Path-way	Minimum Width of Utili-ties Zone	Minimum Total Width of Footpath
Street with ROW < 10m	1.5 m	0.5 m	2.0 m
Streets with ROW > 10m	1.8 m	0.5 m	2.3 m
Any street with retail commercial uses at ground level	2.3 m	1.0 m	3.3 m
Any Arterial (major &/or minor) with retail com-mercial uses at ground level	2.8 m	1.0 m	3.8 m

3. Ensure pedestrian crossings, preferably at grade rather than grade separated, on all major and minor arterials, and all major streets at every 200m maximum distance between 2 crossing.

Indicator - Percentage of total length of all arterials and major streets that have 5 crossings or more for every km of street.

Benchmark - Minimum 100%

Figure 1.12: Continuous pedestrian crossings on major arterials, USA

Monitoring - Streets Audit

Implementation - ULB / UDA / UMTA will implement through Street Design or Street Redevelopment.

1B. Ensure safety and comfort of pedestrians

4. Ensure minimum 1m wide safe refuge for pedestrians at unsignalized crossings on every street where one way carriageway width is more than 3 lanes (9 m) or two-way carriage-way width is more than 4 lanes total (12m).

Indicator - Percentage of un-signalized crossings on streets where one way carriageway is more than 9m or two way carriageway is

Figure 1.13: Safe refuge for pedestrians on un-signalized crossings, India

more than 12m, with safe refuges for pedestrians and cyclists.

Benchmark - Minimum 100%

Monitoring - Streets Audit

Implementation - ULB / UDA / UMTA will implement through Street Design or Street Redevelopment.

Refer - "Street Classification Table" for further details

Figure 1.14: Dedicated phase for pedestrians at signalized intersection, Toronto

5. Ensure safe phase for pedestrians at all signalized intersections

Indicator - Percentage of total number of signalized intersections that have dedicated pedestrian and cyclist phase

Benchmark - 100%

Monitoring - Streets Audit

Implementation - ULB / UDA / UMTA shall implement this through street redevelopment programs.

Figure 1.15: Push button signal for pedestrian crossing, USA

6. Provide push button signals for pedestrians at busy intersections where pedestrian volumes are irregular or unpredictable.

Indicator - Percentage of total number of signalized intersections that have dedicated pedestrian and cyclist phase

Benchmark - Minimum 100%

Monitoring - Streets Audit

Implementation - ULB / UDA shall implement this through street redevelopment programs.

Figure 1.16: Pedestrian priority street, La Ramblas. Barcelona

7. Cities should prepare "Pedestrian & NMT Action Plan" which includes identifying and designating pedestrian and NMT priority streets based on appropriate data on existing and projected volume of trips.

Implementation - NMT cell in ULB / UDA / UMTA should prepare and implement this.

Note - Pedestrian and NMT Action Plan may be prepared as a part of another larger planning effort like the CMP or be a stand alone plan prepared by the city. The most important aspect of this plan is to identify high volume corridors for pedestrians & NMT and to ensure that a network of streets are prioritized for use by pedestrians and NMT.

Figure 1.17: Pedestrian Priority street, USA

8. Allow part time pedestrianisation of all streets (except Major Arterial streets and above in hierarchy) as per demand based on pedestrian volumes

Implementation - UMTA will propose and implement pedestrianisation proposals which will be regulated by Traffic

Police by creating awareness amongst all categories of street users and through on-street monitoring.

9. Ensure all pedestrian pathways, crossings and intersections conform with universal accessibility guidelines (disabled friendly)

Indicator - Percentage length of all pedestrian pathways with universal access design considerations. AND

Percentage of all pedestrian crossings that are universally accessible. AND

Percentage of all intersections with universal access design considerations.

Benchmark - 90%

Monitoring - Streets Audit

Implementation - ULB / UDA / UMTA should have dedicated personnel / department for Universal Access specifically in-charge of disabled friendly access. They should be charged with the responsibility to implement 'Universal Access Design' for all public streets and open spaces as mandated by the Persons with Disabilities Act, 1995. Upgrades and redevelopment of existing streets should be undertaken through street redevelopment program.

Note: In certain historic / core areas of the city, it may be difficult to implement universal access if it requires changing /redefining the grade / slope of public streets which need to be preserved as-is for heritage purposes. This could be the only exception to the above standard and hence the benchmark allows a 10% leeway for the same.

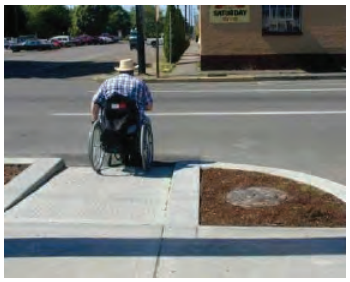


Figure 1.18: Disable friendly crossing , USA

10. Ensure shaded pedestrian pathways on all streets (major streets and above in hierarchy) by providing tree plantation / shading structures with the "Plantation & Furniture Zone" (Minimum. 100 trees per km)

Indicator - Percentage of total length of pedestrian pathway that has tree plantation or shading structures

Benchmark - Minimum 70% (min. 100 trees per km)

Monitoring - Streets Audit

Implementation - ULB / UDA will implement this through street redevelopment programs.

Refer - "Street Classification Table" for further details

Figure 1.19: Shaded pedestrian pathways, Tilak Marg, Delhi. India

11. Provide seating at 50m intervals and where pedestrian volume on the street (> 2500 pphdp) in both directions along all streets (major streets and above in hierarchy) within the "Plantation & Furniture Zone"

Indicator - Percentage of total length of urban streets (Major streets and above in hierarchy) that have at least 30 benches per km on

Figure 1.20: Seating arrangement on streets, India

both sides of the streets

Benchmark – Minimum 60%

Monitoring - Streets Audit

Implementation - ULB / UDA will implement this through street redevelopment programs.

Refer - "Street Classification Table" for further details

12. Provide dust-bins at major intersections and public transport stops/nodes in both directions along all streets (Minor streets and above in hierarchy) within the "Plantation & Furniture Zone"

Indicator - Percentage of total length of urban streets (Minor streets and above in hierarchy) that have at least 30 dustbins per km on both sides of the streets

Benchmark – Minimum 60%

Monitoring - Streets Audit

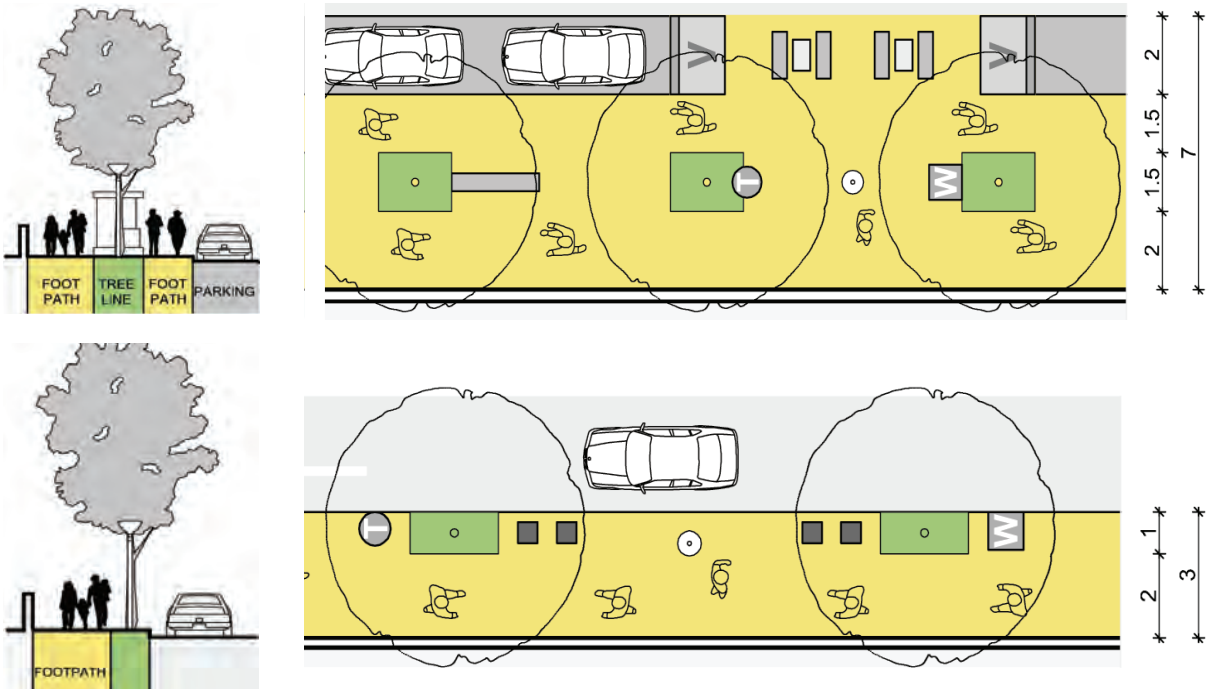


Figure 1.21: Street amenities

Implementation - ULB / UDA will implement this through street redevelopment programs.

Refer - "Street Classification Table" for further details

1C. Encourage pedestrian friendly building access, frontage, and street level uses

13. Ensure primary pedestrian access to buildings from primary street, vehicular access from secondary street where a plot has two or more frontages

Figure 1.22: Pedestrian and vehicular access on CG road, Ahmedabad, India

Indicator - Percentage of all buildings that have primary pedestrian access from a primary street.

Benchmark - Minimum 70%

Monitoring - Development Audit

Implementation - ULB / UDA will implement through Development Control Regulations.

14. Remove minimum requirements for front margins and disallow any type of fencing / compound wall towards arterial streets for all plots with frontage on arterial streets. Exceptions: Institutional land use

Figure 1.23: Remove compound wall and disallow front margin towards arterial streets

Indicator - Percentage of total plots (excluding Institutional uses) on arterial streets with no front margin / front margin without fencing or compound wall

Benchmark - 100% compliance for all new developments and redevelopments

Monitoring - Development Audit

Implementation - ULB / UDA will implement through Development Control Regulations.

15. Disallow parking within front margin for all plots with frontage on arterial streets.

Indicator - Percentage of total plots (excluding Institutional uses) on arterial streets without parking within the front margin space

Benchmark - 100% compliance for all new developments and redevelopments

Monitoring - Development Audit

Implementation - ULB / UDA will implement through Development Control Regulations.

16. Encourage on-street vending activities near public transport nods/parks/ junction of streets etc in place of and in close proximity to on-street parking in clusters not smaller than 5 vending spaces

Implementation - Urban Local Body / Urban Development Authority will implement and regulate on-street vending activities through on-street parking management agencies

Note - This recommendation is aimed at making provision for support services for pedestrians, cyclists, public transport users etc. and may include activities such as kiosks, drinking water facility etc. Wherever possible, these should be aligned with public transport nodes, important public buildings, parks etc. This recommendation is not aimed at catering to natural markets that encroach on streets. Natural markets found encroaching on the ROW of any street should be relocated off-street close to its present location.

Other recommendations:

- Highways within urban areas should be avoided since they disrupt pedestrian activity and disturb neighbourhoods. Where present in built-up areas, they should be treated as major arterial streets and designed as per UTTIPEC's Street Design Guidelines (2010).
- Street design must allow pedestrians to remain at ground level with comfortable and safe access and minimum detours from the most direct path. Grade separated structures (FOB and pedestrian subways) should be avoided to prevent unnecessary detours to reach destinations.
- If grade-separated pedestrian crossings are unavoidable due to presence of highways in urban areas, then such crossings structures should be frequent. The preferred arrangement is to depress the highway and provide at-grade crossings. There must be at least four crossing opportunities per Km in built-up areas. Every crossing should be universally accessible.
- Intermittent buffers, bollards and other physical elements should be used to protect footpaths from encroachment by motor vehicle parking. However, such elements should not form a barrier to pedestrian movement. Continuous railings that constrain pedestrian access are to be avoided.
- The final road level should be fixed for all streets. When re-carpeting roads, previous layers must be scraped such that final road level remains the same.

Case studies

i. Car free zone - Fazilka, India

Figure 1.24: Car Free zone near clock tower area, Fazilka, India

Key Information

- In 2006, GWAF organized Car free street for a week
- Success of event led to creation of car free zone for central area
- Entry for cars banned between 10:00 am to 7:00 pm.
- Beneficial impact of car free zone
  - 10,000 visitors/day in market areas
  - 23% reduction in accidents in central area
  - 3% reduction in air pollution
  - 25% increase in local sales
  - 12% increase in visitors to area
  - Improved community social life
  - 91% people agree that car free zone enhances safety of pedestrians

Fazilka is a small city in Punjab, India located near India Pakistan border. Like most small cities in India, Fazilka has many narrow streets in the old market areas and excessive growth of motor vehicles in the recent years has lead to increasing traffic congestion. In the year 2009, municipal committee decided to convert market area into car free zone. The main market area around clock tower was declared as car free zone. The entry of cars between are 10:00 am to 7:00 pm is banned. Only two wheelers and cycle rickshaws are allowed during this period. placement of traffic calming device and permanent barriers at few locations was the key to success. (Asija, World's First Dial a Rickshaw Facility-Green & Sustainable Technology: Fazilka EcoCab, 2010)

In 2006, a group of people from Graduates Welfare Association Fazilka (GWAF) organized Fazilka heritage festival for one week. As a part of the festival, they converted 300 m long street (Sandhu Ashram road) into pedestrian street. The success of this event led to other opportunities and GWAF conducted an experiment in central zone as car free zone. After the first initiative, GWAF was tried to convince the municipality and market traders about the benefits of this proposal but at the time it was difficult. In the year 2008, the traders were convinced that such a scheme would be beneficial to Ghanta Ghar shopkeepers and program could help decongest the area. Thus, in later phase Shashtri chowk road (800m long)and Wool bazaar road (400 m long) were converted into car free zone. This program improved the air quality, Law and order, traffic related issues, and provided healthy social life. (Kumar, Planning and Design for Pedestrian Safety, 2009)

The successful implementation car free zone has been beneficial in many ways, not only by decongesting the market. The local market traders near

clock tower are now happy with the ban of cars and the trading in the shop has increased by 25% since the ban.

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

Fazilka is a historical town and is likely to have potential for tourism development. Programs like these create more opportunities for enhancing tourism in the area. Following the successful implementation of the project, 70% people agree that car free zone will help to enhance tourism potential for the city. Car free zone has led to reduced accidents and has increased pedestrian safety during day and night time. A large majority (91%) of people have indicated that they would like to see such improvements in pedestrian safety throughout the city along with allowing for slow moving traffic. Further, they suggest that special provision should be made to avoid fast moving motorized vehicles in the residential streets within the city.

ii. Pedestrian priority street - Nanded, India

Key Information

- 50km stretch developed under JnNURM
- Project done with support from ILFS, ICE
- Key design features:
  - Reduce carriageway for motorized Vehicles
  - Pedestrian friendly wide footpaths
  - Dedicated cycle track
  - Dedicated area for vendors
  - Parking space provision at regular interval
  - Building access modified for better pedestrian access

Figure 1.25: Nanded pedestrian priority street, Maharashtra, India

A program called "The Network and Walkability Improvement Project" under Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was conceived in 2006. Nanded (in Maharashtra) is one of the mission cities under JNNURM and Nanded Municipality took the initiative to implement this project. A project to improve the streets of the city was undertaken and pedestrian priority streets were designed and implemented. (Mhaisekar, Presentation on JNUURM Works in Nanded:Nanded Waghala City Municipal Corporation, 2009)

Approximately 50 kms of the streets in Nanded were redesigned, improved

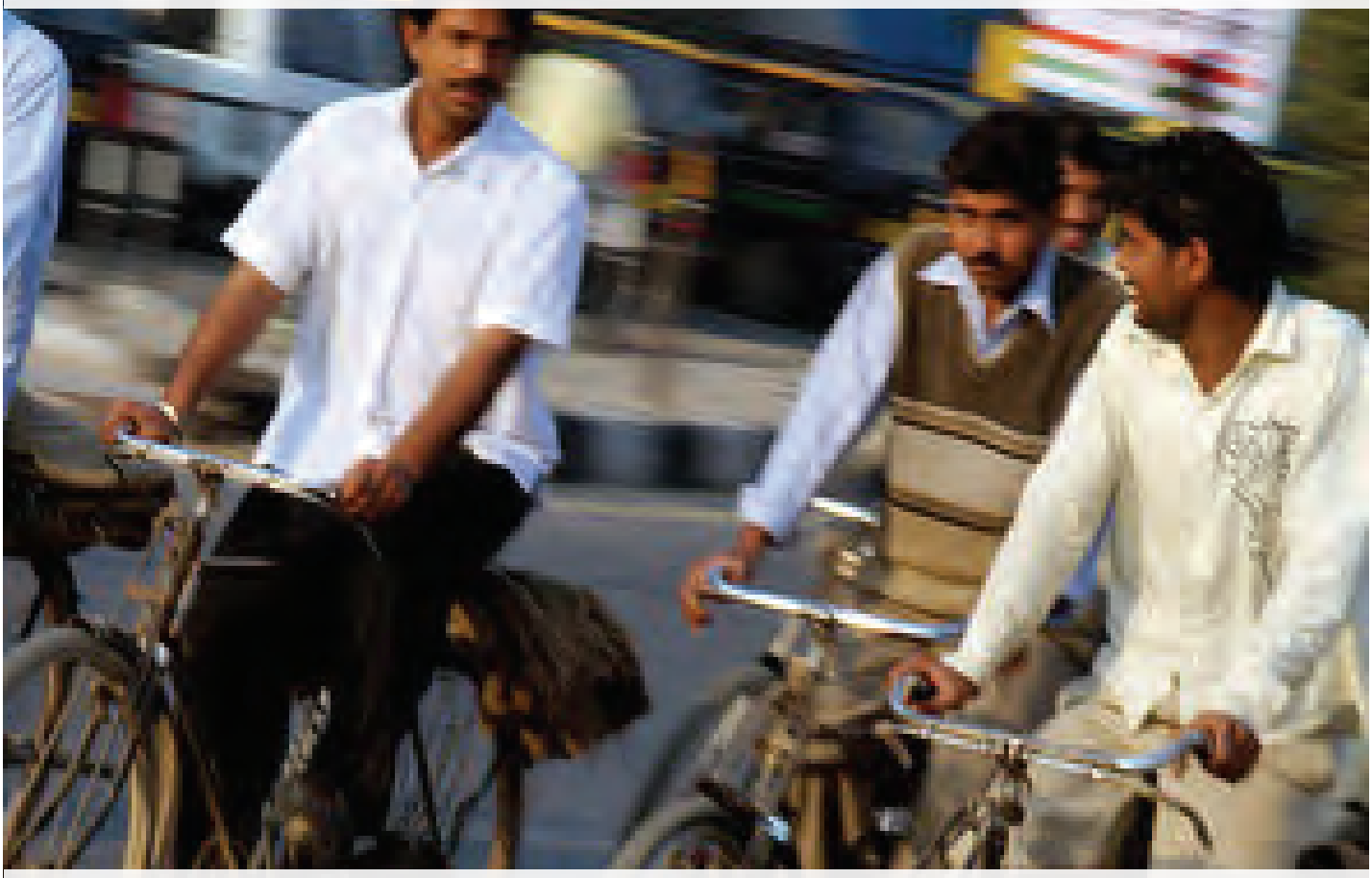
and built. The pedestrian pathways have been planned in such a way that dedicated space is available for pedestrians, cyclists and multiuse zone.

Multi-use zone includes parking space, bus stops, vending zones etc. Usually in the Indian context, vendors encroach on footpath constraining the space available to pedestrians for walking. The design of multi-use zone in street section attempts to minimize the pressure of encroachment on road or on footpaths. (Kumar, Kulkarni, & Parida, Pedestrian Safety in Multi Modal Public Transport: A Way Forward to Create Safer City, 2009)

Pedestrian crossings, pedestrian refuge islands, signage, traffic signals and intersections have been designed and constructed. In certain places, even the entry & exit of the adjacent buildings has modified to enhance pedestrian access.

Principle 2. Cycle

"Prioritize cycling and other non-motorized transport modes"



Sub-principles:

- *Ensure provision of **high quality** cycle infrastructure*
- *Ensure **safety** and **comfort** of cyclists & NMT users*
- *Ensure **coordination** of cycling facilities with public transport facilities*
- *Encourage use of Non-motorized mode for **last mile connectivity** for people*
- *Provide **legal status** and **protection** to cyclists and NMT users*

Principle 2. Cycle

"Prioritize cycling and other non-motorized transport modes"

Cycling is a popular mode of transport in Indian cities. As of 2007, between 10 to 20 percent of all trips were cycling trips across different cities in India (MoUD, 2008). After walking, cycling is the second most efficient and effective mode of transportation for short to moderate distances. There are many benefits to cycling including health, environmental, economic, etc. Considering these multifaceted benefits, a number of cities across the world, notably Amsterdam, Copenhagen and others, have centered their transport policies around promotion of cycling and non-motorized transport.

Figure 2.1: Copenhagen in the 1930s

Figure 2.2: Copenhagen in the 1970s

Figure 2.3: Copenhagen today

Currently in India cycling is considered to be the mode of transportation that is to be used by lower income groups of society, those who cannot afford any other means of transport. It is also used by students of different age groups. Higher income group of people prefer using cars or two wheelers even for short distances. Moreover, the no. of households in urban India that own bicycles are roughly equal to the no. of households that own motorized two wheelers and cars/jeeps put together (Census of India, 2011). However, this is rapidly changing as more no. of households are buying motorized two wheelers and cars. This reality needs to change and use of these modes needs to be brought in day-to-day life style of all sections of society if our future has to be sustainable. It is possible to maintain and improve the mode share of cycling in the day-to-day transport in many Indian cities, by investing in and providing adequate quality infrastructure for cyclists.

> Cities such as Copenhagen have gone full circle in terms of focusing on personal transport modes for their transport policies. The first bike lane in Copenhagen was constructed on Esplanaden in 1892. Cycling was the predominant mode of personal transport up till the 1950s when Copenhagen experienced a decline in utility cycling due to increasing wealth and affordability of motor vehicles. During the late 60s and early 70s the modal share of bicycles fell to an all time low of 10% and Copenhagen was just as car-clogged as anywhere else as their policies focused more on motorized modes. The oil crisis and the environmental movement of the 70s, alongwith several planning reforms brought the focus back on cycling as the sustainable mode for personal use. Today, close to 50% of residents of the city use cycle as their preferred mode of personal transport. (en.wikipedia.org/wiki/Cycling_in_Copenhagen)

Other non-motorized modes such as Cycle Rickshaws and Cycles Rickshaw Trolleys play a similar role as Intermediate Public Transport (IPT) and non-motorized freight transport respectively. Non-motorized vehicles do not consume fuel or cause pollution. Another aspect of non-motorized transport is that it is a significant employment generator for the minimally skilled workforce in small, medium and sometimes even large cities. Cycle rickshaw is a public mode of transport and best suited to provide the last mile connectivity. Many countries recognize the potential of cycling to grow as a mode of transport and act as an alternative to car use to create more sustainable urban futures.

Sub-principles:

2A. Ensure provision of high quality cycle infrastructure

Figure 2.4: High-quality bicycle infrastructure

Currently, most space of the public street is allocated to private motorized vehicle users (MoUD / WSA, 2008). In 2001, only 30% of households in urban India owned motorized vehicles and the remaining households were users of walking, cycling and public transport. This figure has gone up to 45% in 2011 which suggests that bicycle ownership is rapidly declining in India cities (Census of India, 2011). If this has to change and cycling is to be a more well-used mode of transport, it is important to understand the factors affecting / reducing the use of cycling in cities. A number of cities in the world have been successful at promoting the use of cycling by using a multi-pronged approach to improving bicycle use. One of the first and most important aspects of such an approach is having excellent infrastructure. This means providing dedicated & segregated cycle lanes on all major arterials along with proper cycle crossing, cycle parking and other facilities at regular intervals.

Different people use cycle for different purposes and it is important to understand the nature of cycle use in a particular city before undertaking specific infrastructure improvements. The average trip length for all vehicles (excluding walk) in medium and large cities varies from 4.2- 6.9 km and the average trip length for bicycle is 3.1- 4.5 km. It is observed from the trip length frequency distribution that 56% to 72% trips are short trips (below 5km, the typically cycle-able distance) (Tiwari, G. & JAIN, H., 2009). Hence, there is a great potential for cycling due to the typical short distances in Indian cities.

Another key feature of cities that have more recently improved the mode-share of bicycle within their transport is that they have introduced a strong public bicycle sharing program. Such programs have been implemented in many cities including, New York, Washington DC, Guangzhou, Hangzhou, London etc. Some cities in India (Bangalore, Delhi etc) have initiated pilot projects along similar lines. Public bicycle sharing not only helps promote bicycling, it also helps sensitize users of other modes to the needs of cyclists. Certain small & medium sized cities in India have a different version of cycle sharing - cycle rentals where individual vendors provide cycles on rent near key areas (like railway stations). These serve as effective commute option for a number of low and middle income users (Embarq).

Provision of appropriate street space and infrastructure for pedestrians and cyclists can help encourage more people to use these sustainable modes of transport for short and intermediate trips.

2B. Ensure safety and comfort of cyclists & NMT users

Figure 2.5: Bicycle lanes cleared of snow before vehicular carriageway (Odense, Denmark)

The perception of risk among captive riders and potential riders does not show much difference as against popular beliefs. Both the captive users as well as the potential users focus on primarily on physical safety and the difficulties in crossing the intersections (Jain, H. & Tiwari, G., 2010). This is largely because cyclists have to share the same right of way as motorized vehicles that are larger and fast moving. Pedestrians, cyclists & other NMT users form the single major group of users that account for traffic fatalities in India (Mohan, 2009). Hence, it is important to ensure the safety and comfort of cyclists through provision of dedicated segregated cycle tracks along major arterials, safe refuges at unsignalized crossings, ensuring a safe phase for cyclists at signalized intersections etc. safety.

Apart from improving safety, the segregation of vehicles moving at different speeds would help improve traffic flow, increase the average speed of traffic and reduce emissions resulting from sub-optimal speeds. Such segregated paths would be useful to enable full trips using NMT and also as a means of improving access to major public transport stations (NUTP, 2006).

Figure 2.6: Priority for Cyclists at intersections

Perceptions of comfort may vary among the different cycling user groups (Jain, H. & Tiwari, G., 2010). However, clear segregated cycle lanes with minimal conflicts with motorized traffic can greatly affect the sense of comfort of cyclists. A city wide network of cycle lanes with parking & other supporting facilities at regular intervals can help maintain and improve the modal share of cycling in the overall transport of cities. Shade is another important factor for cycling in the Indian context. Street design should ensure that tree plantation zone is aligned with cycle lanes and sidewalks to create comfortable enviroments for pedestrians and cyclists. Adequate lighting for NMT infrastructure is necessary to ensure the safety of NMT users at all times.

Provision of high quality cycling infrastructure in itself is not enough. There needs to be adequate enforcement to ensure that cycle lanes are not encroached and obstructed by other modes and / or by utilities, and the rights of cyclists are protected.

Figure 2.7: Bicycle sharing facility at Waterloo station, London

2C. Ensure coordination of cycling facilities with public transport facilities

Even for trips made using public transport, access to the public transport node from the origin and desitination of a trip would require use of a different mode of transport. Integrating provision of cycling infrastructure with the existing and planned public transport nodes will help ensure that this need is served by walking, cycling or other NMT. It also allows a larger group of people to access public transport at a very low / no cost and use it for longer trips.

Coordination of cycling infrastructure with public transport nodes

can include provision of bicycle parking stands and bicycle sharing facilities near major public transport nodes. Additionally, high capacity public transport modes such as BRT, MRT and light rail should allow for transportation of personal bicycles in non-peak hours. This is particularly useful if a city does not have a bicycle sharing program in place.

Coordination of cycling infrastructure with public transport nodes would ensure that more people have access to public transport and as a result would also increase use of the public transport facilities (NUTP, 2006).

Figure 2.8: Cycle integrated public transport, Sunderland, UK

2D. Encourage use of Non-motorized mode for last mile connectivity for people

After walking and cycling, cycle rickshaws are the next most efficient and effective mode of transportation for short to moderate distances. Non-motorized people movers mainly include cycle rickshaws that provide personal transport. Cycle rickshaws are among the most cost efficient, pollution-free and noise-free vehicles. In addition to being eco friendly, cycle rickshawds also have the added advantage of providing an instant source of livelihood for impoverished migrants from rural areas who regularly come to cities in search of work (Jain, H. et al, 2011). However, cycle rickshaws need to be recognized as an important IPT mode that help provide the last mile connectivity for users of public transport from their origins and destinations to the public transport node. Provision of cycle rickskaw stands at major public transport nodes can help ensure connectivity for commuters and ensure that cycle rickshaws do not occupy the main vehicular carriageway for parking.

In addition to the basic infrastructure, facilities such as drinking water, public toilets etc. can also be provided along the routes to provide support to the cycle rickshaw drivers. Similar facilities already exist for public transport staff.

Figure 2.9: Cycle rickshaw stand at Delhi metro stations

2E. Provide legal status and protection to cyclists and NMT users

Numerous surveys and studies have shown that safety is one of the key issues impacting cycling and NMT use. Provision of strong legal status which allows cyclists and NMT users priority on road space as compared to other motorized modes would go a long way in helping improve the use of these modes.

Legal status of right-of-way and rules of behaviour for motor vehicles are governed by State Motor Vehicle Act. The act also establishes rules for licensing, registration and permits for various types of vehicle use. Since the act is not specific with regard to any hierarchy or priority of Right-of-way on public streets, frequently, cyclists and NMT users are marginalized. Hence, it is important that within this act, there be an acknowledgment of the rights of cyclists as NMT users as legitimate users of street ROW.

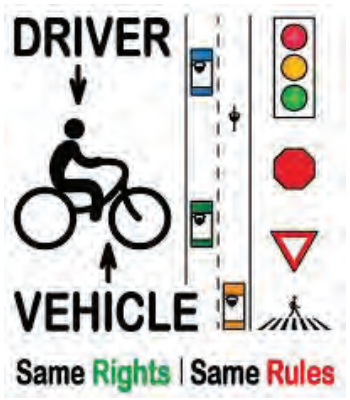


Figure 2.10: Equal rights for cyclists

Recommendations

2A. Ensure provision of high quality cycle infrastructure

Figure 2.11: Continuous unobstructed cycle lane, Delhi, India

1. Provide continuous unobstructed cycle lanes made with high quality paving (Asphalt or Concrete, not paver blocks) minimum 2m wide in each direction on all major & minor arterials, optional on all other streets

   Indicator - Percentage of total length of major arterials that have designated cycle lanes as per minimum standards

   Benchmark - Minimum 100%

   Monitoring - Streets Audit

   Implementation - ULB / UDA will implement through Street Design or Street Redevelopment program

   Refer - "Street Classification Table" for further details

2. Ensure cyclist crossings (along with or separate from pedestrian crossings) on all major and minor arterials, and all major streets at every 200m

   Indicator - Percentage of total length of all arterials and major streets that have 5 crossings or more for every km of street.

   Benchmark - Minimum 100%

   Monitoring - Streets Audit

   Implementation - ULB / UDA

Figure 2.12: On street cycle parking facilities, USA

3. Provide priority to cycle parking at any public / private parking facility by providing for atleast 50 cycles closest to the entry / exit of the parking.

   Indicator - Percentage of total parking facilities (public / private) which have priority parking space for 50 cycles within 10 M of its entry / exit .

   Benchmark - Minimum 70%

   Monitoring - Development Audit

   Implementation - ULB / UDA

4. Implement modern cycle sharing system in all cities >1million population with stations at every major public transport node and other important destinations

   Indicator - Percentage of urban area in cities > 1 million population with an active modern cycle sharing system implemented

   Benchmark - Minimum 40%

   Monitoring - Comprehensive Mobility Audit .

Implementation - ULB / UDA

2B. Ensure safety and comfort of cyclists

5. Provide bicycle boxes at all signalized intersections to prioritize safe crossing by cyclists.

   Indicator - % of signalized intersections with bicycle boxes

   Benchmark – 100%

   Monitoring - Streets Audit

   Implementation - ULB / UDA will implement this through street redevelopment programs.

Figure 2.13: Cycle holding box at intersection, Delhi, India

6. Ensure safe refuge for cyclists on un-signalized crossings for every street where one way carriage-way is more than 7m or two way carriage-way is more than 12m.

   Indicator - % of un-signalised crossings with safe refuge for cyclists (where one way carriageway is > 7m or two way carriageway is > 12m)

   Benchmark – 100%

   Monitoring - Streets Audit

   Implementation - ULB / UDA will implement through Street Design or Street Redevelopment.

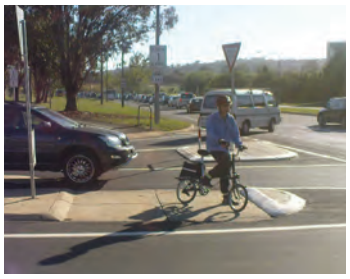


Figure 2.14: Safe refuge for cyclists on un-signalized crossings, USA

2C. Ensure coordination of bicycle facilities with public transport

7. Provide cycle rickshaw / auto-rickshaw stands at all major public transport nodes (and at other important destinations as needed) within 50m from the entry / exits

   Indicator - % of public transport nodes with cycle rickshaw stands for minimum 5 cycles.

   Benchmark – 100%

   Monitoring – Comprehensive Mobility Audit

   Implementation – ULB / UDA should ensure the provision of Cycle Rickshaw Stands near public transport nodes.

8. Provide secure and weather protected cycle parking facilities for at least 100 cycles (or more based on demand) at all major public transport nodes within 50m from exit (stations and above in hierarchy)

   Indicator - Percentage of major public transport nodes (stations and above) with secure & weather protected cycle parking facilities

Figure 2.15: Cycle parking facilities near bus shelter, Netherlands

Figure 2.16: Bicycle sharing station near BRT station, China

Figure 2.17: Bicycle sharing system, Paris

Benchmark - Minimum 100%

Monitoring - Comprehensive Mobility Audit

Implementation - ULB / UDA will implement through Station area redevelopment.

9. Provide cycle sharing stations at all major public transport nodes within 50m from exits and at other important destinations (for cities >1million population, with cycle sharing system)

Indicator - Percentage of major public transport nodes (stations and above in hierarchy) and important destinations with cycle sharing facilities

Benchmark - Minimum 100%

Monitoring - Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will be responsible for implementation. Part funding should be provided by state or central government

2D. Encourage use of Non-motorized mode for last mile connectivity for people

10. Incentivise NMT based rickshaws in congested or core areas of the city by providing NMT priority lanes and NMT parking/stands near the congested / core areas.

Implementation – ULB / UDA will provide the incentives through the NMT component of the Comprehensive Mobility Plan

11. Provide supportive infrastructure in the form of drinking water, toilet facilities, IPT-based rickshaw drivers at regular intervals, at least one such facility every sq.km.

Indicator - Percentage of urban area where there is one such facility (drinking water & public toilet) every sq.km.

Benchmark - Minimum 80%

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA will provide the incentives through the NMT component of the Comprehensive Mobility Plan

Other recommendations:

- Provide stronger legal right-of-way to cyclists and other NMT users. Providing this would require change in existing legal/statutory

framework and an amendment to the existing Motor Vehicle Act of the State. However, through appropriate training and sensitization, people responsible for managing traffic and enforcing traffic regulations can be more sensitive to the needs of the cyclists and NMT users as a first step.

- Ensure design standards for NMT infrastructure must be planned and implemented according to a comprehensive NMT plan. This plan could be part of a larger comprehensive mobility plan (as prepared by the city to meet JNNURM requirements) or could be a standalone plan whose recommendations are implemented by the city through their annual capital improvement plans.
- Encourage Cycle & Cycle Rickshaw repair shops. This can be done through allowing local tax rebates on cycle repair shops or subsidized tax to other shops which have cycle repair facilities.
- In most cities in India, there are no ancillary facilities like toilets / canteens etc for cycle rickshaw pullers, auto rickshaw drivers, hand & animal cart pullers. Hence, it is observed that most people use street space for such uses. It is recommended that cities should have atleast 2-3 facilities where drivers and pullers of the above modes are able to use canteen & rest room services while leaving their vehicles in a safe & secure environment. It is possible to combine these with public transport nodes of a higher order as they include such facilities for other users and one only needs to provide for the safety of their vehicles.
- Provide on-street parking facilities for cycles and cycle rickshaws as per demand.
- Ensure basic safety for bicycle users by making it mandatory to either show proof of helmet or purchase of helmet along with every new purchase of bicycle.

Case studies

i. Dial-a-Cycle Rickshaw Service- Fazilka, India

Figure 2.18: Fazilika Ecocabs, Dial a Cycle Rickshaw service, Punjab, India

Key Information

- Node to Node Connectivity
- Sustainable Technology
- Affordable and Comfortable
- Key design features:
  - Reduce carriageway for motorized Vehicles
  - None call centers serve an average of 1500 Households. Total ECOCAB available in Fazilka - 500
  - Daily passenger ridership - 10000 passengers per day
- ECOCAB won the National Award for Excellence in NMT Intiative from the MoUD in 2011

Cycle rickshaws are a traditional and an eco-friendly mode of transport in India. They continue to play a role as para-transit and non-motorized mode of transport in Indian cities. The world's first dial-a-rickshaw service, ECOCAB, was initiated in Fazilka, Punjab in 2008 by Graduates Welfare Association Fazilka, an NGO dedicated to education, employment, environment and energy. ECOCAB is tool for sustainable movement of passengers and goods in the city and nearby areas. ECOCAB is a dial-a-cycle-rickshaw (similar to dial-a-cab service which attempts to balance its demand and supply through equal distribution of fleet and automation using latest IT tools.

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

The second key innovation in the ECOCAB concept is its operations based on advanced IT infrastructure. The entire ECOCAB service is now IT based. Fazilka is divided in nine different zone of one kilometer by one kilometer grid. Individual grid has its own zone code. Further the city is being served via nine ECOCAB call centers from where the user can dial for rickshaw at doorstep. The users just have to dial ECOCAB number in which the last three digits are zone code. Each traction man carries mobile phone for direct calling facility and its android application is available in the market. Figure 9 shows zone map for ECOCAB service and with contact details and zonal extention code.

Currently in Fazilka, more than 500 ECOCAB is available and daily ridership is 10000 passengers per day. All traction men are provided with

work uniforms and have to follow a code of conduct, which, if broken, can lead to the confiscation of their rickshaw license. In Fazilka, nine call centers have been strategically spread around the town, and each of these serve an average of 1,500 households. The service is usually available between 9:00 a.m. and 6:00 p.m. The scheme functions very similar to the dial-a-cab service and all rickshaw pullers, also known as traction men, have been provided with cell phones.

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

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

Fazilka ECOCAB got a big boost in 2011 when the Punjab and Haryana High Court took decision in one of the news item and ordered the Government of Punjab, Haryana states and UT Chandigarh to implement it in various cities of Punjab, Haryana and UT Chandigarh. In addition, the idea also finds mention in the country's 12th Five-Year Plan, under the low carbon mobility agenda.

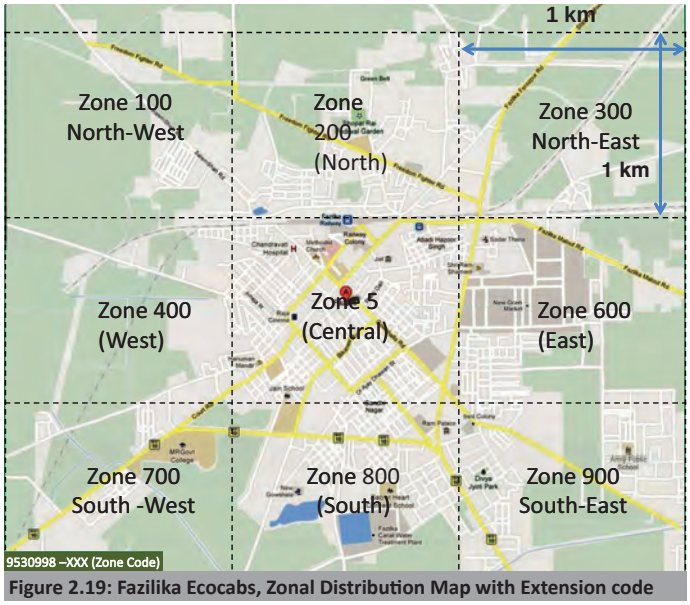


Figure 2.19: Fazilika Ecocabs, Zonal Distribution Map with Extension code

ii. Bicycle Sharing - Guangzhou, China

Figure 2.20: Public sharing bicycle station, Guangzhou, China

Key Information

- Launched June 2010
- Phase 1
  - 5,000 Bicycles
  - 113 Stations
  - 20,000 Bicycles trips per day
  - 4.0 Trips/Bicycle/Day
  - Reduce 7,500 motorized trips per day
- Fees
  - First hour of usage is free.
  - 2nd hour of usage US$0.15
  - 3rd hour of usage US$0.30
  - ≥ 4th hour add US$0.44/hr
- Frequency of bike use:
  - 63% more than 3 times per day
  - 50% more than once per day
  - Additionally, almost every BRT station has some form of bicycle parking.

Guangzhou is one of the fastest growing cities in the world. As the economic hub of China's southern coast, it has undergone three decades of rapid modernization, and until recently, the city's streets were completely overrun by polluting private vehicles. However, Guangzhou has started to change course. In 2010, the city opened its first BRT line making major strides to cut carbon emissions and reclaim space for people, promising more public transport and public bike-sharing systems.

Integration of public bicycle sharing and BRT was initially setup in June 2010. The first phase was implemented along the Zhongshan corridor. This has 18-bicycle station, and more than 1000 bicycles available for the users. By late 2010, this system expanded to 113 station and 5000 bikes mainly around Huajinxinch and Xiayuan BRT station.

Almost every BRT station has some form of bicycle parking facility and many public bicycle stations also provide for private bicycle parking. In 2nd phase, Guangzhou set station around bus stops with more facility.

As a part of overall bicycle infrastructure, full-length, physically separated bikeways were built along both sides BRT corridor, and improved footpaths run through the full corridor. Guangzhou transport department says that the bicycles are currently used for over 20,000 trips per day and 4.0 trips per day per cycle which reduces 7,500 motorized trips per day. Secure, high-density bicycle parking is also available at BRT stations for private bicycle users.

Guangzhou Transport Authority has also infolded Yang-cheng-tong card (like integrated mobility card) that can be used in BRT, Metro train, Taxi and for cycle sharing purpose. cycle sharing users who do not have a Yang-cheng-tong card can use the service by paying a deposit of $45 USD.

The first hour of use is free; this is followed by incremental pricing where users pay an additional 0.15 US$ for the second hour, 0.30 US$ for the

third hour, and 0.44 US$ after every additional hours. The main objective of the pricing modal is to maximize the use of bicycle and rather than increasing the revenue. (Schroeder, Bradley, 2011)

While most cities in the world need some level of public subsidy to cover the difference between operating cost and revenues generated by a public bicycle sharing system, it is well understood that if all avenues of revenue generation are explored, this difference can be reduced significantly so it does not cause an undue burden on the city . such avenues include advertisements on the bikes / stations, partial sponsorships by large institution users like universities etc.

iii. Dedicated Bicycle Lanes - Delhi, India

Key Information

- Cycle traffic share on the 5 important intersections - 15%- 40%
- Fatalities in Delhi in year 2004
  - Share of bicycle fatalities - 9.7%
  - Major and seriously bicycles fatalities - 6.2%
- Bicycle master plan for Delhi
  - Segregated cycle track improved traffic condition
  - Bicycle priority lanes along BRT corridor
  - Concept of Prioritization of space allocation
  - 2.5 m wide NMV lanes on both sides
  - NMV lanes have been visually and physically segregated from pedestrian paths

Figure 2.21: Dedicated Bicycle / NMT lane, Delhi, India

Unlike other urban areas in India, majority of the population in Delhi is not dependent on bicycles for daily commute. However, cycle traffic contributes between 15-40% of the total traffic on the 5 important intersections monitored since 2003. (TRIPP, 2007)

The share of bicycle traffic continues to be substantial despite lack of planned facilities for them. However, bicyclists are exposed to higher risks of getting involved in a road traffic crash. Bicyclists constitute about 9.7% (180 deaths) of the total road traffic fatalities in Delhi in 2004. Also 6.22% (506 victims) are cyclists among those who were seriously injured during road accidents in 2004. (Delhi traffic police, 2005). Cyclists occupy the curb side lane in a mixed traffic situation. They share this lane with transport and goods vehicles, buses and three wheeled scooter taxis, leading to the risk of serious accidents. Thus cycle track segregation is required on all roads with maximum speeds more than 50 km/hr, according to all international design guidelines.

Keeping this in mind, Delhi Master Plan and the Bicycle Master Plan for Delhi advocated for segregated bicycle infrastructure. However, it was

finally implemented with the introduction of BRT corridor in the city. The concept for this corridor Prioritization of space allocation included the following features:

- Segregated bus lanes in the centre of the Road, for uninterrupted traffic movement.
- Safe pedestrian and commuter movement at all locations.
- Segregation of slow traffic such as bicycles to ensure efficiency.

The first corridor of BRT in Delhi, from Ambedkar Nagar to Delhi Gate, is 14.5 km long with ROW varying from 28 meters to 51.5 meters. Bus Lane is in the middle of Road with a width of 3.3 meters. While motorized vehicle lane is on the side of bus lane with a width of 6.75 meters. Separate tracks are made for non-motorized vehicles and pedestrians.

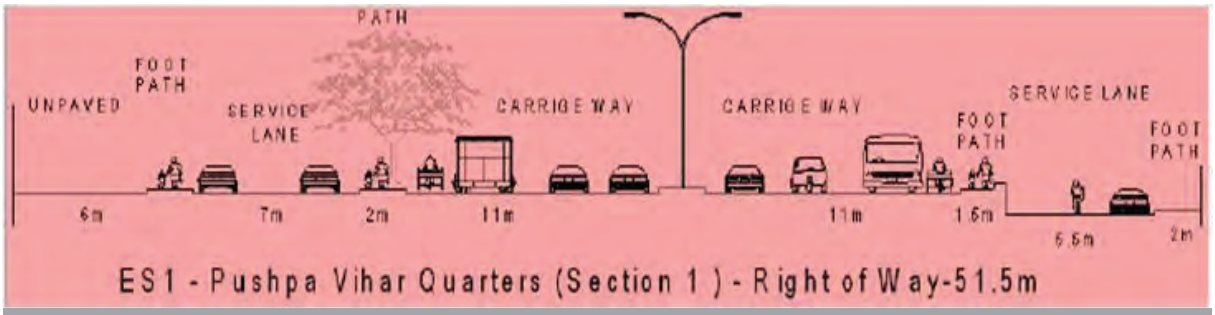


Figure 2.22: Cross section of arterial road before implementation of Delhi BRT project

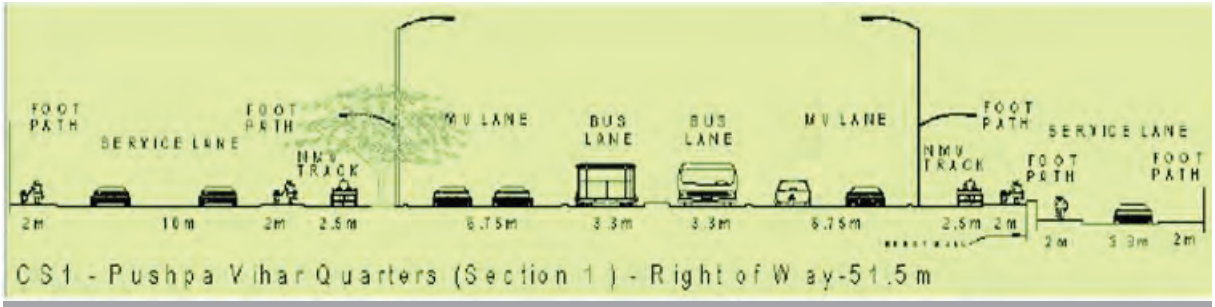


Figure 2.23: Cross section of arterial road after implementation of Delhi BRT project

NMV (cycle) lanes with 2.5m width have been provided throughout the length of the proposed corridor from Ambedkar Nagar to Delhi Gate. These lanes have been segregated from the Motor Vehicle lanes by a 0.75m wide median/unpaved zone (Figure 17) on 75% of the length, more than 0.75m wide green belt/footpath on 20% of the length, 0.3m wide median on 4% of the length of the corridor.

The NMV track has been combined with the pedestrian walkway (due to space constraint) to provide a 3m wide common path for less than 1% length of the corridor. All NMV tracks are accessed through a ramp with a minimum gradient of 1:12.

Figure 2.24: Segregated and painted bicycle track, Delhi, India

Cyclists can use the free left turn at junctions whereas straight and right moving traffic will negotiate the junction at green signals with other vehicles. To allow for safe movement of cyclists at green light on junctions, cycle holding boxes have been demarcated 5 m ahead of the stop line on the carriageway. NMV lanes have been visually and physically segregated from pedestrian paths to make a clear distinction between the areas to be used by each user.

Figure 2.25: Cycle holding box at intersection, Delhi, India

Benefits

Cycle track segregation has helped in improving the traffic flow of other motor vehicles. Even a low cycle volume prevents motorists from using the curb side lane of the carriageway as the speed differential between

the two makes maneuvering between the cyclists almost impossible.

Bicycle lanes also result in better space utilization. For instance a 3.5m lane has a carrying capacity of 1,800 cars per hour whereas it can carry 5,400 bicycles per hour. (Replogle M., 1991) Average occupancy of a car is 1.15 persons and bicycle carries one person. (IRC 106-1990) This implies that in order to move the same number of people we would need 2.6 times the road area that would be required for bicyclists. Given the fact that there is not much space available to expand existing roads, the future mobility needs and projected trips can only be met by increasing the capacity of the existing road network. This can only be achieved by encouraging modes which are more efficient in terms of space utilization. (TRIPP 2008)

Principle 3. Public Transport

"Support access to high-quality public transport"

Sub-principles:

- *Ensure **good quality** public transport service **within walking distance** of homes, jobs, and amenities*
- ***Maximize** public transport capacity in densely developed areas and along growth corridors*
- *Create **reliable & comfortable** public transport services and facilities*
- ***Integrate** public transport with Intermediate Public Transport and cycle facilities to **improve accessibility***
- *Public Transport **node classification system***

Principle 3. Public Transport

"Support access to high-quality public transport"

Figure 3.1: Space occupied by cars vs public transport for same capacity

To cater to urban transport in rapidly growing cities in India, the only sustainable long-term solution is provision of high quality public transport. This has been identified as a critical and urgent need; and much has been initiated through the Jawaharlal Nehru National Urban Renewal Mission (JnNURM). However, a lot more needs to be done to make public transport efficient, accessible and affordable to the majority of people.

The advantages of a high-quality public transport system include reduction in traffic congestion, improved travel time, reduction in energy consumption and emissions and public health. It also helps provide affordable transport alternative that is socially inclusive. High quality public transport also ensures comfort as well as a "go anywhere anytime convenience" for people of all ages and abilities. It benefits everyone, including people who never use public transit themselves but who experience less traffic and parking congestion, improved safety, and reduced need to chauffeur non-driving family members and friends.

A fully-integrated, 'seamless' network with short waiting times and easy transfers can help encourage people to switch from private vehicle use to public transport. Hence, one of the most important task is to ensure access to good quality public transport for majority of residents in the city. Public transport includes various services such as buses, trams, trains, rapid transit (metro rail, bus rapid transit system (BRTS) etc) and water-based modes like ferry (VTPI, Public Transit Improvements, 2011).

Public transport cannot be successful without appropriate access and last mile connectivity which in Indian cities is largely provided by intermediate public transport (IPT) modes such as cycle rickshaw, auto rickshaw, taxi, etc., Moreover, IPT provides the only public mode of transport in many small and medium sized cities in India. In both cases, IPT plays an important role in providing mobility at a very low cost to a large section of the population. It is important to address the needs for these modes and to organize and streamline the operations for better reliability and safety. However, IPT modes should not be seen as a replacement for public transport modes in larger cities (cities with population more than one million).

Sub-principles:

3A. Ensure good quality public transport service within walking distance of homes, jobs, and amenities

Figure 3.2: 400m coverage of public transport nodes, Sydney, Australia

In order for public transport to be well-used, it is important that it serves majority of residential areas, workplaces and other destinations within the city. Hence, a well networked system with adequate reach is one of the first requirements of a good public transport system.

Public transport systems have different capacities, reach and the cost at type / technology of public transport to the demand and nature of urban fabric that may be unique for each city. The utility of any of these systems has to be judged in terms of how well it serves the individual trip needs, how many people can benefit for the same investment, and how flexible it is in meeting the changing demands of the city. Optimal capacity is one that best fulfils travel demand. Travel demand depends upon city size, trip lengths, location, density of jobs and residences and other socioeconomic conditions. System demand depends upon the ease of access, low fares, and dependability. A high-capacity system succeeds if there is demand for it within walking or easily accessible distance. (Tiwari, 2006).

Once the public transport has been planned and is undergoing implementation, it is important to reinforce this massive infrastructure improvement by incentivising new development to locate in close proximity to the public transport nodes. This will not only help the PT service attract ridership, it will also ensure that more people have access to the new infrastructure.

Each public transport trip requires at least two walk trips; at the beginning and at the end. For efficient utilization of a high quality public transport, pedestrian access to public transport needs to be prioritized. Public transport nodes should be located within a comfortable walking distance from majority of homes, jobs and services. Also a good walking environment encourages people to walk longer to reach public transport. This enhances the feasibility of investment-intensive mass rapid transit like BRTS and Metro Rail.

In small Indian cities, auto rickshaws, taxis, cycle rickshaws are used as the main mode of public transport. As trip lengths are shorter in smaller cities, IPT modes are able to serve majority of population in a more efficient manner than public transport in terms of network coverage. However, there is a need to regulate the IPT modes and organize the routes and stands.

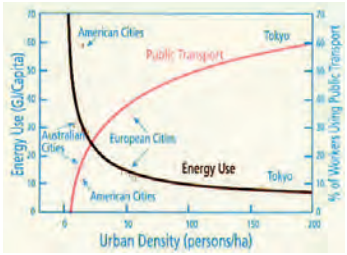


Figure 3.3: The relationship between energy use, public transport share and density

3B. Maximize public transport capacity in densely developed areas and along growth corridors

The demand of public transport is always higher in densely developed areas than in low density areas. This needs to be reflected in the design and planning of the public transport services and nodes. High density areas within the city need easily accessible, frequent and reliable service in order to meet the travel demand and encourage people to use public transport.

Figure 3.4: Reliable, fast public transport - BRT Delhi

3C. Create reliable & comfortable public transport services and facilities

The reliability and comfort of using public transport services determine the ease of accessibility and eventually the number of people that will switch over from private modes.

The reliability of public transport services should aim for frequent and efficient service that reduce journey times and transfer times during peak periods. Public transport services should focus on comfort and convenience of users for all aspects of the entire trip. This includes convenience of interchanging modes if needed, and switching to intermediate public transport or a bicycle sharing system with minimal discomfort / delay.

In order to provide high quality public transport, it is important to outline level-of-service factors that can be used to evaluate service quality and set targets. These include:

- Availability and Extent of area served
- Service frequency.
- Relative speed. By providing bus lanes, transit buses can be faster than automobile travel on congested roads, which is very important for attracting discretionary travelers.
- Adequate space/lack of crowding
- Nice stations (well maintained, clean, safe, not too crowded, amenities such as washrooms and vendors)
- Good pedestrian access to transit stations
- Universal design (accommodates people with disabilities)
- Convenient user information
- Temperature control (not too hot or too cold, for example, shade from hot sun and large operable windows in hot weather

3D. Integrate public transport with Intermediate Public Transport and cycle facilities to improve accessibility

Though individual public transport services may be designed well, unless they are well integrated with other modes of public transport, overall success is unlikely. Hence, any public transport service should not be designed in isolation from other existing and planned public transport modes. Intermodal intergration of all public transport modes is key for ensuring overall success of public transport usage. This intermodal integration in crucial especially between a public transport service and its immediate lower category of public transport mode.

Integration of public transport with Intermediate Public Transport and cycle facilities can also greatly improve the accessibility, ridership and eventually the sustainability of the system. Provision of Intermediate Public Transport stands and cycle sharing stations needs to be in close proximity to major public transport stations to improve the accessibility and ridership.

For public transport trips, the beginning and the last end journey can be served by Intermediate public transport vehicle. Ensuring location of IPT stand near residential areas generate trips up to public transit station. Provision of IPT will also generate employment opportunity and provide more sustainable and affordable transport.

Figure 3.5a: Intermodal integration, Bus stop integrated and planned at Metro station, London, UK

Figure 3.5b: Integrate public transport, IPT & cycle modes

3E. Public Transport node classification system

Defining a hierarchy of public transport nodes helps implementing agencies decide priority of investments and location of appropriate right user facilities. At a public transport node where it is possible to interchange between different routes it is particularly important that the public transport node is prioritized for investment and well-equipped with user facilities. The transfer time can otherwise affect the whole journey in a negative way (Directorate-General Energy & Transport, 2010).

The location and type of public transport node should be decided based on the number of routes coming together at the node, accessibility of the node and its potential ridership volumes and significance in the city.

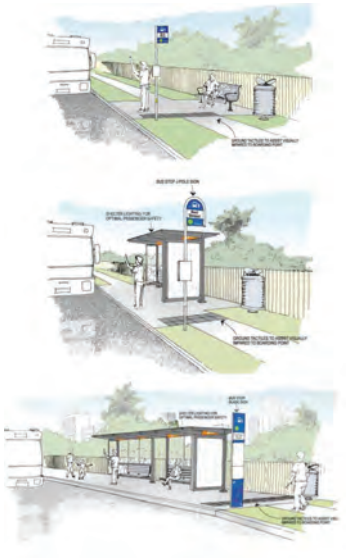


Figure 3.6: Bus stop hierarchy

Recommendations

3A. Ensure good quality access to public transport service within walking distance of homes, jobs, and amenities

1. The entire urbanized area of the city should be within walking distance of public transport nodes for cities with million-plus population (public transport system based on demand).

   Indicator - Percentage of urbanized area within 400m walking distance of public transport nodes (Only regulated IPT stops and routes may be included).

   Benchmark – 100%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA / UMTA will be responsible for implementation through the mobility component of the Comprehensive Regional Plan.

2. The entire urbanized area of the city should be within walking distance of public transport nodes & IPT nodes for cities with population less than one million.

   Indicator - Percentage of urbanized area within 400m walking distance of public transport nodes.

   Benchmark – Minimum 80%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA / UMTA will be responsible for implementation through the mobility component of the Comprehensive Regional Plan.

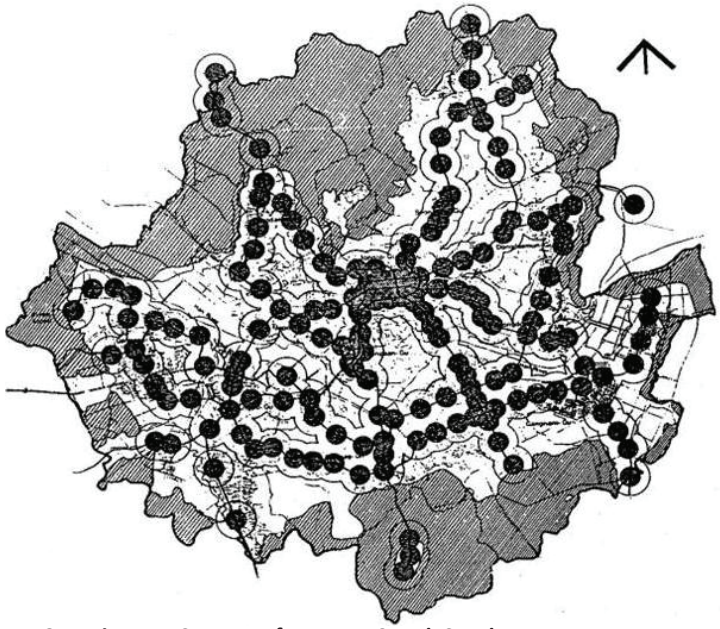


Figure 3.7: Distance Coverage from BRT, Seoul, South Korea

3. The type of public transport service to be provided should be determined based on various factors such as system demand, line capacity, system cost, construction time, cost per passenger, commercial speed etc. (Tiwari, 2006). As a general principle, provision of public transport service of a particular type should follow prioritization as mentioned: Bus, BRT / Tram, Metro /Light rail, Commuter rail.

   Implementation – ULB / UDA / UMTA will be responsible for implementation. In the case of rail-based public transport service, state government and other relevant agencies may also be involved.

Bus based public transport service:

At a minimum, public bus service should be provided where estimated demand for public transport on any given corridor is greater than 1,000 passengers per hour per direction in at least one direction.The number of buses required in any city per 1,000 population will depend on the public transport mode share, the presence or otherwise of rail or other public transport modes, the capacity of the buses, the extent to which they may be utilized in terms of daily kilometers per bus, and the daily number and average length of bus journeys undertaken by each inhabitant of the city. With so many variables the minimum requirement varies considerably from city to city, but should typically lie between 0.5 and 1.2 per 1,000 population. (www.ppiaf.org)

Rail based public transport service:

A metro rail project is recommended in cities which ordinarily have:

- Peak hour peak direction traffic (PHPDT) of more than 20,000 for at least 5 kms of continuous length by 2021
- Total population of more than 2 million as per 2011 census
- Average trip length of more than 7–8 kms for motorised trips
- At least 1 million ridership per day on organised public transport

These criteria are in the nature of guidelines and are not to be construed as entitlement for a metro project. As huge public money is involved in construction of these projects, in all such cases, in the first instance, feasibility of relatively cheaper options should be examined. (Planning Commission, GoI, Twelfth Fiver Year Plan, 2013)

4. New developments that depend on high intensity of users (like new regional shopping centers, institutions etc.) should be incentivized to locate within 800m of a public transport node & provide their own shuttle service linking to a public transport node.

   Indicator – Percentage of all such new development proposed in the metropolitan area that is within 800m of a public transport node or has provided a shuttle service linking with a public transport node.

   Benchmark – 100% compliance

   Monitoring – Comprehensive Mobility Audit

   Implementation – ULB / UDA will be responsible for implementation, using development control regulations (Development Control Rules) and building permits. Norms should be created for the identification of thresholds for high intensity of users based on land use and density which can be used for this

Figure 3.8: Free shuttle service provided by IKEA mall, UK

purpose.

Refer - See ITE (Institute for Transport Engineers) trip generation procedures (ITE, 2004).

5. All new public buildings (institutional / educational / cultural etc) should be located within 400m of a public transport node

Indicator – Percentage of new public buildings planned that are within 400m walking distance of public transport stations.

Benchmark – 100% compliance

Monitoring – Development Audit

Implementation – ULB / UDA will be responsible for implementation, using Development Control Rules.

Figure 3.9: Federation Square, Melbourne. Public building location from public transport station

6. Prioritize provision of continuous unobstructed pedestrian pathways min. 1.8 m wide within 400 m of each public transport node

Indicator – Percentage of all streets within 400m of public transport nodes which have minimum 1.8m wide continuous unobstructed pedestrian pathway.

Benchmark – 100% compliance

Monitoring – Streets Audit

Implementation – ULB / UDA through Street Redevelopment Program OR Station Area Planning around PT nodes

Note: Provision of minimum standards of sidewalks within 400m of public transport nodes can help ensure that the public transport service is accessible by more number of people.

3B. Maximize public transport capacity in densely developed areas and along growth corridors

7. Frequency of public transport service should be based on demand

Implementation – ULB / UDA / UMTA will implement this through the mobility component of the Comprehensive Regional Plan.

Note: It is important to provide adequate public transport service frequently to meet demand in existing densely developed areas. If it is not done, such demand will shift to shared rickshaws, 2 wheelers, etc. Thus indicator for this recommendation could be percentage of trips by private motorized vehicles along the corridor and benchmark will be <50%.

3C. Create reliable & comfortable public transport facilities

8. All public transport services should have node specific time table which should be strictly followed by them

Indicator – Percentage of times that the public transport service falls behind schedule.

Benchmark – Rail based should be less than 10 percent, bus based less than 20 percent, in mixed less than 30 percent (to be validated).

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA / UMTA will ensure and implement this in coordination with public transport agencies through system design and operations plan.

9. There should be no disruption (breakdowns/ route deviation) in the public transport services.

Indicator – Percentage of trips that have breakdowns / route deviation

Benchmark – Less that 10% of all trips

Monitoring - Comprehensive Mobility Audit

Implementation – Public transport agencies will ensure this through co-ordination and integration with plans of all Urban Local Bodies within the metropolitan region.

10. Public transport vehicles should not be operating in over-capacity conditions more than 5% of the total peak hour trips on any given day.

Indicator – Percentage of peak hour trips where numbers of passengers exceed the designed capacity of vehicle

Benchmark – Less than 5% of peak hour trips.

Monitoring - Comprehensive Mobility Audit

Implementation – Public transport agencies will be mandated to report % of peak hour trips where they exceed capacity. They may be requested to improve frequency or add additional routes parallel to the one that is routinely overcrowded.

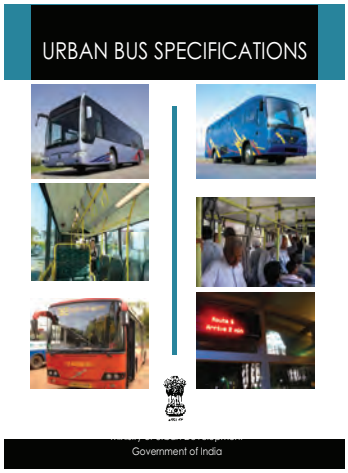


Figure 3.10: Urban bus specification, published by Government of India

11. All public transport buses should be compliant with Urban Bus Specifications (Ministry of Urban Development, 2008)

Indicator – Percentage of public transport buses that adhere to Urban Bus Specifications.

Benchmark – 100% compliance

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA / UMTA will ensure and implement this in coordination with public transport agencies through system design and operations plan.

3D. Integrate public transport with Intermediate Public Transport and cycle facilities to improve accessibility

12. Ensure public transport feeder service stations are within 50m of rapid transit stations (BRTS, MRT) where routes of the two services are intersecting or overlapping

Indicator – Percentage of rapid transit stations with other public transport feeder service stations within 50 m level walk from station exit, where routes of the two services are intersecting or overlapping.

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA / UMTA will ensure and implement this in coordination with public transport agency through Station Design / Redesign.

Pedestrian entry/ exit from public transport	
Multi-modal interchange	Within 50m from entry/exit of Public Transport
Cycle Parking/ Sharing station	Within 50m from entry/exit of Public Transport
Intermediate Public Transport Stand	Within 150m from entry/exit of Public Transport
Private vehicle parking	Within 150m from entry/exit of Public Transport

13. Provide IPT(Taxi/ auto rickshaw/ cycle rickshaw) stands within 50m of rapid transit stations (BRTS, MRT) where routes of the two services are intersecting or overlapping

Indicator – Percentage of rapid transit stations (where atleast two routes are overalpping or intersecting) with IPT stand within 50m of the entrance / exit of the station.

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA / UMTA will ensure and implement this in coordination with public transport agency through Station Design / Redesign.

Figure 3.11: Intermediate public transport stand near BRT station, Curitiba

14. Intermediate Public Transport Stand should be located close to all major public transport nodes within 150m level walk from entrance / exit

Indicator – Percentage of major public transport stations with Intermediate Public Transport Stand located within 150m (2 min) level walk from station entrance / exit.

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA / UMTA will ensure and implement this in coordination with public transport agency through Station Design / Redesign.

Figure 3.12: Cycle parking facility near public transport stand at Delhi metro station, India

15. Vehicular drop-off area should be located away from the main pedestrian exits at all major public transport nodes

Indicator – Percentage of major public transport stations where vehicular drop-off area is located away from the main pedestrian entrances / exits

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will ensure and implement this in coordination with public transport agency through Station Design / Redesign

16. Public car parking location for fringe area public transport stations or public transport terminal stations (not within core areas) should be within walking distance but not adjacent to the station.

Indicator - Percentage of fringe area public transport stations / public transport terminals providing car parking within walking distance (less than 400m) but not adjacent to the station (more than 150 m).

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation - ULB / UDA will regulate this through parking regulations in Development Control Rules. Public transport agency will provide public car parking at these locations.

Figure 3.13: Automatic fare collection system for all modes of public transport, Hong Kong

17. Electronic integrated fare collection for different modes of public transport should be mandatory

Indicator - Percentage of public transport nodes (including all public transport modes such as MRT, BRTS, buses etc) with electronic integrated fare collection.

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation - ULB / UDA will implement this in coordination with the various public transport agencies through ITS.

Figure 3.14: Interconnected BRT and Railway station through FOB, Ahmedabad

18. Ensure seamless transfers between stations of different modes of rapid transit services where the routes are intersecting or overlapping

Indicator - Percentage of multi- modal rapid transit nodes (BRTS, MRT) where routes are intersecting or overlapping, with seamless transfers through weather protected area.

Benchmark - 100%

Monitoring - Comprehensive Mobility Audit

Implementation – ULB / UDA will implement this through Station Design / Redesign by ensuring compulsory provision of a certain percentage of all big transportation projects (say above Rs. 1000 cr. projects) for inter-modal connectivity & Non-motorized transport linkages.

3E. Public Transport Node Classification System

19. Classify all public transport nodes based on the following hierarchies:

A transport node is defined as either a point to access the transport network or a point through which it is possible to change transport mode.

- ***Intermodal Stations***

These can include interchanges, terminals of major truck services of the public transport system. These public transport nodes usually deal with large volumes of passengers and multiple public transport routes and modes. Hence, all services need to be accommodated within a single weather protected structure and furthermore the layout and design needs to ensure seamless transfers to reduce transfer times.

Figure 3.15: Multimodal Junction, King Cross. London

- ***Rapid transit stops (Bus / Rail)***

These include all stops of rapid transit services such as Metro, BRTS, trams etc. that run on fixed guided ways. Such stops may or may not deal with multiple routes of the same rapid transit service. Inter-modal connectivity is still important for such stops, but need not be within a single enclosed structure.

Figure 3.16: Bus rapid transit stops, Ahmedabad

- ***Bus shelters***

These include all bus stops that are important in terms of passenger demand and / or cater to multiple routes from the same location. These stops need to have a shelter that should provide information on the public transport service options available from that stop.

Figure 3.17: Bus shelter, Chennai

- ***Bus stops***

These include all nodes on the public bus service that do not fall within any of the above categories. These should include at the very least a flag-post with public transport routes and frequency information displayed on it.

Figure 3.18: Bus stop, Copanhagen

Major public transport nodes are defined as all public transport nodes that fall within the “Stations” and “Rapid transit stop” categories. A minimum standard set of facilities need to be provided for every hierarchy level. This is shown in the adjoining table..

Implementation - ULB / UDA / UMTA can implement this through a public transport network plan, which can be a part of the mobility component of the Development Plan, or the Comprehensive Regional Plan.

Minimum set of standards for public transport node by classification

		Bus stop	Bus shelter	Rapid transit stop	Intermodal Station
Information (sign)	**Location, number & name**	M	M	M	M
	Information telephone number	M	M	M	M
	Fare zone information	P	P	M	M
Information (display)	**Stop-specific time tables (departures times)**	P	M	M	M
	Routes serving the stop & frequency	M	M	M	M
	Route destination	M	M	M	M
	Real-time information	-	P	M	M
Information (network)	**Public transport & locality map**	P	M	M	M
	Information telephone / device	-	S	P	M
Information (regulatory signage)	**Marked bus zones**	P	M	M	M
	Bus zone signs	P	M	M	M
	Stop identification sign (marker)	P	M	M	M
Furniture	**Shelter**	S	M	M	M
	Seating	S	P	M	M
	Bin	P	M	M	M
	Bicycle rack	S	S	P	M
Access	**Pedestrian refuge / crossing**	P	M	M	M
	Footpath	P	M	M	M
	Tactile ground surface indicator	P	M	M	M
Security	**Well-lit / nearby street lighting**	P	M	M	M
	CCTV / security cameras	-	S	M	M
	Emergency phone	-	S	M	M
	Public phones	-	S	P	M
Other facilities	**Drinking water facility**	-	S	P	M
	Public toilet	-	S	S	P
	Commercial vending machine / kiosk	-	S	P	M
Interconnectivity	**Seamless transfer**	-	-	S	M
	Weather protected transfer	-	-	S	M

M : Mandatory
P : Preferred
S : Site specific
- : Not applicable

Other recommendations:

- Ensure mode share for public transport remains within the recommended limits

City (Population in millions)	Public modes (% share)
0.5 - 1.0	70 - 80
1.0 - 2.0	75 - 85
2.0 - 5.0	80 - 90
5.0 plus	85 - 90

Figure 4. Recommended Mode Share

(Ministry of Urban Development and Wilbur Smith Associates, 2008)

Monitoring – Comprehensive Mobility Audit

Case studies

i. Alwar Vahini, para-transport system, Alwar, India

Figure 3.19: Mini passenger car, Alwar Vahini, Alwar, India

Key Information

- Alwar Vahini's launched: 1310 vehicles (projected – 2200)
  - Three wheelers Replaced: 720
  - Direct Employment provided to 3000+ persons.
  - Daily Passengers currently carried - 1,15,000+ passengers
  - Government Expenditure: Zero
  - Revenue generated through tax (VAT, Central Excise etc) on Alwar Vahini vehicles : Rs 17 crores
  - Individual Private Expenditure on Alwar Vahini: Rs 48 Crores
- Independent Market Survey shows extremely high level of satisfaction among citizens.

Alwar a medium-sized city in Rajasthan with a population of approximately 3.6 lakhs people spread over 45 sq.km area (approx). Rapid growth, industrialization and urbanization have led to increasing the demand and supply gap for basic infrastructure and transport needs. Hence a need was felt to have an effective, sustainable and cheap public transportation system.

Figure 3.20: Overcrowded passenger transport vehicle.

Being a medium sized town, a metro system or a BRTS or even a city bus service may not have been viable as there isn't enough intensity of travel throughout the day. Until now, the most common means of public transport in Alwar city was three-wheelers in the form of auto rickshaws or three wheeler tempos. A majority of these were more than a decade old and in very poor condition. In addition, women, elders and children generally avoided them.

In 2011, the district administration, with the support of various government agencies and private partners, launched the "ALWAR VAHINI". The vehicle behind this concept is a mini-van type passenger vehicle which is used as a mode of public transport. This concept has made possible a number of key improvements through its implementation:

Figure 3.21: Destruction of existing passenger transport vehicle

1. The old polluting three wheelers were given away by the owners in exchange of the new low-polluting (Euro-IV compliant) vehicles with capacity to carry six passengers. These old noisy vehicles were destroyed by the city so they do not find their way back into operations. In return of their old vehicles, the owners were being provided new vehicles on a long term loan of 5 years. With the new vehicles, the RTO and the district administration fixed the routes of service which provides a more reliable service to the end users. A number of new bus stops were also created to ensure proper waiting area for the commuters.

2. Punjab National Bank provided extended 5-year loans at 14.5% interest for the new Alwar Vahini vehicles. With an attractive exchange offer in place, this helped the existing owners of three wheelers take up the Alwar Vahini as they did not have to pay additional money or put forth any other collateral.

3. A cooperative society was set up to help provide health / medical insurance to all drivers of Alwar Vahini. They are also required to undergo free compulsory medical checkup once every year.

4. The Urban Improvement Trust (UIT) of Alwar provided support in terms of uniforms, ID Cards, Group insurance and soft skills training to the drivers. UIT also built the support infrastructure in the form of bus stops, signages, lighting along major junctions, traffic signals, CCTV monitoring cameras and an advanced police control room.

5. An NGO was engaged in imparting soft skills related to etiquette and driving discipline. This was important as the main motto of the project was "samman aur sewa" (respect and service).

With implementation of Alwar vahini, number of people using IPT services like tempo has increased. It is a well planned IPT service. The service has been segregated based on various routes which are displayed on the vehicle in the form of route stickers. Also, it follows a color coding model wherein vehicles with white color run within the city whereas red colored vehicles take passengers from the city to the neighbouring villages.

All these vehicles are parked in line at predefined selected stops. The service lays emphasis on the frequency i.e. the vehicle resumes service even if there is a single passenger without wasting time to wait for other passengers to come and the vehicle gets filled. The service has been segregated as per the routes designated and along each route an association has been formed. These associations have worked closely with the community to create awareness and replace the earlier autos slowly in phases.

The ALWAR VAHINI model can be considered as a successful model primarily because of its institutional strength. However, they still have not been able to create a single body above the various route based associations as planned. Moreover, it may not be considered as a sustainable and financially sound model looking at the number of empty trips taken by the vehicles.

Alwar Vahinis are not very visible on railway station owing to a strong hold of black six seated autos who do not allow to create a dedicated stand. Another issue is of the bus stands which were earlier planned; however, they have not yet come up across the cities as there is no willingness to build bus stops. Currently, the city has large number of cycle rickshaws being operated. To create a more sustained model, the next stage could involve integration of Alwar Vahini with cycle rickshaws for last mile connectivity.

While these improvements show significant change over the previous and

Figure 3.22: Alwar vahini bus stand

Figure 3.23: Female only Alwar vahini

Figure 3.24: On call Alwar vahini taxi

official halting areas for the vehicles, in general, the Alwar Vahini has been greatly successful in achieving the goals of low-cost, sustainable public transport for a small town. Another request from many representatives from many areas is that certain RSRTC roadway routes should be opened up for use by Alwar Vahini. However, currently, this is not possible due to viability constraints.

In the initial phase, more than 500 rickshaw drivers and tempo users participated in this exchange programme and exchanged their vehicle with new "ALWAR VHANI". Currently, more than 1,100 Alwar Vahinis are plying the streets in Alwar District and 720 old polluting three wheelers have been scrapped in exchange of this new mode. The scheme provides direct employment to more than 3,000 persons. Rough survey shows extremely high level of satisfaction among citizens. More than 1.20 lakh people use the services of Alwar Vahini every day.

Alwar Vahini has also recently initiated On-call taxi services at a premium rate, a women's only service and they are about to launch a pilot cycle renting / sharing service with 50 cycles for tourist and other short duration cycle users. A significant aspect of this project is that this has been initiated and implement with zero financial support from the government. The government's role in this has been one of facilitation and coordination. Another key achievement of this project is that it has been implemented within 2 months of its conception.

As a result of all the above improvements, the project Alwar Vahini was very well received by users in the city. It has been praised not just in Alwar but also at various forums where it was presented as a model for low cost sustainable urban transport solution for small and medium-sized cities. Recently, the Ministry of Urban Development (MOUD) circulated a notice proposing that projects similar to Alwar Vahini for providing greener, cleaner and safe mode of public transport.

ii. Integration of NMT with Public transport - Portland, USA

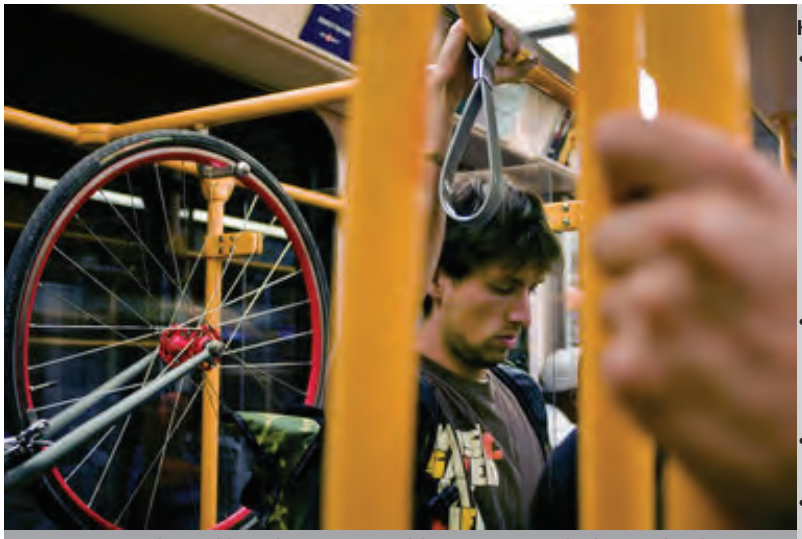


Figure 3.25: Dedicated bicycle space in Public transport vehicle, Portland, USA

Key Information

- Bicycle integration with LRT
  - 2000/day carry bicycle
  - No permits
  - No additional cost
  - No time restriction
  - Low floor vehicle for bike access
  - Passenger without bikes has priority.
  - Dedicated space for bicycle in Public transport
- Bicycle integration with BRT
  - All public buses have racks
  - Bike racks in front and side of bus to carry cycle.
- 76% bicycle users carry bicycle in LRT and BRT
- Reduce the risk of bike theft and vandalism.

Very few cities in the world have initiated efforts to integrate cycling and public transport. Portland is one of the few which has implemented the entire range of integration measures. Bike-and-ride in Portland mainly involves bikes on transit vehicles. TriMet Portland's public transport system estimates that ten times more bikes taken in LRT vehicles than parked at LRT station. (Fishman, 2009)

More than 2000 cycles users travel with their Bike in LRT vehicle where less than 300 Bike users park their vehicles at station. Every train has a low-floor car especially designed to facilitate bike access, with waiting areas and four bike hooks located near the doors. However, passengers without bikes have priority to board crowded trains. No extra charges, no permits and no time restriction make this policy easier for users. (Sherwin, 2010., Pucher & Buehler, 2009)

Figure 3.26: Secure bicycle lockers near public transport station, Portland, USA

All buses in the Portland area have bike racks, another inducement for cyclist to ride with their bikes instead of parking them. Portland does not provide much bike parking at train and bus stations. In 2009, there were 670 bike parking spaces at TriMet LRT stops and transit centers, which are major transfer hub for several bus or LRT lines. Half of them are bike lockers. More than 15 bike lockers owned by Portland city are in down town area near bus or rail service. (Wright, Lloyd, 2010)

Portland does not have any public bicycle sharing stations. This shows high bike mode share and wide range of other pro-bike policies and programs. To improve bike parking at transit stops by installing 196 bike lockers and 168 bike racks near LRT Extended route. (Transpotation Department of Portland, 1998)

TriMet survey indicates that 76%of cyclist would not be willing to park their Bike at a transit station even if the secure biking space is available. The advantage is that users can use the Bike at both ends of the transit trip and it reduces the risk of bike theft and vandalism.

Portland carefully and explicitly coordinates its bikeway network with its public transit network. Bike routes designed to facilitate access to public transport stops and most transit centers are served by multiple bikeways.

iii. Integrated transit system - Hong Kong

Key Information

- Hong Kong transport authority Launched in 1993
  - 20 million cards sold in market
  - 95% population using octopus card
- Octopus card can be used for payment at
  - All major public transport
  - Convenience stores
  - Supermarkets
  - Fast-food restaurants
  - On-street parking meters
  - Car Parking areas
- Additionally, administrative offices, some schools and colleges using card for attendance

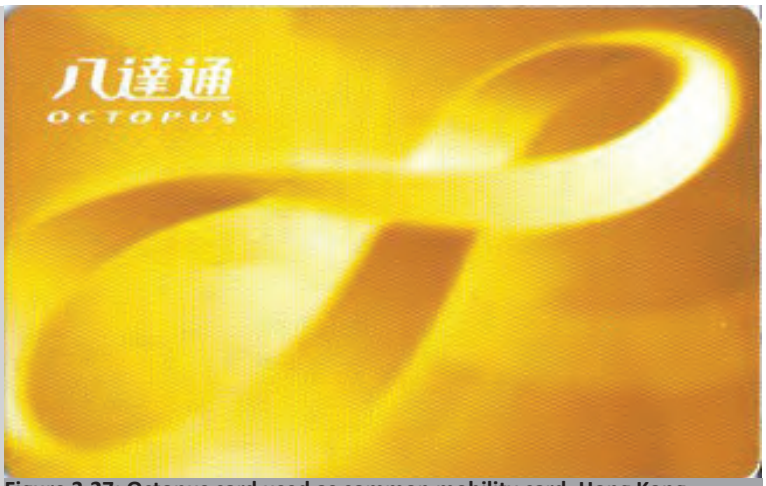


Figure 3.27: Octopus card used as common mobility card, Hong Kong

Hong Kong's Octopus card is a rechargeable contact less stored value smart card used to transfer electronic payments in online or offline systems in Hong Kong. Octopus card was launched in 1997 to collect fares for mass transit system and now users use Octopus card in all modes of public transport in Hong Kong. The Octopus is also used for payment at on-street parking meters, car parks and many other place. According to Octopus Cards Limited, operator of the Octopus card system, there are more than 20 million cards in circulation, nearly three times the population of Hong Kong.

The MTR (Mass transit Railway) one of the main railways in Hong Kong launched magnetic card as fare ticket in 1979. Similarly In 1989, KCR (Kowloon-Canton Railway) and KMB (Kowloon Motor Bus) buses providing to the feeder service to MTR and KCR station and to city bus service in Hong Kong also launched their magnetic cards in 1993, using more advanced technologies and lunched new contact less smart cards.

In 1994, MTR Corporation collaborated with four other major transit companies in Hong Kong to create a joint-venture business to operate the Octopus system. More than 3 million cards were issued for use within the first three months of the system's launch. (Alliance, 2003)

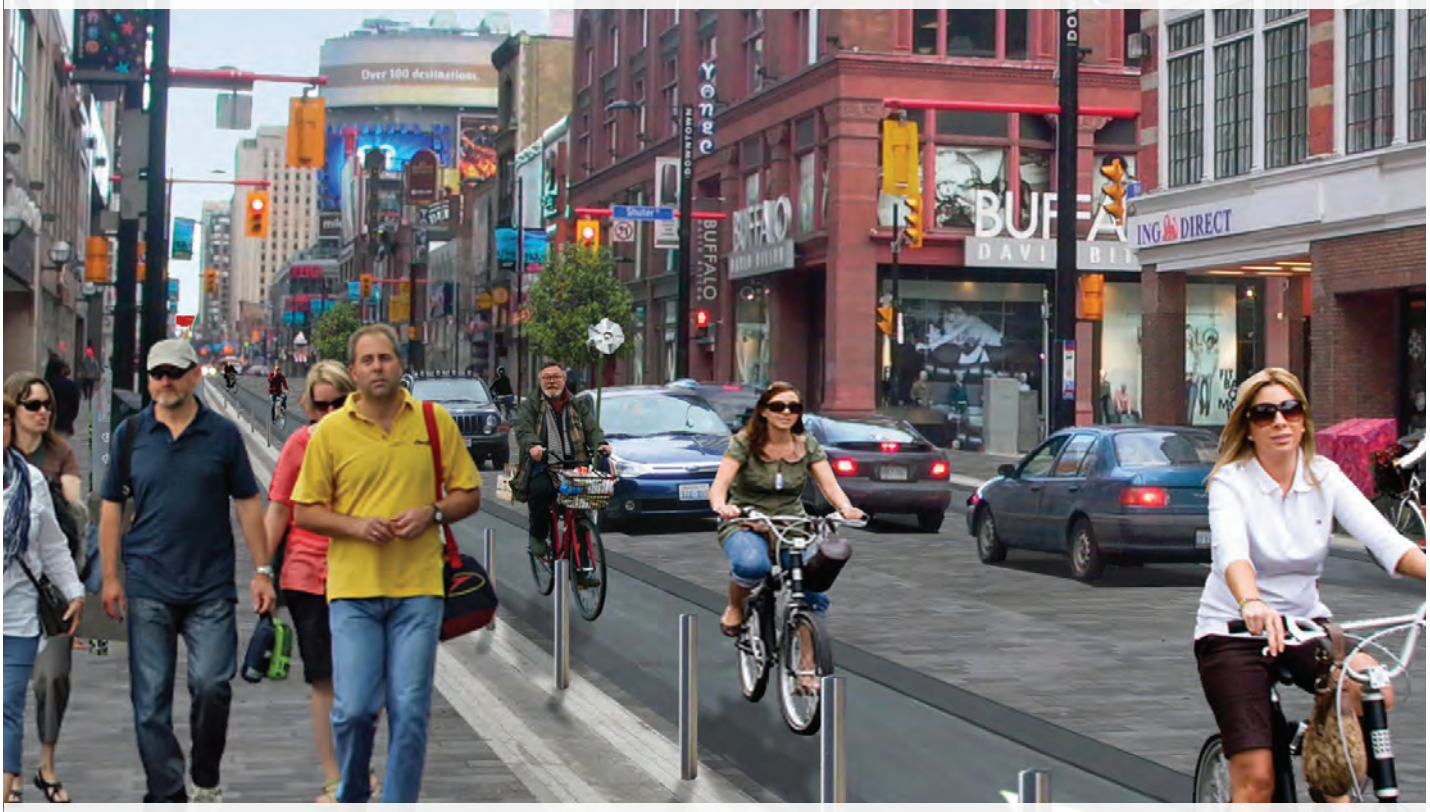
The main reason for the quick success of the system was that MTR and KCR required that all holders of Common Stored Value Tickets replace their tickets with Octopus cards within three months or have their tickets made obsolete, thus forcing their combined base commuters to switch quickly.

In 2003, Octopus Card Company found another application of Octopus card and Hong Kong government replaced all 18,000 parking meters with

Octopus card operators system. It opened in the year 2004. Additionally the Octopus card are also used in the school and colleges for the student's attendance. As of November 2004, all parking meters in Hong Kong were converted. They no longer accept coins and Octopus became the only form of payment accepted. The card is now commonly used in most, if not all, major public transport, fast food restaurants, supermarkets, vending machines, convenient stores, photo booths, parking meters, car parks and many other retails business where small payment are frequently made by customers.

Principle 4. Connect & Complete

"Create well-connected network of complete streets"



Sub-principles:

- *Create a **complete streets network** with comprehensive yet **simple street classification system** that covers all types of streets and roads in the city*

- *Ensure all streets are developed as **complete streets** that enable safe and comfortable travel for people of all ages and abilities, and users of all modes including walking, cycling and public transport*

- *Create **dense street networks** that enhance walking, cycling, and vehicle traffic flow*

- *Create **pedestrian access corridors** through existing developed areas to facilitate walking*

Principle 4. Connect & Complete

"Create well-connected network of complete streets"

Complete Streets are streets for everyone. They are designed and operated to enable safe access for all users, including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. Complete Streets make it easy to cross the street, walk to shops, and bicycle to work. They allow buses to run on time and make it safe for people to walk to and from train stations. (smartgrowthamerica)

Conventional Planning	*Complete Streets Planning*
Freight/service vehicle	Pedestrian
Automobile traffic	Bicycle
Automobile parking	Bus
Bus	Freight/service vehicle
Bicycle	Automobile traffic
Pedestrian	Automobile parking

Conventional Versus Complete Streets Planning Hierarchy

In order to create Complete Streets, many transportation and planning agencies will need to change the way they approach designing and implementation of urban roads. It also emphasises to routinely design and operate the entire right of way to enable safe access for all users, regardless of age, ability, or mode of transportation. It accentuates every transportation project to make the street network better and safer for drivers, transit users, pedestrians, and bicyclists – making community a better place to live.

Figure 4.1: Information portal about Boston Complete Streets program is transparent and available on the web in in a user friendly format.

Urban streets serve multiple modes of motorized and non-motorized transport and accommodate multiple functions such as space for social interaction, recreation, informal economic activities, etc. As a result of this there are various types of streets that have different character and demand for infrastructural services. Narrow, residential neighbourhood streets are more characterized by pedestrian friendly activities whereas major arterial and transit corridors are more traffic oriented streets, commercial streets and educational institutions show pedestrian character and industrial corridor require heavy transit facilities. It is important to recognize and classify streets based on the functional requirements and to cater to all modes of motorized as well as non-motorized transport.

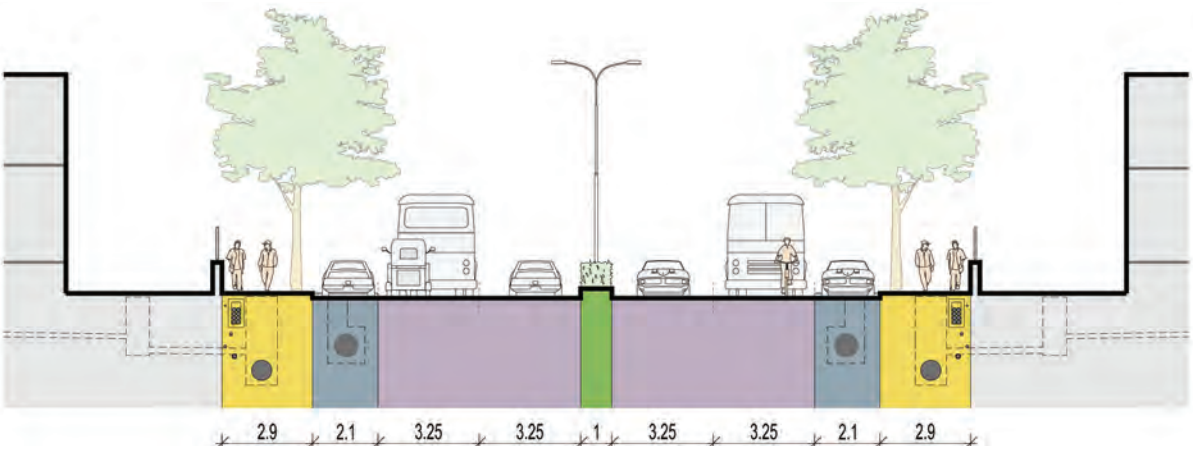


Figure 4.2: A Typical Right of Way Section

One such approach in creation of Complete Street is developing the entire Right of Way (ROW) of the streets that can ensure adequate allocation of space to the relevant activities and that the entire ROW is efficiently and optimally used. Complete streets are roadways designed and operated to enable safe, attractive, and comfortable access and travel for all users, including pedestrians, bicyclists, motorists and public transport users of all ages and abilities.

Street network represents the movement network of any given area and is characterized by its permeability and connectivity. The street network influences walkability of an area and has a major impact on choice of routes available for trips of various lengths and as a result it also impacts traffic congestion. Permeability reflects average block sizes with reference to choice of travel mode. Smaller block sizes encourage walking and cycling as one can get to reach more destinations within the same walking distance as compared to an area with larger block sizes. Connectivity primarily refers to continuity of routes and the ease of way finding. This plays an important role in determining which routes are chosen for various types of trips.

An inefficient and poorly designed street network can indirectly cause many problems, traffic congestion remains high as people have fewer route choices to complete their trips and hence everyone relies on few well connected routes. This can also lead to increase in trip lengths and decrease in average travel speeds for some journeys. Use of non-motorized modes like cycling and walking is greatly affected when the scale of street network caters mainly to motorized modes (i.e. block sizes are larger). This can indirectly cause expensive or inconvenient travel for some groups of people as not everyone can afford motorized transport for all their journeys.

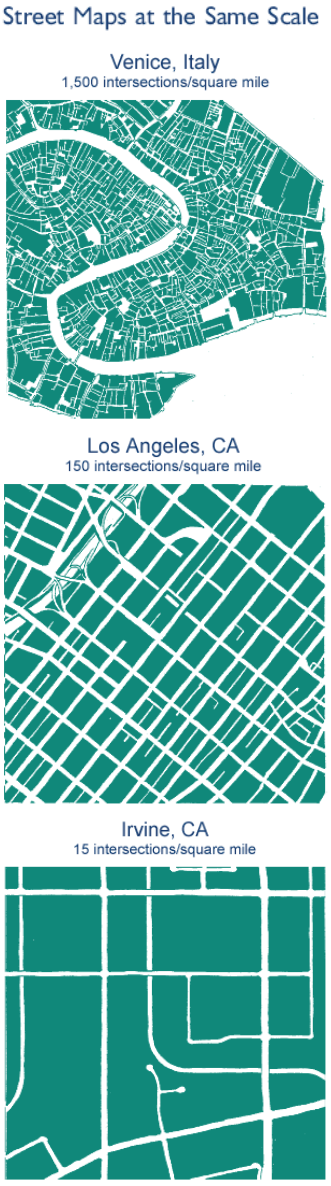


Figure 4.3: These diagrams show three street layouts — extremely walkable, moderately walkable, and unwalkable — with their counts of intersections per square mile

Sub-principles:

4A. Create a complete streets network with comprehensive yet simple street classification system that covers all types of streets and roads in the city.

Street classification systems in India usually address regional roads such as highways, expressways and sub-regional roads such as district roads and village roads. However, this system does not adequately address the different types of urban streets. It has been observed that cities in India widely accept the Indian Road Congress(IRC) codes to design the streets and roads but what they miss out is that even the IRC states that the typical cross-sections mentioned are for general guidance and that cities should design their roads and streets as per the specific context in terms of basic nature and intensity of the traffic.

Figure 4.4: Vancouver: Streets for all

Urban streets are multi-character and multi-functioned streets that only act as a mode of transportation and commute but also as a vital space for social, financial, recreational and informal interactions. Moreover it is essential to address the classification of streets prior to roads is because in most of the cases that would the the point from where a journey would initiate.

4B. Ensure all streets are developed as complete streets that enable safe and comfortable travel for people of all ages and abilities, and users of all modes including walking, cycling and public transport.

Figure 4.5: Vital Statictics For First Protected Bicycle Lane In USA

Complete streets are thoroughfares/ part of roadways designed and operated to enable safe, attractive, and comfortable access and travel for all users, including pedestrians, bicyclists, motorists and public transport users of all ages and abilities.

A complete street has roughly seven zones namely Frontage, Pedestrian zone, Plantation & Furniture zone, Non-motorized zone (NMV zone), Multi-functional zone and Vehicular zone and Median. Each of the zones can accommodate specific facilities, a list of which is given below. Each street type may have some or all of the facilities mentioned in the list. Some facilities can be placed in different zones depending on the street design. In some cases where insufficient right of way and money will not be able to accommodate all this zones in such case, best practice is to prioritize walking, cycling, and public transport zones over vehicular zone in complete street design.

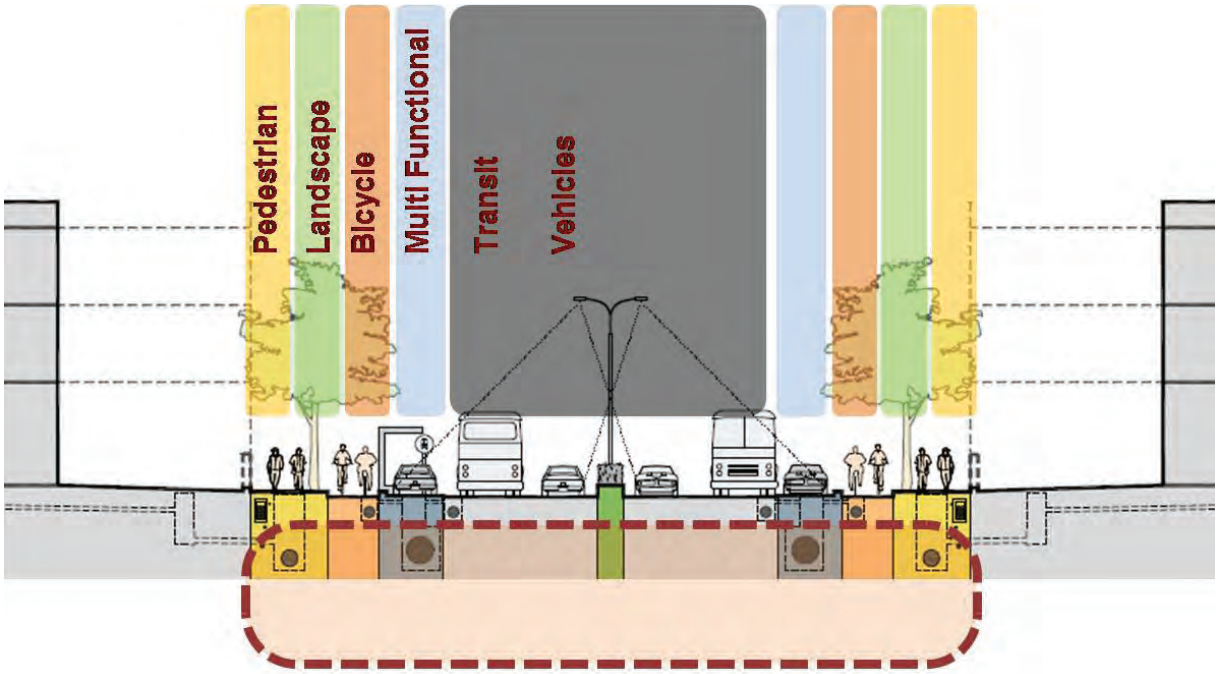


Figure 4.7: A Complete Street Section

The following is a list of facilities that can be accommodated within each zone:

Frontage

- Built to line structure

Pedestrian Zone

- Unobstructed walking space

Plantation & Furniture Zone

- Trees
- Benches
- Dust-bins
- Pedestrian lighting
- Street lighting

Non-Motorized Vehicular Zone

- Cycle lane
- Cycle Stand
- Signage

Multi-functional Zone

- Parking
- Vendor zone
- Bus stop

- Rickshaw stand
- Street signage
- Service / Access lane

Vehicular Zone

- Vehicular lanes
- BRTS / mass rapid transit

Median

- Street light
- Plantation

Allocation of ROW space for each zone should be proportionate to the activities and number of users on the streets. For example, streets with retail commercial frontages and entrances of schools, colleges and other uses generating high pedestrian volumes should have sidewalks that are a minimum of 3m width or wider.

4C. Create dense street networks that enhance walking, cycling, and vehicle traffic flow.

Provision of a denser network of streets can be very helpful in reducing the traffic congestion. Other than creating a compact well-networked precinct it also:

• optimizes traffic flow by providing more direct routes which leads to fewer vehicle kilometers of travel (VKT) than conventional suburban networks,

• reduces travel delay by allowing travelers to choose alternate routes to destinations, reduces the impacts of high traffic volumes on residential collectors,

• encourages walking and cycling by reducing the block sizes and providing improved safety,

• offer users relatively direct walking routes to transit stops and helps to facilitating circulation within an area by all travel modes (Institution of Transportation Engineers, 2011).

4D. Create pedestrian access corridors through existing developed areas to facilitate walking

Studies show that more than 40 to 50 percent of the daily trips in many of our cities have distances less than 5km. (Ministry of Urban Development, 2010) Walking and cycling considering their environmental and health benefits are the most suitable modes of transportation for such short trips. However in India, people prefer using motorized vehicles and avoid walking and cycling even for short distances. This can be attributed to as

Figure 4.6: Pitt Street, Sydney. AUSTRALIA.

incomplete street network or poorly designed pedestrian access and cycle tracks (Ministry of Urban Development, 2010). Efforts should be taken to provide a complete street network considering motorized vehicles, pedestrians as well as cyclists and create pedestrian access corridors through existing developed areas to facilitate walking for short distances.

Recommendations

4A. Create a complete streets network with comprehensive yet simple street classification system that covers all types of streets and roads in the city.

1. Classify all urban streets and roads using the following classification system.

   The classification system defines six urban street types based on size, function and connectivity of the street within the wider movement network.

   ### Major Arterials

   All the streets that form a strong transportation network and serve the residents of the city to travel from one area to another area within the city are known as the major arterials

   ### Minor Arterials

   All the streets in the city that connect two major arterials and provide efficient transportation linkages within the city are termed as minor arterials.

   ### Major Streets

   All the streets in the city that connect two major or minor arterials within the city are termed as major streets.

   ### Minor Streets

   Further, there are streets connecting two major streets which are mainly act as local/neighborhood streets are known as minor streets. Streets having a major street at one end are also classified as minor streets.

   ### Local Streets

   Streets that are narrow, not very continuous and only serve the immediate development are classified as local streets.

   ### NMT-only Streets

   Streets that provide access for pedestrians and cyclists only are known as NMT-only streets. Pedestrianised areas can also be included in this category. These streets can allow restricted access for vehicles for service at specific times of the day.

Implementation - ULB / UDA / UMTA can implement this through a Complete Streets Network Plan, which can be a part of the mobility component of the Development Plan, or the Comprehensive Regional Plan.

4B. Ensure all streets are developed as complete streets that enable safe and comfortable travel for people of all ages and abilities, and users of all modes including walking, cycling and public transport.

2. Cities should ensure that all streets are designed and implemented according to i) city / state specific street design guidelines OR ii) national street standards for urban roads prepared by IRC / MOUD.

   Indicator - Percentage of streets (categories minor street and above) in the city that are designed and developed as per city/ state street design guidelines OR national street standards by IRC / MOUD

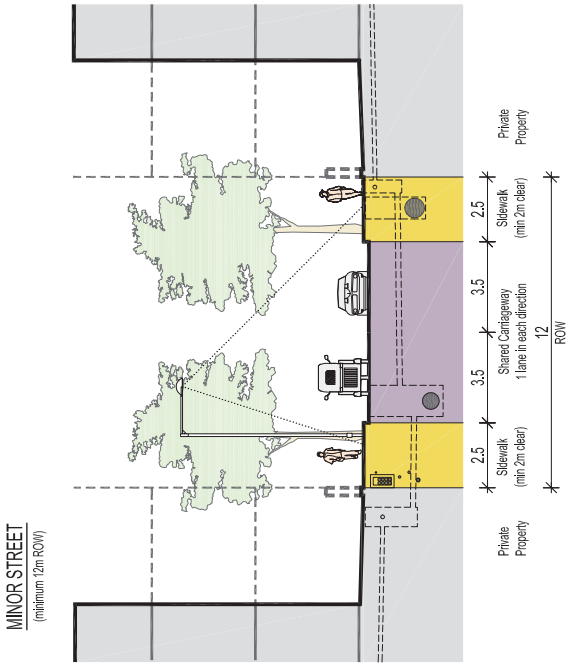
   Benchmark - 90%

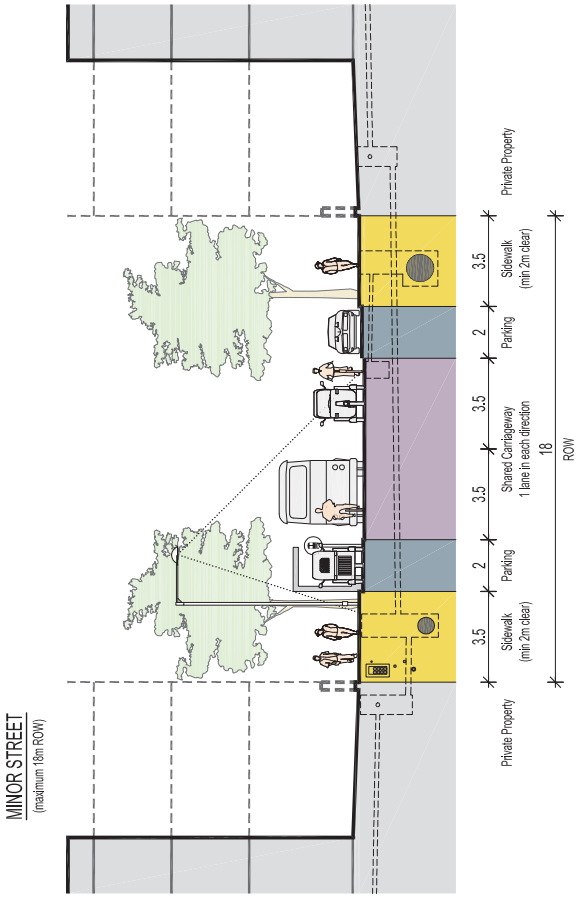
   Implementation - ULB / UDA through Street Redevelopment Program

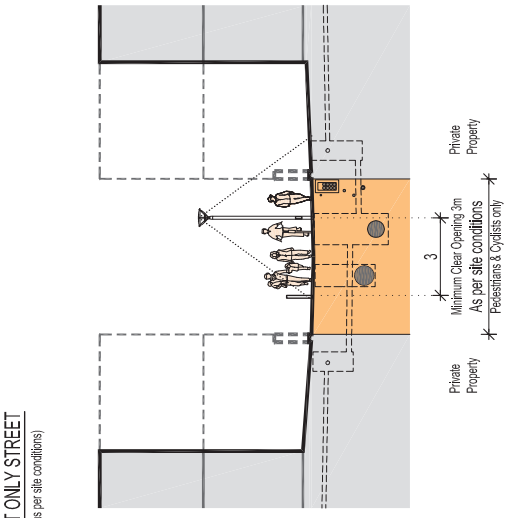
   Monitoring - Streets Audit

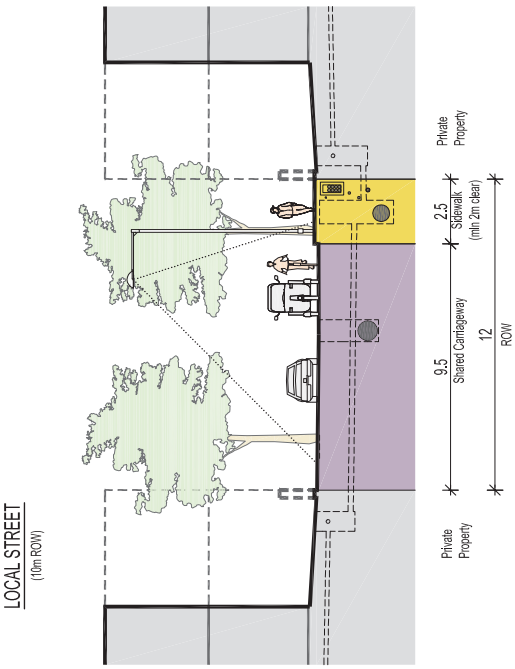
   "Street Classification Table" on pg. 112 outlines an approach to street design that may help cities prepare their own street design guidelines if needed. An example of city / state specific street design guidelines is the one prepared by UTTIPEC for implementation within Delhi.

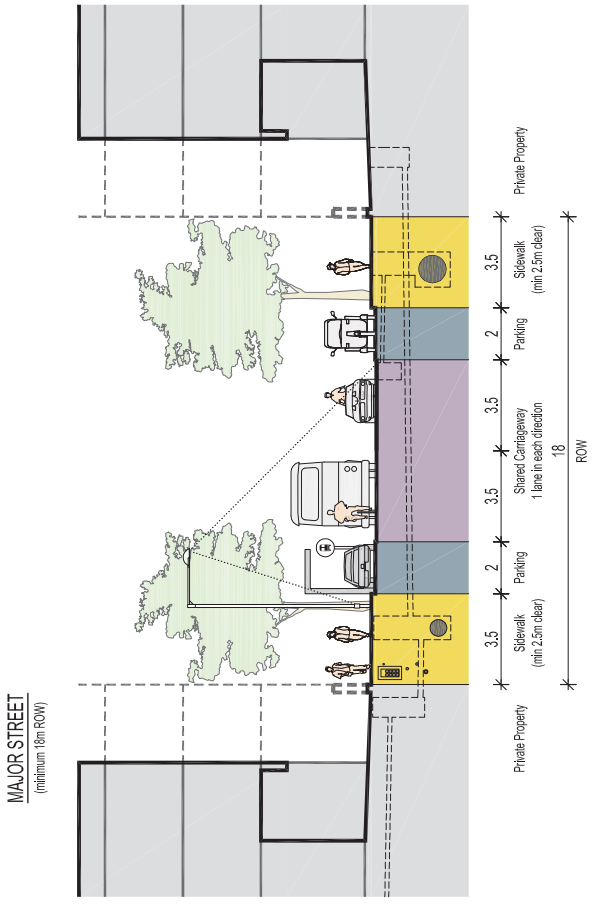
   Note – It is understandable that certain streets within historic areas and/or within slums etc. may not be able to meet the design standards outlined for the state / city. However, it is possible to account for such areas within the street design guidelines and hence design/implement these streets according to the guidelines. Thus, there is no reason for any street within the city to be built at standards different from what the guidelines recommend.

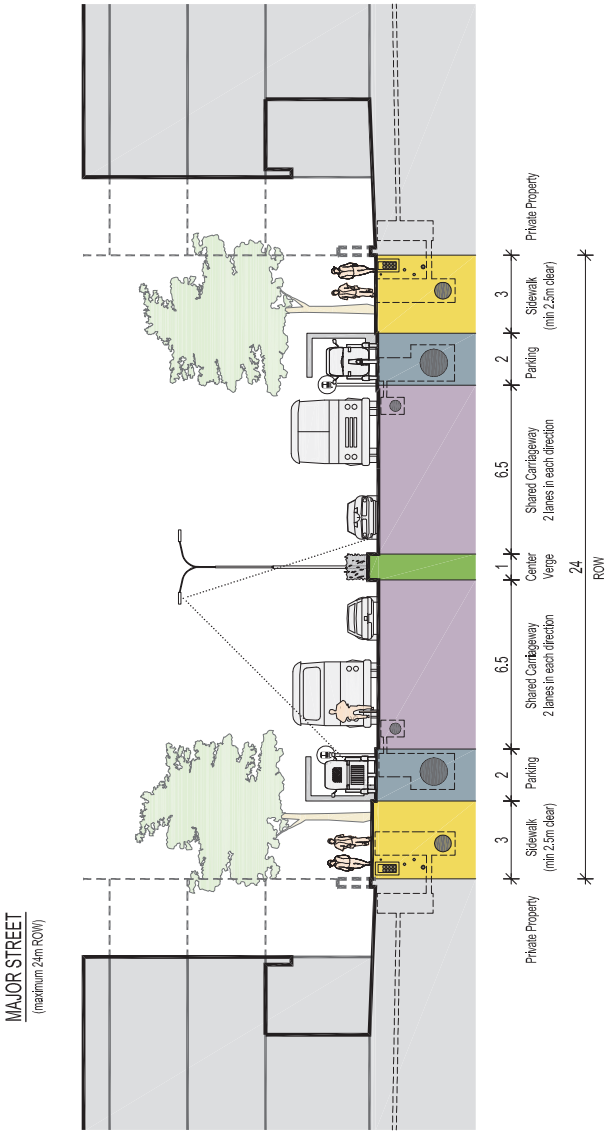

MINOR STREET
(minimum 12m ROW)
Private Property
2.5
Sidewalk
(min 2m clear)
3.5
3.5
Shared Carriageway
1 lane in each direction
12
ROW
2.5
Sidewalk
(min 2m clear)
Private Property

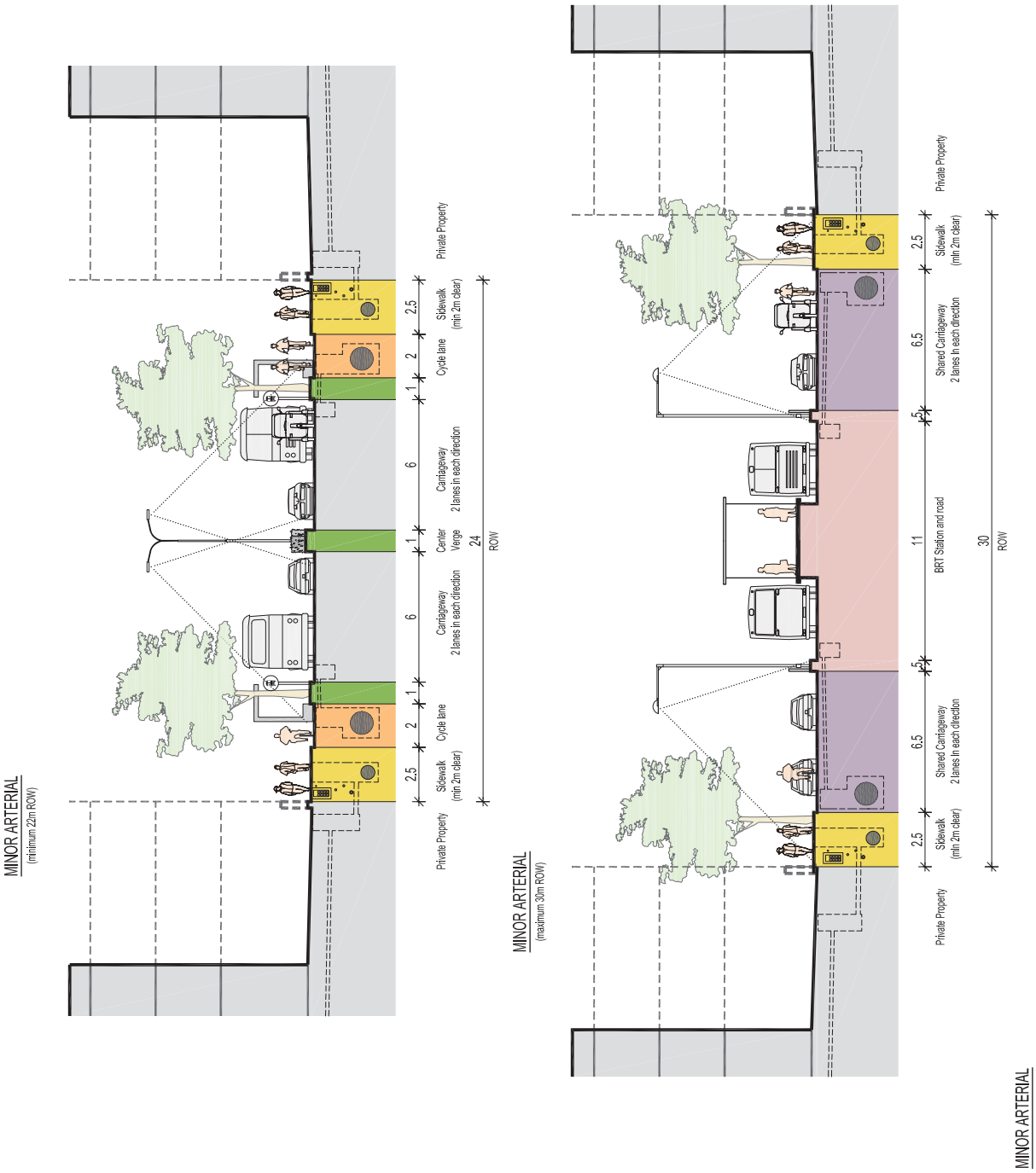

MINOR STREET
(maximum 18m ROW)
Private Property
3.5
Sidewalk
(min 2m clear)
2
Parking
3.5
3.5
Shared Carriageway
1 lane in each direction
18
ROW
3.5
Sidewalk
(min 2m clear)
2
Parking
3.5
Private Property

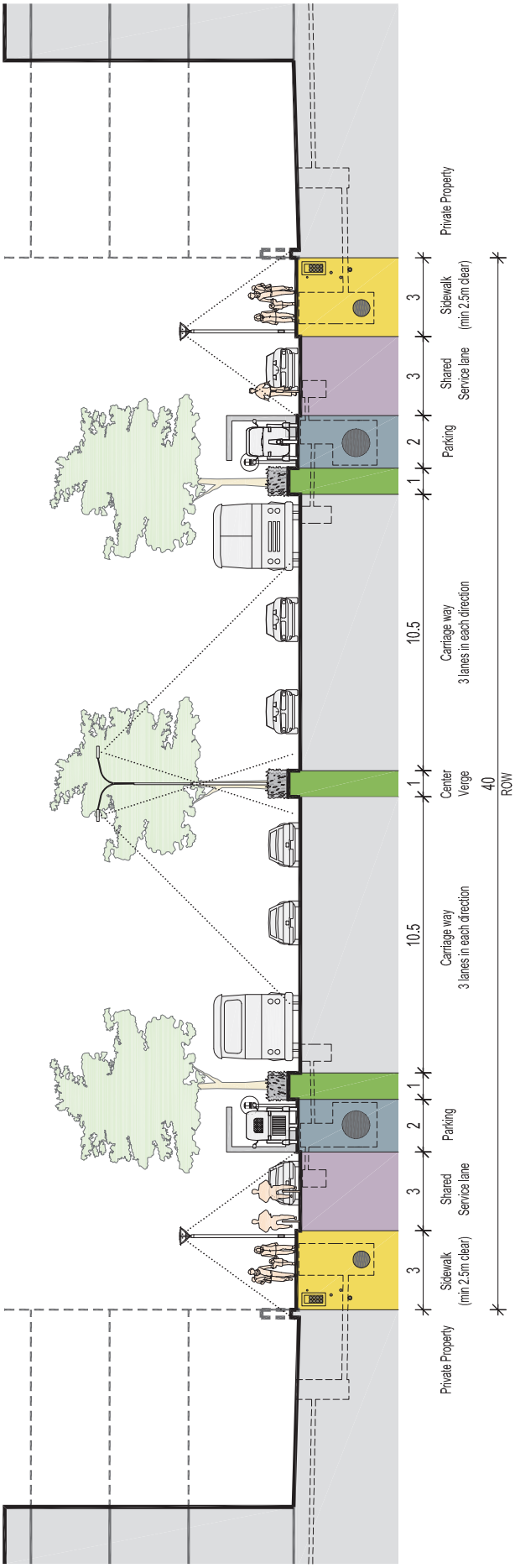

NMT ONLY STREET
(as per site conditions)
Private Property
3
Minimum Clear Opening 3m
As per site conditions
Pedestrians & Cyclists only
Private Property


LOCAL STREET
(10m ROW)
Private Property
2.5
Sidewalk
(min 2m clear)
9.5
Shared Carriageway
12
ROW
Private Property

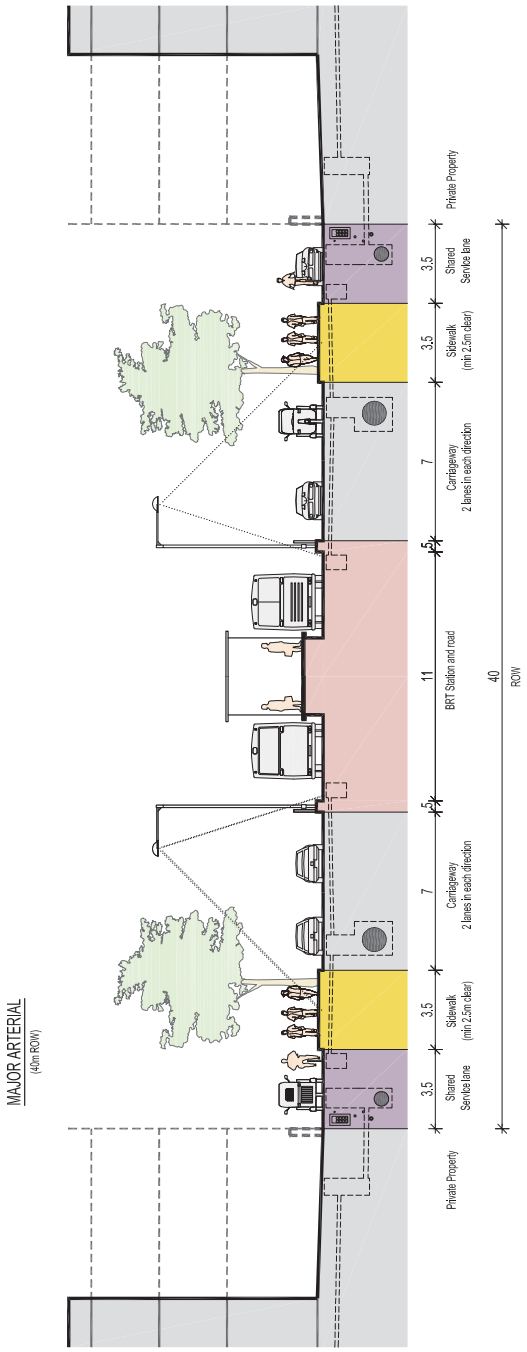

MAJOR STREET
(minimum 18m ROW)
Private Property
3.5
Sidewalk
(min 2.5m clear)
2
Parking
3.5
Shared Carriageway
1 lane in each direction
3.5
2
Parking
3.5
Sidewalk
(min 2.5m clear)
Private Property
18
ROW

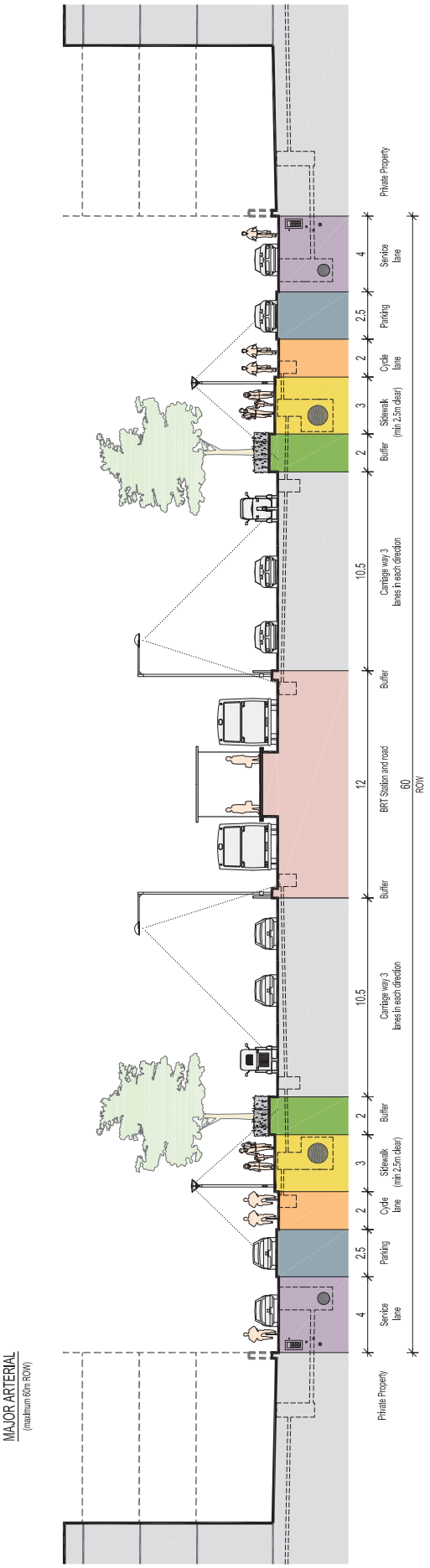

MAJOR STREET
(maximum 24m ROW)
Private Property
3
Sidewalk
(min 2.5m clear)
2
Parking
6.5
Shared Carriageway
2 lanes in each direction
1
Center
Verge
6.5
Shared Carriageway
2 lanes in each direction
2
Parking
3
Sidewalk
(min 2.5m clear)
Private Property
24
ROW


MINOR ARTERIAL
(minimum 22m ROW)
Private Property
2.5
Sidewalk
(min 2m clear)
2
Cycle lane
1
6
Carriageway
2 lanes in each direction
1
Center
Verge
6
Carriageway
2 lanes in each direction
2
Cycle lane
2.5
Sidewalk
(min 2m clear)
Private Property
24
ROW
MINOR ARTERIAL
(maximum 30m ROW)
Private Property
2.5
Sidewalk
(min 2m clear)
6.5
Shared Carriageway
2 lanes in each direction
5
11
BRT Station and road
5
6.5
Shared Carriageway
2 lanes in each direction
2.5
Sidewalk
(min 2m clear)
Private Property
30
ROW
MINOR ARTERIAL



MINOR ARTERIAL
(maximum 40m ROW)


MAJOR ARTERIAL
(40m ROW)
Private Property
3.5
Shared Service lane
3.5
Sidewalk (min 2.5m clear)
7
Carriageway 2 lanes in each direction
5
11
BRT Station and road
5
7
Carriageway 2 lanes in each direction
3.5
Sidewalk (min 2.5m clear)
3.5
Shared Service lane
Private Property
40
ROW


MAJOR ARTERIAL
(maximum 60m ROW)
Private Property
4
Service lane
2.5
Parking
2
Cycle lane
3
Sidewalk (min 2.5m clear)
2
Buffer
10.5
Carriage way 3 lanes in each direction
Buffer
12
BRT Station and road
Buffer
10.5
Carriage way 3 lanes in each direction
2
Buffer
3
Sidewalk (min 2.5m clear)
2
Cycle lane
2.5
Parking
4
Service lane
Private Property
60
ROW

Exurban ← → Urban

	Expressway	Highway	Arterial Roads Major arterial	Sub arterial roads Minor arterial	Collector street Major street	 Minor street	Local Streets Local street	 NMT Only street
ROW	As per IRC codes	As per IRC codes	40m - 60m	24m - 40m	18m - 24m	12m - 18m	6m - 12m	Less than 6m or as per site conditions
Connectivity	Intercity only	Intertown, village, city	Main citywide roads	Streets with major arterials at both ends	Streets with arterials at both ends	Streets with major street at atleast one end		Streets for pedestrians & cyclists only, can also include pedestrianised areas, not continuous for more than 200m without intersections
Design speed	As per IRC codes	As per IRC codes	30 - 60 Kmph	30 - 40 Kmph	20 - 30 Kmph	15 - 30 Kmph	<20 Kmph	Service access for vehicles can be allowed only at specific times of the day
Carriageway	As per IRC codes	As per IRC codes	Minimum 2 vehicular lane in each direction with dedicated bus lane and Maximum 3 vehicular lanes in each direction with median and separated service lanes allowed, lane width min 3.0m - max 3.5m	2 vehicular lane in each direction, lane width min 3.0m - max 3.5m	Maximum 2 lanes in each direction, lane width min 2.9m - max 3.3m, for 1 vehicular lane in each direction lane width - 3.5m	Maximum 1 vehicular lane in each direction, lane width - 3.5m	No lane demarcation needed, shared space encouraged	Not applicable
Central median	As per IRC codes	As per IRC codes	Required. Minimum 0.3m width and At Pedestrian crossings, medians should have min 1.5m safe refuge	Required. Minimum 0.3m width and At Pedestrian crossings, medians should have min 1.5m safe refuge	Optional. Required only if carriageway is 2 lanes in each direction, minimum 0.3m width	Not permitted	Not permitted	Not applicable
Street lighting	As per IRC codes	As per IRC codes	Required. Maximum at 15m height within the central median or within the "Plantation & Furniture Zone", as per site conditions	Required. Maximum at 15m height within the central median or within the "Plantation & Furniture Zone", as per site conditions	Required. Maximum at 12m height within the central median or within the "Plantation & Furniture Zone", as per site conditions	Required. Maximum at 12m height within the central median or within the "Plantation & Furniture Zone", as per site conditions	Required. Maximum at 10m height within shared space as per site conditions	Not applicable
Cycle lane	Not permitted	Not permitted	Required. Segregated cycle lane - minimum 2m clear width in each direction	Recommended if ROW > 22m, segregated / demarcated cycle lane - minimum 2m clear width in each direction, can be combined with service / access lane	Recommended if ROW > 16m, demarcated cycle lane - minumum 2m clear width in each direction	Recommended if ROW > 16m, demarcated cycle lane - minimum 2m in each direction	Pedestrian / cyclist priority over right of way	No segregation between pedestrians and cyclists
On-street parking	Not permitted	Not permitted	No parking with direct access from main carriageway. Access to be provided from service lane.	Parallel parking only if directly accessed from main carriageway minimum 2.0m clear width	Optional. Parallel parking minimum 2.0m clear width if provided	Optional. Only if ROW > 14m, parallel parking - minimum 2.0m clear width on any one side (odd even days system) can be provided	Optional as per site conditions	Not permitted
On-street vendor space	Not permitted	Not permitted	Optional, only in place of parallel parking, maximum upto 50% of parking spaces as per demand	Optional, only in place of parallel parking, maximum upto 50% of parking spaces as per demand	Optional, only in place of parallel parking, maximum upto 50% of parking spaces as per demand	Optional, only in place of parallel parking, maximum upto 50% of parking spaces as per demand	Not permitted	Optional, only if ROW > 4m, and in designated vendor zones only
Service lane / Access lane	Required. No direct access from any street except at intersections	Required. No direct access from any street except at intersections	Required only if ROW > 40, can be combined with cycle lane, minimum 3.0m - 3.3m clear width	Optional	Not permitted	Not permitted	Not permitted	Not permitted

Pedestrian lighting	Not permitted	Not permitted	Required. Illumination level 30 lux	Required. Illumination level 30 lux	Required. Illumination level 20 lux	Required. Illumination level 20 lux	Required. Illumination level 20 lux	Required. Illumination level 20 lux
Plantation & furniture zone	Not permitted	Not permitted	Required. Minimum 1m space adjoining sidewalk on either side	Required. Minimum 0.7m space adjoining sidewalk on either side Tree cover – min 25% of the total street ROW.	Required. Minimum 0.7m space adjoining sidewalk on either side	Required. Minimum 0.7m space adjoining sidewalk on either side	No designated "Plantation & Furniture Zone"	No designated "Plantation & Furniture Zone"
Street furniture	Not permitted	Not permitted	Required. Benches as needed and dust-bins at every bus stop, within the "Plantation & Furniture Zone"	Required. Benches as needed and dust-bins at every bus stop, within the "Plantation & Furniture Zone"	Required. Benches as needed and dust-bins at every bus stop and intersection, within the "Plantation & Furniture Zone"	Required. Benches as needed and dust-bins at every bus stop and intersection, within the "Plantation & Furniture Zone"	Optional as per site conditions	Optional as per site conditions
Tree plantation / Shading structures	Optional	Optional	Required. Shade providing trees every 6m, preferred along sidewalk & additional on median Tree cover – min 15% of the total street ROW.	Required. Shade providing trees every 6m, preferred along sidewalk & additional on median Tree cover – min 25% of the total street ROW.	Required. Shade providing trees every 6m, within the "Plantation & Furniture Zone"	Optional, within the "Plantation & Furniture Zone"	Optional as per site conditions	Optional, required only if ROW > 3m
Sidewalk	Not permitted	Optional. Required only where passing through urban areas, minimum 2.5 m unobstructed walking space	Required. Minimum 2.0m unobstructed walking space Required minimum 3.0m if Any Arterial with retail commercial uses at ground level	Required. Minimum 2.0m unobstructed walking space. Required minimum 3.0m if Any Arterial with retail commercial uses at ground level	Required. Minimum 2.0m unobstructed walking space. Required minimum 2.5m if Any Arterial with retail commercial uses at ground level	Required. Minimum 2.0m unobstructed walking space. Required minimum 2.5m if Any Arterial with retail commercial uses at ground level	Shared space Minimum 1.5m clear unobstructed walking space	
Pedestrian & cyclist crossings	Required. Pedestrian overbridge / underpass every 400m where passing through urban areas	Required. Pedestrian overbridge / underpass / at-grade for pedestrians & cyclists, every 400m where passing through urban areas	Required. Pedestrian overbridge / underpass / at-grade crossings for pedestrians & cyclists only, At every intersections, signalised if at-grade	Required. At-grade crossings for pedestrians & cyclists only, every 200m, signalised / non-signalised	Required. At-grade crossings for pedestrians & cyclists only, every 200m, signalised / non-signalised	Optional, pedestrian / cyclist right of way	Optional, pedestrian / cyclist right of way	NMV crossing at every 200m
Barriers to pedestrian crossing			Allowed at median or edge of Foot path only if at grade ped crossing or grade separated crossing available every 400 m (5 min walk).	Not Allowed	Not Allowed	Not Allowed	Not permitted	
Public transport	Required. Within 400m of intersection, where passing through urban areas	Required. Within 400m of intersection, where passing through urban areas	Required. Public transport stop or station every 800m	Recommended. Public transport stop or station every 800m	Recommended. Public transport stop or station every 800m	Recommended. Public transport stop or station every 800m	Not permitted	
Flyovers & Underpasses	Required for intersection with all categories of streets (including other expressways)	Recommended for intersections with major arterials only	Not recommended for intersections with streets such as minor arterials and below in heirarchy	Not recommended	Not recommended	Not permitted	Not permitted	

NOTE: Highway should follow characteristics of major arterials and should be designed as such when passing through urban areas, unless it is grade separated

Zones

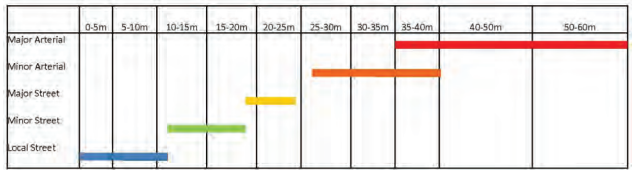
Vehicular zone

Multifunctional zone

Plantation & furniture zone

Pedestrian

ROW



4C. Create dense street networks that enhance walking, cycling, and vehicle traffic flow.

3. Restrict a maximum uninterrupted block face of no more than 150m.

   Indicator - Percentage of urban area with minimum 50 intersections per sq km.

   Benchmark - 100%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA will implement this through Development Plan and Local Area Plans.

   OR

   Indicator - Percentage of the urban area where distance between adjacent street intersections (not traffic intersections) is less than or equal to 150m

   Benchmark - 100%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA will implement this through Development Plan and Local Area Plans.

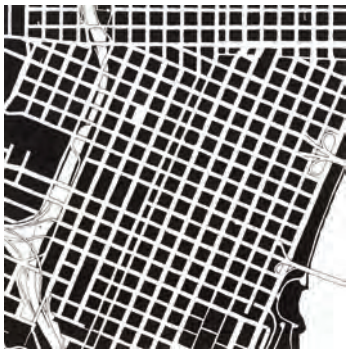


Figure 4.8: Regular street block, Portland

4. Major arterial with ROW> 40m should have service lane to separate local traffic from through traffic and to provide access to surrounding properties.

   Indicator - Percentage of length of major arterials (ROW>40m) with service / access lanes.

   Benchmark - Minimum 70%

   Monitoring - Streets Audit

   Implementation - ULB / UDA will implement this through street redevelopment programs.

Figure 4.9: C G Road, Ahmedabad

5. Disallow cul-de-sacs longer than 100m unless there is a pedestrian, cyclist connection at the dead end.

   Indicator - Percentage of cul-de-sacs that are less than 100m or have a pedestrian-cyclist connection at the dead end

   Benchmark - Minimum 90%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA will implement this through Development Plan and Local Area Plans.

4D. Create pedestrian access corridors through existing developed areas to facilitate walking

6. Create pedestrian access corridors at a maximum

150m C/C through existing developed areas

Indicator – length of new pedestrian access corridors created should be equal to the length of new vehicular streets created.

Benchmark – Ratio should be 1. (Length of new pedestrian access corridors should be 100% equal to the length of new vehicular streets created)

Monitoring – Streets Audit

Implementation – ULB / UDA will take care of implementation through Development Plan and Local Area Plans

Figure 4.10: Pedestrian access corridors through existing developed area near Sabarmati riverfront, Ahmedabad

Case Studies

i. Small and Varied blocks - Savannah, USA

Figure 4.11: Residential block structure of Savannah, USA

Key Information

- Founded in 1733 and planned by James Edward Oglethorpe
- Block size
  - 675 feet X 675 feet
  - Centrally developed open space
  - Smaller streets blocks encourage walking
  - Also, encourage NMT vehicles for short trips.
- One block developed for residential and another developed for public purpose

Small block size is essential to create lively walkable urban areas. In most North American cities older areas show smaller block size than newer suburban development. . This smaller block promote walking activity for short distance trips. (Vialard, Alice, 2012)

One the best example of a dense street network is in Savannah (USA). The roads are typically narrow, and some of those streets could also be called alleys. Savannah founded in 1733 and laid out by General James Edward Oglethorpe. The ideal plan prepared by Oglethorpe has four wards and squares. Two new wards were added in 1735, after that 18 more further implemented. Further fragmentation of existing blocks is not possible mainly because blocks are already small. The major block (called "ward) is 675 feet x 675 feet(205 metres) square. The Street spacing in the North-South direction is 110 metres and, 79 metres in the East-West direction. Streets and building lots organized around a central open space or square. (David, Mark, 2006., Siksna, 1997))

The streets bounding the wards allow uninterrupted movement of traffic while the internal streets are interrupted by the squares to create a pedestrian-friendly scale. Savannah is an example, where block size is small and development of block is for two different purposes. One block is for residential and the other used for public uses. (Brinckerhoff, 2006).

Numerous studies have been (and are still being) conducted on the block structure and morpohology of Savannah which provides natural traffic calming for pedestrians and bicyclists while retaining high degree of connectivity.

ii. Small and Regular blocks - Portland, USA

Key Information

- Block size
  - 200 feet X 200 feet
  - Smaller streets blocks encourage walking and cycling activity
  - 28% of total pedestrian trips generated through Inner city areas.
- Walking in inner city areas of Portland is safer and convenient mode of transport

Figure 4.12: Block structure of Portland, USA

The city block is fundamental to the physical structure of the city. The city center of North American cities provides good examples of block size in urban areas and Portland is one of them. Portland is located on west coast of USA. The development of this city formed block, size of 200 square feet.(Lit, Andrew, 2009.,Smith, James, 2006)

The minimum block size provides routes to transit stops and provide easy circulation for commuters by all travel modes. Residents of neighborhoods with shorter block lengths are more likely to walk to their destinations. Reducing block size can help create a community that is more accessible to pedestrians and bicyclists and thus encourages more walking and bicycling. (Savannah Residential Block, 2010)

In 1997, Portland transport authority (METRO) completed a street design study in which the impact of street connectivity on potential vehicle traffic conditions along major streets was modeled and evaluated. The connectivity study found that, the high levels of local street connectivity reduced the amount of local traffic on major streets. (City Block)

The study reported that about 28% of all trips in these inner, mixed-use areas made on foot, compared to 5% in suburban areas in the region. The survey commissioned by the Portland Office of Transportation in 1994 showed that residents in inner areas were very satisfied with the safety and convenience of walking in their neighborhoods.

Principle 5. Integrate

"Integrate land use and transport to create high density, mixed-use, transit oriented developments"

Sub-principles:

- *Align **density** to availability of public transport*
- *Encourage appropriate **mix of uses** for new developments close to mass rapid transit nodes*
- *Ensure availability of **affordable housing** in close proximity to mass rapid transit nodes*
- ***Align** location of different land uses with availability of transport infrastructure*

Principle 5. Integrate

"Integrate land use and transport to create high density, mixed-use, transit oriented developments"

Cities have always been shaped by transport; where the planning and design of cities has always impacted transport choices. (thisbigcity.net) However, for a long time, transport planning and land-use planning has been undertaken independent of each other which have led to a number of unintended consequences resulting in the sprawling of cities.

Figure 5.1: Pedestrians friendly Transit Oriented Development in Bogotá.

Land use and transport integration deals with how transportation investments can be best aligned with development plans; and how transport can take further the vision for the future of our cities. At a minimum, what the coordination of land use and transportation requires is, that those concerned with the well-being of a community (or region, state or nation) assess and evaluate how land use decisions affect the transportation system and how can it increase the viable options for people to access opportunities, goods, services, and other resources to improve the quality of their lives. In turn, the transportation planners need to be aware of the effects the existing and future transportation systems may have on land use development demand, choices, and patterns (U.S. Department of Transportation FHWA). Integration of these two main components of city planning also requires extensive coordination between the various departments of the city's planning agencies.

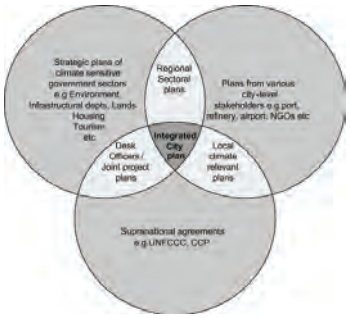


Figure 5.2: Ideal City Plan: Integration of various sectors

Moreover it is also important to integrate NMT and IPT with the overall development, as they are some of the most affordable modes of transport for the urban poor in addition to being a source of income for them.

The primary criteria for the integration of land-use and transport is to achieve a compact and mixed use development that also focuses on sustainability aspect of the development and the community. To achieve these desired outcomes Transit Oriented Development (TOD) has been accepted as one of the most desirable andefficient tools. Transit Oriented Development (TOD) is generally characterized by compact, mixed use development near new or existing public transportation infrastructure that provides housing, employment, entertainment and civic functions within walking distance of transit. This approach allows cities to focus on their scant resources in a manner which maximizes its value for users and residents of the city.

Figure 5.3: Bicycle rickshaws are still an essential NMT mode of transport in many parts of India

Sub-principles:

5A. Align density to availability of public transport

Balancing demand with the transit capacity is essential for an efficient and self-sustaining transit system. The "transit-oriented development" – theory says that allowing higher densities near mass rapid transit nodes can help increase ridership of the transit system and decrease overall infrastructure costs. This boosts location efficiency and increases mobility choices. This can be planned and implemented through station area planning.

Figure 5.4: Curitiba's Master Plan integrated transportation with land use.

5B. Encourage appropriate mix of uses for new developments close to mass rapid transit nodes

Mixed land uses in close proximity to mass rapid transit nodes are important for multiple reasons. It has been found that areas with mixed land uses generate fewer motorized trips and even the ones that are generated are of shorter trip length. People living in mixed-use areas in close proximity to public transport are less tempted to own motorized vehicles and hence rely more on public transport for longer trips.

Traditionally, Indian cities have had more mixed-use areas. However, the introduction of modern town planning principles (as seen in Chandigarh and other planned cities of 20th century) has led to segregation of uses with defined residential areas and shopping centres. This has led to increase in motorized trips in a number of cities. Delhi has a number of such 'planned' areas where residential uses are segregated from the commercial and amenities. This results in an increase in number and length of motorized trips.

Figure 5.5: Integrated landuse-transport and pedestrian friendly neighbourhood, Queen's road, Hong Kong

5C. Ensure availability of affordable housing in close proximity to mass rapid transit nodes

Low-income group depends on public transport. Hence it is essential to allocate affordable housing that can cater to households from the low-income group. This helps promote social inclusion and creates socially sustainable neighbourhoods.

Most urban services, public or private, employ and depend on a large number of people from low-income groups. The availability of affordable housing along the transit corridor and transit nodes will not only suffice the issue of housing for the low-income group but would also open the oppurtunity for them to use public transport, more frequently and at affordable costs.

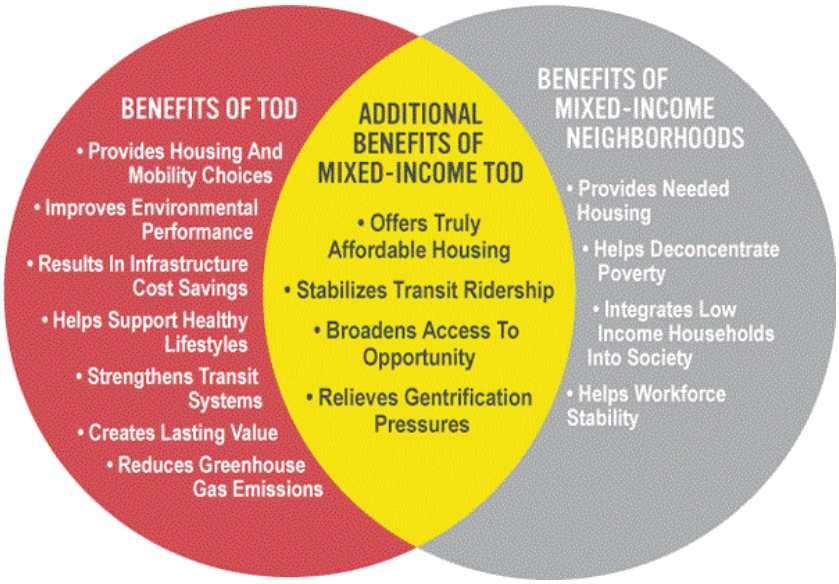


Figure 5.6: Benefits of mixed-income TOD

5D. Align location of different land uses with availability of transport infrastructure.

Integration of land use and transport planning must also look at micro-level planning issues such as compatibility and location of certain uses in reference to the urban transport network. Traffic intensive land uses usually generate high levels of vehicular movement at concentrated spots. This can increase traffic congestion greatly if the location of such spots is not aligned with the street network, intersections etc. It is important to understand that traffic congestion is not just because of poor transportation planning, but also because of poor integration between land use and transport.

Recommendations

5A. Align density to availability of public transport

Figure 5.7: Transit oriented development along BRT route, Guangzhou

1. Increase Floor Space Index (FSI) (by at least two times) within 400m walking distance of Mass Rapid Transit (high speed, high capacity systems like BRTS and above) stations

   Indicator - Percentage of mass rapid transit station areas where FSI has been increased.

   Benchmark - Minimum 80%.

   Monitoring – Development Audit

   Implementation – ULB / UDA / UMTA will implement this through station area planning or development control regulations and DP/ Master plans.

   Note: Most of the cities in India have a very low FSI and thus less density. The increase in FSI focuses on meeting the demand in the existing available areas rather than in the extended location

   .

5B. Encourage appropriate mix of uses for new developments close to mass rapid transit nodes

2. All new developments and redevelopments within the mass rapid transit station area should have a mix of residential and at least one of the following non-residential uses: institutional, government, office commercial, retail commercial.

   Indicator - Percentage of new developments and / or redevelopments with mixed use

   Benchmark - Minimum 100%

   Monitoring - Development Audit

   Implementation – ULB / UDA will implement this through development control regulations.

5C. Ensure availability of affordable housing in close proximity to mass rapid transit nodes

3. Ensure that at least 20% of built space within 400m of mass rapid transit stations is dedicated towards affordable rental housing for low income groups.

   Indicator - Percentage of mass rapid transit stations with affordable housing units equivalent of 20% of the built space within the influence zone (400m)

   Benchmark - Minimum 50%

   Monitoring - Development Audit

Implementation – ULB / UDA / UMTA will implement this through station area planning. Land and construction cost should be subsidized by distributing them over the remaining 80%. The affordable rental housing should be maintained and managed by local authorities through designated NGOs.

Note:Planning Regulation adopted for Ahmedabad Development Plan 2021:

- In order to enhance the supply of land for affordable housing, a new dedicated zone R AH of 1 km width has been proposed on the outer side along Sardar Patel Ring Road. This accounts for 75 sq. km of area and shall accommodate about 15 lakh affordable housing units. This overlay zone shall be applicable only for development of affordable housing with unit upto 80 sq m. The base FSI for affordable housing in this zone shall be 1.8 with chargeable FSI of 0.9 at reduced rates as specified in GDR.
- The development regulations have been revised with appropriate modifications which include:
- No ground coverage criteria after leaving required margins and common plot
- Parking requirement of affordable units has been relaxed and shall be 10% of utilizable FSI
- Additional FSI which is chargeable shall be available at reduced rates i.e.
- For housing unit size upto 50 sq.m – 10% of Jantri rates
- For housing units above 50 sq.m - 66 sq.m – 20% of Jantri rates
- Common open plot shall be provided as 10% of the total plot area. However, if common plot is provided at one place in one contiguous piece then the requirement shall be only 8%.

5D. Align location of different land uses with availability of transport infrastructure.

4. Vehicular entrances and exits of Traffic intensive land-uses such as large scale commercial malls, office buildings, petrol-pumps, party plots etc. should not be located within 300m of a major intersection (intersection involving major and / or minor arterials)

Indicator - Percentage of major intersections with traffic intensive uses within 300m distance.

Benchmark - Maximum 10%

Monitoring - Development Audit

Implementation - ULB / UDA will implement this through Development Control Regulations

Case Studies

i. Transit Oriented Development Policy and framework - Delhi, India

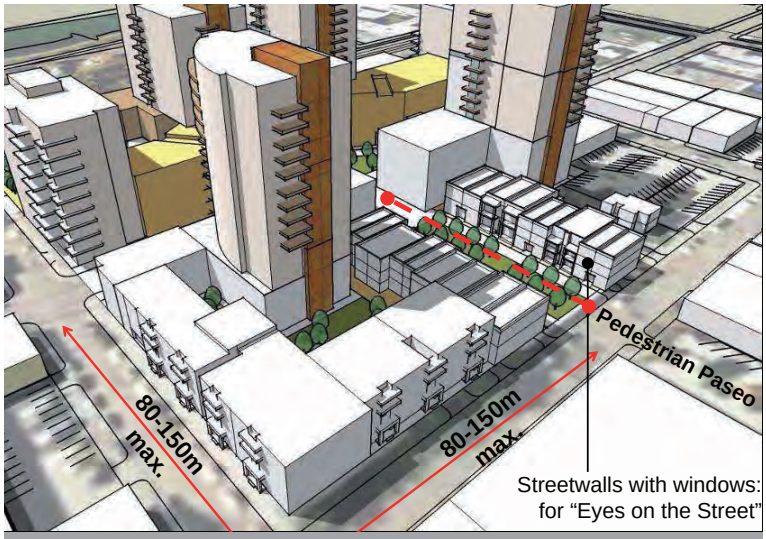


Figure 5.8: Anand Vihar TOD pilot project, Delhi, India

Key Information

- Master Plan for Delhi – 1962: lacked integration of infrastructure, landuse and transport.
- UTTIPEC & Delhi Development Authority: framed a Transit Oriented Development for Delhi.
- TOD Influence Zone:
  - Zone 1: Intense TOD Zone
  - Zone 2: Standard TOD Zone
  - Zone 3: TOD Transition Zone
- Land-types under the Influence Zone:
  - Redevelopment/ Infill sites, Greenfield sites and Retrofit
- TOD Policy framed for Delhi:
  - holistic approach to the overall transit oriented development

Context for TOD in Delhi

The concept plan of the Master Plan for Delhi in 1962 was a poly-centric planned city with major transport nodes and work centers but what it lacked was to address the integration of infrastructure, landuse and transport.

Since then, Delhi has seen a lot of discrepancy in its investments into developing a Public Transport System and its approach towards physical planning of the city. Today not only it is a major auto-centric state in the country but also a majorly polluted state. The dominance of private-motorized commute has lead to a scenario today, where transport policy and planning for the state, though adding heavy investments to public transportation, looks more like auto-oriented framework.

In this alarming situation there is an unavoidable need to develop a framework that enforces, enhances and incentivizes the use of public transport that is not only faster, safer and convenient but also restructures and redefines the concept of Sustainable Cities. Thus to achieve this, Unified Traffic and Transportation Infrastructure (Planning & Engineering) Centre (UTTIPEC) in close co-ordination with Delhi Development Authority framed a Transit Oriented Development - Policy, Norms & Guidelines for Delhi.

"Transit Oriented Development is essentially any development, macro or micro, that is focused around a transit node, and facilitates complete ease of access to the transit facility, thereby inducing people to prefer to

walk and use public transportation over personal modes of transport."

Benefits of TOD to Delhi

The Delhi TOD framework is designed not only to increase the living quality of the citizens but also to benefit the agencies in Transit, Land & Road services. It envisages itself as a holistic approach towards integrating existing infrastructure, land-use and future transportation options.

Along with providing a cheaper public transport, better livable environment and quality of life it also focuses on affordable housing, mixed-use & high density development and public-private partnership development opportunities to provide the required infrastructure at an affordable and timely manner.

The TOD policy would not only induce the ridership through public transport but would also potentially increase revenue from land due to increased development with lesser public money investment.

Zoning of TOD for Delhi

A maximum up to 2000 m. wide belt on both sides of centre line of the MRTS Corridor is designated as TOD Influence Zone which has been identified in the combined Zonal Development Plans of Delhi for public

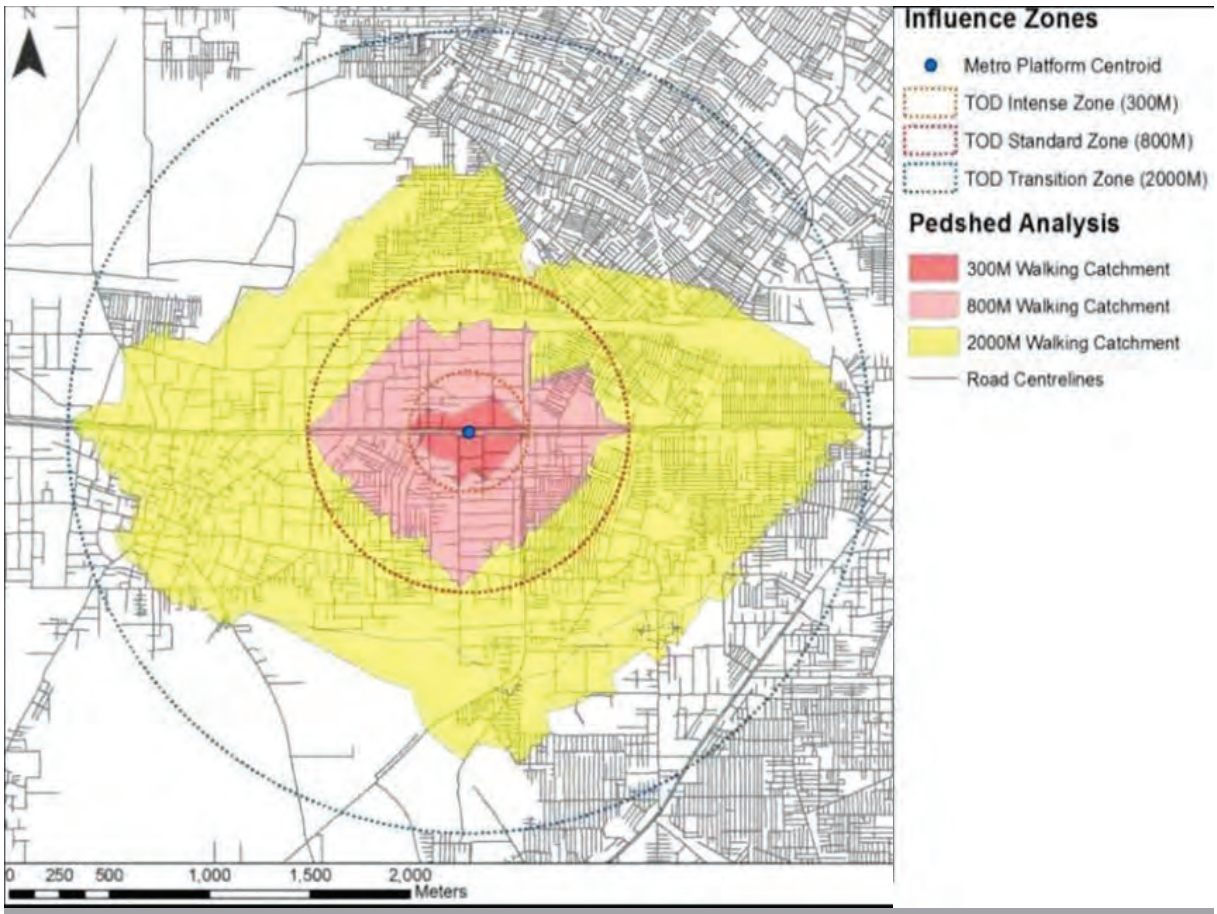


Figure 5.9: Influence and coverage area under MRTS and BRTS, Delhi, India

notification. This entire zone will be designated as a "White Zone" with its specialized policies and development control norms based on Influence Zone Plan. However this norms and policies would be framed with utmost considerations to;

a. Special Areas - Lutyens' Bungalow Zone, Chanakyapuri., DIZ Area and Matasundari Area and Civil Lines Bungalow Area which may have height restrictions.

b. Monument Regulated Zones (as per ASI guidelines).

c. Flight funnel zones shall follow the height restrictions as per regulations of Airport Authority of India.

d. Environmental Protection Zones (as per Chapter 9).

e. Seismic Zones such as fault lines.

Moreover, to facilitate an organized development and to bring transparency in the development process as per TOD, the Influence Zone is further divided as:

Zone 1: Intense TOD Zone (300 M influence zone of all MRTS Stations)

Zone 2: Standard TOD Zone (800 M influence zone of all MRTS Stations)

Zone 3: TOD Transition Zone. (2000 M influence zone of all MRTS Stations)

Land-types under the Influence Zone

Considering the exiting development and availability of the basic infrastructure, there would be a need to identify the type of development as per the land-type and thus frame the regulation as per ground realities. To facilitate this, the land falling under the Zone 1 and Zone 2 will be categorized as: Redevelopment/ Infill sites, Greenfield sites and Retrofit.

Influence Zone Plan

A Detailed Influence Zone Plan is a document that provides a framework and vision for future TOD development for a single or a set of MRTS stations. Any public or private development within the Influence Zone Plan Areas must adhere to the overall strategies, framework and benchmarks provided by the Plan. The Plan shall be prepared or be approved by the competent Planning Authority for each influence zone area in a phased manner, customized to site characteristics and context.

The plan shall include the following components:

1. Urban Design Framework
2. Transport Impact Assessment & Mitigation Strategies
3. Decentralized Infrastructure and Sustainability Plan
4. Economic Viability and Implementation Model

Policy

1. Redevelopment within developed areas of the city would be permitted only when an overall Influence Zone Plan has been prepared for the Station.
2. Densification should be allowed in all plot sizes subject to the project complying to the approved Influence Zone Plan, so that incremental development and densification can start taking place.
3. It is highly inappropriate to allow land banking in TOD zones.
4. Penalties should apply to all developers as well as Govt. bodies, to prevent inefficient use of valuable land and thus to ensure time bound densification along with MRTS corridor.

Norms

1. If Influence Zone layout plan for the station area does not exist, no individual developments with TOD norms shall be permitted.
2. If Influence Zone Plan for the station area exists, any project size of more than 50 Ha or an individual building will be sanctioned if it is in adherence to the influence zone plan prepared by the Planning Authority.
3. For projects accommodating more than 5000 residential population, the residents/ cooperative societies/ private developers should get the detailed layout and services plan prepared in consultation with the concerned authority for finalapproval. Variations from the existing influence zone plan prepared by DDA would be permissible subject to adherence to all TOD norms and Codes.

TOD Policy and Development Control Norms

1. Each TOD must have the following components:
2. Pedestrian & Cycle/ Cycle-Rickshaw Friendly Environment
3. Connectivity: Create dense networks of streets and paths for all modes.
4. Multi-modal Interchange: Mass transportation modes servicing the area should be well integrated to afford rapid and comfortable modal transfers.
5. Modal Shift Measures: Shift to Sustainable Modes by Using Design, Technology, Road Use Regulation, Mixed-Use, Parking Policy and Fiscal Measures
6. Placemaking and Safety: Urban places should be designed for enjoyment, relaxation and equity.
7. High Density, Mixed-Income Development: Compact Neighbourhoods for Shorter Commutes and Equity for All Sections of Society.

Policy Details and Development Norms for Pedestrian & Cycle/ Cycle-Rickshaw Friendly Environment

For any multi-modal or transit oriented development, pedestrian movement/ circulation plays a vital role. In countries like India, where one can also see a significant use of cycle as a mode of transport, pedestrian and cycling should go hand-in-hand. A well planned, designed and maintained pedestrian and cycling/non-motorized transport (NMT) dedicated lanes will help in reducing the use of motorized vehicles, at least for short trips.

The affordability and equity for the use of Public Transport are two major challenges that Delhi is facing. With major urban poor relying on walking as a mode of transport, UTTIPEC put forward the following policies and standards to amplify and enhance the pedestrian and cycling condition in the city.

Policy

- Design for pedestrian safety, comfort and convenience on all streets.
- Create street-level activity and well and well-watched streets for pedestrian security and enjoyment.
- Provide adequate amenities for pedestrians, cyclist, NMT and public transport users.
- All streets, public spaces and buildings must be universally accessible.

Norms and Standards

Adherence to Chapter 12 UTTIPEC Street Design

Conclusion

The TOD Policy framed for Delhi gives a holistic approach to the overall transit oriented development where rather than just increasing the density and FAR for the particular precinct it details out the over-all basics to implement and create a more livable and sustainable built environment.

ii. Transit Oriented Development - Curitiba, Brazil

Key Information

- Integrate land use with transportation in Curitiba
  - Trinary road design system
  - Major roads in Curitiba designated for BRTS
- Development along BRT
  - Permissible FSI along BRT route is five time the plot size
  - ZR-4 - Residential zone mid-rise
  - ZR-3-FSI up to 1.3 times the size of parcel
  - ZR-2 – FSI restricted to the size of the plot.
- Ridership and Usage
  - Passenger volume – 1.9 to 2.1 million trips per day
  - 11,000 passengers per hour per direction.
  - Bus capacity – 270 passengers

Figure 5.10: Transit oriented development along BRT corridor, Curitiba, Brazil

Curitiba (a medium size city) is widely known for one the best and most sustainable transit system in the world. Curitiba's high capacity transit system was not developed in one or two years, it was planned and implemented over three decades. Curitiba's planners developed a master plan, which integrated transportation and urban land use. The plan focused on cost effective well-planned system to meet the transportation needs of the city. (leroy, W.; Demery, Jr., 2004)

The first comprehensive plan for Curitiba, developed in 1943,(Agache plan) prepared to strengthen Curitiba's core by building radial avenues that linked downtown with the rest of the city as well as concentric ring road. In reality, the city never had the money to implement the Agache Plan completely.

After the failure of first master plan, in early 1960s the local authority decided to prepare new master plan. With the adoption of the new Master Plan in 1965, the projected layout of the city changed dramatically. In the new plan, the city was not planned to grow in all directions (as per the Agache Master Plan); rather, the growth was planned along designated radial corridors. This was supported by zoning and land use policies promoting high-density development along the corridors.

Toward End of 1960, central Curitiba started showing signs of overcrowding and serious traffic congestion. To avoid the traffic congestion, the master plan required to channel overspill growth along five structural axes (also called "transit arteries" later). The new structural axes become the main catchment for new development. Downtown Curitiba was not a primary destination any more; it was a hub and terminus.

The important step towards implementation of master plan came up during 1971. The new elected mayor took the decision to implement the new master plan. The mayor converted downtown streets to pedestrian

ways. The city's downtown and historic sector was partly closed for vehicular traffic and space was utilized for pedestrian users. The Master Plan also provided economic support for urban development along the arteries through the establishment of industrial and commercial zones and mixed-use zoning, and encouraged local community self-sufficiency by providing each city district with its own adequate education, health care, recreation, and park areas. By 1992, almost 40 percent of Curitiba's population resided within three blocks of the major transit arteries. (TCRP, 2009)

Land within two blocks of the structural axes was declared as zoned for mixed commercial-residential uses. Higher densities were permitted for office space, since it traditionally generates more transit ridership per square foot than residential space. Beyond these two blocks, zoned residential densities taper with distance from transit ways. Very limited and time-restricted public parking is available in the downtown area, and private parking is very expensive.

As the population increased during the period from 1970 through the present, Curitiba's bus system evolved incrementally. It required expansion of service routes, frequencies and capacities, improvements in fare payment and scheduling to facilitate the passenger transferring process.

During mid 1980's the ridership had grown, enough to support a rail network, but capital costs were prohibitive. Instead, a high-capacity high-speed service known as "direct service" was introduced on the one-way exclusive bus lanes that parallel the main corridors one block away. This service, including the tube stations and was far cheaper, faster and less disruptive than the light rail system. (Henrique, Luis; Fragomeni, C, 2008)

Based on 1991 traveler survey results, it was estimated that 28% of direct bus service users previously travelled by private car. Residential patterns changed to afford bus access on the major arteries to a larger proportion of the population. The main three arterials were built during mid of 1980's. During this period, the population growth was 73%, while the population growth along the arteries was 120 %.

Currently approximately 1,100 buses make 12,500 trips per day, serving more than 1.3 million passengers per day, which is 50 times more than the same number 20 years ago. 80% of the travelers use either the express or direct bus service, while only 20 percent use the conventional feeder services. Additionally to enjoying speedy and reliable service, commuters spend only about 10 percent of their income on travel.

Density and FSI

The initiative of zoning regulations also provide various bonuses and that promote higher densities immediate to the transit ways. Majority of parcels within structural axes, which consist two blocks within trinary road system, was reserved for mix development (commercial and residential).

The permissible development (FSI) along structural corridor for office building is five times the area of plot size. The first two floors extended up to the property lines where building structures directly face exclusive bus ways and auxiliary lanes, which create space between building and street curb for sidewalks. 50% of ground and second floors was used for retailers and commercial users and allocated space was not count as against permissible plot ratios. Thus, nearly all of the first two floors of building that front transit ways are devoted to retail shops and restaurant or eateries shops.

Residential zone is placed outside the structural axes and within easy walking distance from the main transit lines. Residential density reduces as distance from the transit line increases. The other side of the one-way transit artery was also developed as residential zone (ZR4), where eight to twelve stored mid rise height buildings constructed. In the ZR4 zone, building area can be developed twice the plot area size. The next roads coming out from one way is local streets, where low rise three to five stories garden apartments were buildings permitted. ZR3 zone, which is also residential zone and permissible FSI under the ZR3 zone, would be 1.3 times the size of the parcel size. In addition, ZR2 zone, which allowed single semi detached single story housing. ZR1 zones allow some neighbored small retails shops.

Affordable Housing

Land acquisition along or close to structural axes created opportunities for planners to regulate and direct growth. In past 25 years, housing for low-income families was build near transportation corridors. Another initiative came up in which developers can buy up to two extra floors of residential buildings by contributing to the housing authority and the contribution was set at 75% of the market value of the extra building area provided.

Bus Rapid Transit System

Curitiba's "bus rapid transit" system includes (1) trunk line buses operating on the busways as "express" services and "direct" services operating on the adjacent one-way arterial streets. Feeder buses serve the arterial trunk lines on the five structural axes but they are not given priority over other traffic. The "express" services are segregated from other traffic. The integrated terminals (multi-modal terminals) are located at every 4 kilometers. "Direct" express bus services run along the one-way roads on each side of the central roads that form the structural axes.

These services feature fewer stops, and passengers pay before boarding the buses in special raised tubular stations. The service was initiated in 1991 with four routes that parallel the busways. By 1995, 12 lines served more than 225,000 daily trips. Reports of the passenger volumes on the complete citywide system vary from about 1.9 to 2.1 million passenger trips million per day (which includes transfers as separate trips). Reported

daily bus way ridership volumes are approximately 188,000 passengers in the north south corridor, 80,000 in the Boqueirao corridor and 52,000 in the east corridor and 19,000 in the west corridor. The most heavily loaded corridor carries about 11,000 passengers per hour per direction, which is consistent with headway of 90 seconds and a bi-articulated bus capacity of 270 passengers per bus. Curitiba has all the factors that make up rapid passenger handling for a successful rapid transit system, i.e. wide bus doors; level access; five doors per bus that are designated for separate, simultaneous boarding and alighting; no fare payment or display of passes to drivers; etc.

Principle 6. Compact

"Encourage compact regions with short commutes"

Sub-principles:

- *Prioritize & incentivise* ***reuse*** *and* ***infill*** *of existing developed urbanized areas*

- ***Channel new development*** *to areas adjacent to existing urbanized areas*

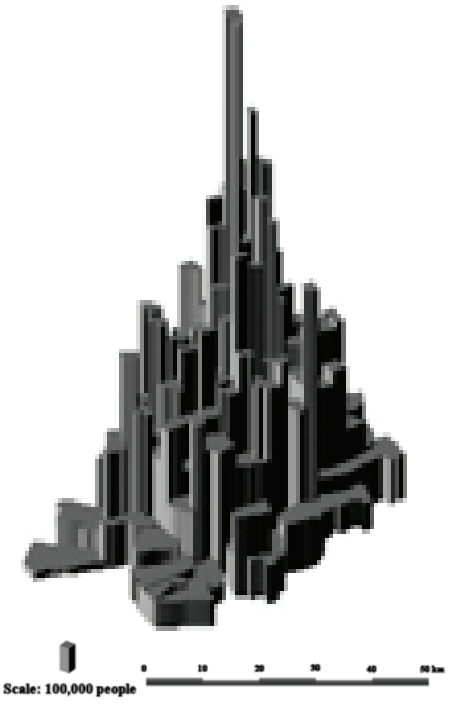
Principle 6. Compact

"Encourage compact regions with short commutes"

Figure 6.1: Urban Sprawl: By Choice or By Force?

Compact development is an urban planning and design concept to minimize the impact of human activity on the environment by keeping the area for urban development low while preserving surrounding natural, agricultural and forested areas. Such a development may at times be at high densities and could be served with an efficient public transport system and an urban street network that is dense and well-connected to encourage walking and cycling.

The concept aims to reduce overall energy consumption by ensuring that travel for work or leisure is optimized. This is mainly achieved by concentrating new development close to existing urbanized areas and developing vacant pockets of land. The concept also emphasis on developing adequate supporting physical and social infrastructure (parks, gardens, public health facilities, libraries etc.) within the dense areas to enhance quality of life of the residents of such a compact development.



Shanghai: 7397000 people - 244 sq km

Figure 6.2: Compact urban form like that of Shanghai makes it feasible to provide Public Transport as a low per capita cost.

Sub-principles:

6A. Prioritize & incentivise reuse and infill of existing developed urbanized areas

Prioritizing and directing growth within the urbanized areas enables more efficient use of urban services and infrastructure. This can be implemented mainly in two ways. Development can be encouraged or facilitated in vacant parcels of land or land that was previously developed, for example vacant industrial mill land. This is known as urban infill. Adaptive reuse is another way, where older structures which have outlived their uses are converted into new ones (Joachim, 2011).

Redevelopment of existing areas is an expensive, messy and tedious process for developers. Such infill / adaptive reuse can only be successful if there are enough incentives for developers to undertake redevelopment of existing areas.

Figure 6.3: London Scenarios: Infill Development possibilities

Development Plans or Master Plans of a city needs to adopt planning policies and strategies that incentivize new developments, encourage redevelopment and infill development in existing areas. These can help integrate land use planning proposals with the urban transport strategy to promote sustainable patterns of growth of the city. Moreover such plans have the potential to unify and integrate all urban components of a city, which otherwise would be planned separately. Also, local development regulations need to formulated so as to include incentives in the form of higher FSI along transit corridors, in CBD areas, existing underdeveloped areas, development of affordable housing etc.

Moreover, for those areas of the city which are currently compact or dense, i.e. core city area, for example, Howrah in Kolkata, Walled city area in Ahmedabad, Bhuleshwar in Mumbai; these areas need to be

serviced with better public transport and better physical infrastructure so as to complement it with newly developed urbanized areas.

6B. Channel new development to areas adjacent to existing urbanized areas

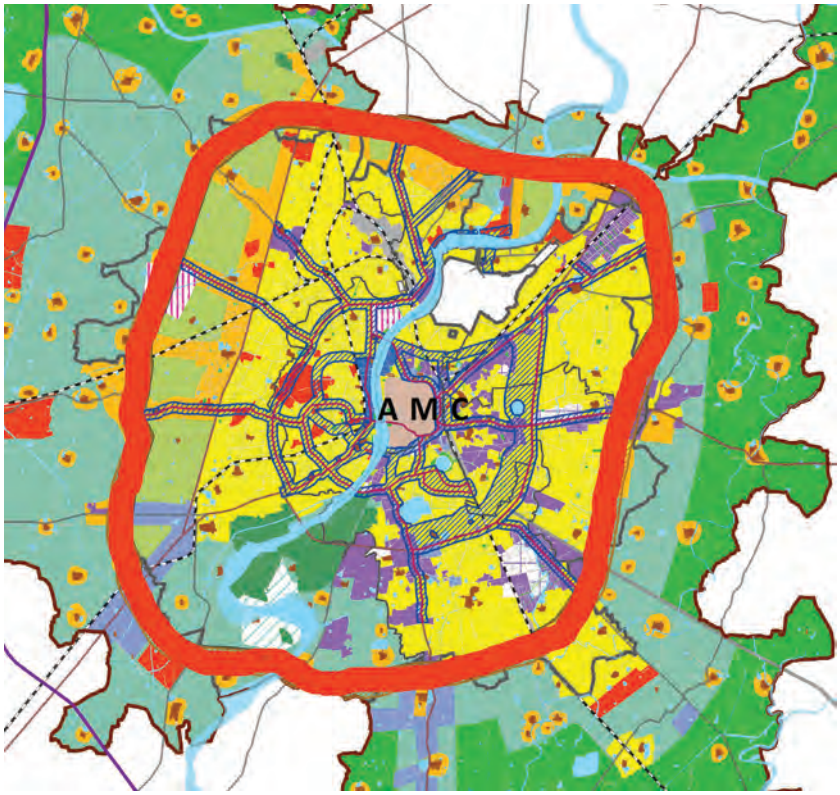


Figure 6.4: Draft Development Plan 2021 for Ahmedabad has defined its growth boundary to channel new developments near existing urbanised areas.

Figure 6.5: Redevelopment Scenario: Gulmohar Park Mall, Ahmedabad

Figure 6.6: Infill- development Scenario: Alpha One Mall, Ahmedabad

Traditionally, most cities do not prefer to invest in upgradation of physical infrastructure and public transport but rather open up new areas for development. This is because just as for developers even for the city it is easier and cheaper to provide infrastructure in new / green-field areas than the brown-fields.

However, large scale infrastructure like water treatment facilities and sewage treatment plants work well only at a certain scale. Hence, in the long run scattered infrastructure would turn out to be more expensive than concentrated infrastructure (which is possible by improving infrastructure in existing areas). Not just from infrastructure, but also from social well-being perspective, it is better to live in denser environments close together than living in scattered manner in sprawling areas.

Thus, it is essential to limit areas for new developments by restricting the release of new land for zoning and development. This in turn would prevent urban sprawl and encourage compact development

Recommendations

6A. Prioritize & incentivise reuse and infill of existing developed urbanized areas

1. Increase Floor Space Index (FSI) along existing and future transport corridors in the city

   Indicator - Percentage of total length of existing and proposed corridors with increase in FSI

   Benchmark - Minimum 80%

   Monitoring - Development Audit

   Implementation - ULB / UDA should implement this through the Comprehensive Regional Plan / development control regulations

   Note: Applicable for cities with more than 1 million population.

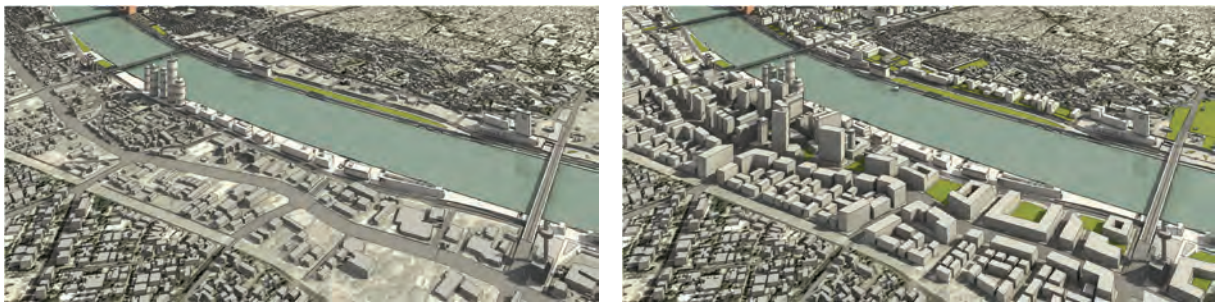


Figure 6.7: Existing & propoaed scenarios for increase in FSI along transport corridors.

2. Calculate property tax based on permissible built floor space instead of actual built floor space

   Implementation - ULB / UDA can implement this through amendments in Development Control Regulations

3. Introduce incentives and strategies to encourage redevelopment and infill development

   Indicator - Percentage of vacant and underutilized land getting redeveloped per year

   Benchmark - Minimum 10% per year

   Monitoring - Development Audit

   Implementation - ULB / UDA will implement this by introducing incentives and suitable development control regulations

4. Avoid claiming multi or double cropped agricultural land for development uses by using Transfer of Development Rights (TDR) mechanisms

   Indicator - Percentage of agricultural land claimed for development will be an indicator.

   Benchmark - 100% compliance

   Monitoring - Development Audit

Implementation – ULB / UDA will implement this through the Comprehensive Regional Plan and TDR policies.

5. Restrict / limit zoning of new development areas

Indicator - Proportion of development potential in newly developed area v/s development potential of existing areas

Benchmark – Development potential of existing areas to be higher than newly developed areas

Monitoring - Development Audit

Implementation - ULB / UDA will implement this by controlling land use and suitable development control regulations

Note – Development potential can be calculated as:

- For newly developed areas (X) :

  (Total Plot Area x allowable FSI)

- For existing areas (Y):

  (Total Plot Area x allowable FSI) – (Existing Built-Up Area)

Y should be greater than X.

6B. Channel new development to areas adjacent to existing urbanized areas

6. New areas opened for development should be adjoining existing developed areas unless separated by undevelopable natural barrier

Indicator - Percentage of total area opened for development (that is adjoining existing developed areas)

Benchmark – Minimum 80%

Monitoring - Annual Development Audit

Implementation - ULB / UDA will implement this by controlling land use and suitable development control regulations

Case Studies

i. Encourage infill and reduce sprawl - Ahmedabad Revised Development plan 2022

Figure 6.8: Proposed development framework, Ahmedabad, India

Key Information

- Presently vacant and available land in residential zones R1 and R2 - 65 sq.km
- Nearly 38 million sq.m. of built space can bemade available in the zoned areas R1 and R2 if
- approximately 50% of this vacant land (33 sq.km) gets developed due to the development demand and FSI incentives
- land area develops at the rate of 60% of the permissible FSI and
- 20% of plots undergo redevelopment in R1 zone.

The previous planning policies of Ahmedabad focused more on horizontal planning than vertical. In the previous Development Plan 2001, additional land was opened up in the periphery which resulted in sprawl while the inner core development areas maintained less density. Therefore, the Revised Development Plan 2022 for Ahmedabad has been formulated to encourage compact city form and encourage infill development.

It follows one of the principles of compact growth which includes

- Reduce sprawl by encouraging compact city form which helps shorten commute trips, makes infrastructure more efficient and leads to a higher quality of life
- Discourage the development inducing infrastructure in far flung areas

To effectively implement this, enhanced General Development Regulations (GDR) and effective zoning principles have been used. These planning tools manage growth, regulate density and organize land uses within the urban area.

In order to encourage compact city form and to enhance mobility through transit oriented development following are some of the important steps taken up in the

1. Incentivize development in existing zoned area(R1 and R2) : In order to optimize the utilization of vacant land and areas with old development primarily in R1 and R2 zones, incentives in terms of payable FSI were introduced that would help encourage development

and redevelopment within this area.

2. Incentivize development in CBD : A new zone of Central Business District (CBD) is carved out from the existing zone to create a high density district with a distinct character and a clearly identifiable urban form. This zone will promote and incentivize regeneration and rejuvenation of city's central area and transform it into a vibrant, mixed use, transit oriented, walkable CBD that is attractive for business, entertainment and tourism. Along with base FSI of 1.8, additional chargeable FSI of 3.6 is made available to incentivize the development in this zone bringing total permissible FSI to 5.4. Also, height restriction is removed to allow maximum height as approved by Airports Authority of India (AAI).

3. Encourage compact development along transit corridors: A Transit Oriented zone is introduced as an effective tool to promote compact, transit oriented development within the walking distances of public transit routes such as BRTS and Metro. (200m on both sides along BRTS and Metro)

4. Organize development in Growth Centers : Keeping the principles of compact growth in focus, growth centers are planned at Sanand, Mahemdabad, Kalol, Dehgam and Bareja in order to support/

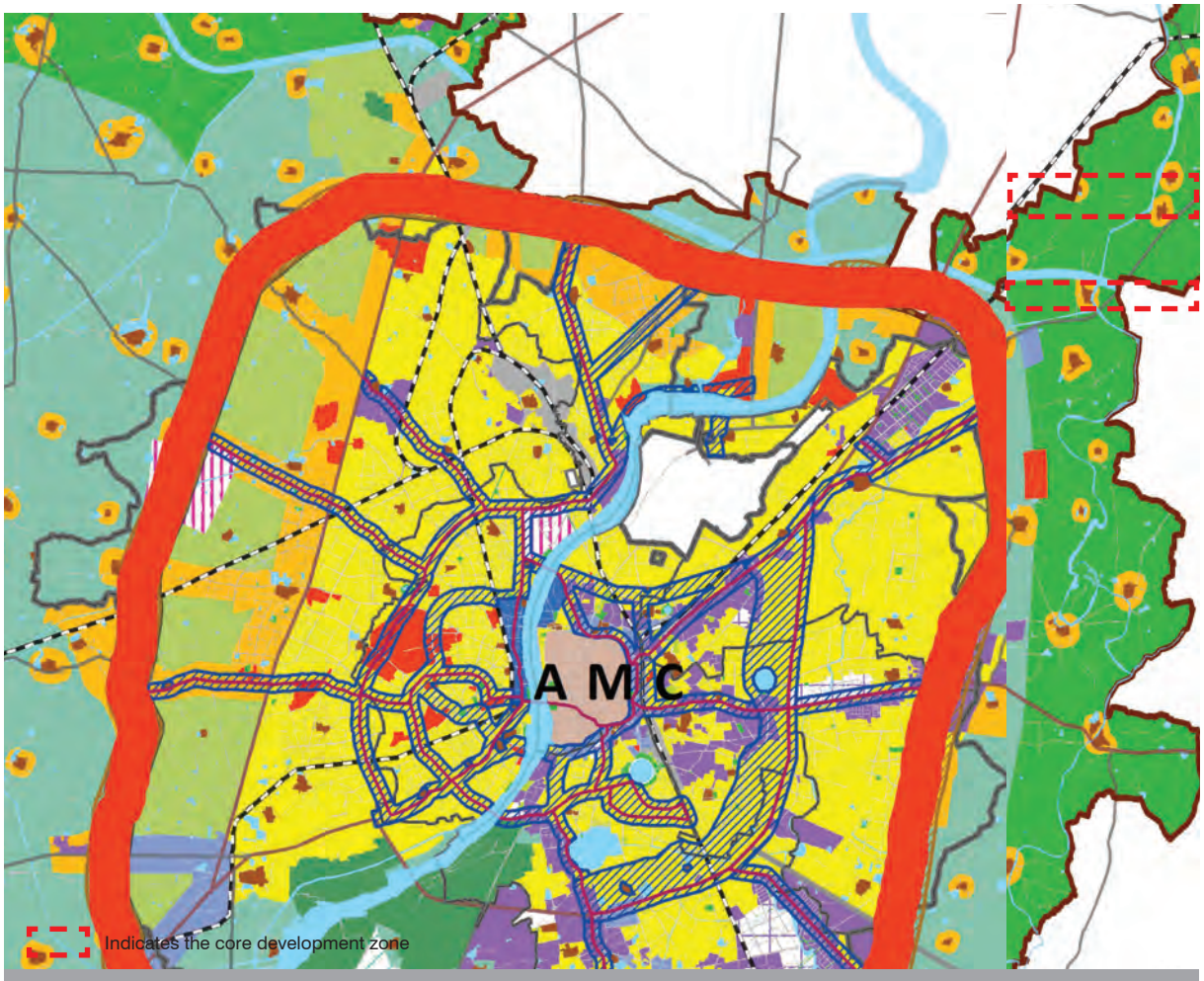


Figure 6.9: Development potential zone within existing urban area, Ahmedabad, India

accommodate population in various SEZs, SIRs and industrial clusters around Ahmedabad

5. Allow for natural growth around villages through buffers: The growth around village should be accommodated in immediate vicinity of the village Gamtal in contiguous manner. Therefore, a buffer of 200 is provided around Gamtals having population less than 5000 and 300 m around Gamtals having population of more than 300 m where specific regulations and uses may be permitted according to GDR.
6. Restricting development to preserve prime agriculture land : To preserve fertile double cropping land as well as reduce sprawl, necessary regulations have been framed in GDR and Prime Agriculture Zone has been introduced so as to discourage any development other than agriculture and some of the support activities.
7. Development around existing zoned areas to incentivize affordable housing : In order to enhance the supply of affordable housing, a new overlay zone RAH is identified within 1 km wide stretch on the outer side of SP Ring Road covering around 75 sq.km of land area. This overlay zone shall be applicable only for development of affordable housing with unit sizes upto 80 sq m. All other developments shall be permissible as per the existing zones only. The RAH overlay zone shall take precedence over the underlying R1, R2, R3, Commercial and Agricultural zone.
8. The base FSI for affordable housing in this zone shall be 1.8 with chargeable FSI of 0.9 at reduced rates as specified in GDR. For all other developments the FSI shall be permissible as per the provision of the base zone as identified in GDR.

ii. Vacant land Policy - Cleveland, USA

Figure 6.10: Windmill developed on previously vacant land, Cleveland

Key Information

- One of the most successful land bank in USA
- Focus on converting tax-reverted property to new uses
- Vacant land information
  - Parcel identified through Aerial imagery
  - 13 sq.km vacant land in Cleveland city
  - 20,000 vacant or vacated land
  - 7500 parcels under land bank control
- Community Development Corporation (CDCs) involved with land bank
- Involvement of CDCs
  - Purchase vacant land
  - Prepare master Plan for vacant land
- Property Tax concession for distressed land proposed for redevelopment.

Cleveland is a thriving city within the state of Ohio in USA. The city is located in the northeastern Ohio. Recently, in the aftermath of the global financial crises, the city of Cleveland has been adversely impacted through falling property prices, severe home-loan foreclosures and an increasing incidence of vacant/vacated properties and land within the city. These changes in Cleveland's population and economic base have created an opportunity for the city to re-imagine its future.

Figure 6.11: Previously vacant land developed as community space and gardens.

Currently, approximately 3,300 acres of land in Cleveland is vacant, most of which was previously occupied. This vacant, or vacated, land represents about 20,000 parcels (plots) of land, more than 7,500 of which are under City control in Cleveland's Land Bank. This scenario creates a unique opportunity for Cleveland to rebuild a vibrant community that provides a better quality of life for its residents. (Cleveland City Planning Commission, 2008)

The City of Cleveland is noted as having one of the top residential land bank operations in the country, particularly for being one of the first cities to address vacant, abandoned and underutilized properties while simultaneously planning and restoring properties for neighborhood reuse. (Keating, Dennis W, 2006)

In the aftermath of the housing crises in US, the city expedited its foreclosure process (even though it can take up to three years) jointly with the land bank's ability to cancel delinquent taxes on acquired property.

This made it one of the models of aggressive vacant land reutilization. Under the City Land Bank law, the Land Bank distributes all the acquisitions within 15 years, hence planning for final parcels for housing and neighborhood redevelopment can be done.

The City of Cleveland has already taken significant steps to advance the sustainable re-use of vacant land. Cleveland's Land bank has legal and administrative powers to sell properties at below-market value. The bank also has ability to waive property taxes for distressed properties proposed for redevelopment. One of the more interesting aspects to Cleveland's land bank structure, as compared to other cities, however, is its use and reliance on local community development corporations (CDCs) to purchase the properties once acquired and managed by the land bank. (Cleveland State University & GLEFC, 2005)

Local CDCs are now working with the City of Cleveland to implement agricultural pilot projects over the next several years throughout the city. A total of 66 project aiming to renovate vacant land have been implemented throughout Cleveland, 31 of which are urban agriculture related, 13 are market, gardens, and the remaining are community gardens and windmills. The urban farms will provide supplemental income to many farmers and primary income for one or two farmers. These projects are limited to city-owned land. The city has agreed to a five-year lease for the pilot projects, with the goal of transferring title to the community group or individual farmer after the expiration of the lease. (Alexander, Frank S, 2011.; Dewar, Margaret, 2009)

Large CDCs network and major CDC supported organizations are capable and ready to reuse land for neighborhood revitalization in a strategically planned way. The city's willingness to work with and distribute 500 to 800 parcels per year to local CDCs (at $100 per parcel) provides an avenue for ongoing planning and cooperation critical to the success of housing redevelopment. (Pagano, Michael A; Bowman, Ann O'M., 2000)

iii. FSI mechanism to regulate growth - Seoul, South Korea

Figure 6.12: Development with high FSI near transit station in Seoul, South Korea

Key Information

- Different FSI to regulate growth near transit corridor
- World's third largest metro system
  - Metro linked CBD with other suburban areas.
- Allowable FSI near main metro nodes higher compare to other areas.
- FSI regulation in Seoul
  - 8 to 10 FSI in CBD areas
  - 0.5 to 4 FSI in residential area
  - 10 FSI near metro nodes
- FSI value decrease as distance increase from metro station nodes

Over the years, Seoul has implemented various growth management techniques and FSI & TDR tools are prominent among them. Seoul's compact development with large CBD area and newly developed sub centers is important. (KWON, Young Jong, 2010)

Seoul's metro system is world's third largest metro system, which linked various sub centers and CBD via different routes. To create compact and sustainable development, Seoul's has different allowable FSI for different

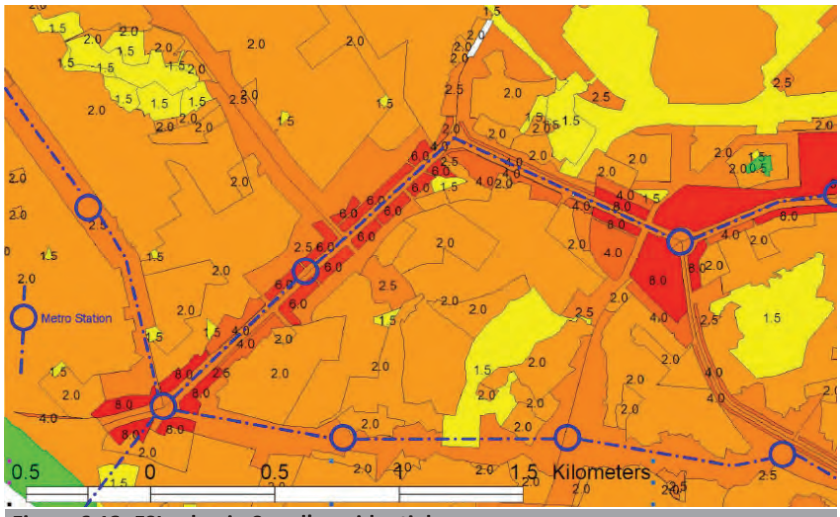


Figure 6.13: FSI value in Seoul's residential area

areas. For CBD area, the permissible FSI is 10 and for the rest of the CBD area and various sub centers, the permissible FSI is 8. Seoul's development authority allowed 0.5 to 4 FSI in residential areas. (Bertaud, 2010)

Permissible FSI in areas around main metro nodes is higher compared to other areas within the same district. Areas around metro nodes can use maximum FSI value 10 and FSI decreases as distance from metro station increases. (Rakwatin, Preesan; Watanabe, Naoki; Yonemura, Takahiro, 2010)

Principle 7. Parking

"Influence private vehicle usage through parking"

Sub-principles:

- ***Formalize*** *and* ***regulate*** *all on-street parking provision and usage*
- ***Disincentivize*** *free parking within private developments*

Principle 7. Parking

"Influence private vehicle usage through parking"

Figure 7.1: Urban Sprawl: By Choice or By Force?

Figure 7.2: The Parking Road

Figure 7.3: Parking Congestion, Dhaka

For every trip undertaken by vehicles, there arises a need for the vehicle to be parked. Parking convenience not only affects the ease of reaching the destinations but also the overall journey & accessibility. Hence it would not be wrong to say that parking today plays a crucial role in the process of designing and defining the comprehensive urban transportation system.

Once an essential component of transportation design and system, today parking has become a source of arguments, conflict and inefficiency, threatening future developments by occupying the major potential parcel of lands that can be utilized for betterment of society. Parking facilities are not only a major expense to the society but also a most common problem faced by designers, operators, planners and other officials.

Parking problems are mostly defined/ derived either in terms of demand-supply analysis or in terms of demand-management analysis. In most of the cases, management solutions tend to be better than expanding supply because they support more strategic planning objectives (Litman, 2011).

Frequently planners mistake parking as a needed infrastructure rather than a Travel Demand Management (TDM) tool. Travel Demand Management is a practice wherein various strategies (policies, programs, services and products) are used to change travel behaviour (how, when and where people travel) in order to increase the efficiency of transport systems and achieve sustainability of mobility systems. TDM strategies aim to control and manage the demand for travel, especially by private vehicles through various means such as pricing measures, regulatory measures, etc. TDM programmes are demand oriented rather than supply oriented i.e. they manage travel of population rather than trying to provide for more physical capacity for travel. TDM measures try to lessen the burden on the existing road infrastructure and reduce the need to invest in costly road improvement measures. (source: Toolkit on Transport Demand Management)

Sub-principles:

7A. Formalize and regulate all on-street parking provision and usage

Parking can be managed and regulated to encourage more efficient use of parking resources and more efficient travel. Free parking results in unorganized conditions and is one of the reasons behind traffic congestion. Frequently, on-street parking is provided at the cost of providing adequate street space for pedestrians and cyclists. Pay and use parking not only helps in organizing parking, regulating traffic and maintenance of the streets, but also disincentivizes private vehicle ownership and usage.

Parking management can also help generate revenue that can in turn be used for the maintenance and upkeep of the streets. Parking pricing should be market based and its management should be out sourced in order to manage it efficiently.

Figure 7.4a: TDM as a tool to manage the growth and periodic shifts in traffic demand

Figure 7.4b: The effects of parking prices in Grosvenor Square, London

7B. Disincentivize free parking within private developments

Minimum parking requirement for private developments is governed by the building bye-laws. This is usually available free of the allowable maximum Floor Space Index within any given plot. Removing these regulations and letting the market decide the provision will be helpful in not only ensuring that supply matches demand, but also in ensuring that the major cost of parking is borne by the people who own and use them rather than distributing the cost over all the residents regardless of whether they own a car or not.

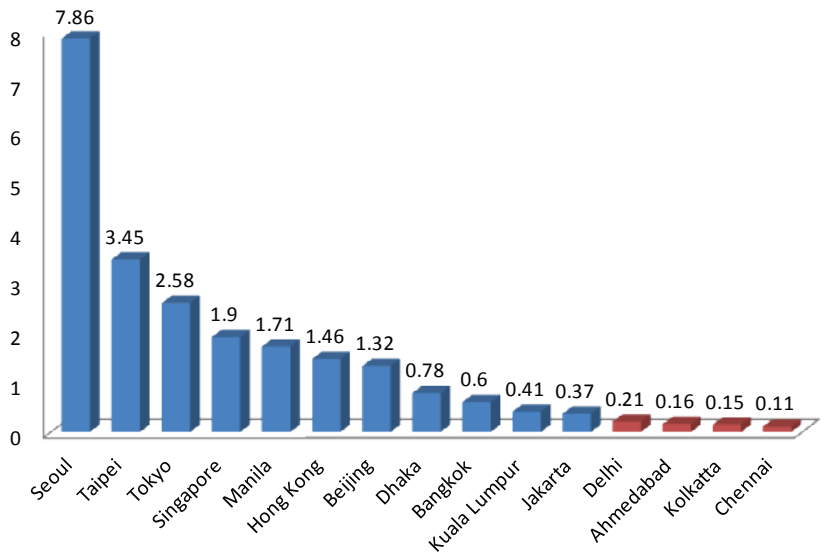


Figure 7.5: Low Parking charges (here shown in US $) in Indian Cities encourages cars.

Recommendations

7A. Formalize and regulate all on-street parking provision and usage

Figure 7.6: On street paid parking on major streets, USA

1. All on-street parking on major and minor streets and above in hierarchy should be designated as paid parking

   Indicator - Length of paid on-street parking (on Major streets and above) compared to overall length of all formal on-street parking (on Major streets and above)

   Benchmark - Minimum 100%

   Monitoring- Comprehensive Mobility Audit

   Implementation – ULB/UDA will implement this through appointment of parking management agency

2. Ensure restriction of free and unorganized on street parking in CBD areas

   Indicator – Percentage of paid and organized on street parking in CBD

   Benchmark –100%

   Monitoring – Comprehensive Mobility audit

   Implementation – ULB/UDA will implement this through appointment of parking management agency

Figure 7.7: Parking regulation through parking permits, Singapore

3. All parking on minor and local streets should be regulated through permits and should be charged

   Indicator - Length of regulated on-street parking (on Minor and Local streets) compared to overall length of all formal on-street parking (on Minor and Local streets)

   Benchmark - Minimum 100%

   Monitoring- Comprehensive Mobility Audit

   Implementation – ULB / UDA / UMTA will implement this through the mobility component

4. On-street parking-price should be market-based

   Implementation – ULB / UDA / UMTA will implement this through the mobility component

   Note - Market based pricing ensures that parking is charged based on the location of the parking space and also it can be used to disincentivse long term parking that discourages private vehicle usage for all trips.

5. Parking management and compliance should be out-sourced.

Implementation – ULB / UDA should have a "Parking Management" Department that will implement this through a tendering process.

Note:

Private sector involvement in on-street parking is common in many cities, without any clear-cut correlation between such delegation and successful on-street parking management. Activities that can potentially be delegated separately to the private sector include on-street parking pricing itself, enforcement against illegal or disruptive parking, and enforcement against pricing-related violations.

Delegation should also include the use of towing of vehicles parked obstructively, which is feasible even where vehicle registration systems are unreliable.

7B. Disincentivize free parking within private developments

6. There should be no minimum requirement for parking in private developments

Implementation – Urban Local Body / Urban Development Authority will implement this through Development Control Rules

Some city governments offer incentives for the private sector to build more parking (over and above requirements) and to open this extra parking to the public. This policy comes with the condition that the extra parking must be made open to the public.

Note:

It should be noted that development bonuses are not free of cost. Just like land itself, such bonuses can be considered a public sector resource with an opportunity cost. A bonus to incentivize parking can be used to promote something else, such as low-cost housing or public space. (Asian Development Bank – Parking policy in Asian cities)

7. Parking should not be free of FSI in private developments

Implementation – Urban Local Body / Urban Development Authority will implement this through Development Control Rules

Case Studies

i. On-Street Parking Use Zones - San Diego, USA

Figure 7.8: Blue zone parking area, San Diego, USA

Key Information

- CBD Area : 5.87 sq.km
- On Street Parking Space – 55,000
- Parking meters – 38,000
- Parking Zone
  - Red Zone / Fire zone
  - White Zone / Passenger loading zone
  - Yellow Zone / Commercial loading zone
  - Blue Zone / Handicapped parking zone
  - Green Zone / Short term parking zone
- Timings for parking zone
  - Red Zone: No parking anytime
  - White Zone: Parking allowed as per posted time limit
  - Yellow Zone: No parking during 8:00 am to 6:00 pm
  - Blue Zone: No limits for Handicapped
  - Green Zone: Parking allowed as per posted time limit

San Diego is one of the major cities in the U.S. The City of San Diego's parking regulations help regulate available on-street parking, maintain traffic flow and enhance public safety. These regulations complement the City's commitment to promote a quality living environment for residents and visitors. (Stienstra, Sjoerd, 2008)

Within CBD area, commercial parking requirement are determined by the level of commercial use and proximity to the transit. Outside the CBD areas, residential parking requirement estimated based on the land use district and size of dwelling units. For multi- family residential building required, more space compared to area near to transit station or low-income housing development. (Department S. D.), (San DiegoTransport Department,)

Although San Diego has high parking requirements in place, the City also has a zoning regulation to reduce parking requirements and support alternative modes. Parking is completely banned near intersection, crosswalk, footpath and parkways. Within 15 feet of fire station, driveway or fire hydrant location parking banned. even in areas where parking permitted, continuous parking not allowed for more than 72 hours. Parking for loading and unloading of goods in residential areas banned, unless they park the vehicle in designated parking zone. On-street Parking Zones throughout San Diego feature colour coordinated curbs and/or signs to help drivers quickly identify parking rules for the area. (Centre City Development Corporation, 2009)

Red Zone is NO PARKING/NO STOPPING ZONES. A red curb means, "No stopping any time" When signs are used in place of a red curb, the prohibition is in effect on the days and times specified on the sign.

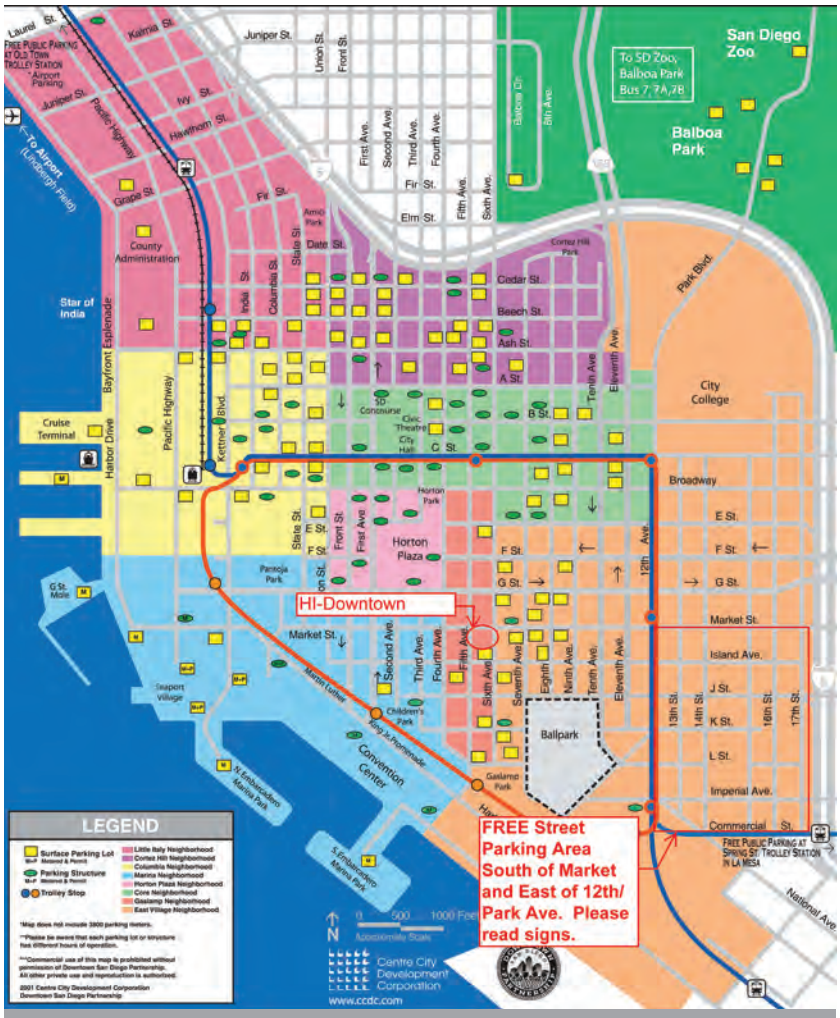


Figure 7.9: Parking space location, San Diego, USA

Figure 7.10: Red parking zone

Figure 7.11: Yellow parking zone

Figure 7.12: White parking zone

Figure 7.13: Blue parking zone

Yellow Zone is COMMERCIAL LOADING ZONES. In this zone, trucks and commercial vehicles permitted to stop for 20 minutes to load or unload goods. Passenger vehicles may also stop for three minutes to load or unload passengers. Commercial loading zones are in effect between 6:00 am to 6:00 pm, Sundays and City holidays excepted, unless otherwise posted.

White Zone is PASSENGER LOADING ZONES. In white zone, vehicles allowed to stop for the purpose of loading or unloading passengers. The time limit is three minutes, or ten minutes in front of a building. Passenger loading zones are in effect 24 hours a day, 7 days a week, unless otherwise posted.

Blue Zone is DISABLED PERSONS PARKING ZONES. Vehicles displaying a distinguishing placard or license plate issued to disabled persons by the California Department of Motor Vehicles may park in this zone. If a person have a disabled placard or license plate, person can also park at green curbs or in time limit zones with no time restriction and at metered parking spaces for free and with no time restriction. Additionally, parking in the blue crosshatch area designated for wheelchair lifts prohibited and subject to a fine.

Green Zone is SHORT-TERM TIME LIMIT PARKING ZONES. Parking is limited to the time stencilled on the curb or posted on a sign. In most cases, the time limit is either 15 or 30 minutes. Short-term time limit parking zones are in effect 8:00 am to 6:00 pm, Sundays and City holidays excepted, unless otherwise posted.

While there is significant off-street parking available, general tendency of people is to park in the closest available location. Hence, managing on-street parking become extremely important to allow judicious use of public space.

ii. Parking Pricing zones - Copenhagen, Denmark

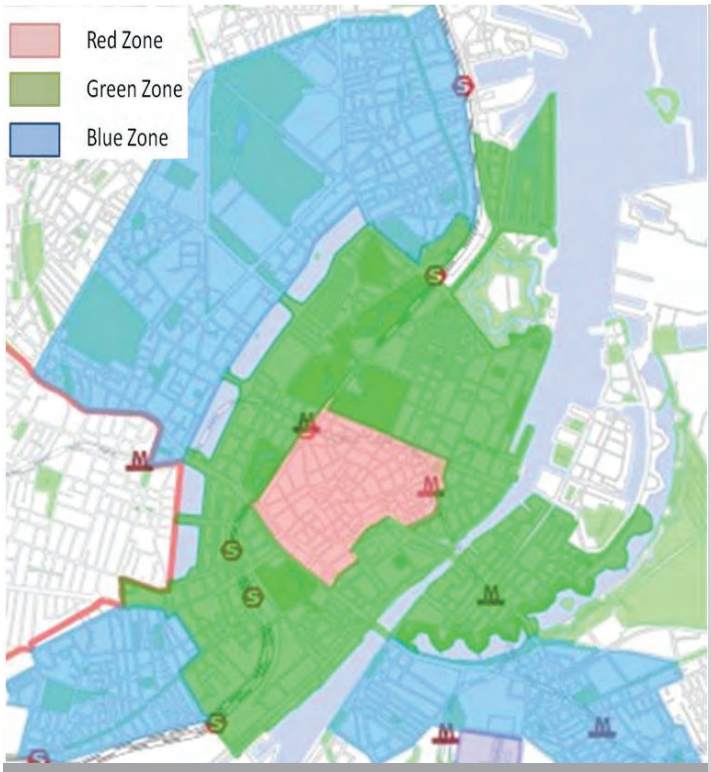


Figure 7.14: Parking zones, Copenhagen, Demark

Key Information

- Inner city area: 6.7 sq.km
- City divided into three parking zone
- Parking Regulation during weekdays
  - Red zone: 5US$/hour between 8:00 am to 5:00pm
  - Green zone: 3US$/hour between 8:00 am to 5:00pm
  - Blue zone: 2US$/hour between 8:00 am to 5:00pm
- Charges in all three zones during weekdays
  - 2US$/hour between 5:00 pm to 11:00pm
  - 0.50 US$/hour between 11:00 pm to 8:00am
  - Car users reduces by 6%
  - 9% transit ridership increased

While Copenhagen is renowned world over as the cycling capital of the world, the city has also undertaken major reforms in parking. During the period from 2000 to 2004, measurement of congestion in Copenhagen was shows that congestion rose by about 20% in this period. The measurements showed that there was an annual fall in driving speed over the years, from 34 km/h in 1985 to 27 km/h in 2005. (Corporation, 2009., (Tørsløv, Niels, 2010)

In September 2009, the Copenhagen City Council established 3,000 new parking spaces and closed 1,000 on-street parking spaces in the inner metropolitan area. As a part of their strategic master plan for parking, City transportation department divided urban area into three traffic zones: the Copenhagen tariff zones – red, green and blue -, which are all charged

differently. It covers the Copenhagen city centre and the inner bridge areas. The closer one gets to the city centre, the more expensive it is to park ones vehicle. (Parking, 2009., Litman, Parking Pricing Implementation Guidelines, 2011)

In the parking zones, the users have to pay for parking from Monday to Saturday, between 8.00 am to 6.00 pm. Blue zone is the cheapest, where parking cost is 2 US$/hour; Next is the Green Zone, where parking is 3 US$/hour; and lastly the Red Zone, is the most expensive one, at 5 US$/hour. (Jensen, Søren B., 2000.; Impact of Copenhagen's Parking Strategy, 2009)

In all three zones, prices are 2 US$/hour between 6:00 pm to 11:00 pm and 0.50 US$/hour between 11.00 pm and 8.00 am except Sunday. Parking is free between the 6.00 pm on Saturday to 8.00 am on Monday and on public holidays.

After the establishment of parking zones, car traffic has fallen by about 6% since 2005. The main reasons for the fall in car traffic are improved parking facilities. Fifteen percentages fall in parking ratio of commercial users during the morning rush hours, while forty percentages fall in private parking users during the morning rush hours in the inner city area. The essential reason is that private parking users are more susceptible to higher payment than commercial users. (Litman, Parking Pricing Implementation Guidelines, 2011)

The main result of the analysis shows that the proportion going to their work by car has fallen from 22% to 16%. On the other hand, the proportion going by train for a certain part of the journey has risen from 24% to 33%. The proportion using bus and bicycle or walking to their work has only changed little.

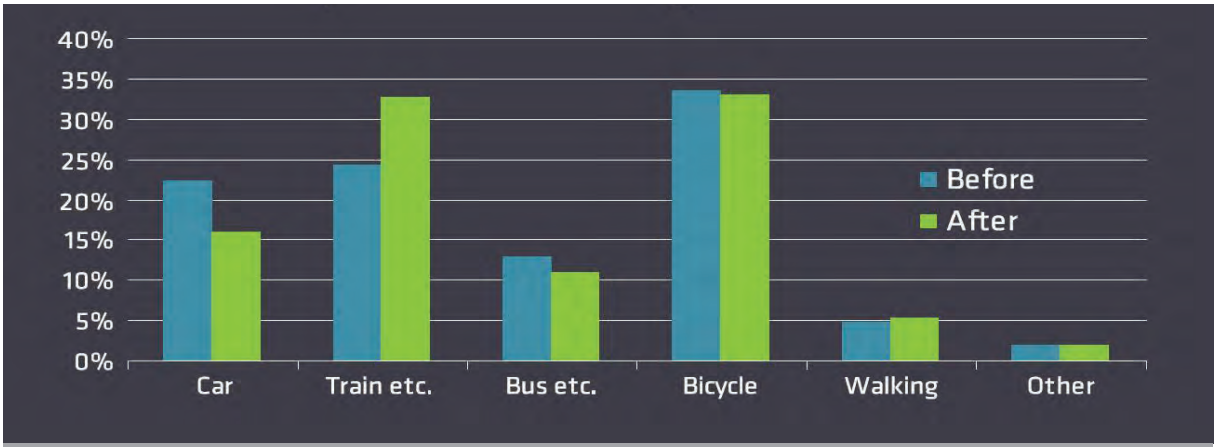


Figure 7.15: Means of transport before/after Parking Strategy

Parking Management - Seoul, South Korea

Figure 7.16: Parking zones, Seoul, South Korea

Key Information

- Ministry of Transportation (MOT) of Korea enacted the Urban Transportation Improvement Promotion Act (UTIPA) in 1986
- Parking policy - Resident Parking Permit Program (RPPP)
  - Users have to purchase parking permits
  - More than 70% people approved of RPPP
- Parking timeings and cost
  - All day: 33 US$/month
  - Day time: 25 US$/month
  - Night only: 17 US$/month
- Intiative "My Garage scheme" to support RPPP
  - Space inside the house converted in to a parking lot
  - 50% of the construction costs were supported by local governments.

Korea has experienced a rapid increase in automobile ownership from the 1980's to the present. With the surge in the number of private cars, most of the cities, particularly the large cities like Seoul, have been suffering from serious parking problems in both residential areas and CBD.

In 1983, a report by Korea Advanced Institute of Science and Technology (KAIST), "A Study on the Transportation Improvement Plan for Seoul Metropolitan Areas," strongly suggested that parking facilities should be expanded through a variety of methods. In addition, the Ministry of Transportation (MOT) of Korea enacted the Urban Transportation Improvement Promotion Act (UTIPA) in 1986. UTIPA required local cities or developers to provide parking facilities for citizens. Major UTIPA provisions related to parking facilities include the following:

- Every city with a population of 100 thousand or more population should establish and implement a transportation improvement plan in which parking facility plan comprises a major portion.
- Every construction project involving fairly large size structures should prepare the transportation plan for areas in and around the project area and pass the transportation impact assessment (TIA) administered by the government.

Now, as per the "Parking Policy in Asian Cities" by Asian Development Bank (ADB), Seoul falls under the longer-motorizing group, criteria being, the timing of each city's early surge of car ownership, which is taken to be their passage through about 20 to 60 cars per 1,000 persons and whether this took place more than 15 years ago or was much more recent. (Anon., 2011)

Seoul has a much lower city-center office parking requirements than in its outer areas and has been the most active of the Asian cities in adopting and innovating with parking management policy tools, including

its parking maximums, residential permits, and varying on-street parking pricing by zone.

In-Chul Hwang in one of his paper presentation regarding "Parking Problems and Policy Direction in Korea," recommended that house-attached parking space standards should be tough, while the regulation for parking building should be relaxed for the expansion of parking facilities in residential areas. Most city governments have accepted such policy directions since 1996. In the case of Seoul City, the objectives of the parking policy can be summarized as follows.

1. Reasonable control of parking demand in CBD or congested commercial areas.
2. Strong enforcement of parking violations
3. Reasonable arrangement of parking facilities in residential areas
4. Expansion of park & ride facilities using public and private investment

Figure 7.17: Parking zones, Seoul, South Korea

iii. Resident Parking Permit Program (RPPP) – A major parking policy

RPPP makes parking spaces available to users by creating curb-parking spaces along the inside roads of residential areas. In principle, a parking lot is assigned to the user who bought the parking permit. Previously, there were just open spaces along the inside-roads of residential areas, where illegal free parking was tacitly approved. As the demand for community parking increased, however, such open spaces were not sufficient to accommodate all users and many conflicts arose between community neighbors. RPPP was a solution for such problems. Three kinds of permits are available: all-day, daytime only, or nighttime only. The monthly price for a permit is about 40 thousand won (US$ 33) for an all-day permit, 30 thousand won (US$ 25) for a daytime-only permit, and 20 thousand won (US$ 17) for a nighttime-only permit. Normally, community people whose residence is near the lot have a priority in buying a permit. In case of a daytime permit, people who work at a permanent job near the lot have a priority.

Introduction of RPPP did get rid of the conflicts between community neighbors over limited parking spaces. According to a survey by the Seoul City Government, more than 70% of city residents approved of RPPP. Compared to disorderly illegal parking, the arranged parking pattern improved the walking conditions along the inside-roads. Moreover, the revenue from the parking lots can be utilized to fund other parking developments.

"My Garage scheme" – An initiative to support the RPPP

The "My Garage scheme" was promoted with some incentives by some

Figure 7.18: After and before scenario of "My garage scheme"

local Ku governments in Seoul and other major cities. In Korea, a house usually has a solid wall, with more or less spaces inside the wall.

If the wall can be removed, there may be good space to utilize as a parking lot. The "My Garage scheme" is a kind of social campaign to remove the wall partially or fully to construct a parking lot under some financial support from the local government. However, it is not easy for the residents to remove their walls, since it is Korean tradition to live within solid walls traditionally. In 1998, only 650 lots were made in Seoul despite that 50% of the construction costs were supported by local governments.

Also since parking spaces are very short in supply, certain local streets over 5.5 meters wide in Seoul were converted to one-way roads with car parking provided on one side where the residents could rent a designated space by paying about 30,000 won (about U.S.$23) per month.

Principle 8. Shift

"Shift from unsustainable mobility to sustainable modes by regulating road use, parking and other fiscal measures"

Sub-principles:

- ***Discourage private vehicle usage*** *in CBDs and other congested areas*
- *Encourage use of* ***"greener" vehicles*** *for motorized public and private transport*
- *Promote and incentivize use of private and semi-private* ***shared transit*** *services*
- ***Promote*** *and incentivize use of public transport services*
- *Use* ***participatory approach*** *for the planning of large infrastructure projects*
- *Provide* ***support*** *for* ***advocacy campaigns*** *and voluntary groups*
- *Ensure* ***availability*** *and* ***accessibility*** *of* ***appropriate information*** *at all public and significant private destinations*

Principle 8. Shift

"Shift from unsustainable mobility to sustainable modes by regulating road use, parking and other fiscal measures"

Figure 8.1: Shifting from unsustainable modes to sustainable modes

City category	NMT & PT
Category-1a	42 %
Category-1b	66 %
Category-2	61 %
Category-3	56 %
Category-4	53 %
Category-5	57 %
Category-6	74 %
National	**66 %**

Figure 8.2: % modeshare of walking, cycling and public transport in Indian cities

In India, more and more people rely on private transport for the majority of their daily trips. However, at present walking, cycling and public transport still account for more 40% of the mode share in Indian cities of all sizes (MoUD, WSA, 2008). There is a need to focus on retaining the mode share and to improve it in the future.

To cater to rapidly growing cities in India, the sustainable long-term solution is provision of high quality public transport. It is essential that investment in high quality public transport should increase. Also, the existing networks should be expanded, the existing fleet should be upgraded, and the existing service should be more reliable. Furthermore, it is necessary to understand the behaviour of users, i.e. how users manage their travel needs. Shifting people from unsustainable modes to sustainable modes can be accomplished by influencing their travel behaviour.

However, ensuring provision of good quality public transport is not sufficient for people to shift from their private motorized transport. In order to do this, there needs to be a framework of incentives and disincentives that will gradually influence people's travel behaviour.

Market based mechanisms such as congestion charges, high parking fees; vehicle taxes will encourage users to shift from private transport to public transport. Also, having proper information and signages will help improve usage of public transport. Advocacy and user education will go a long way in shaping the mind set of people in favour of sustainable transport.

In the long run, this shift will help address transport issues and lead to many benefits, including economic benefits, congestion reduction, carbon reduction, and improvements in public health.

Sub-principles:

8A. Discourage private vehicle usage in CBDs and other congested areas

Congestion pricing and parking management mechanisms can help deal with heavy traffic congestion situations on particular routes or areas in a

city. Congestion pricing can improve the situation by managing different types of trips with respect to peak hours. This can mean shifting the non-work-related travel on the streets during rush hour to less busy times, thereby reducing congestion. It is important to note that the purpose of congestion pricing is not to stop all vehicles from taking a particular route but rather to remove some of the vehicles from peak periods to off-peak hours.

Parking management mechanisms can also help reduce congestion on streets by organizing and regulating parking, thereby ensuring that the vehicular carriage-way is used more efficiently for moving traffic. Both the mechanisms can be used to reduce the amount of private vehicle use within congested areas and should be accompanied by the provision of high-quality public transport so that mobility choices for people are not reduced.

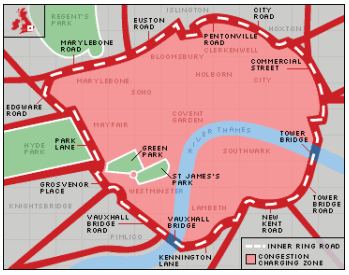


Figure 8.3: Congestion Charge zone in Central London

8B. Encourage use of "greener" vehicles for motorized public and private transport

Switching to a cleaner and fuel-efficient technology helps greatly reduce air pollution and overall vehicle emissions. Private and public transport vehicles switching to cleaner technologies can help reduce the overall city's energy consumption and Greenhouse Gas emissions. In many Indian cities, PUC (Pollution Under Control) is mandatory for all motorized vehicles. It is mandatory for every vehicle owner to carry a valid PUC certificate and maintain and drive the vehicle in a condition so as to comply with the prescribed emission norms. Unfortunately, in majority of Indian cities enforcement of law is a major issue. Without proper monitoring mechanism, this system will not work properly.

Figure 8.4: CNG public buses, Delhi

Compressed Natural Gas (CNG) is a cleaner fuel type which has been implemented as the primary fuel for buses and auto rickshaws in many cities. This has helped these cities reduce ambient pollution in terms of particulate matter and help improve efficiencies of operations. Many other cities can take up conversion of bus fleet and auto rickshaws to use CNG as primary fuel. Cities will have to incentivize agencies that will undertake such conversion and also incentivize setting up of new CNG fuel stations.

There are many other recommendations that are beyond the powers of cities and ULBs. These can be taken up by respective state governments / departments.

For example, in the recent past there has been a steady increase in the use of diesel propelled vehicles in India not for agricultural purposes but for private use within cities. This is mainly due to the subsidy on diesel. Such subsidies for private vehicle use should be offset by appropriate increase in registration / other taxes which will ensure that the subsidies are not misused for private benefit. These things such as tax on diesel vehicles and reduction in diesel subsidies is already being undertaken at the national level. State governments can levy additional tax to control the growth of diesel vehicles if needed.

Another key issue is that road tax to be paid at the time of registration of vehicles is a one-time payment. Considering the rapid increase in construction and maintenance costs, it is not feasible for the government to support upkeep of roads through these one-time taxes. Moreover, road tax can be a good tool to control the number of vehicles on road. Hence, it is better to have road tax based on annual mileage of vehicle travel in a single year than single lifetime payment. So the users may save on taxes if they reduce their annual vehicle travel. For this, the payment mechanism may need to be streamlined so it does not create additional burden at the RTO. With today's technology, it is very easily possible to ensure that these payments reflect the true cost of maintenance and upkeep of roads and footpaths on an annual basis.

Figure 8.5: Carpooling to work

8C. Promote and incentivize use of private and semi-private shared transit services

Public transport services are not very extensive in their coverage in most cities in India. Many people rely on Intermediate Public Transport services and other private / semi private services for covering the "last mile" of their trip. Formalizing and integrating these services with the public transport nodes can help ensure that people can complete their trip without any connectivity gaps. Cycle sharing facilities at such locations can also offer people more mobility choices. Organizations that have a large number of employees can also promote car-pooling, ride-sharing programs whereby people travelling to the same areas can share their private transport.

Figure 8.6: Promoting use of public transport

8D. Promote and incentivize use of public transport services

The provision of high-quality public transport services is not enough by itself to encourage people to switch over from private vehicle use. Local, state governments can facilitate this process by incentivizing public and private organizations and their employees for using public transport for their daily work related trips. Usually such programs or initiatives incentivize use of public transport for longer terms through subsidizing monthly and yearly public transport passes; thereby reducing commuter trips.

Figure 8.7: Public participation for transport projects

8E. Use participatory approach for the planning of large infrastructure projects

Public participation activities help the decision makers build public support and trust. Although the goal is always better decisions, the level of public influence on a decision and the tools used to inform and involve the public may vary. Public participation encourages social inclusion and promotes a feeling of ownership of the project and can ensure that the project is

well received by the public. For some planning initiatives, appropriate participation may be limited to public information. Other initiatives and key decisions may require much more involvement, incorporating techniques commonly associated with social science and marketing research, facilitation and mediation, organizational development, and/or consensus building (MetropolitanCouncil, 2004). Planning processes that use public participation benefit from better decisions, and a more supportive role of public at the end of the project.

8F. Provide support for advocacy campaigns and voluntary groups

Advocacy groups create change by influencing government or society to act on local issues, demands and needs of specific user groups. Advocacy groups may use a variety of methods such as public awareness campaigns, media activity, demonstrations and so on to help raise awareness about the different issues related to sustainable transport. They serve as an interface between the government and the people in helping facilitate better communication to influence public behaviour. Local authorities should create a cell that can further facilitate communication between such groups and the various departments of the local civic authorities.

Figure 8.8: Accessibility audit of buses by Samarthyam, Delhi

8G. Ensure availability and accessibility of appropriate information at all public and significant private destinations

Journeys by public transport - in contrast to journeys by car, on foot or by bicycle - are characterized by the fact that more detailed knowledge is required about public transport services. Inadequate knowledge about public transport provision and the need to plan the journey are barriers that contribute to lower use of public transport. Rather than spending time and energy to obtain the necessary information, the majority of people would prefer the ease of using private vehicles.

Good travel and wayfinding information is important for users to be able to plan their journey well, and also for retaining and attracting more passengers. The goal should be to spread awareness about availability of public transport services. In today's information age, it is not sufficient to have information in one medium. The information should be available in multiple mediums which cater to multiple user groups. For the individual traveller, it is easiest when all information about public transport in a region is available at a single point, providing information about all possible choices, giving the best alternative for the user (Lodden, 2004).

Figure 8.9: Bus stop with adequate information and map

Recommendations

8A. Discourage private vehicle usage in CBDs and other congested areas

Figure 8.10: CBD area as congestion zone in London, UK

1. Implement congestion zones within CBD area, parks, commercial, shopping districts and other congested areas identified through traffic congestion study

   Indicator - Percentage of modal share of private motorized vehicles in CBD areas.

   Benchmark - Percentage of modal share of private motorized vehicles in CBD areas should be within the suggested ranges:

City (Population in millions)	Private modes (% share)
0.1 - 0.5	25 - 35
0.5 - 1.0	20 - 30
1.0 - 2.0	15 - 25
2.0 - 5.0	10 - 20
5.0 plus	10 - 15

   (Ministry of Urban Development and Wilbur Smith Associates, 2008) (Refer Figure 3)

   Monitoring- Comprehensive Mobility Audit will monitor the change in mode share for private motorized transport.

   Implementation – ULB / UDA / UMTA will implement this through the mobility component of the Comprehensive Regional Plan

   Note: the implementation of congestion pricing may be for CBD like in London or for majority of urbanized area like in Singapore depending on the recommendation of the congestion pricing study.

8B. Encourage use of "greener" vehicles for motorized public and private transport

2. Rating of vehicles according to emission norms (GHG emissions per person per km) should be made compulsory

   Indicator - Percentage of vehicles that have implemented this rating system.

   Benchmark - 100% compliance

   Monitoring - Comprehensive Mobility Audit

   Implementation – RTO will implement this through Motor Vehicles Act

3. Switch all public transport and intermediate public transport vehicles to CNG or equivalent technology with equal or lower emissions

   Indicator - Percentage of public transport / Intermediate Public Transport vehicles using CNG or equivalent technology driving within the city

   Benchmark - Minimum 100%

   Monitoring - Comprehensive Mobility Audit

   Implementation –ULB / UDA / UMTA will implement this through city level legislations

4. Incentivize CNG and alternate fuel technology pumping stations

   Indicator - Percentage of CNG & alternate fuel pumping stations compared to the total number of fuel stations within the city

   Benchmark - Minimum 50%

   Monitoring - Comprehensive Mobility Audit

   Implementation ULB / UDA / UMTA will implement this through appropriate incentives

Figure 8.11: Use of CNG as alternative fuel

8C. Promote and incentivize use of private and semi-private shared transit services

5. Create appropriate tools to encourage car pooling or similar shared transit service

   Indicator – Percentage of total motorised work-based trips through car pool or similar shared transit service

   Benchmark – 80%

   Monitoring – Comprehensive Mobility Audit

   Implementation – ULB/UDA should facilitate the implementation of such service by incentivizing public / private organizations that encourage long term use of shared transit for its employees.

   Note - Private and semi-private shared transit services may include car pooling, shared IPT services, private company buses etc.

Figure 8.12: Use of buses as mode of transportation for employees in Wipro, India

8D. Promote and incentivize use of public transport services

6. Incentivize all public / private organizations that encourage use of public transport for its employees

   Implementation – This will be implemented by ULB / UDA initiatives through tax-breaks for public / private organizations that encourage long term use of public transport for its employees.

8E. Use participatory approach for the planning of large infrastructure projects

7. Mandate a minimum of 3 public consultation meetings at the beginning, mid-point and final design stage of the project for every large infrastructure improvement project (of more than 100 crore rupees)

   Indicator - Percentage of projects that have such public consultation

   Benchmark – 100% compliance

   Monitoring - Comprehensive Mobility Audit

   Implementation – ULB / UDA / UMTA will implement this through appropriate incentives

8. Allocate minimum 3 percent of the budget for large infrastructure improvement projects (more than 100 crore rupees) to advocacy, outreach and capacity building with users and stakeholders

   Indicator - Percentage of projects that have such an allocation

   Benchmark – 100% compliance

   Monitoring - Comprehensive Mobility Audit

   Implementation – ULB / UDA / UMTA will implement this through appropriate incentives

8F. Support for advocacy campaigns and voluntary groups

9. Institute a city wide advocacy and outreach wing / cell and encourage local advocacy groups and user associations under UDA/ULB charged specifically to influence public behaviour towards walking, cycling and using public transport through advertising, campaigns, ambassadors etc. and

   Implementation - Community users, NGOs, ULB etc. Support from local authorities is necessary for any such effort from independent groups or organizations.

8G. Ensure availability and accessibility of appropriate information at all public and significant private destinations.

10. Implement Integrated Information Systems for coordinating the different modes of public transport

Indicator - Whether such a system has been implemented or not

Benchmark - Yes / No

Monitoring- Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will enforce this and public transport agencies will implement this

11. Provide Inter modal Public Transport journey planner services via information portal on the phone and internet, and at major public and private destinations

Indicator - Percentage of public transport nodes that have implemented such services

Benchmark - Minimum 100%

Monitoring- Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will implement this through an Intermediate Public Transport plan within the Comprehensive Regional Plan

12. Provide information on transit routes and service frequency at all public transport nodes (including bus stops) in three different languages (English, Hindi and Local language)

Indicator - Percentage of public transport nodes (including bus stops) with information on transit routes and service frequency.

Benchmark - Minimum 100%

Monitoring- Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will enforce this and public transport agencies will implement this

13. Provide Passenger Information Systems including information on transit frequency, routes, local street map for a radius of 400m from the transport node, at public transport nodes (bus shelters and above in hierarchy)

Indicator - Percentage of public transport nodes (bus shelters and above) with Passenger Information System

Benchmark - Minimum 80%

Monitoring- Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will enforce this and public transport agencies will implement this

14. Provide Intermediate Public Transport information regarding contact information, locations of nearest Intermediate Public Transport stand at all public transport nodes (bus shelters and above)

Figure 8.13: Information for different modes of public transport

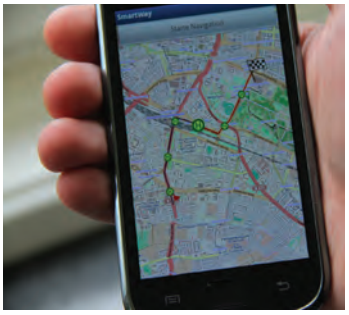


Figure 8.14: Public transport Information available on Phone and Internet, London

Figure 8.15: Transit route map, Ahmedabad BRT

Figure 8.16: Local information for 400 m radius available at bus stop

Figure 8.17: Public transport map and other information available at bus shelter

Indicator - Percentage of public transport nodes (bus shelters and above) with Intermediate Public Transport information

Benchmark - Minimum 80%

Monitoring- Comprehensive Mobility Audit

Implementation - ULB / UDA / UMTA will implement this through an Intermediate Public Transport plan within the Comprehensive Regional Plan

Other recommendations:

- Registration tax should be higher for vehicles that have a low emissions rating and it should be lower for vehicles with a higher rating within the same vehicle category
- Sales tax should be higher for vehicles that have a low emissions rating and it should be lower for vehicles with a higher rating within the same vehicle category
- Registration tax and Sales tax should be higher for diesel propelled vehicles that fall within the light motor vehicle and sport utility vehicle category as compared to other vehicles within the same category that use non-subsidized fuel technology
- Road tax payment should be based on annual miles travelled of vehicle in a single year and not single lifetime payment

Case Studies

i. Area Licensing Scheme - Singapore

Figure 8.18: Area Licensing Scheme in CBD area, Singapore

Key Information

- Congestion Zone area – 7.25 sq.km
- Total share of roads –12%
- Phase - I (1975)
  - Time regulation - 7:30 am to 6:30 pm
  - Manually Operated
- Phase II (1994)
  - Time regulation - 24 hours in CBD area.
  - Manually Operated
- Phase III (1998)
  - Time Regulation - 24 hours in CBD area
  - Operated by Electronic Road Pricing gantry
- Traffic reduction in CBD area - 7 - 8%
- Public trasnport users incresed by 65%

Singapore is one of the most densely populated and urbanized countries in the world. It has a population of more than 5.3 million people, residing on an island of 710 square kilometer area. Due to rapid urbanization and economy growth, travel demand has increased tremendously over the last few decades. Since, Singapore is country where the land scarcity is major issue, country cannot use vast amount of land for roads. Currently city has used 12% of its total land for roads. Master plan of Singapore also includes integration of transport and land use with provision of quality public transport and comprehensive road network, which maximizes the use of its capacity. Singapore Land Transport Authority (LTA) manages demand of road usage through ownership and usage measures, which include Vehicle Quota System (VQS) and Area Licensing Scheme (ALS). Purpose of Vehicle Quota System (VQS) is to restraint vehicle ownership and Area Licensing Scheme (ALS) is to restraint vehicular usage in Singapore city.

Singapore LTA implemented its first congestion-pricing zone in 1975, which was initially known as Restricted Zone (RZ). Initially, it was a manual system but now it has high tech digital system to control vehicles in CBD areas. Under Restricted Zone the motorist were required to purchase and display an area license on their windscreens or handle bars for motorcycles prior to entering the RZ during the hours of operation.

The area licenses had to be bought in advance from post offices, petrol stations, on area license sales booths located on the approach roads or convenience stores prior to entry point of Redistricted Zone. The purchased license was valid for a day and vehicles could make multiple trips into the RZ. For enforcement purposes, police constables were deployed at each gantry position to carry out visual checks on each

vehicle. The ALS had effectively controlled congestion in the RZ for more than twenty years. It had successfully maintained the traffic flows within RZ during the morning and evening peak hours despite an increasing vehicle population from about 100,000 in 1975 to 230,000 in 1994.

In the beginning of 1994, the Area Licensing Scheme (ALS) was extended to the whole day to even out traffic flow between 7:30 am and 6:30 pm to achieve a better utilization of the RZ road network throughout the day and allow for a higher volume of traffic to be carried without congestion.

The manual Area Licensing Scheme (ALS) was fully replaced by Electronic Road Pricing (ERP) system in 1998. The objective of the ERP scheme was to charge vehicles for the use of the road at places and at times, where and when they cause congestion. Therefore, the main difference between ERP and the earlier ALS is the pay-when-you-use principle, which is different from the old scheme where charges are on a per license basis regardless of the number of times that motorists enter the RZ or passes the expressway gantries.

In high tech ERP system, a Cash Card is inserted into the On-Board Unit (OBU), which is fixed permanently in the vehicle and powered by the vehicle battery. When vehicle passes an ERP gantry the cash balance after the ERP charge deduction is shown on the On-Board Unit (OBU), for 10 seconds. The electronic system has the ability to vary the prices based on traffic conditions and by vehicle type, time and location. Today all vehicles are charged, (exclude emergency vehicle).

In 2005, the coverage of ERP expanded the gantries around Singapore central business district and on major arterials and expressways. To ensure optimal use of road space and to maintain optimal speeds, the system is revised quarterly.

The implementation of the ERP has effectively reduced the traffic volumes in the Central Area (CBD) during the morning peak hours and off peak hours by about 7-8% as compared to the ALS previously implemented before 1998. This reduction is due mainly to a decline in the number of multiple trips made into the Restricted Zone. Nevertheless, the roads in the RZ have sufficient capacity to cope with the traffic volumes during the evening peak hours. Based on Year 2004 records, an average of about 260,000 ERP transactions are generated daily and out of this just 0.5% of the transactions involve violation cases with “No CashCard” and CashCard with “Insufficient balance”. With a strict preventive maintenance regime, LTA has managed to maintain an average system availability rate of 99.5% over the last few years of operation.

After replacing the ALS with the ERP system, traffic levels have decreased a further 15 percent. In addition, 65% of commuters now use public transport, an increase of nearly 20%. Reduced traffic in the charging zone led to a 176,400-pound reduction in CO2 emissions and a 22-pound reduction in particulate matter. The system has curbed traffic demand and managed road space for highest productive capacity, cutting congestion, pollution, emissions, and fuel use.

ii. Congestion Charging Zone - London, UK

Figure 8.19: CBD area as congestion pricing zone , London, UK

Key Information

- Congestion Zone area – 35 sq.km
- Timings and Charges
  - Cost : 18 US$/day
  - Time : 7:00 am to 6:00 pm
- Benefits
  - Reduction in traffic – 21%
  - Cycling activity increase - 43 %
  - Level of Pollution is reduced
  - Improved ridership of public transport – 12%
- Revenue generation utilized in public transport

The greater London (central zone) Congestion Charging Scheme was introduced in February 2003. Since then a number of variations to the schemes have been made in order to make adjustments and improvements in its operation. (Amin, Nurul, 2009)

The main aims of the congestion zone is: (i) reduce congestion in inner areas, (ii) encouraging drivers to shift from private vehicles to public transport, walking and cycling and (iii) reducing greenhouse gases and pollution level. Drivers have to pay US$18 daily congestion charge between 7:00 AM to 6:00 PM during weekdays within congestion zone.

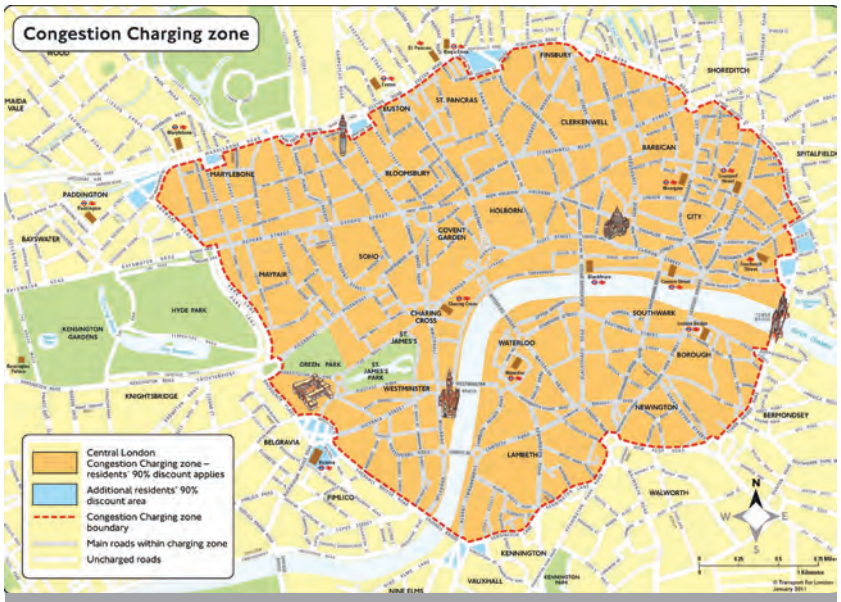


Figure 8.20: Congestion zone, London

iii. Car Free Day - Bogota, Colombia

Key Information

- Bogota celebrate car free day in month of February.
- Car free day's benefits
  - Zero Accidental death
  - 20-22% reduction in pollution level
  - 10% increase in public transport ridership
  - 20-30% reduction in hospital emergency consultation
  - 89% population had no difficulties with the transportation system
  - 92 % arrived at work place and educational place normally
  - More than 8 lakh cars stay in the garage on this day
  - More than 5 lakh people use bicycle on car free day

Figure 8.21: Car free day, Bogota, Colombia

A Car-Free Day encourages motorists to give up their car for a day. September 22 is celebrated as World Car-Free Day. Currently Bogotá holds the world's largest car-free weekday event covering the entire city. The first Car-Free Day was organized in February 2000 and became institutionalized through a public referendum. (Susa, Ivan Humberto Baquero, 2011)

The city of Bogotá in Colombia took a monumental step in promoting reduced dependence on automobiles, by holding the world's largest Car-Free Day. From 6:30 am to 7:30 pm, private cars banned from city streets (over the entire extended urban area). While some 850,000 private cars stay home in their garages, city residents turn to public transport, bicycles, taxis, regional train, roller-skates and other modes of transit to get to their destinations. (Car Free Bogota: the response to the transportation challenge)

One and a half million people cycled on the day, and 10% more people than average used public transport to get around. A substantial reduction in contaminants was reported for the day, with NOx being reduced by 8%, carbon monoxide decreased by 22%, and particulates reduced by 21%.

The Car-Free Day was the first day in more than three years that not one person died in a traffic accident compared to the daily average of 2-3 reported deaths. Although there were some reported crashes, and injuries, there were far less than an average day. Some hospital clinics reported a decrease of 20 to 30% in the emergency consultations.

Such reductions save public costs in health care, police and other associated services. For Car-Free Day to be implemented on a more regular basis, more work will have to be done with retailers, many of whom experienced losses in sales. A national polling firm revealed that 87 percent of citizens agreed with the Car-Free Day; 89 percent had no difficulties with the transportation system they used during the event; and 92 percent arrived at work, school or university normally. Even more

important is that 88 percent would like to hold another car-free day.

One poll showed only 7% of retailers experiencing an increase in sales, while the remainder experienced either stable or lower sales. In Bogotá, despite the lack of benefits for most retailers, 44% of retailers in one poll still believed the day was a success. However, retailers must be closely involved with planning car free events to ensure that they too can benefit.

The success of the day has led to local transportation, city planning and environmental teams in Bogotá working on plans to create an entirely new and innovative plan for "alternative transportation system for Third World Mega cities".

The plan includes one of the world's most comprehensive bicycle transportation networks (more than 200 km of system built or under construction), stringent parking measures and major provisions for pedestrians taking trips within the city. Also under way is the strategic renovation and redeployment of a public transport system presently consisting of some 30,000 buses of various sizes and types, and 55,000 taxis.

Principle 9. Safety

"Ensure safety and security in urban transport"

Sub-principles:

- *Incorporate **safety in the design, operations** and all other aspects of the entire urban transport system*

- *Ensure **safety** and **security** of all public transport services and all of its users*

- *Ensure a **secure public realm** that will encourage pedestrian movement, cyclists and commuters*

- *Ensure that the City Traffic Authority takes a proactive approach toward **implementing, executing** and **educating** the City Traffic guidelines and regulations, for Pedestrians, NMV and MV*

Principle 9. Safety

"Ensure safety and security in urban transport"

Figure 9.1: Unsafe pedestrian crossings

Figure 9.2: Conflict between various modes of transport

Transport safety can be defined as vulnerability to accidental injury (usually involving at least one vehicle as the instrument causing the injury), whereas transport security can be defined as vulnerability to intentional criminal or antisocial acts suffered by those engaged in trip making. Both these factors play a major role in determining the choice of travel mode that an individual makes. (Gwilliam, 2002)

Safety also includes service level benchmarks and industry norms that determine the quality of the transport infrastructure. Ideally, all motorized vehicles, public and private, should adhere to existing safety norms . Aand where such norms do not exist, they need to be created.

Safety as a component of transportation systems has raised major concerns regarding road traffic safety as

- Traffic fatality rates have been increasing in most cities.
- Pedestrians, bicyclists and two wheeler riders comprise of 60-90% of the total fatalities.
- Motorcyclists represent a large portion of urban fatalities (about 25%).
- Several studies indicate that the involvement of trucks in fatal crashes is greater than expected.
- Nighttime driving in India is substantially riskier than daytime driving. (source: Geetam Tiwari_Safety Accessibility Action Plan 2030)

ACCIDENT PRONE ZONE

I)Top five states which reported maximum number of road accidents

Maharashtra	68,438
Tamil Nadu	65,873
Madhya Pradesh	49,406
Karnataka	44,731
Andhra Pradesh	44,165

II) Top five cities which reported maximum number of road accidents

Mumbai	25,471
Delhi	7,281
Bangalore	6,031
Indore	4,995
Bhopal	3,459

III) Major causes of road accidents in 2011

Driver's fault	77.5 %
Pedestrian's fault	2.4 %
Cyclist's fault	1.3 %
Defect in road condition	1.5 %

IV) Urban – rural distribution

Accidents in rural areas	53.5 %
Road accident deaths in rural areas	63.4 %
Accidents in urban areas	46.5 %
Road accident deaths in urban	36.6 %

TOTAL ROAD ACCIDENTS IN 2011	**4,97,000**
TOTAL ROAD ACCIDENT DEATHS	**1,42,485**

Figure 9.3: 2011 staistics for road accidents and death by road accidents in India

Sub-principles:

9A. Incorporate safety in the design, operations and all other aspects of the entire urban transport system

Good design and adequate provision of street infrastructure helps substantially in making the urban environment safer and comfortable for pedestrians and cyclists. Operational changes, such as management of freight traffic, can also greatly enhance the safety of pedestrians and cyclists. Also, public awareness of street safety issues, in a formalized and structured manner, can help influence user behaviourbehavior and attitudes. Informing and educating motorists about priority of modes and right of way can also help ensure the safety of pedestrians and cyclists.

Figure 9.4: BRTS Corridor in Ahmedabad

Figure 9.5: Typical mandatory road signages

Figure 9.6: Along with CCTV warning it is also essential to have contact details of direct Help-Line

9B. Ensure safety and security of all public transport services and all of its users

Personal security while using public transport services plays an important role in the choice of travel mode for any trip undertaken. Depending on the location and time a variety of surveillance and security measures can be adopted. These measures should also ensure the safety and security of the physical property of all the public transport services and vehicles. This can help further enhance the perception of personal security for all the users of the public transport services.

Figure 9.7: Public safety and security is critical at public transports and thus should be displayed by a color and sign that is easily understandable

9C. Ensure a secure public realm that will encourage pedestrian movement, cyclists and commuters

Safety and security within the public realm plays a major role in choice of travel mode. Active frontages and mixed land uses can ensure natural surveillance but with limitations. Adequate lighting for vehicles and pedestrians can greatly help reduce street accidents. Surveillance through CCTV cameras can help keep a check on anti-social activities and help in enforcement of traffic rules and regulations. Emergency services and security alarms are necessary to address emergencies and help instil a sense of security in pedestrians, cyclists and commuters at all times of the day.

BEFORE

AFTER

Figure 9.8: Southbank Centre Redevelopment Masterplan, London

9D. Ensure that the City Traffic Authority takes a proactive approach toward inplementing, executing and educating the City Traffic guidelines and regulations, for Pedestrians, NMV and MV

Figure 9.9: 2010 BMW Children's Traffic Safety Education
traffic_education.html)

Figure 9.10: "Helmet and Traffic Safety Awareness Campaign"

It is evident that well framed guidelines and regulations for commuters, both public and private users are necessary but what is more important is to ensure that this set of regulations are implemented and followed by the end users. A proactive effort from the RTO and the local police departments is necessary, not only to monitor this regulations but also educate the commuters who break such regulations. The traditional approach of fining the user who breaks the laws is mandatory but what should also be practiced is to keep those records noted so that after repeating the error for next three times, his driver's license can be suspended.

Moreover most of the people learn driving and not the driving rules in their early teens under the guidance of their elders. The youth accounts to a major population of the country and it is necessary that these youngsters grow with better road users' knowledge. Graduated licensing programs is one such option to minimize this impact where the students have traffic education as a mandatory subject and are eligible for a driving license only after clearing this program with a satisfactory results.

Recommendations

9A. Incorporate safety in the design, operations and all other aspects of the entire urban transport system

1. Incorporate pedestrians' and cyclists' safety within the driver's instruction manual, driver's tests and licensing processes for all motorized vehicles

   Indicator - Percentage of drivers of all motorized vehicles trained and licensed in defensive driving

   Benchmark - 100%

   Monitoring - Comprehensive Mobility Audit

   Implementation - RTO and traffic police will implement through changes in drivers' licensing procedures and through street safety improvement / awareness programs

   Note: The RTO should not only issue a Driver's Manual but provide informal education to the motorists about how to share the road with bicyclists and pedestrians is integral to bicyclist and pedestrian safety.

9B. Ensure safety and security of all public transport services and all of its users

2. Provide Close Circuit TV (CCTV) camera coverage at all major public transport nodes

   Indicator - Percentage of major public transport nodes equipped with CCTV cameras

   Benchmark – Minimum 70%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA / UMTA will ensure this facility and the public transport agencies will implement it.

   Note: Apart from the use of technology for public safety, the strategies like Crime Prevention Through Environmental Design (CPTED) should be adopted. CPTED, is based on the idea that the proper design and effective use of the built environment can lead to a reduction in the incidence and fear of crime, and an improvement in the quality of life.

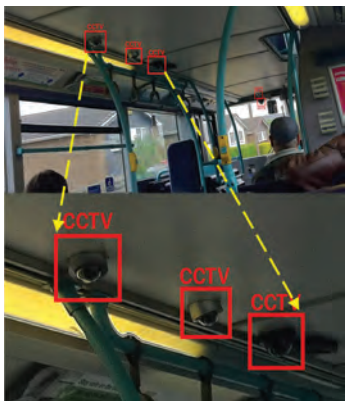


Figure 9.11: CCTV cameras in public transport vehicle

3. Provide CCTV cameras on all public transport vehicles such as buses, metro train etc.

   Implementation - Public transport agencies should implement this to ensure the safety and security of their public transport vehicles and its users.

4. Provide security alarms at all public transport stops, shelters, stations, terminals and on all public transport vehicles such as buses, metro train etc.

   Indicator - Percentage of public transport stops, stations, terminals, buses, trains equipped with security alarm system

   Benchmark - Minimum 90%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA / UMTA will ensure this facility and the public transport agencies will implement it.

5. Mandate dedicated women-only compartments, zones in all public transport vehicles (buses, trains etc.)

   Indicator - Percentage of public transport vehicles with dedicated women-only compartments or zones

   Benchmark - Minimum 90%

   Monitoring - Comprehensive Mobility Audit

   Implementation - ULB / UDA / UMTA will ensure this and the public transport agencies will be responsible for implementation

Figure 9.12: Women-only compartment, Mumbai local trains

6. Provide dedicated women-only public transport services for particular routes and times based on demand

   Implementation - ULB / UDA / UMTA should facilitate the provision of such services based on demand

7. Mandate security guards at all major public transport nodes at all hours of the day

   Implementation - ULB / UDA / UMTA should ensure this facility and the public transport agencies should be responsible for implementation

Figure 9.13: Dedicated women-only train, Delhi, India

9C. Ensure a secure public realm that will encourage pedestrian movement, cyclists and commuters

8. Provide adequate vehicular street lighting

   Indicator - Percentage of all vehicular streets, having 90 percent working street lights located at least one in every 20 m

   Benchmark - Minimum 100%

   Monitoring - Streets Audit

   Implementation - ULB / UDA will implement this through annual street maintenance programs

Figure 9.14: Vehicular Street lights, Ahmedabad

Figure 9.15: Pedestrian Street lights, USA

9. Provide adequate pedestrian street lights, (Minor streets and above in hierarchy) and on all NMT-only streets

Indicator - Percentage of all vehicular streets (Minor streets and above in hierarchy) and all NMT-only streets having 90 percent working street lights at least one in every 10 m

Benchmark - Minimum 100%

Monitoring - Streets Audit

Implementation - ULB / UDA will implement this through annual street maintenance programs

Note: Required Illumination levels for different types of roads:

- Arterial Roads: 30 Lux
- Pedestrian Crossings/ Intersections: 50 Lux
- Local Street: 10 Lux
- Foothpath/ Cycle Track: 20 Lux

(Source: MoUD, IUT, Design of urban roads, Code of Practice (Part1), 2012)

Figure 9.16: CCTV cameras at intersection

10. Provide CCTV cameras at all major intersections

Indicator - Percentage of total major intersections having functioning CCTV cameras

Benchmark - Minimum 80%

Monitoring - Streets Audit

Implementation - ULB / UDA will implement this advanced security system through street safety improvement programs

Figure 9.17: "ECO cab", on-call NMT service in Fazilka, India

11. Promote on-call Intermediate Public Transport service with call registration, registered meters and licensed drivers for all cities

Implementation - ULB / UDA / UMTA should be responsible for the implementation

12. Standardized street signage including street names, on all streets and intersections (Minor streets and above in hierarchy) to aid way-finding

Indicator - Percentage of number of streets / intersections (Minor streets and above in hierarchy) that have street signage including street name installed.

Benchmark - Minimum 70%

Monitoring - Streets Audit

Implementation - ULB / UDA / UMTA will implement this through street redevelopment programs

13. Ensure provision of on-call emergency services for all major BRT, Metro stations, outside of public transport nodes, at major destination like malls, cinema halls, hospitals etc.

Implementation - ULB/UDA should facilitate the implementation of such service

9D. Ensure that the City Traffic Authority takes a proactive approach toward inplementing, executing and educating the City Traffic guidelines and regulations, for Pedestrians, NMV and MV

14. Initiate Traffic Civic Awarness programs that is executed and implemented by UDA or ULB's at various locations.

Implementation - ULB/UDA should facilitate the implementation of such programs with the help of public transport agencies and NGO's.

Other recommendations:

- Initiate traffic education as a mandatory subject in the education system where the driver's license is issued only after satisfactory completion of that course.

Case Studies

i. Reduction in fatalities through improved design, New york, USA

Figure 9.18: Improved tunnel design to reduce fatalities, USA

Key Information

- Manhattan appears to be the most dangerous borough for pedestrians in New York City
- Fatalities in Manhattan borough
  - pedestrian fatalities - 47%
  - pedestrian severe injuries - 34%
- Fatalities on Intersections and Arterial streets
  - pedestrian crashes occurred at intersections - 74%
  - pedestrian crashes occurred on Arterial streets - 60%
- Action plan
  - USE 3E approach (Engineering, Enforcement and Education)

Over the past decade New York City has made tremendous progress in reducing its traffic fatalities. 2009 was in fact the safest year on record since the City began collecting data in 1910; annual traffic fatalities are down by 35 percent compared to 2001.

With the aim to reduce the pedestrian fatalities further and create a walk-able environment, the Department of Transport (DOT) along with the engagement with key agencies like New York City Police

Department (NYPD), New York City Health Department (DOHMH), and New York State Department of Motor Vehicles (DMV) formulated citywide strategies. The Action Plan mainly focused on vulnerable road users such as pedestrian, bicyclists and motorcyclists. Vulnerable road users accounted for 71% of New York City's traffic fatalities and pedestrians accounted for 52% of traffic fatalities from 2005-2009.

The borough of Manhattan appears to be the most dangerous borough for pedestrians in New York City, possessing the highest rate per 100,000 population of pedestrians killed or severely injured (KSI). 43% of pedestrians killed in Manhattan lived in another borough or outside of New York City. Within Manhattan, a disproportionate number of pedestrian crashes occurred on major two-way streets. Major two way streets (e.g. Canal, 14th, 125th, Park and Adam Clayton Powell) account for 47% of pedestrian fatalities and 34% of pedestrian severe injuries, but only 12% of the Manhattan street network.

Spots: Intersections, Arterial Streets, Bicycle Lanes

Intersections: In New York City, 74% of pedestrian KSI crashes occurred at intersections. The design of New York City's street infrastructure

is a likely explanation for this difference; small block sizes and grid patterns result in a high intersection density and encourage crossing at intersections.

Nearly half (47%) of pedestrian fatalities and severe injuries occurred at signalized intersections; surprisingly, most (57%) of these crashes occurred while the pedestrian was crossing with the signal. Although crashes are clustered at intersections, they are widely dispersed along dangerous streets.

Arterial Streets: Arterial streets account for 60% of pedestrian fatalities but only 15% of the road network. In addition, pedestrian KSI crashes on arterial streets are 2/3 more deadly than crashes on non-arterial streets.

In New York City, the densely populated activity (land-use) and wider, high volume - high speed designed roads (transport) play a vital role in pedestrian crashes. Wider roads and lanes in dense population results in increased speeding and diminished driver's awareness.

Moreover, serious pedestrian crashes are about two-thirds more deadly on major street corridors than on smaller local streets and 79% of crashes that kill or seriously injure pedestrians involve private automobiles as opposed to taxis, trucks and buses.

Bicycle lanes: Pedestrian KSI crashes on streets with bike lanes were 40% less deadly as crashes on other streets until DOT introduced the dramatic expansion of the bicycle network, building 200 miles of new bike lanes between 2006 and 2009. This expansion has not only increased safety and access for bicyclists, but has improved safety for pedestrians as well.

Time

40% of pedestrian KSI crashes occurred in the late afternoon/early evening. Late night pedestrian KSI crashes are nearly twice as deadly as other time periods. Nearly 20% more pedestrian KSI crashes occurred per month during the Winter holiday season.

The Action Plan

The Action Plan consists of highly targeted, data-driven policies and programs identified to have the highest impact on reducing pedestrian fatalities and severe injuries, while safely maintaining traffic operations. Using a three-pronged approach to road safety (Engineering, Enforcement and Education), these policies and programs will be vital tools in driving DOT to reach its strategic goal of reducing fatalities by 50% by 2030.

Engineering

Traffic engineering and road design have the most day-to-day impact on how we experience the streets of the city. DOT's engineering recommendations are focused on pedestrian safety, but also aim to increase safety and quality of life for all users of New York City's streets.

Figure 9.19: Manhattan Street - Before implementation

Figure 9.20: Manhattan Street - After implementation

Corridor & Intersection Ranking: To better identify, prioritize and evaluate projects

DOT will create a ranking system for both corridors and intersections, capable of assigning a percentile rank based on severity-weighted injuries (intersections) or severity-weighted injuries per mile (corridors). Locations will be compared with other locations in the same borough and citywide.

Using crash data from NYPD, New York State DOT/ DMV and NYCDOT, as well as geographic information from New York State DOT and the Department of City Planning, this system will allow planners to efficiently identify high-crash corridors, prioritize proposed projects based on crash data, and evaluate the effectiveness of projects after implementation.

High Crash Corridors: DOT will address minimum 60 miles per year

A minimum of 20 miles of these streets per year will be addressed by intensive safety redesigns. These projects would employ a full toolbox of design options, including pedestrian refuge islands, road diets, sidewalk extensions, pedestrian plazas, bicycle lanes, lane reconfigurations, signal timing modifications, countdown signals, markings, signage and parking regulation modifications.

Executed

Safe Streets for Seniors: Safe Streets for Seniors is a pedestrian safety initiative targeted at 25 neighborhoods with high densities of senior pedestrian crashes. Safety improvements were implemented in the first five pilot areas in 2008 and, as of July 2010, six areas have been completed and work is underway in ten additional areas. The remaining neighborhoods are currently under consultant study. Within the project areas, DOT has added crossing time at over 400 traffic signals, installed 25 pedestrian refuge islands and numerous curb extensions, median extensions, pedestrian ramps and LPIs.

ii. Women's only Local Trains - Mumbai, India

Figure 9.21: Ladies special train and compartment, Mumbai, India

Key Information

- Indian railways initiated program in Mumbai for local trains.
- Dedicated Ladies compartment
  - Up to 13 years age children allowed in compartment.
  - Women's compartments in express trains for long route trains
- Dedicated Ladies Special trains in Delhi and Mumbai
  - Special trains for women's
  - Nine compartment
  - Run twice in day
  - Trains available during morning and evening peak hours
  - Provide safety to female commuters.

As an initiative towards empowerment of women, Indian railway has been providing a special compartment for women in local trains of Mumbai.

Mumbai suburban railway has two different classes in local train for regular passengers. Similarly, for ladies, a second-class and first class compartment is available in each local train. (Women-only suburban special train, 2009)

Though these compartments are reserved exclusively for women, male children up to the age of 13 can travel in this compartment accompanied by a woman. Adult men are not allowed to travel, and may face a penalty or jail. Certain additional coaches also serve as women-only compartment during the day's peak hours. In such coaches, men are allowed between 11:15 pm – 6:30 am. (Timings of Ladies Special Trains in Mumbai, 2012)

A note near the doors of the compartments indicates the restrictions. The second class ladies only coaches are designated by green and yellow stripes. Similar stripes are located on the platform near the coach. First class ladies only compartment is designated by red and yellow stripes.

Additionally in Mumbai, Indian Railways has also initiated women's only trains to provide better safety and security. Central line has one train from CST (Chatrapati Shivaji terminus) to Kalyan Station in the evening once in day. The Mumbai local train also has connectivity on harbor line and western line between and these trains connect Panvel, Virar, Borivali, Bhayander to Church Gate twice, in a day (morning and evening). A women only compartment is also available in certain express/long distance trains in Indian railways. (Timings of Ladies Special Trains in Mumbai, 2012)

iii. Women's only taxi cab service - Mumbai, India

Key Information

- "For-She" - a call-a-cab facility for women only
- Service available in Delhi, Mumbai and Kolkata
- Charges
  - No extra rates charged for service
- Service provided
  - On call booking facility
  - All cabs connected through GPS
  - All cabs have GPRS facility
  - Martial art training help female drivers to handle worst condition

Figure 9.22: "For-She" Women's only cab, Mumbai, India

As an initiative towards safety and security of women, For-She Travels and Logistics Private limited (FTL) launched a call-a-cab service for women in the year 2008 in India. FTL is committed to train female drivers for

commercial driving and guarantees suitable earning opportunities for the women. A “For-She” cab shows a promising future in making travelling safer for women in Delhi and Mumbai region. This is the first fleet of taxis operated only by women.

The passengers are in safe hands as the drivers are not only well-trained in driving but also in martial arts. Thus, they are competent enough to meet any eventuality. It is anticipated that the number of the cabs will be increased as the demand of these cabs is witnessing a continuous growth. For-She cabs also provide on-call booking facility. Every cab kept under a thorough watch through a GPS system. The cabs also have a constant connectivity through GPRS, which facilitates the cab driver and passengers as well. (Taxi Service for Women)

All India Women’s Conference (AIWC) and OAIS, a private company; hold the credit of providing training to 20 women cab drivers each in the initial stages. (Taxi Service for women, 2009)

Principle 10. Freight

"Integrate freight planning with urban transport"

Sub-principles:

- *Plan and organize* ***freight movement*** *in the city*
- *Manage the delivery of goods within the city through a* ***appropriate mode and time restrictions***
- *Encourage* ***cleaner and safer modes*** *for transportation of goods within the city*
- *Encourage existing* ***non-motorized means of goods transport*** *within the city*

Principle 10. Freight

"Integrate freight planning with urban transport"

Although freight vehicles represent a small portion of total Vehicles Kilometers Travelled (VKT), they tend to impose large impacts on the traffic conditions (VTPI, Freight Transport Management, 2011). Planning and implementing a freight traffic management plan can have several benefits such as reduced congestion, cost savings on street maintenance, pollution reduction, increased safety for pedestrians and cyclists, among others.

In India, urban freight vehicle travel in total metropolitan vehicle travel is substantial with a 37% contribution (gtz, Sustainable Urban Freight in Asian Cities, 2012). Currently, there is no standardization of mode or type / size of vehicle for freight delivery in Indian cities. Usually heavy four-wheeler vehicles like truck and tempo, three-wheeler medium size tempos and NMT vehicles like hand carts, animal carts or cycle rickshaw trolleys are used to transfer the goods from one part of the city to another depending on the distance of commute, quantum of goods and cost

Figure 10.1: Unsafe pedestrian crossings

Figure 10.2: Unsafe pedestrian crossings

Figure 10.3: Unsafe pedestrian crossings

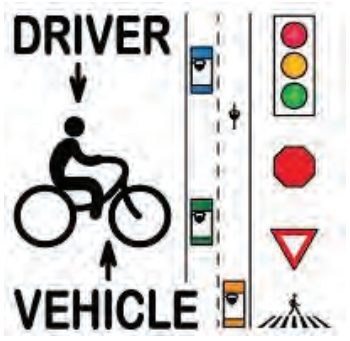


Figure 10.4: Unsafe pedestrian crossings

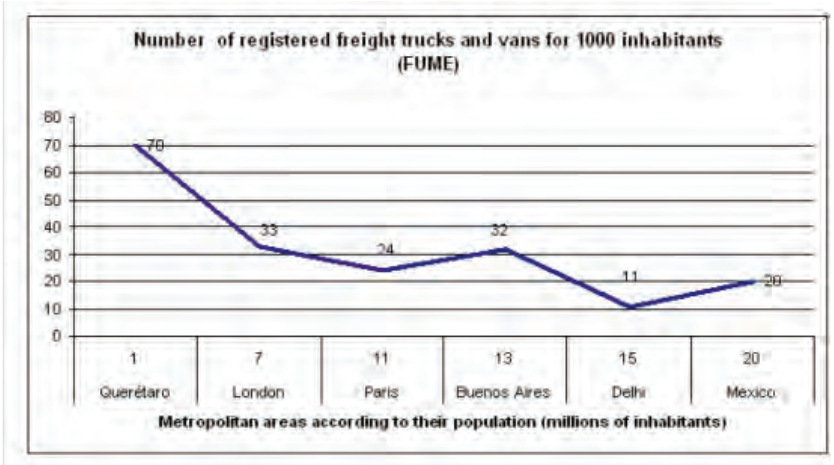


Figure 10.5: Freight Urban Mobile Equipment (FUME) and cities size

Apart from motorized modes of freight transport, non-motorized modes occupy significant proportion of the total freight travel. This is usually viewed unfavorably by many cities as non-motorized modes are slow and sometimes conflict with motorized passenger traffic. But more importantly, non-motorized modes of freight provide employment at the lowest rung of the skill ladder. Rickshaws, Hand carts, etc., are modes used by the unskilled workers and they provide a much needed service at very cheap rates. It is important to recognize this dual benefit of non-motorized freight transport while trying to address issues of last leg connectivity.

Solutions such as truck terminals and transport-nagars, while being popular, have failed to adequately address the conflict of large freight

vehicles with local urban traffic. Hence, there is a need to holistically address the issues of freight.

In Indian context, even the mobile vegetable and food vendors serve as an important last mile connectivity for freight. They not only transport goods essential to daily needs of a section of society, they also deliver it at source of demand. Hence, it is important to recognize the role of vendors in sustainable freight management of the city. While some vendors do encroach on scarce street space, if provided with appropriate safe road space to travel on, and dedicated space to sell their goods / services, vendors could significantly reduce the total motorized freight movement.

Unorganized and unregulated freight traffic on urban streets can lead to many problems. Restriction of heavy vehicle or by regulation delivery of goods through time management reduces traffic in the city. while restricting the movement of heavy & motorized freight vehicle through the city, non motorized vehicles such as hand cart & cycle rickshaws may be allowed to ply at all the times. This incentivizes their use during peak hours and reduces the percentage of freight by motorized vehicles

Sub-principles:

10A. Plan and organize freight movement in the city

Figure 10.6: Freight Urban Mobile Equipment (FUME) and cities size

Distribution of goods happens at different scales, from national, regional, city, and local levels. The movement of goods across these scales also happens through different modes such as air, ship, rail, roads and through different sized vehicles. It is therefore important to locate distribution centers for goods based on the scale of movement. The pattern of movement and delivery of goods in and around urban area has a big impact on traffic congestion and can adversely affect the urban environment in numerous ways. Better organization of this sector through a freight management plan can help mitigate the adverse effects. This plan can address issues regarding location of distribution centers, mode of transport, time restrictions, fuel consumption and technology, air and noise pollution, etc. For example, a regional distribution centre should ideally be located on the outskirts of the city in close proximity to regional transport infrastructure, while a local distribution centre can be located and distributed within the city, closer to the retail outlets.

Figure 10.7: Various signages to indicate Loading Zones as per specified timings

10B. Manage the delivery of goods within the city through appropriate mode and time restrictions

The movement of goods through the city has a negative impact on the urban environment. Larger goods vehicles can be difficult for pedestrians and cyclists to cope with. Speed of the delivery vehicles also has an impact on safety on urban streets. Regulations on delivery times, size of vehicles and speed can greatly improve urban environments.

10C. Encourage cleaner and safer modes for transportation of goods within the city

Delivery vehicles tend to cause a lot of noise and air pollution. Encouraging greener and cleaner technologies can help in mitigating pollution issues, and also increase efficiency of the vehicle itself. Every vehicle registered with the RTO should be PUC (Pollution Under Control) certified and the enforcement, implementation and monitoring should be done on a regular annual basis and not just when a commuter violates the traffic rules.

Fig 10.8: Eco-friendly urban cabs by FedEx

10D. Encourage existing non-motorized means of goods transport within the city

Around the world in many cities, last mile delivery of goods is done by using non-motorised or electric cycle or tricycle. In Indian cities, tricycle or trolleys are still used for the goods delivery for smaller distance. Insufficient and poor infrastructure is one the reason that NMT mode for freight delivery is not popular in Indian cities. In many parts of India, the postman's at Indian Post still uses bicycle as a mode of transport to deliver the post. Hence, rather than converting such existing sustainable non-motorised vehicles into motorized, it is in fact advisable to provide better infrastructure or modifying the efficiency NMT goods delivery vehicles which will encourage use of this mode for freight delivery in urban areas.

Fig 10.9: Postmen in India still use bicycle as the mode of transport for delivery

Recommendations

10A. Plan and organize freight movement in the city

Fig 10.10: London Freight management plan

1. Prepare and implement a freight management plan for the city

   Implementation – ULB / UDA / UMTA will implement this through the freight planning and management component of the Development plan/ Master plan/ City mobility plan

   Note - Applicable for cities with population more than 1 million

2. Locate regional distribution centres in close proximity to regional transport infrastructure

   Implementation - ULB / UDA / UMTA will implement this through the freight planning and management component of the Development plan/ Master plan/ City mobility plan

10B. Manage the delivery of goods within the city through appropriate mode and time restrictions

3. Encourage use of smaller delivery vehicles within the city

   Implementation - ULB / UDA / UMTA will implement this through the freight management plan

Fig 10.11: Use of smaller vehicles for goods delivery in Urban area, France

4. Regulate delivery times and size of motorized delivery vehicles on all urban streets

   Indicator - Percentage of urban area where delivery times are limited to off-peak hours.

   Benchmark - Minimum 60%

   Monitoring - Comprehensive Mobility Audit

   Implementation -ULB / UDA / Traffic police will implement this through traffic rules and guidelines

5. Set and enforce maximum speed limits for all delivery vehicles at all times within the city

   Implementation - ULB / UDA / Traffic police will implement this through traffic rules and guidelines

   Refer - “Street classification table” for details on speed limits

10C. Encourage cleaner and safer modes for transportation of goods within the city

6. Incentivize use of 'green' delivery vehicles (cleaner technologies, higher fuel efficiency and lower emissions) within the city

   Indicator - Percentage of delivery vehicles using CNG or equivalent technology driving within the city

   Benchmark - Minimum 50%

   Monitoring - Comprehensive Mobility Audit

   Implementation – ULB / UDA / UMTA will implement this through the freight management plan

10D. Encourage existing non-motorized means of goods transport within the city

7. Incentive use of NMT vehicle like hand-carts, cycle-rickshaw, trolleysfor last mile connectivty

   Implementation – ULB / UDA through Freight management plan.

Fig 10.12: Use of electric bicycle for goods delivery in core city area, France

Other recommendations:

- Cities with high amount of through freight traffic must have ring road/bypass road on periphery of the city to avoid through movement & conflict of freight vehicle

Case Studies

i. Entry restriction for freight delivery in urban areas - Boston, USA

Figure 10.13: Commercial parking for loading-unloading of goods, Boston

Key Information

- Commercial vehicle prohibited in busy downtown
- Boston transport department implements time regulation
- Timings
  - 11:00 am to 6:00 pm
  - Banned commercial vehicles from entry to downtown
  - 1,800 parking meters
  - Double the fines for peak hours violations

In an unregulated environment, many freight deliveries within urban areas occur during peak periods for passenger transportation. High volumes of delivery trucks during peak travel times can lead to roadway congestion, and the impact of delivery vehicles stopping in the travel lane is particularly disruptive during these times. Major contributor for congestion on major commercial corridors is double-parking. Double-parked vehicles reduce the capacity of the street. This can be particularly severe when double parking occurs during peak commuting hours in high commercial streets. (Parking management on major corridors, 2010)

The solution to this issue could be to limit freight deliveries to off-peak periods for passenger transportation. One of the alternatives is, by prohibiting entry of motorized delivery vehicles to the area, or other is to restrict loading and unloading while allowing for through-travel during peak hours.

Boston is one of the major cities in Massachusetts, which has adopted similar concept to regulate urban freight movement. The City of Boston has restricted commercial vehicles from using certain streets in its busy Downtown Crossing area between 11 AM and 6 PM. (Traffic rules and regulations city of Boston; Boston Transport Department, 2003)

Commercial vehicle operators may seek a permit to enter Downtown Crossing for short period for special circumstances, such as an emergency or a one-day event. Utility companies may enter at any time to respond to emergencies, and exceptions made for the US Postal Service and local newspapers after 2 PM. Often delivery vehicles also end up occupying on-street parking spaces. To regulate parking better, BTD has installed 1800 parking meters on different location. In addition, most of parking meters are in operation between 8:00 am to 8:00 pm. BDT also raised the parking fines any double the fines for peak hour's violations for on street parking.(Off-Street Loading Guidelines; 2006)

ii. Comprehensive Freight Plan & Non motorized vehicles for delivery of goods – Paris, France

Key Information

- Electrical tricycle use since 2003
- ***La Petite Reine*** provide electric cycle and is responsible for freight delivery.
- City provides space for goods consolidation near city center.
- Delivery Vehicle
  - Vehicle used for last mile delivery
  - Electric motor operated
  - Up to 100kg goods hauling capacity
  - Express delivery inner city area
  - 20 electric vehicles
  - Approximately 7,00,000 parcels per year delivered

Figure 10.14: Electric tricycle for freight delivery in Paris, France

The City of Paris has understood the importance of proper freight planning. Total freight movement passing through Paris is about 32 million tonnes per year, including 1 million by rail, 2.5 million by waterway. Of this, commercial flow accounts for 40% of total at 1.6 million movements per week, consumer flow another 50% of total and other (waste/removals etc) is 10%. (Wisetjindawat, Wisinee, 2010)

Freight also consumes 25% of total transport energy, 50% of diesel consumption and is responsible for 60% of particulate emissions. Thus in order to enhance freight operations while minimizing its harmful impacts, the city of Paris prepared a comprehensive freight plan. One of the components of this plan was to promote distribution of goods through non-motorized means. (Taniguchi, Eiichi; Imanishi, Yoshi, 2008)

Figure 10.15: Use of bicycle for freight transport

The city of Paris has experimented with freight deliveries using electric tricycles in since 2003. A private company called La Petite Reine uses this mode to make deliveries. The city has provided a consolidation area near the center of Paris. The Company provides consolidation and last-mile delivery services, focusing on food products, flowers, and small parcel. In addition to store and business deliveries, parcel deliveries are made directly to customer's homes. (Wisetjindawat, Wisinee, 2010)

Delivery vehicles are tricycles assisted by an electric motor. The maximum delivery weight is 100 kg. The project began as a trial, but is considered a success and has been implemented permanently. It has also expanded from four designated central areas to all of Paris. Similarly FedEx Corporation has initiated an electric, non-carbon emitting tricycle for goods delivery in Paris. (Better Market Street: Existing Conditions & Best Practices, Part Two: Best Practices, 2011)

Part 3: Implementation

Chapter 1. Implementation tools

1.1. Introduction

To achieve the goals outlined for sustainable urban transport in India, robust tools need to be specified for implementation. In the existing policy purview, there is inadequate emphasis on implementability.

For implementation of standards for Sustainable Urban Transport, the following tools are required:-

1. **Audits:** To evaluate the existing conditions and monitor progress.

2. **Comprehensive Planning:** Needs to consider several aspects to enhance livability of the area through coordinated improvements in transport, physical and social infrastructure at region, city and local level

3. **Programs:** For implementing the guidelines and standards.

4. **Institutional Structure that supports sustainable transport planning:** For implementing the standards, channeling the funding and overseeing programs and audits

5. **Supportive economic framework:** For providing a framework of funding for urban transport sector's programs and projects

Implementation tools may be programmatic, regulatory, economic or informational activities or measures. While some may be applicable at the local level, others may be needed at state or national level.

1.2 Audits

Most cities in India do not have adequate information regarding urban transport within their cities. The information, even if it exists, is frequently piecemeal and outdated. Hence, it is our recommendation that cities initiate the process of planning for sustainable urban transport by first finding out the state of urban transport within their area. This can be done through the audits proposed below. Once improvements have been made, the audits will also help serve as a monitoring tool to ensure positive development in urban transport sector initiatives.

In order to promote transparent and fair audits, using support from third-party agencies to implement the audits would go a long way. This will help bring the required transparency and accountability.

The Ministry of Urban Development has initiated work in this direction through introduction of a Service Level Benchmarking exercise (Service Level Benchmarks for Urban Transport at a Glance). This exercise was envisaged for cities participating in the JnNURM. Systems for collection of data, monitoring and institutional responsibilities have also been outlined. However, developing cities may need to address several challenges to

create performance management systems. Therefore, it would be a better idea to start with performance evaluation, develop requisite ways of monitoring, make improvements and then move towards creating a benchmarking system. (Measuring public transport performance, GIZ, 2011)

Alongside, the Institute of Urban Transport (IUT), has taken steps towards improved data collection and management systems for the urban transport sector. Building requisite capacity for these activities is also being given serious thought.

To add to MoUD's initiatives, annual audits, as envisaged in this report, are necessary. These audits are related to all Principles of Sustainable Urban Transport detailed in Part 2 of this report.

Urban Local Bodies and other city level parastatal agencies should develop systems for measuring, reporting and monitoring data for urban transport systems. A third party evaluation audit will then be requested for, by the local authorities. Moreover, experts and professionals in urban transportation need to be included in the audit committees to strengthen the evaluation mechanism. The audits will also have to recognize the overall master plans of the city's growth.

However, given the current scenario, the local authorities may outsource the collection of data along with its evaluation to a third party. Also, to start with, a sample audit may be conducted on an annual basis whereas the results could be published once in five years owing to implementation constraints.

Ministry of Urban development has carried out several initiatives to facilitate ULBs and states in urban transport capacity building. The Guidelines and Toolkits for Urban Transport Development have been prepared by a Technical Assistance on Urban Transport Strategy funded by the Asian Development Bank for the Ministry of Urban Development (MoUD), Government of India. These documents are designed to help decision makers and practitioners in states and municipal governments who are concerned with urban transport development in medium-sized cities in India. The city authorities can refer to the various checklists prepared to evaluate an existing proposal or study. (For further details refer to sti-india-uttoolkit.adb.org)

Similarly, the urban local bodies can refer to PPP toolkit for improving PPP decision making processes prepared for Ministry of Finance, Govt. of India under a non-lending technical assistance co-financed by AusAID through the South Asia Region Infrastructure for Growth Initiative, Public-Private Infrastructure Advisory Facility (PPIAF) and the World Bank. It comprises various checklists and templates to evaluate a proposal or project. (For further details refer to http://toolkit.pppinindia.com/)

1.2.1. Streets Audit

The streets audit is envisaged as a metropolitan area /city level audit. The purpose of this audit is to help understand the state of street infrastructure in the city. The audit will attempt to examine all aspects of street infrastructure and assess them quantitatively and qualitatively. This will need significant effort in the beginning but eventually it could be done more effortlessly as it get enmeshed within the existing processes of city staff. This audit may be carried out annually or biannually based on the capacity and resources available with the city authorities.

Monitoring of standards and specifications related to the Principles of Sustainable Urban Transport, as outlined in Part 2 of this report.

Main components envisaged in this audit are:-

1. Measure availability and quality of pedestrian infrastructure.

1A.1 Percentage of streets (categories minor street and above) in the city that are designed and developed as per city/state street design guidelines OR national street standards by IRC / MOUD

1A.2 Percentage of streets having unobstructed pedestrian pathway of minimum standards

1A.3 Percentage of total length of all arterials and major streets that have 5 crossings or more for every km of street.

2. Measure availability and adequacy provisions related to safety and comfort for pedestrians.

1B.4 Percentage of un-signalized crossings on streets where one way carriageway is more than 9m or two way carriageway is more than 12m, with safe refuges for pedestrians and cyclists.

1B.5 Percentage of total number of signalized intersections that have dedicated pedestrian and cyclist phase

1B.6 Percentage of total number of signalized intersections that have dedicated pedestrian and cyclist phase

1B.9 Percentage length of all pedestrian pathways with universal access design considerations AND Percentage of all pedestrian crossings that are universally accessible AND Percentage of all intersections with universal access design considerations

1B.10 Percentage of total length of pedestrian pathway that has tree plantation or shading structures

1B.11 Percentage of total length of urban streets (Major streets and above in hierarchy) that have at least 30 benches per km on both sides of the streets

1B.12 Percentage of total length of urban streets (Minor streets and above in hierarchy) that have at least 30 dustbins per km on both sides of the streets

3. Measure availability and quality of cycle infrastructure.

2A.1 Percentage of total length of major arterials that have designated cycle lanes as per minimum standards

2A.2 Percentage of total length of all arterials and major streets that have 5 crossings or more for every km of street.

4. Measure availability and adequacy provisions related to safety and comfort for cyclists.

2B.5 % of signalized intersections with bicycle boxes

2B.6 % of un-signalised crossings with safe refuge for cyclists (where one way carriageway is > 7m or two way carriageway is > 12m)

5. Measure service parameters of public transport services in terms of pedestrian access.

3A.6 Percentage of all streets within 400m of public transport nodes which have minimum 1.8m wide continuous unobstructed pedestrian pathway

6. Monitor streets are developed as complete streets.

1A.1 and 4B.2 Percentage of streets (categories minor street and above) in the city that are designed and developed as per city/state street design guidelines OR national street standards by IRC / MOUD

7. Monitor availability of dense street network.

4C.4 Percentage of length of major arterials (ROW>40m) with service / access lanes.

8. Measure availability and adequacy of pedestrian access corridors as per standards.

4D.6 Length of new pedestrian access corridors created should be equal to the length of new vehicular streets created

9. Monitor availability of public realm to encourage pedestrian movement, cyclist and commuters.

9C.8 Percentage of all vehicular streets, having 90 percent working street lights located at least one in every 20 m

9C.9 Percentage of all vehicular streets (Minor streets and above in hierarchy) and all NMT-only streets having 90 percent working street lights at least one in every 10 m

9C.10 Percentage of total major intersections having functioning CCTV cameras

9C.12 Percentage of number of streets / intersections (Minor streets and above in hierarchy) that have street signage including street name installed.

1.2.2. Development Audit

The development audit is also envisaged as a metropolitan area / city level audit. The purpose of this audit is to understand the attributes of private and public development as it happens every year. City / Development Authority may have to modify the forms they use currently for purpose of issuing building / occupancy permits if it has to undertake this study without spending much effort. This audit may be carried out annually or biannually based on the capacity and resources available with the city authorities.

This audit will help monitor standards and specifications related to the Principles of Sustainable Urban Transport, as outlined in Part 2 of this report. Main components envisaged in this audit are:-

Monitoring of standards and specifications related to:-

1. Measure adequacy and relevance of the implemented standards related to encouraging pedestrian-friendly building access.

1C.13 Percentage of all buildings that have primary pedestrian access from a primary street

1C.14 Percentage of total plots (excluding Institutional uses) on arterial streets with no front margin / front margin without fencing or compound wall

1C.15 Percentage of total plots (excluding Institutional uses) on arterial streets without parking within the front margin space.

2. Monitor total parking facilities for cycle parking

2A.3 Percentage of total parking facilities (public / private) which have priority parking space for 50 cycles within 10 M of its entry / exit

3. Measure service parameters of public transport services in terms of adequate frequency and possibilities of maximum direct routes, as per standards.

3A.5 Percentage of new public buildings planned that are within 400m walking distance of public transport stations.

5. Monitor the availability and effectiveness in implementation of guidelines related to aligning density in cities.

5A.1 Percentage of mass rapid transit station areas where FSI has been increased.

6. Monitor the appropriateness in implementation of guidelines related to mix of uses around mass rapid transit nodes.

5B.2 Percentage of new developments and / or redevelopments with mixed use

7. Monitor availability of affordable housing as per guidelines.

5C.3 Percentage of mass rapid transit stations with affordable housing units equivalent of 20% of the built space within the influence zone (400m)

8. Monitor appropriateness in implementation of guidelines related to aligning land use to transport infrastructure.

5D.4 Percentage of major intersections with traffic intensive uses within 300m distance

9. Measure increase in reuse and infill of existing developed urbanized land.

6A.1 Percentage of total length of existing and proposed corridors with increase in FSI

6A.3 Percentage of vacant and underutilized land getting redeveloped per year

6A.4 Percentage of agricultural land claimed for development will be an indicator.

10. Monitor zoning of new development areas.

6A.5 Proportion of development potential in newly developed area v/s development potential of existing areas.

Development potential can be calculated as:

- For newly developed areas (X) :
  (Total Plot Area x allowable FSI)
- For existing areas (Y):
  (Total Plot Area x allowable FSI) – (Existing Built-Up Area)

Y should be greater than X.

6B.6 Percentage of total area opened for development (that is adjoining existing developed areas)

1.2.3. Comprehensive Mobility Audit

The Comprehensive Mobility Audit is envisaged as a thorough and comprehensive version of the current Comprehensive Traffic and Transportation Studies that are being undertaken by some cities. The purpose of this audit is to measure and understand the state of public transport mobility and other aspects such as parking etc. within the city through its impact on mobility. This audit should be carried out once every five years to monitor the progress of initiatives undertaken by local authorities.

This audit will cover the entire metropolitan area and all mobility-related aspects, not just traffic aspects. Its main components are:-

1. Measure availability and quality of infrastructure for cyclists.

2A.4 Percentage of urban area in cities > 1 million population with an active modern cycle sharing system implemented

3. Measure coordination of bicycle facilities with public transport

2C.7 % of public transport nodes with cycle rickshaw stands for minimum 5 cycles

2C.8 Percentage of major public transport nodes (stations and above) with secure & weather protected cycle parking facilities

2C.9 Percentage of major public transport nodes (stations and above in hierarchy) and important destinations with cycle sharing facilities

4. Measure provision of support facilities for NMT & IPT rickshaw drivers

2D.11 Percentage of urban area where there is one such facility (drinking water & public toilet) every sq.km.

5. Measure service parameters of public transport services in terms of adequate frequency and possibilities of maximum direct routes, as per standards.

3A.1 Percentage of urbanized area within 400m walking distance of public transport nodes (Only regulated IPT stops and routes may be included)

3A.2 Percentage of urbanized area within 400m walking distance of public transport nodes

3A.4 Percentage of all new development (that depend on high intensity of users) proposed in the metropolitan area that is within 800m of a public transport node or has provided a shuttle service linking with a public transport node.

6. Measure reliability and comfort of Public Transport services.

3C.8 Percentage of times that the public transport service falls behind schedule

3C.9 Percentage of trips that have breakdowns / route deviation

3C.10 Percentage of peak hour trips where numbers of passengers exceed the designed capacity of vehicle

3C.11 Percentage of public transport buses that adhere to Urban Bus Specifications

7. Measure efforts towards inter-modal integration.

3D.12 Percentage of rapid transit stations with other public transport feeder service stations within 50 m level walk from station exit, where routes of the two services are intersecting or overlapping.

3D.13 Percentage of rapid transit stations (where atleast two routes are overalpping or intersecting) with IPT stand within 50m of the entrance / exit of the station.

3D.14 Percentage of major public transport stations with Intermediate Public Transport Stand located within 150m (2 min) level walk from station entrance / exit

3D.15 Percentage of major public transport stations where vehicular drop-off area is located away from the main pedestrian entrances / exits

3D.16 Percentage of fringe area public transport stations / public transport terminals providing car parking within walking distance (less than 400m) but not adjacent to the station (more than 150 m).

3D.17 Percentage of public transport nodes (including all public transport modes such as MRT, BRTS, buses etc) with electronic integrated fare collection.

3D.18 Percentage of multi- modal rapid transit nodes (BRTS, MRT) where routes are intersecting or overlapping, with seamless transfers through weather protected area.

8. Monitor restrictions on block sizes.

4C.3 Percentage of urban area with minimum 50 intersections per sq km. OR Percentage of the urban area where distance between adjacent street intersections (not traffic intersections) is less than or equal to 150m

4C.5 Percentage of cul-de-sacs that are less than 100m or have a pedestrian-cyclist connection at the dead end

9. Monitor availability of on-street parking space provision and parking space usage.

7A.1 Length of paid on-street parking (on Major streets and above) compared to overall length of all formal on-street parking (on Major streets and above)

7A.2 Percentage of paid and organized on street parking in CBD

7A.3 Length of regulated on-street parking (on Minor and Local streets) compared to overall length of all formal on-street parking (on Minor and Local streets)

10. Measure effectiveness of congestion reduction methods through change in mode share.

8A.1 Percentage of modal share of private motorized vehicles in CBD areas.

11. Measure the increase in use of greener vehicles.

8B.2 Percentage of vehicles that have implemented this rating system.

8B.3 Percentage of public transport / Intermediate Public Transport vehicles using CNG or equivalent technology driving within the city

8B.4 Percentage of CNG & alternate fuel pumping stations compared to the total number of fuel stations within the city

12. Measure increase in share of private and semi-private shared transit services

8C.5 Percentage of total trips through car pool

13. Measure implementation of public participation and consultation initiatives

8E.7 Percentage of projects that have such public consultation (minimum of 3 public consultation meetings at the beginning, mid-point and final design stage of the project for every large infrastructure improvement project (of more than 100 crore rupees))

8E.8 Percentage of projects that have such an allocation (minimum 3 percent of the budget for large infrastructure improvement projects (more than 100 crore rupees))

14. Measure accessibility and adequacy of information

8G.10 Whether such a system (Integrated Information Systems for coordinating the different modes of public transport) has been implemented or not

8G.11 Percentage of public transport nodes that have implemented such services

8G.12 Percentage of public transport nodes (including bus stops) with information on transit routes and service frequency

8G.13 Percentage of public transport nodes (bus shelters and above) with Passenger Information System

8G.14 Percentage of public transport nodes (bus shelters and above) with Intermediate Public Transport information

15. Measure adequacy of safety-related aspects and extent of their implementation.

9A.1 Percentage of drivers of all motorized vehicles trained and licensed in defensive driving

9B.2 Percentage of major public transport nodes equipped with CCTV cameras

9B.4 Percentage of public transport stops, stations, terminals, buses, trains equipped with security alarm system

9B.5 Percentage of public transport vehicles with dedicated women-only compartments or zones

16. Monitor location of freight distribution center at all scales.

10B.4 Percentage of urban streets where delivery times are limited to off-peak hours.

17. Measure the extent to which incentives for using ‘greener‘ fuel technology freight vehicles has worked.

10C.6 Percentage of delivery vehicles using CNG or equivalent technology driving within the city

Specifically for Urban Transport, few implementation tools are listed in the following sub-sections. These tools talk about specific programs and localized policies necessary for integration of land use and urban transport planning.

1.3 Comprehensive Mobility Plan

Most cities / urban areas are required to prepare a development / master plan for their jurisdiction according to the town planning act of the particular state. However, development plans/master plans – for the most part – are narrowly focused on planning for land uses and development control regulations (Development Control Rules) in order to facilitate growth of new areas. So far, very few development plans have focused on the integration of land use and transportation planning.

In order to benefit from incentives and funding through JnNURM, it was mandatory for cities to undertake a comprehensive mobility plan (CMP); which a number of cities have completed. Critique of the existing set of CMPs include no integration with overall vision for the city, no integrated approach to land use planning, minimal emphasis on addressing the needs of non-motorized modes of travel etc.

Hence, there is a clear and immediate need for cities to prepare mobility plans (either stand alone OR as part of a larger level comprehensive planning effort), which are integrated with the overall vision and the land use policies being framed for the city. This will help cities better plan their resources to help alleviate transport problems in this intense phase of urbanization. These plans may include areas within and/or outside the city and may have special focus on certain areas that need more detailed analysis / proposals.

1.3.1 Proposed Structure for Comprehensive Mobility Plan

This plan should address and include detailed strategies and components such as :

i) Vision, goal, Objective, Strategy

ii) Scope

iii) Existing urban transport environment

- Review of land use pattern
- Existing transport infrastructure

- Public transport system
- Urban Goods movement/ Freight
- Traffic safety and enforcement
- Institutional and financial situation
- Environment and social situation

iv) Transport demand surveys

v) Development of Urban land use and transport - plans, proposals and strategies

- Land use-transportation integration
- Transit oriented development through station area planning
- Public transport improvement Plan
- Street design and street classification system
- Development of complete streets network
  - Network improvement
  - Pedestrian network and NMT improvement Plan
  - Dedicated bicycle network plan
- Parking management plan
- Freight movement plan
- Intermodal facilities
- Signage and way finding

vi) Implementation programs

- Redevelopment of existing urban areas
- Local area plans
- Street Redevelopment Program

vii) Capacity building

viii) Roles and Responsibilities of various departments

ix) Financing options[1]

The planning process should include Public Participation at least 2 stages,

1) Visioning and Issues Identification stage, and

2) Review of Proposals Stage.

The planning should be based on integrated modeling to have an objective way of assessing and evaluating the proposals and their impacts against the goals.

[1] Refer Comprehensive Mobility Plans (CMPs) : Preparation toolkit, ADB and MoUD

The planning process and monitored data should be transparently available to public via web site and other means. The planning department (within the city/ Urban Development Authority) should have a consistent and uniform mandate, constitution and authority. The city / designated authority should co-ordinate with all sub-agencies within the urban area for preparation of the CMP. Based on the 74th Amendment Act, 1998, ward and village level planning should be encouraged at the grass roots level to participate in such planning exercises. Transport plans of each urban local body should be completely consonant with master plans / development plans or any other such statutory plans.

The city / designated authority must ensure that there is no conflict between plans at any of these levels. The Urban Transport Plan should be reviewed, monitored and updated at regular intervals of 5 years (or earlier).

1.3.2 Critical elements of the Comprehensive Mobility Plan

The overall composition of the Comprehensive Mobility Plan has been outlined above. Specifically for Urban Transport, few implementation tools are listed in the following sub-sections. These tools talk about specific programs and localized policies necessary for integration of land use and urban transport planning.

a. Transit Oriented Development through Station Area Planning Program

This is a local area planning tool to address the need for public transport-oriented development or Transit Oriented Development (RECONNECTING AMERICA, Centre for Transit –Oriented Development, 2007). Station Area Planning Programs should be used for implementation of spatial plans and urban transport networks around public transport stations.

Figure 1.1: Transit Oriented district

Growth around Public Transport stations should create symbiosis between land use and availability of high capacity public transport. Each station area plan may cover a “pedshed”, or walking distance, of 400 m radius or an administrative ward. Like the town planning scheme mechanism, the station area plans should be a statutory provision to • Land use changes

- Circulation and connectivity improvements in street network
- Mandatory provision of affordable housing
- TOD – supportive parking policies

The Urban Local Body and the ward level planning cell should work on creating each station area planning program. Each station area should be defined and mapped based on the stipulated radius of 400m walking distance from the station exit. Under this program, guidelines should be

set for all development control regulations for the station areas. Decisions about the permitted land uses and densities should be made based on the specific needs of each station area in each city.

b. Station Design

Station design is a part of the actual design of Public Transport system. However, the city may recommend guidelines and standards regarding access and integration with surrounding areas / other modes of local transport. This could be defined as a sub-set to the station area planning program or as standalone station design guidelines. The public transport agency will be responsible for design of station areas.

c. Street Classification & Complete Street Network

It is important to recognize and classify streets based on the functional requirements and to cater to all modes of motorized as well as non-motorized transport. To ensure design of complete streets, each city will have to classify its urban streets, as a first step. Principle 4 in Part 2 of this document outlines a matrix Street Classification including various elements and their dimensions / specifications. The Indian Roads Congress (IRC) has identified similar categories of streets and the above classification is aligned with that overall classification. IRC recognizes that urban streets will need to be designed based on the specific conditions of urban areas (IRC 86 – 1988 and IRC 103:2012). Hence, for urban areas, street classification should follow the needs of the city.

The street classification system used here should be based on character and context of a street rather than simply depending on the ROW width. For example, a relatively narrow street may be an important spine with significant urban activities and connecting important areas in different parts of the city. It would be a mistake to identify such street as a 'collector' or 'local' street under conventional ROW width based systems.

In addition to ROW widths, the classification system considers parameters such as length of the street, what does it connects, land use characteristics etc. It is proposed that any future work regarding the road/ street network must be based on this street classification system and the relevant guidelines provided for them.

Once a comprehensive street classification is complete, the city needs to develop the complete streets network. This means identifying missing pieces of the overall network and developing those streets as per the classification system identified above. The city also needs to upgraded based on a long term Street Redevelopment Program.

d. Pedestrian Network and NMT Plan

Improving pedestrian infrastructure in Indian cities requires dedicated focus and attention on part of city officials. Hence, in order to implement pedestrian and NMT improvements effectively, it is recommended to prepare Pedestrian Network and NMT Plan as a part of CMP (or separately) which would integrate pedestrian and NMT requirements of the city. Below are some of the major elements our streets need to incorporate to develop / create pedestrian & NMT friendly environment.

- Continuous, obstruction free, well paved walking surfaces of along both sides of the streets.
- Clear 2 m clear sidewalk
- Tree covered well streetscape with well designed street furniture and other elements.
- Clearly defined, safe pedestrian crossing at intersections and appropriate locations.
- Active street frontages to create safe environment
- Small block sizes to allow better pedestrian connectivity in perpendicular direction with surrounding neighbourhoods.

In order to create a pedestrian friendly city with walkable streets and neighbourhoods, these elements must be incorporated in design of all urban roads to be constructed in future.

e. Bicycle Network Plan

In order to improve the level of bicycle us in our cities as safe and sustainable means of urban transport, it is essential to connect public transit nodes, industrial areas, educational institutions and parks and open spaces with the continuous, safe and efficient network of bicycle friendly streets. Hence, it is recommended to prepare 'Bicycle network plan' as a part of CMP (or separately) that identifies a network of streets to be developed as bicycle priority streets for the city. The plan shall identify appropriate types of bicycle lanes on various street types. The bicycle network shall comprise all types of bicycle lanes such as

- Dedicated Bicycle Lanes
- Demarcated bicycle Lanes
- Shared Lanes on bicycle priority streets

Bicycle plan shall identify guidelines and standards for designing these lanes and facilities. Also it will identify important locations for various bicycle facilities such as bicycle parking at transit stations, parks and gardens, major shopping centers, major public institutions, education institutions.

f. Local Parking Plan and Management Policy

Each metropolitan area should implement a parking policy. The policy should follow the recommended standards and guidelines for Sustainable Urban Transport, as outlined in Part 2, Principle 7 (Influence private vehicle usage through parking).

A parking management plan needs to be prepared and parking zones identified around major parking generators such as prime commercial streets, local business districts, transit station areas, informal market areas, and would typically include streets of surrounding residential areas that are likely impacted by spill-over parking and related issues.

To improve management of parking, some modifications will be needed in Development Control Rules also. Suggesting these changes should form part of the local parking policy. Management of and compliance with this local parking policy should be out sourced to the private sector. This will help aid setting of charges based on market demand and collection of charges. Charges thus generated will help fund parking management.

Figure 1.2: Parking management plan

g. Freight movement plan

Each metropolitan area should conduct a review of urban goods terminals, markets; regulation, and practices relating to heavy goods vehicles, transporting hazardous goods movement, such as petroleum products. It also comprises aspects such as travel demand management, safety, strategic fright network of freight routes for the city etc.

h. Signage and way finding

Wayfinding is the methodology of arranging indicators to guide people to find their destinations. Signages are tools that aid in way finding. There are various types of signages like written, graphical, textured, map, pictorial, audio, video etc. Consistency of colour, size, height, etc would be critical for a successful signage program.. The importance for designing and planning for way finding is not yet fully realized in Indian context. Looking at the present scenario of signages in the Indian cities, it is recommended to prepare and implement a 'Comprehensive Signage & Wayfinding Plan' as a part of CMP for wayfinding. This plan could be implemented using public private partnership (PPP), by providing advertising rights as a tool to implement and maintain the signage system.

i. Funding of CMP

Currently, funding for creation of pedestrian, cyclist and NMT infrastructure is completely neglected. It is recommended that JNNURM programme

to include NMT infrastructure projects and facilitate development of infrastructure through dedicated funds for the same. (Also recommended in Twelfth Five year plan – Urban development as well). For Pedestrian, NMV, streetscaping, the funding may be provisioned as 50% by GoI and 50% by State Govt./ ULB/ Parastatal where as introduction of Public Bicycle Scheme and upgradation of cycle rickshaws needs to be done through 100% funding by GoI.([Recommendations of Working Group on Urban Transport for 12th Five Year Plan] Operation and maintenance can be done through public private partnership.

As discussed earlier, audits would play an important role to evaluate the existing conditions and monitor progress of the urban transport initiatives undertaken. However, one of the primary constraints which the city authorities are facing is lack of funds.

1.3.3 Implementation programs

a. Program for Redevelopment of Existing Urban Areas

Promotion of compact development, densification along public transport networks and strong disincentives for sprawl are important for achieving sustainable urban transport. Each metropolitan area should ensure that its spatial planning is in line with Sustainable Urban Transport principles. One of the key components for this is the appropriate and timely redevelopment of existing urbanized land. This can be achieved through localized programs for promoting redevelopment of existing areas. Also, special Vacant Land Cell needs to be formed in each city which would primarily focus on development and better utilization of vacant lands. Programs that are time-bound and have clear orientation and objectives should be created by the MPCs or Urban Development Authorities as part of the Comprehensive Urban Transport plans.

b. Local area Plans

A Local Area Plan is a micro level planning tool that will help implement the City's vision at local area level taking into account the needs of the existing ward/ neighborhood or any area within the city. The objective including improvement in overall mobility, pedestrian accessibility, public transportation, gardens, open space, amenities, infrastructure and enhancement of overall neighborhood character, so that the city can be better equipped to accommodate future growth in a sustainable and livable manner.

A typical Local Area Plan shall include:

1. Study of exiting areas, its built form, development character and activity

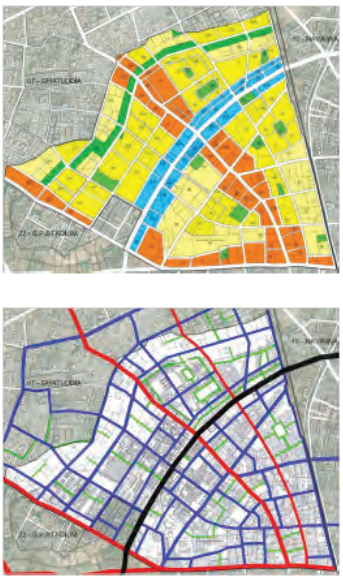


Figure 1.3: Local Area plan

patterns

2. Specific proposals and recommendations for improvements of
   i. Streets network and public transportation infrastructure
   ii. Parks, Gardens, Plazas and public spaces
   iii. Physical infrastructure
      - Sewerage
      - Solid waste
      - Storm water
      - Street light
3. Social infrastructure
      - Schools
      - Health centers/ clinics
      - Vendor spaces
      - Public toilets
      - Libraries
      - Fire stations
      - Fitness centers
      - Sports facilities

A Local Area Plan will include detailed assessment of existing conditions and involve local stakeholders to derive various proposals and recommendations. It will recommend various improvements in infrastructure and amenities based on the established standards and guidelines (such as identified in the Development Plan, UDPFI etc).

Local Area Plans can be commenced by the Urban Area Development authority or Municipal Corporations with help of experts and professionals. A local Area Planning Committee should be formulated that will guide and oversee the preparation and implementation of the plan. The Area Planning Committee may comprise an urban planning official, a city engineer, an architect, a locally elected official, prominent local residents who are familiar with the planning area and understand the local needs. In the planning process, it should also involve and take inputs from various stakeholders such as the local community; land owners, NGOs, developers etc. The development authority or municipal corporation may also hire professional teams to help with preparing and implementing the plan.

Delhi has adopted local area planning through preparation of zonal development plans. Till now, 14 zonal development plans have been prepared.

c. Street Redevelopment Program

It is essential for the cities to initiate Street Development Program to develop complete streets that enables safe and comfortable travel for users of all modes including walking, cycling and public transport; and for people of all ages and abilities. These streets need to be developed so as to provide dedicated space for all activities or zones like pedestrian movement, cycle tracks, parking space, commercial and informal activities, plantation and landscape, street furniture and lighting and also regulates traffic flow. These streets also integrate utilities and infrastructure in the design to allow for seamless construction and ease of maintenance.

ULBs/UDAs need to undertake the program in a staged manner. The program needs to be initiated by identifying various existing streets that need to be redeveloped and prioritizing them. Some of the streets then need to be taken up for redevelopment on a pilot basis to assess the success. Also, Street Design Manual needs to be prepared to standardize street design details which will further assist the technical team of UDA/ ULB in implementation.

1.4 Capacity building

Urban transport professionals are generally not employed by city agencies or the State Government leading to lack of planning skills in the urban development authority / local authorities. Capacity Building program is therefore crucial for creating public acceptance and demand for sustainable mobility and livable cities, changing established values and strengthen outreach and capacity. (Ministry of Urban Development, 2009).

Capacity building includes several activities – Education, training, knowledge creation and dissemination. Training of city officials needs to be taken up through leaders program for in service officers and young leaders program for the post graduates and other young professionals. Training programs for city officials and other stakeholders would enable them to undertake small planning assignments and to supervise and monitor the work of the consultant.

Since capacity building would involve some additional time, the city authorities can also take assistance or work in collaboration with Technical experts of the field.

As an overview, capacity building programs should be aimed at:-

1. Reorientation of regulations

2. Reorientation of administrative framework

3. Technical and Institutional capacity

   a. Reorientation of academic curriculum to reflect the subject of urban

transport along with land use –transport integration.

b. Facilitate specialized courses in urban planning for City engineers, town planning officers, etc

c. Skill-building programs for existing professionals in the field.

d. Experience-sharing platforms

e. Pilot and demonstration projects

4. Support for training and orientation programs for:

a. Non-state actors and other stakeholders

b. Media

5. Safety –

a. Capacity building city engineers, town planners, safety auditor, traffic police (every year: Minimum 5 officers must be trained for road safety in each million plus city.

b. Training programs initiated must include special programs for traffic safety.

To implement the above mentioned steps for capacity building, the city authorities can avail funding assistance from the Capacity Building Scheme for Urban Transport launched by the MoUD, with a fund requirement of 99 Crore between 2009 and 2014 (Ministry of Urban Development, 2009). A major component is Training (for strategic decision makers, technical staff, operators, etc.) covering various areas such as sensitization, institutional development, financing and cost and benefit analysis, demand assessment, urban transport planning, modal integration, environment issues implementation, operations and traffic management. The total number of trainees proposed to be covered over a five year period is 2,500.

In addition, there is a centrally sponsored scheme for urban transport planning. Under this scheme, the MoUD has been assisting Cities to prepare Comprehensive Mobility Plan, launch awareness campaign on sustainable urban transportation and develop projects under Clean Development Mechanism through funding 80% of the project cost. For preparation of Detailed Project Reports in Urban Transport, assistance upto 50% for the project cost is provided. In addition, Training of Trainers and Practitioners has been taken up.

Also, Institute for Urban Transport (IUT) a professional body set up under the purview of the Ministry of Urban Development Government carries out several capacity building initiatives on behalf of the MoUD. The city authorities can avail assistance from IUT in carrying out training programs in several subjects related to urban transport.

Similarly, Centers of Excellence in Urban Transport set up by MOUD is a resource centre for education, research and training in planning and management of urban transport. The centers carry out numerous training, seminars and workshops for professionals, city authorities, state

government organizations as well as other agencies related to urban transport.

Better communication mechanisms and dissemination of knowledge about best practices among ULBs can help improve their performance. The Peer Experience and Reflective Learning (PEARL) initiative led by the National Institute of Urban Affairs (NIUA) is one such attempt by the Ministry of Urban Development. The Vibrant Governance programme implemented in a number of states is another example of a training programme to help government officials understand the priorities of governance and the importance of their role in it. (Report on Indian Urban Infrastructure and Services, 2009-2010)

Apart from the above initiatives taken in the country, several bi-lateral and multi-lateral development agencies have evinced a keen interest in the urban sector. Projects are being implemented with the of the World Bank, Asian Development Bank, Japanese International Cooperation Agency, Department for International Development (DFID) and recently the AFD (French Agency for Development). Most of these projects contain a Capacity Building component which may include provision of consultants, exposure visits, establishment of third party monitoring agencies, project implementation units and specific training programs focusing on the project of interest implemented by them.

In states like Andhra Pradesh (APUSP- DFID), Karnataka (KSUDP - ADB), Kerala (KSUDPADB), Tamil Nadu (TNUDP - WB), Rajasthan (RUIDP- ADB), Madhya Pradesh due to implementation of major urban development projects funded by the multi- lateral agencies focusing on Urban Local bodies it was contingent on the local bodies to build training and capacity building programs as part of the project implementation. This has led to perceptible improvements in institutional capacity. (Report of the Working Group on Capacity Building for the Twelfth Plan)

1.5 Roles and responsibilities

According to the Indian Constitution, Urban Transport is a State Subject. Thus, implementation of the recommendations of this report falls under the State's roles and responsibilities. However, urban local bodies have been assigned some of the responsibilities of Urban Transport through the respective Municipal act. This has further been reinforced by the 74th Constitutional Amendment (and the twelfth Schedule, which outlines power, authority and responsibility of Urban Local Bodies). Effective implementation of Sustainable Urban Transport needs to be taken up by corresponding agencies and departments within the municipal administration.

Role of the Urban Local Body

Currently, the Urban Local Body (ULB) has several powers and functions

defined in The Bombay Provincial Municipal Corporations Act, 1949 related to urban transport such as:

- Construction and regular maintenance of streets
- Construction of street improvement projects such as flyovers, bridges, underpasses etc.
- Providing street lights
- Provision and Maintenance of Transport Undertaking (for running bus service).

Under the Bombay Provisional Municipal Corporation (BPMC) Act, there is provision of creating a Transport Committee. According to the act, this transport committee would be in-charge of the transport undertaking, but if organized appropriately, this Transport committee could be tasked with all aspects of urban transport within the powers of the city. BPMC Act also identifies a Transport Manager who would be responsible for overseeing the affairs of the Transport undertaking (like a bus service etc). This role could also be expanded to include other aspects of urban transport within the transport managers' purview. For, those cities not having this provision, the Municipal Commissioner can use his discretionary powers to appoint such as committee.

For facilitating funding for transport initiatives, NUTP propose the creation of an Urban Transport Fund. This can go a long way in ensuring financial viability of various urban transport improvements.

To make cycling a popular and well accepted mode of transportation in India and to provide safe pedestrian and cycle infrastructure, a dedicated NMT cell should be created within each municipality/municipal corporation. This will help ensure that the needs of the most vulnerable users of streets – pedestrians and nmt users – are not marginalized in the planning and implementation of new improvements for urban transport.

The city buses and BRTS would need to be brought under a city specific SPV instead of the present system of their management being done by State Transport Undertakings (as is the case in many states).

Together, the above improvements will help bring a more focused approach to urban transport at the city level and will help improve conditions for end users of all modes of transport.

The municipal entities need to be strengthened as local governments with 'own' sources of revenue, predictable formula-based transfers from state governments, and other transfers from the Government of India and state governments to help them discharge the larger responsibilities assigned to them by the 74th Constitutional Amendment. Improved tax revenues combined with rational user charges will enable cities to leverage their own resources to incur debt and also access new forms of financing through public private partnership (PPP). (The High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, 2012)

Important recommendations given by HPEC are

- ULB should have functional autonomy, i.e. functions of local governments vis-à-vis state governments, and their entities must be unambiguous
- ULB should have financial autonomy and be required to be financially viable, i.e. local finances, including own revenue and inter-governmental transfers, must match local requirements and should be accompanied by the necessary autonomy to expend these resources;
- local functionaries must be competent to discharge the local functions effectively, i.e. an ongoing process of training and dissemination of knowledge must be built into the system of governance, functional outcomes, including authority for approving and disbursing moneys for approved projects, must match the finances allotted within a framework of transparency, accountability, and community participation; and
- social accountability must be ensured

The HPEC Committee strongly recommends the setting up of an independent Urban Utility Regulator whose responsibility will be to ensure that service standards are met and that user charges cover costs within a framework which is spelt out in a transparent manner.

Role of Urban Development Authority

In order to facilitate planned growth of cities and urban areas, most states have set up Urban Development Authorities through either a State Town Planning Act or a special Urban Development Authority Act. In most cases, Urban Development Authority is required to work in close collaboration with the municipal authority which lie within its jurisdiction. The role of Urban Development Authorities is primarily to plan for the new developing areas, provide planned framework of streets and other infrastructure, etc. UDAs in different parts of the country use different mechanisms for implementing their plans. One of the more popular means of doing this is through development of Townships.

Township Model

Here, the UDA acquires the agricultural land surrounding the city and then redevelops this land (either by themselves or in partnership with private developers) and sells developed properties to end users. This model has faced many challenges in the past and though it continues to remain popular with Development Authorities (and States) it does not provide for original land owners to benefit from the development process (as most of the upgraded land value accrues to the UDA/developer).

Town Planning Scheme Model

An alternate approach to this is the Town Planning Scheme model. This is a statutory process of land pooling - land readjustment process where the land belonging to a number of different land owners is pooled. A certain percentage of total land is deducted for provision of various streets, common services and other amenities. The remaining land is returned back to the original owners. Since this land is now urban land with provision of services etc, its value is much higher than the original agricultural land. Original land owners

benefit from this increase in value and hence this is a more equitable process of land development. This has been successfully used in Gujarat for a long time and is coming back as a statutory process in many other states.

In certain states, UDA is also responsible for provision / management of public transport at regional level. There are proposals for setting up of Unified Metropolitan Transport Authority (UMTA) in various urban areas. If successful, these can be established either at the same level or in conjunction with the structure of existing UDAs. This will help build institutional strength at the regional / metropolitan level and also help address both Development and Transport issues hand in hand. See section on UMTA for further details

Role and Responsibilities of State

To support and facilitate the ULB/UDA in implementing urban transport initiatives State Government will need to support the city in many ways.

1. State can help update / create appropriate legislation to empower ULB / UDA with responsibility related to Urban Transport.
2. Without adequate staffing and capacity, ULB will not be able to fulfil their responsibilities. Hence, State may also need to support with technical support through state level urban transport organizations until such time that cities have adequate capacity of their own.
3. State may need to set up appropriate review processes and procedures to ensure that cities are implementing urban transport policies and initiatives with intended results.
4. Without appropriate financial support many cities' plans will remain on paper. Hence, strong financial support program from the state will help cities address issues of urban transport within their jurisdiction in a comprehensive manner.
5. A Road Transport Safety Board can be set up at State level in each State to deal with urban transport safety issues in a comprehensive, scientific and a systematic manner.

Roles and Responsibilities of Central Government

Through JNNURM and other similar programs the Central Government has and may continue to plan a crucial role in driving the agenda for sustainable urban transport forward.

1.6 Financing Urban Transport

Despite being a major contributor to economic value generation in urban areas, urban transport has not received serious consideration. Financing urban transportation requirements needs to be taken-up as a priority (PricewaterhouseCoopers Pvt. Ltd., 2008).

Urban transport financial resources should be pooled within an urban transport fund. This fund should be administered by a strategic transport authority at the city or metropolitan level.

Currently, one of the important source of finance is petrol cess and/ or congestion charges. This is considered to be a progressive charge. This can also be called environmental tax based on polluter pays principle.

On all the existing vehicles an annual green cess has been proposed at the rate of three percent of the insured value of the personalized vehicles. For the ease of collection the annual cess will be collected through insurance companies along with the annual insurance premium. The Urban Transport Tax or Cess has been proposed on Purchase of New Cars and Two Wheelers assumed at the level of 7.5% of the total cost of the vehicles.

Many cities across the world following congestion charging such as Singapore, London. In India, congestion charges are being planned to be imposed in the CBD area of Ahmedabad by the local urban development authority.

Instruments for capturing value from proximate and indirect users would be under the jurisdiction of Urban Local Bodies through imposition and collection of taxes or levies. Such revenues should be earmarked for use in

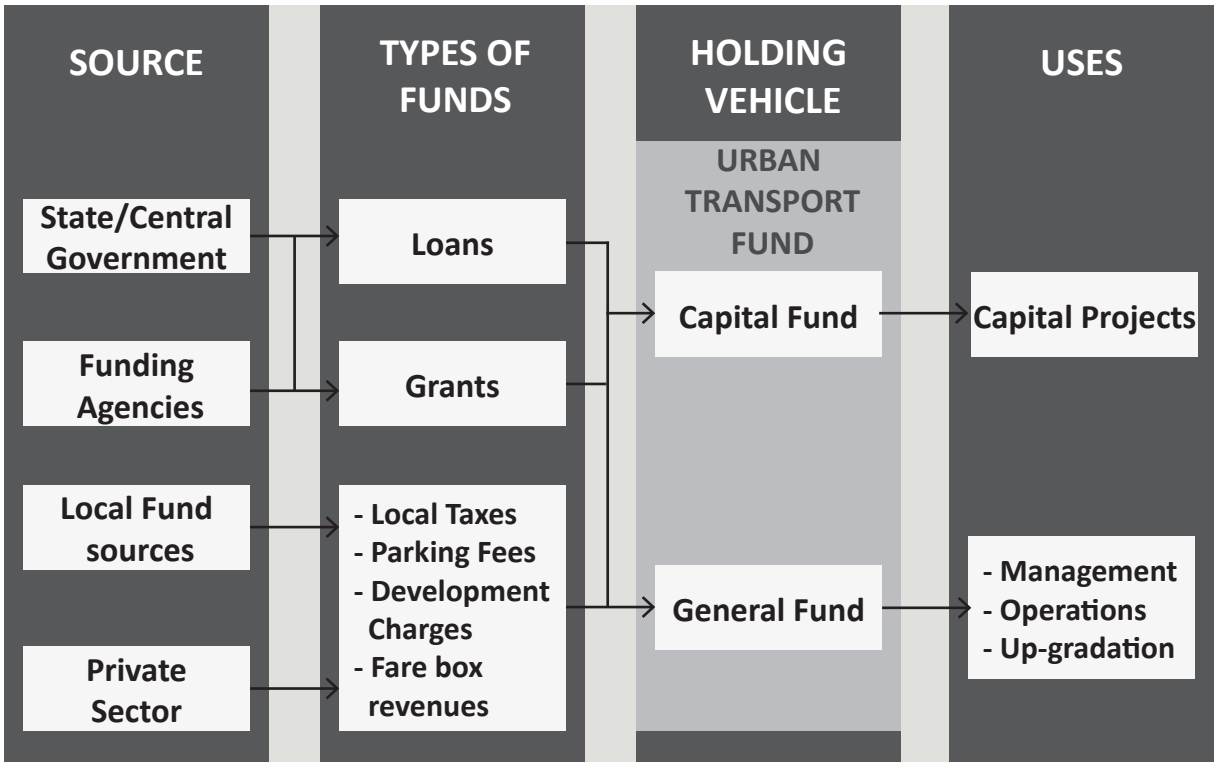


Figure 1.4: Sources and Uses of the Urban Transport Fund

urban transportation related projects. For this, it may be necessary to ring-fence these revenues from the consolidated fund of state governments and Urban Local Bodies (PricewaterhouseCoopers Pvt. Ltd., 2008).

Cities across the world have used four key funding sources:-

1. Land Monetization

2. Property tax and user charges

3. Debt and support from Government

4. PPP

Public institutions need to develop innovative instruments that capture value from indirect and proximity beneficiaries so that urban transportation projects do not excessively rely on real-estate development for financing. A policy on budgetary allocations, user charges and tapping other source of funds based on taxation of non-user beneficiaries, land development and vehicle taxation should be provided to the city. Intergovernmental transfers should normally be made to the fund and should be structured in such a way as to avoid distorting the efficient allocation of resources within the transport sector at the local level.

Domestic debt should be facilitated with Government Guarantee and interest subsidy to the SPV. Also, public transport should be exempted from taxes. Private sector financing for transport infrastructure should be raised through competitive tendering of concessions that may be supported by public contributions as long as these have been subject to proper cost benefit analysis. When allocating funds to urban transport, the relationship between transport policy and other sector policies, in particular housing, should be borne in mind.

Financing of pedestrian and cyclist infrastructure should be through a combination of funding from Govt. of India, State Govt./urban local body, development agencies, property development, loan from domestic and financial institutions as well as PPP.

UT Authority in city can control all funds related to capital cost of UT projects as well as operational subsidies, if any. Resource generation policy could be formulated after detailed study

A city/State-level development fund could be set up through proceeds accruing to ULBs from innovative sources like land monetization and other land based instruments should be pooled into a 'ring fenced' city development fund and then used only for urban infrastructure projects and projects for providing shelters to the urban poor in respective cities and not for any other purpose.

In view of the capital intensity of transport projects, it is suggested that the fund may have two parts—

(i) Fund marked for urban transport projects and

(ii) fund for other infrastructure and shelter related projects.

To start with, such funds may be created in metropolitan cities. To meet

the demands of smaller ULBs, each State should set up a State Financial Intermediary, on the lines of Tamil Nadu Urban Development Fund (TNUDF), which can then pool funding requirements of the ULBs in the State and provide economies of scale. (Twelfth Five Year Plan)

ULBs can utilize the option of leveraging Municipal Bonds including Pooled Financing to raise funds. For example, Ahmedabad Municipal corporation had come up with Rs 1000 million worth municipal bonds in 1998. It was a sort of a landmark as it is the first instrument to be issued without a state gurantee. The proceeds of these bonds were utilized to fund the city's water supply and sewerage project.

Further, ULBs to exclusively levy property tax, profession tax, entertainment tax and advertisement tax and retain the whole of their proceeds (hereinafter referred to as 'exclusive taxes').

1.7 Unified Metropolitan Transport Authority

Ministry of Urban Development has mooted the idea of a Unified Metropolitan Transport Authority (UMTA) to coordinate urban transport and related issues in cities over 1 million in population. While this is a significant development that could help integrate efforts and agencies working on urban transport issues, lack of adequate powers, financing and clarity of role has resulted in very different understanding of UMTA in different states. In certain cases where UMTA has been set up through executive order, it has been able to serve the needs of the urban areas (and state, case of DULT Karnataka), while in certain other places where it has been set up as a coordinating committee, it has failed to be effective.

Regardless of what the future holds for UMTA in various states, cities already have adequate authority (statutorily) to be able to improve urban transport within their jurisdiction. They can further enhance this by working collaboratively with the Urban Development department at the State level. With appropriate leadership and willingness at the city level, cities can make a huge difference to the state of urban transport without relying too

Recommendations of Isher Ahluwalia Committee on Financial Devolution to ULBs

- Insert a 'Local Bodies Finance List' (LBFL) along the lines of the Union and State Lists
- Empower ULBs to exclusively levy property tax, profession tax, entertainment tax and advertisement tax and retain the whole of their proceeds (hereinafter referred to as 'exclusive taxes'). In case States continue to levy and collect profession tax or entertainment tax, then the entire revenues, net of collection cost, should be passed on to the ULBs
- Constitutionally ensure sharing of a pre-specified percentage of revenues from all taxes on goods and services (including motor vehicle tax and stamp duty) which are levied by States to enable ULBs to meet their functional responsibilities assigned to them by the 74th Amendment (hereinafter collectively referred to as 'revenue-shared taxes')
- Provide for formula-based sharing of the divisible pool with the ULBs and also grants-in-aid to ULBs from the divisible pool for bridging, wherever necessary, horizontal fiscal imbalance.

much on UMTA if it does not exist or if it is not effective.

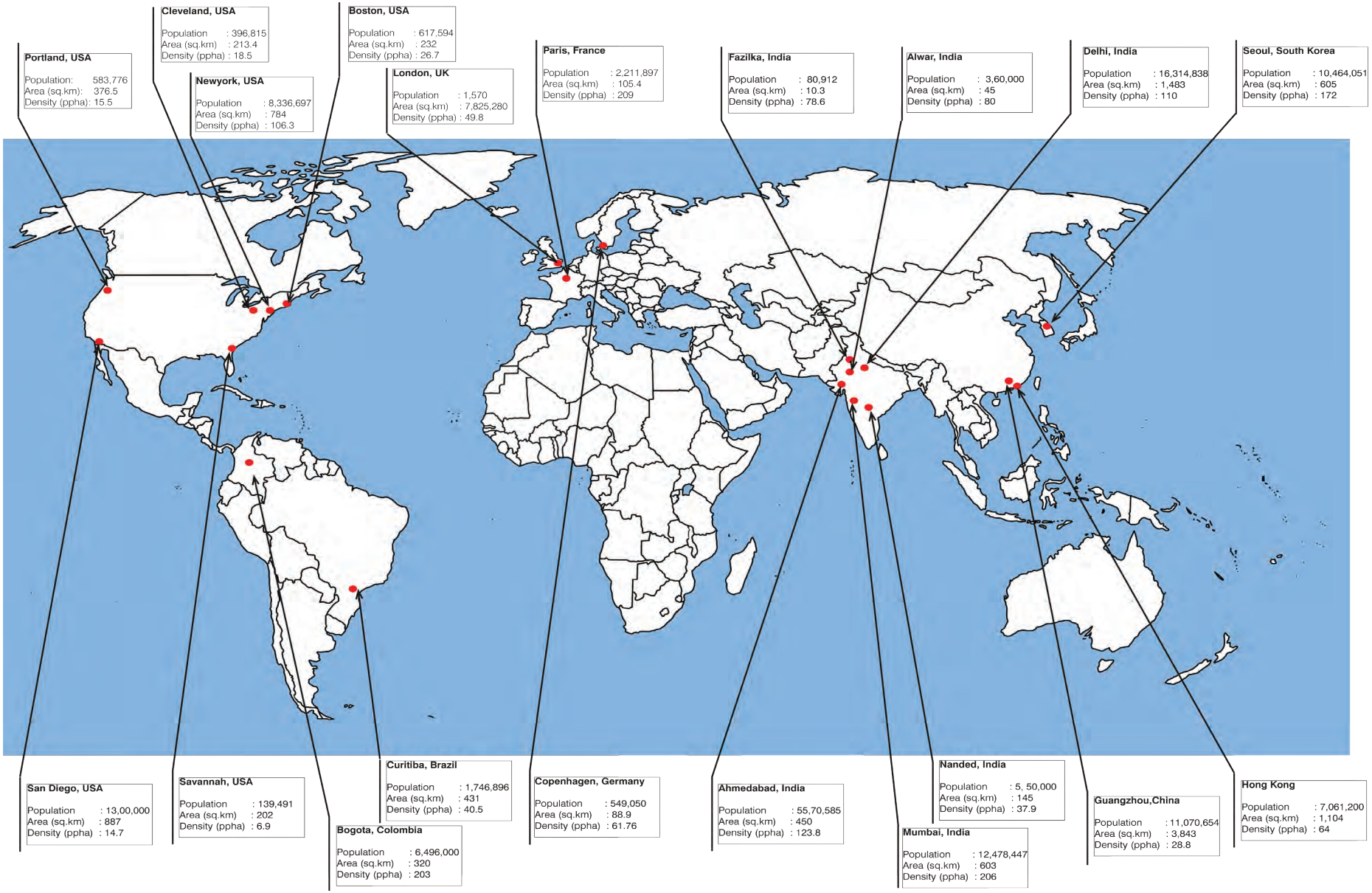
1.8 Implementation of 74th Amendment

According to the 74th Constitutional Amendment Act, 1992, there is a mandatory provision for constituting a Metropolitan Planning Committee (MPC) in all metropolitan areas (urban areas having population greater than 1 million). A number of these metropolitan areas have existing metropolitan/urban development authorities. These authorities could serve as technical / secretarial assistants to MPC in the disbursement of their roles and duties etc.

According to the act, the Metropolitan Planning Committee shall be responsible for preparing development plans for the metro area and coordination of plans prepared by urban local bodies and panchayats of the area. MPC shall also be responsible for allocation of resources and phasing and prioritization of development works within its jurisdiction.

Despite the fact that this act has been in effect for the past 20 years, very few metropolitan areas have actually constituted functional Metropolitan Planning Committees. Devolution of planning power to the metropolitan level and ward level has not yet happened. The tiered structure of decision making as outlined above provides for people at the village / ward level to have a role in the planning and implementation of development works, while at the metropolitan level and above, the agencies are responsible for facilitation and technical advice.

According to the act, MPC should include/integrate existing Urban / Metropolitan Development Authorities as technician support and advisory to the committee. Heads of the Urban Development Authority (UDA) and the Unified Metropolitan Transport Authority (UMTA) shall be members of the MPC. The MPC shall be responsible for co-ordinating the functions of the Urban Development Authority and the UMTA. In the hierarchy, UMTA shall be placed parallel to the Urban Development Authority. This will promote integration between spatial planning and urban transport.


Portland, USA
Population: 583,776
Area (sq.km): 376.5
Density (ppha): 15.5
Cleveland, USA
Population : 396,815
Area (sq.km) : 213.4
Density (ppha) : 18.5
Newyork, USA
Population : 8,336,697
Area (sq.km) : 784
Density (ppha) : 106.3
Boston, USA
Population : 617,594
Area (sq.km) : 232
Density (ppha) : 26.7
London, UK
Population : 1,570
Area (sq.km) : 7,825,280
Density (ppha) : 49.8
Paris, France
Population : 2,211,897
Area (sq.km) : 105.4
Density (ppha) : 209
Fazilka, India
Population : 80,912
Area (sq.km) : 10.3
Density (ppha) : 78.6
Alwar, India
Population : 3,60,000
Area (sq.km) : 45
Density (ppha) : 80
Delhi, India
Population : 16,314,838
Area (sq.km) : 1,483
Density (ppha) : 110
Seoul, South Korea
Population : 10,464,051
Area (sq.km) : 605
Density (ppha) : 172
San Diego, USA
Population : 13,00,000
Area (sq.km) : 887
Density (ppha) : 14.7
Savannah, USA
Population : 139,491
Area (sq.km) : 202
Density (ppha) : 6.9
Curitiba, Brazil
Population : 1,746,896
Area (sq.km) : 431
Density (ppha) : 40.5
Bogota, Colombia
Population : 6,496,000
Area (sq.km) : 320
Density (ppha) : 203
Copenhagen, Germany
Population : 549,050
Area (sq.km) : 88.9
Density (ppha) : 61.76
Ahmedabad, India
Population : 55,70,585
Area (sq.km) : 450
Density (ppha) : 123.8
Nanded, India
Population : 5, 50,000
Area (sq.km) : 145
Density (ppha) : 37.9
Mumbai, India
Population : 12,478,447
Area (sq.km) : 603
Density (ppha) : 206
Guangzhou,China
Population : 11,070,654
Area (sq.km) : 3,843
Density (ppha) : 28.8
Hong Kong
Population : 7,061,200
Area (sq.km) : 1,104
Density (ppha) : 64

Abbreviations

ADB	Asian Development Bank
BMLTA	Bangalore Metropolitan Land Transport Authority
BMTA	Bangkok Mass Transit Authority
BRTS	Bus Rapid Transit System
CAG	Comptroller and Auditor General
CBD	Central Business District
CCTV	Close circuit Television
CNG	Compressed Natural Gas
CPCB	Central Pollution Control Board
CPWD	Central Public Works Department
CSE	Centre for Science and Environment
CTTS	Comprehensive Traffic and Transportation Study
DCR	Development Control Rules
FSI	Floor Space Index
FOB	Foot Over Bridge
GDP	Gross Domestic Product
GHG	Greenhouse Gases
IPT	Intermediate Public Transport
IRC	Indian Roads Congress
ITDP	Institute for Transport and Development Policy
ITS	Intelligent Transport Systems
IUT	Institute of Urban Transport
LMV	Light Motor Vehicle
LRTS	Light Rail Transit System
LTA	Land Transport Authority, Singapore
MMRDA	Mumbai Metropolitan Region Development Authority
MoPNG	Ministry of Petroleum and Natural Gas
MoRTH	Ministry of Road transport and Highways
MoUD	Ministry of Urban Development
MPC	Metropolitan Planning Committee
MPV	Multi purpose Vehicle
MRTS	Mass Rapid Transit System
MTW	Motorized Two Wheelers

MVV	Münchner Verkehrs- und Tarifverbund, MVV (Munich Transport and Tariff Association)
NGO	Non Governmental Organization
NMT	Non Motorized Transport
NTDPC	National Transport Development Policy Committee
NUTP	National Urban Transport Policy
NYCTA	New York City Transit Authority
PWD	Public Works Department
RTO	Regional Transport Office
SPCB	State Pollution Control Board
SPV	Special Purpose Vehicle
SRTC	State Road Transport Corporation
STP	Syndicat des Transports Parisiens (the Paris transport authority)
SUV	Sport Utility Vehicle
TCPO	Town and Country Planning Organization
TD	Transport Department, Hong Kong
TERI	The Energy and Resources Institute
TOD	Transit Oriented Development
UD	Urban Development
UDA	Urban Development Authority
ULB	Urban local body
UMMTA	Unified Mumbai Metropolitan Transport Authority
UMTA	Unified Metropolitan Transport Authority
UTTIPEC	Unified Traffic and Transport Infrastructure (Planning and Engineering) Centre
VKT	Vehicle Kilometers Travelled
VTPI	Victoria Transport Policy Institute

Definitions

Affordable housing	Housing that is subsidized and predominantly aimed at lower income groups
Core area	Areas immediately surrounding the CBDs of the city
Fringe area	Areas on the periphery of the city limits
Floor Space Index	The ratio of the combined gross floor area of all floors including areas of all walls and columns except areas specifically exempted under these Regulations, to the total area of the building unit.
Intermediate Public Transport (IPT) service	Intermediate Public Transport service includes modes of travel such as taxis, rickshaws etc. that are privately owned but operate for public use
Major intersection	Street intersection of any two arterials (major and minor included)
Major public transport node	Public transport nodes that fall within the “Stations” and “Rapid transit stop” categories of the public transport node classification system
Mass rapid transit station area	Area within 400m walking distance from a metro station (mass rapid transit)
New development	Development on a piece of land that was previously vacant
NMT mode	Non-motorized transport mode includes all modes of travel that is powered by human and / or animal energy. These include walking, cycling, cycle rickshaws, cycle carts, bullock carts, etc.
Redevelopment	Development on a piece of land that was previously occupied by buildings
Right of way	Area within the public domain for streets between property edges on either side
Road	Street that focuses predominantly on transportation
Station Area Plan	Development plan or proposal for areas within 400m walking distance from a public transport station
Street	Any public right of way that accommodates non-motorized and motorized modes of transport and facilitates public interaction
Urban block	Area of urbanized land surrounded on all sides by streets (vehicular and / or pedestrian streets) and / or physical break such as railway line, river etc.
Urbanized area	Areas of the city that have been developed for any land use other than agricultural land use

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PART 3

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