PLANNING FOR PEDESTRIAN-ORIENTED CITIES IN INDIA: A CASE OF CHENNAI CITY

A DISSERTATION

Submitted in partial fulfillment of the requirements for the award of the degree of

MASTER OF URBAN AND RURAL PLANNING

By

ARUNA VENKATRAMAN

DEPARTMENT OF ARCHITECTURE AND PLANNING
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
ROORKEE - 247 667 (INDIA)

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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in this thesis entitled **"PLANNING FOR PEDESTRIAN-ORIENTED CITIES – A CASE OF CHENNAI CITY"** in partial fulfillment of the requirement of the award of the Degree of Master of Urban and Rural Planning submitted in the Department of Architecture and Planning, Indian Institute of Technology, Roorkee, is an authentic record of my own work carried out during the period of July 2010 to June 2011 under the supervision of R. Shankar, Professor, Department of Architecture and Planning, Indian Institute of Technology, Roorkee.

The matter embodied in the thesis has not submitted by me for the award of any other degree.

Dated: 29 June 2011

Place: Roorkee

(ARUNA VENKATRAMAN)

This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

(R. SHANKAR)

Professor

Department of Architecture and Planning

Indian Institute of Technology, Roorkee

Roorkee – 247667

Uttarakhand, India

Dated: 29 June 2011

Place: Roorkee

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EXECUTIVE SUMMARY

Walking is one of the most simplest and basic modes of transport in a city. Almost every individual walks at some point of time in his or her journey. Walking has numerous health benefits, environmental benefits, economic benefits, transportation benefits and social benefits, because of which people must be encouraged to walk. Creating an attractive and a safe pedestrian environment is a key to developing more livable and walkable communities.

With the advent of industrialization and motorization, the urban street scene had become chaotic. The city streets were choked with an explosion of automobiles and private motor traffic. Traffic congestion and environmental pollution had worsened the public realm of the urban space. In conjunction to the urban problems, there was a revolution to control the motorcar movement and create more space for pedestrians, which dawned in early 1940s in Europe. Pedestrianization was introduced as a strategy to relieve the core and other distinct precincts of the city from the misery of traffic congestion. The overall pedestrian environment was made aesthetic and convenient. Pedestrian movement has since then, been gaining centre stage internationally because of the realization that has dawned towards creating sustainable, eco-friendly and transit-oriented cities.

The Indian pedestrian scenario, however, is a contrast to the international experiences. Though a majority of people tend to walk in India, the cities are experiencing a rapid decline and deterioration of public transport and pedestrian environment. It is ironical and a matter of disastrous consequences that while there is a rapidly growing concern for making urban development compact and pedestrian-oriented, Indian cities are becoming more apathetic to the pedestrians. The pedestrian infrastructure is in a state of despair and the pedestrian space has been reduced to negligible.

In this context of making our cities energy-conserving and 'green', this dissertation aims to draw useful lessons from international experiences & study the prevailing condition of the pedestrian environment in Indian cities and suggest strategies to improve the pedestrian environment and make the cities pedestrian-oriented, through the case of Chennai city.

In chapter 1, the background of the study is discussed, followed by the aim, objectives, scope and limitations of the dissertation. The methodology for the dissertation is evolved and the schedule of work to be carried out during the course of the dissertation is prepared.

In chapter 2, literature based study has been done on the various aspects of pedestrian environment and pedestrianization strategies. Chapter 2 outlines the importance of walking

and its numerous benefits and discusses the various attributes and components that make a successful pedestrian environment. It also discusses the concept of pedestrianization and its various strategies. An elaborate study of pedestrian design standards and guidelines has been described and the chapter ends by discussing the legislations and initiatives prevalent in the West and in India and their implementation gap.

In chapter 3, international case studies have been studied to understand the success stories of pedestrianization & the strategies employed and how it has benefitted the area & brought more people on foot in the streets. It also discusses a relevant case study of the measures undertaken to improve the pedestrian environment, in an area where pedestrianization cannot be implemented. Useful lessons have been inferred from each of these case studies.

In chapter 4, the existing pedestrian scenario of Indian cities has been discussed. Relevant policies and guidelines proposed by urban local bodies and authorities and some key projects undertaken to improve the pedestrian environment are outlined. It also shows a clear picture of the existing pedestrian facilities in Indian cities to draw useful inferences on the overall pedestrian environment in India.

In chapter 5, the study profile of Chennai has been discussed. The chapter gives a general outline of the city, its traffic and transport and the master plan proposals for transport in the future. The chapter describes the proposals identified in the master plan & the Chennai Comprehensive Transport Study for pedestrians and identifies the two areas selected in the city for extensive study and analysis and the preparation of the proposals.

In chapter 6, the primary survey and field study carried out in certain parts of Chennai city has been discussed. Pedestrian count survey, questionnaire survey, visual survey of the study areas and technique to evaluate select stretches in the city have been outlined and major findings and inferences have been drawn for preparing the recommendations and proposals.

In chapter 7, the proposals and recommendations have been discussed. It discusses the detailed planning and design strategies recommended for the select study areas. It also describes the general planning recommendations suggested for the city road and the design guidelines are elaborated, which ought to be followed to bring about a remarkable change in the exiting pedestrian environment. The chapter concludes by suggesting policy recommendations for making other Indian cities pedestrian-responsive.

CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAPS

LIST OF ANNEXURES

ABBREVIATIONS AND ACRONYMS

CMA	Chennai Metropolitan Area
CMDA	Chennai Metropolitan Development Authority
WHO	World Health Organization
CVD	Cardio-vascular disease
UTTIPEC	Unified Traffic and Transportation Infrastructure Planning and Engineering Centre
LED	Light Emitting Diode
FAR	Floor Area Ratio
IRC	Indian Road Congress
DDA	Delhi Development Authority
ITDP	Institute for Transportation and Development Policy
ADA	American Disabilities Act
IPC	Indian Penal Code
MoUD	Ministry of Urban Development, Government of India
NUTP	National Urban Transport Policy
NMT	Non-motorized traffic
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
CDP	City Development Plan
DPR	Detailed Project Report
ULB	Urban Local Bodies
TNUDF	Tamil Nadu Urban Infrastructure Development Fund
JLLM	Jones Lang LaSalle Meghraj
BRTS	Bus Rapid Transit System
ROBs	Road over bridge
RUBs	Road under bridge
CTTP	Comprehensive Traffic and Transportation Plan
BMR	Bangalore Metropolitan Region
SEZ	Special Economic Zone
NH	National Highway
MTC	Metropolitan Transport Corporation
MMDA	Madras Metropolitan Development Authority
KCL	Kirloskar Consultants Limited
CBD	Central Business District
PCU	Passenger Car unit
TNPCB	Tamil Nadu Pollution Control Board
PTC	Pallavan Transport Corporation
CCTS	Chennai Comprehensive Transport Study
L.B.	Lattice Bridge

CREDAI	Confederation of Real Estate Developers' Associations of India
LRTS	Light Rail Transit System
MRTS	Mass Rapid Transit System
F.S.I.	Floor Space Index

1 INTRODUCTION

1 INTRODUCTION

1.1. The Context of Walking

Walking can be seen as the most common and basic mode of mode of transport and urban mobility in a city. Every individual is a pedestrian at some point of time, in his or her journey (Michelle Ernst, 2009). Walking connects activities within a certain range very easily. Walking is a means of experiencing and interacting with the local environment and wider societies in a way not possible, when using other forms of transport, particularly motor transport (C. E. Kelly, 2008). Jane Jacobs puts it, "Streets and their sidewalks, the main public places of a city, are its most vital organs. If a city's streets look interesting, the city looks interesting, if they look dull, the city looks dull." (Rakesh, 2005). Walking also has many positive impacts in terms of health, environmental, economic and socio-cultural benefits, on the individual as well as on the city (U.S. Department of Transportation, 2010), apart from contributing to the creation of liveable, walkable and sustainable communities.

1.2. Pedestrian Environment and Pedestrianization

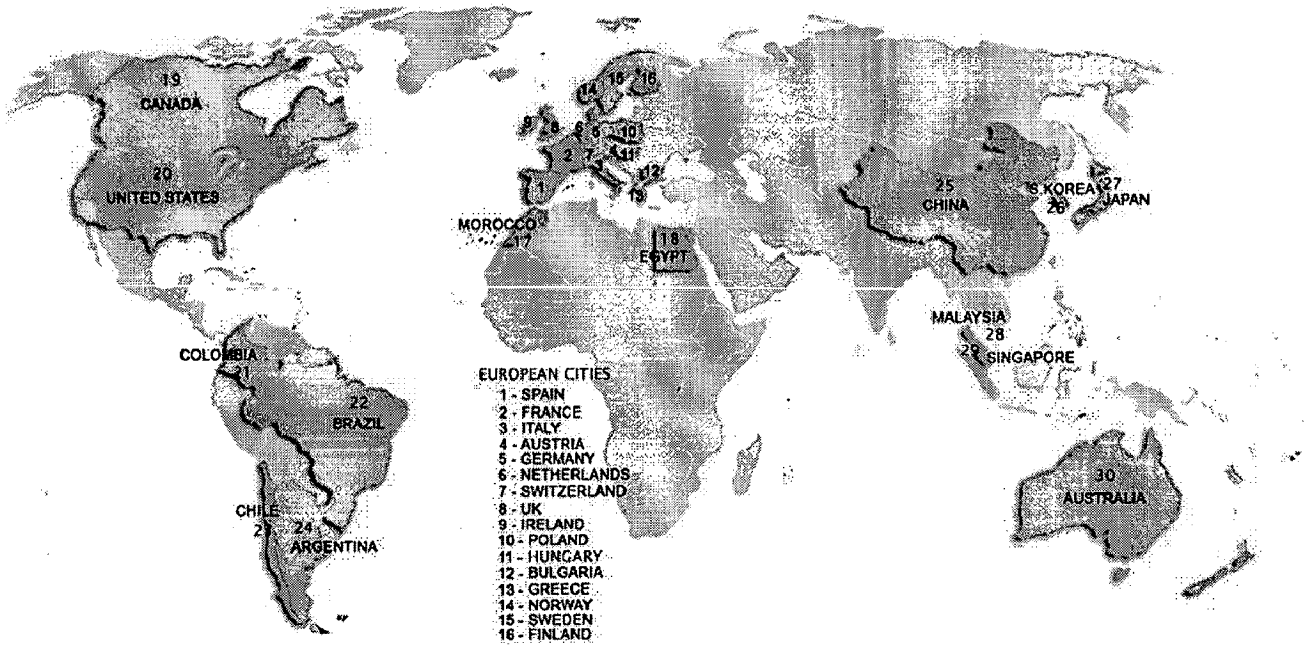
Surveys and research by environmental psychologists have shown that a comfortable pedestrian environment improves the quality of experience of a journey on foot (Sarkar, 2002). Many cities abroad have realized the benefits of walking and have incorporated viable solutions to restore cities to the people and improve the pedestrian environment. The quality of pedestrian environment is enhanced by a proper blend of the nine attributes that make a successful pedestrian environment – dimensional adequacy, safety & security, universal accessibility, convenience, continuity, comfort, cleanliness & maintenance, attractiveness & visual quality and vitality. Sidewalks are the major pedestrian arteries of a city street and facilitating them with well-designed pedestrian amenities and facilities would enhance the functionality of the pedestrian path (Pradeep Sachdeva, 2010).

Another innovative strategy adopted in many European and North American cities is pedestrianization, wherein the cars and vehicle access to a street or an area is partially or completely restricted, for exclusive use of pedestrians (Iranmanesh, 2008). It originated first in the European countries after the post war period, when the cities were getting affected by traffic congestion, environmental pollution, swarming vehicles on the roads and the increasing risk to the lives of people who walk. It can be achieved essentially by banning the cars completely or partially and declaring strictly pedestrian zones from which motorized traffic is either excluded or under restricted access (Landscape Institute , 1996). Pedestrianization has started gaining

importance in recent decades in developing countries because of the realization that has dawned towards making sustainable, eco-friendly and transit-oriented cities.

1.3. Origin and International Experience

The first attempt to make pedestrian-friendly streets started in European cities in 1940s and later spread to North America in early 1960s. By 1975, nearly every major city in Europe had banned cars from significant portions of its historic district and retail areas (Brambilla, 1977). The attempt to create 'pedestrian-friendly cities' spread later to many parts of South America and a few cities in Australia and Asia. The countries which took initiatives towards improving the pedestrian environment in some of their cities and pedestrianizing their city centres are shown in Map 1.1.



Map 1.1: Countries which took efforts towards pedestrianization and set a world-wide revolution

Source: By Author

In many European countries, the city centers have been completely pedestrianized to preserve its historic character and to eliminate traffic noise and congestion from the central area. In Amsterdam, Netherlands, for example, the city government pedestrianized its city centre between 1980-90s (Fig. 1.1) and introduced a comfortable and affordable tram system for easy commutation, which has led to the sustainable management of the city centre's public realm making walking an enjoyable experience along with an affordable tram system (Brambilla, 1977). Similar efforts were taken in Bogota (Columbia), Copenhagen (Denmark), Cologne (Germany), Ottawa (Canada) and many other cities to pedestrianize some of their streets and integrate them with a good public transit network.

In Minneapolis, skyways were constructed in 1985, joining the building blocks at an elevated level, to provide safety, security and comfort to the pedestrians (Fig. 1.2). In Manhattan in New

York, the sidewalks were widened and intermediate pedestrian boulevards were created, as a part of the Midtown Manhattan Pedestrian Network Development Project in 2000 (Deptt. of City Planning, Deptt. of Transportation, 2000) to provide comfort to the flocking numbers of pedestrians in the commercial precinct (Fig. 1.3). Similar attempts were made in many other cities abroad like Helsinki, Stockholm, Rotterdam and Paris to improve the overall pedestrian environment.

Fig. 1.1: Amsterdam Citycentre
Source: www.flickr.com

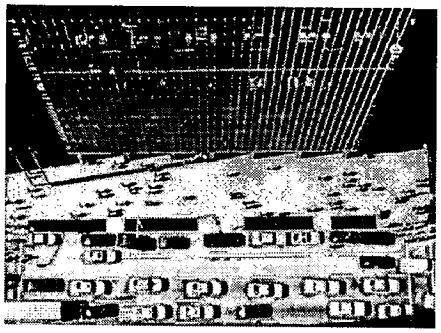


Fig. 1.2: Wide sidewalk, Manhattan
Source: www.flickr.com

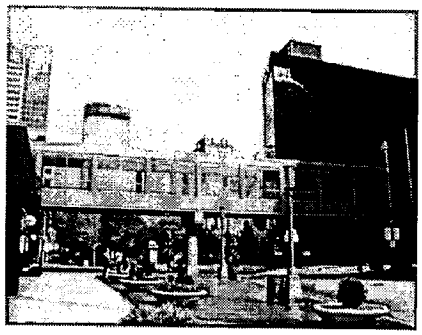


Fig. 1.3: Minneapolis Skyway
Source: www.flickr.com

1.4. Indian Scenario

The impact of traffic has been dramatic in Indian cities. With the population increasing rapidly, the transport demands in most Indian cities have also increased substantially (Singh, 2005). The backwash effect of urbanization can be seen in the form of traffic congestion, increasing levels of pollution, public transport not able to keep pace with demand requirements, swarming vehicles on the roads and the case of deterioration of pedestrian facilities. With the increasing densities in the metro cities, the allocation of a pedestrian space has decreased to the point, where pedestrians are squeezed to the left over spaces between traffic and buildings, which is alarming (Watson.D., 2003). Safe and efficient transport has become a challenging issue.

Apart from the mammoth increase in vehicle demand, causalities of pedestrians have also increased proportionately in cities. Pedestrians are the worst victims of road accidents in India. Out of the 1,14,590 deaths in road accidents in 2007, 10,125 deaths were accounted of pedestrians (Nimhans, WHO, 2008) .On an average, 50% of the pedestrians are victims of cars, buses and trucks. Inspite of this, a majority of people are dependent on walking, cycling or using the mass transport. A 2008 study of 30 cities showed that 16-57 per cent of all trips involve no vehicles at all. The modal split of walk is high in many of the Indian cities (Table 1.1). In Delhi, 31.8% of the total trips are made through walk and this holds as 32.7% for Chennai (Fig. 1.4).

Table 1.1: Modal Split in Indian Cities (as a % of Total Trips)

City Population (in million)	Walk	Bicycle	Two-wheeler	Mass Transport	Car	IPT
Less than 0.5	34	3	26	5	27	5

0.50–1.0	32	20	24	9	12	3
1.0 – 2.0	24	19	24	13	12	8
2.0–4.0	25	18	29	10	12	6
4.0-8.0	25	11	26	21	10	7

Source : Review of Urban Transportation in India, Sanjay K.Singh, Journal of Public Transportation, 2005

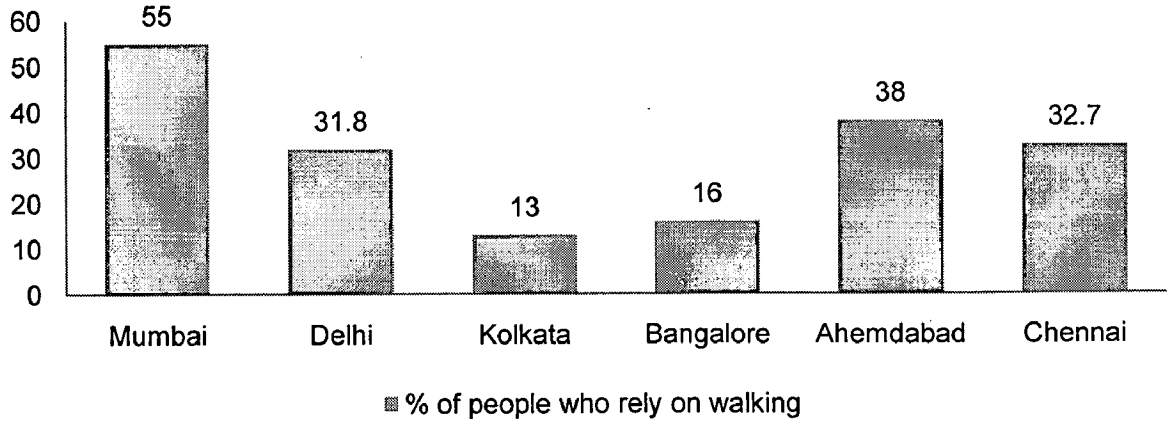


Fig. 1.4: Modal split of walk in the four major metro cities of India

Source : The alternative urban futures report - Urbanisation & sustainability in India : An Interdependent Agenda, Sanyal.S., Nagrath.S., Singla.G., 2009

The Indian experience of pedestrian environment is one of contrast compared to countries abroad. Inspite of such a large share, pedestrians are sidelined and our city transportation plans do not give preference to pedestrians and public transport. The pedestrian infrastructure and amenities in the country are pathetic and in a state of neglect. The width of the sidewalks is usually inadequate and they are a case of poor design and maintenance. They are often encroached by hawkers, unauthorized parking and pavement dwellers and are obstructed with utility boxes, electric poles, garbage dumps and construction debris. There are no provisions made for the wheel-chair users in the sidewalks. Amenities like street furniture, street lighting, landscaping, litter bins, telephone booths and post boxes are usually absent. Utilities are ill-planned and often one can observe problems like broken manholes, water logging and broken cables blocking the sidewalks.

In all, the Indian pedestrian environment is far from satisfactory and taking a look at the pedestrian experiences abroad, there is a serious need to make the pedestrian experience attractive and convenient by employing suitable strategies and through careful design.

1.5. Need for the Study

The above discussion calls for an urgent need for a sustainable transport system in Indian cities and to correct the current urban scenario of traffic congestion, road accidents and neglected pedestrian infrastructure. Efforts must be taken to make provisions in city plans for people on foot by integrating pedestrians in urban planning.

In the current scenario, urban development in India calls for an urgent need to –

- Make our cities fully energy-conserving and climate-responsive.
- Reduce the use of automobiles and thereby traffic congestion.
- Enhance the quality and usability of the public spaces i.e. the streets.
- Aim for a healthy future for the community.
- Make walking more attractive and convenient than any other form of transport.
- Make urban development more sustainable and easily accessible.

The study intends to survey the prevailing conditions of pedestrian environment of our cities, by taking the case of Chennai, and the potential role, an improved pedestrian environment can play in *developing people-centric cities.*

1.6. Aim of the Study

The study aims at evolving planning and design guidelines and strategies for improving and integrating the pedestrian environment with land use through the case of Chennai.

1.7. Objectives

1. To study the components of urban pedestrian environment and the concept of pedestrianization and their role in urban living and planning.
2. To study the best practices, planning & design standards, innovative strategies and institutional mechanisms prevailing in select foreign countries and draw useful guidelines for Indian cities.
3. To analyze the prevailing pedestrian environment and institutional provisions in Indian cities in the context of urban planning and development.
4. To study and analyze the problems of pedestrian environment in select areas of Chennai city in the context of its planning and development.
5. To propose integrated planning & design guidelines and strategies for improving the pedestrian environment in specific areas of Chennai and for the entire city at large.
6. To make policy recommendations for making Indian cities pedestrian-responsive.

1.8. Scope

1. The study areas in Chennai have been selected on the basis of the availability of secondary data and the feasibility of undertaking field surveys.
2. The outcome of the study could be applied to other Indian cities with suitable alterations in the planning guidelines and standards.

3. The study focuses on pedestrianization and improving pedestrian facilities in an urban environment and therefore other traffic and transportation aspects will not be studied in detail.

1.9. Limitations

1. The data accuracy, reliability and coverage of primary data are limited by the practical difficulties of the field survey.
2. Due to constraints in time, manpower and availability of resources, only a few selected areas of Chennai were studied and their problems analyzed.

1.10. Methodology

The dissertation will be carried out in different stages:

1. Background studies and the framing of aim, objectives, scope and limitations of the study.
2. Extensive Literature study to understand the benefits of walking, the concept of pedestrian environment & its various components, the concept of pedestrianization & its various strategies and various pedestrian design standards & guidelines.
3. International case studies of successful examples and their useful policies & implementation strategies, their standards & guidelines, to derive lessons from their examples.
4. Study of the prevailing pedestrian environment in India, the policies and guidelines available, the master plan provisions, the city development plan provisions and pedestrian-oriented projects implemented by far in select Indian cities.
5. Study of Chennai city & the master plan proposals; explicit studies carried out for pedestrians and the existing pedestrian environment in the city.
6. Initial processing and compilation of data, findings and inferences, guidelines, principles and strategies from literature study.
7. Data collection of Chennai city and the existing pedestrian environment along select stretches of Chennai metropolis through field surveys, photo study, informal interviews, visual observation and through secondary data from government agencies, research institutions, libraries, journals, internet and by discussions with various officials.
8. Creation of database on pedestrian environment from collected data & its analysis and the digitization of maps.
9. Preparation of integrated planning and design guidelines and strategies for improving the pedestrian environment in select areas of Chennai and the entire city at large.
10. Policy recommendations for making other Indian cities pedestrian-oriented.

The methodology for the dissertation work is further explained in Fig. 1.5.

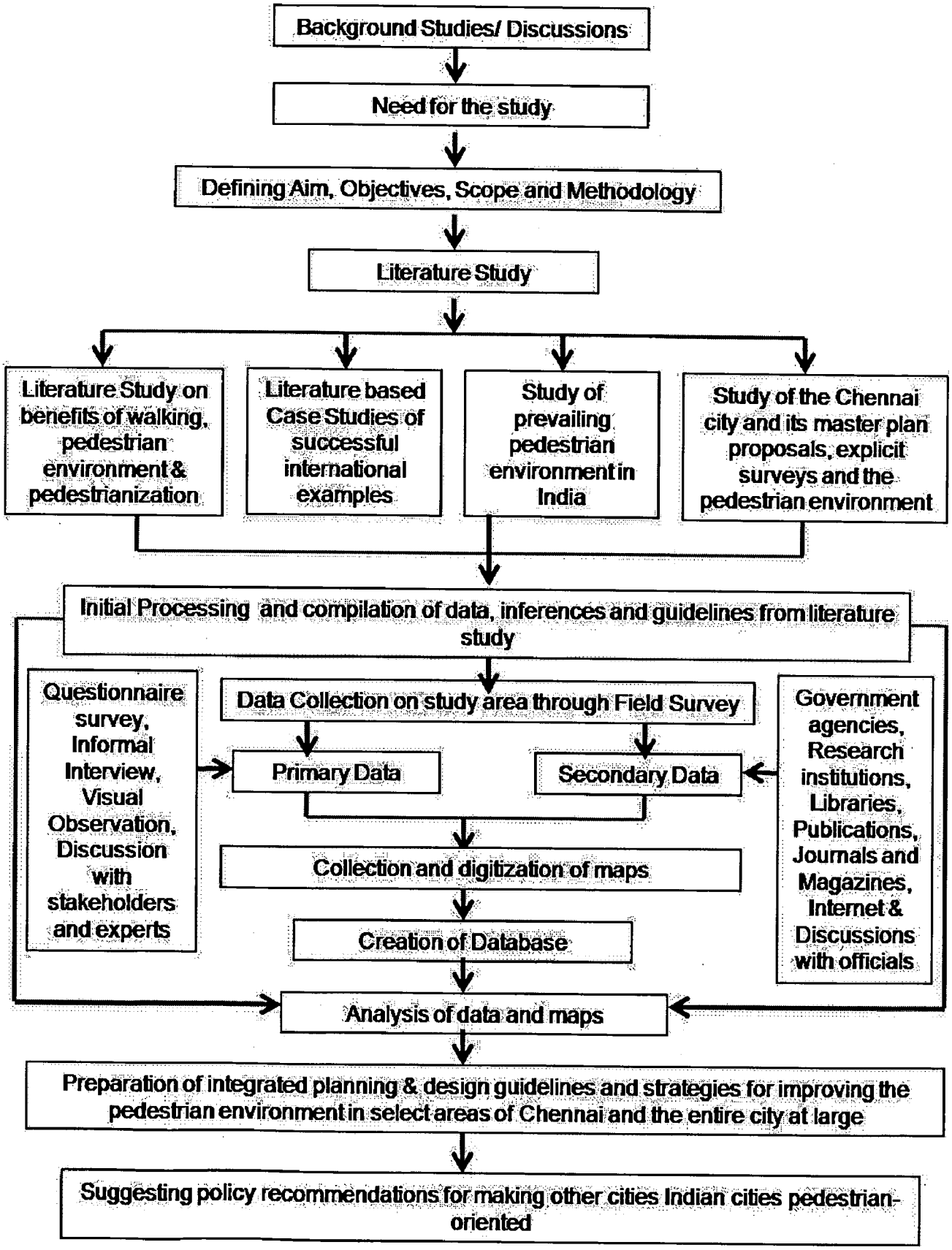


Fig. 1.5: Chart showing Methodology for Dissertation Work

1.11. Schedule of Work

The schedule of work for the dissertation is shown in Table 1.2. It describes the various tasks carried out during the course of the dissertation.

Table 1.2: Schedule of work for dissertation

S.No.	Month	Tasks
1.	June – July 2010	• Secondary data collection from CMDA. • Photographs taken of certain stretches.
2.	August-September 2010	• Literature collected on pedestrianization, pedestrian environment and Indian pedestrian scenario.
3.	September 2010	• Presentation for the first review.
4.	August – November 2010	• Literature collected on benefits of walking, pedestrian environment and its various components, the concept of pedestrianization and various pedestrian design standards and guidelines. • Literature collected on international case studies and successful examples. • Study of the prevailing pedestrian environment in India. • Field survey done on traffic and pedestrian count along select stretches of the city.
5.	November 2010	• Presentation of the second review.
6.	December 2010 - February 2011	• Secondary data collection of Chennai city from government agencies, research institutions, libraries, publications, journals, internet and by discussions with various officials. • Field study of select stretches of Chennai. • Visual survey of select stretches of Chennai. • Collection of maps from CMDA. • Questionnaire survey on pedestrian safety. • Discussion with officials from various organizations on pedestrian improvement projects executed in the city. • Selection of study areas. • Digitization and preparation of maps. • Analysis of the data. • Evaluation of select stretches of Chennai based on

		pedestrian evaluation matrix. • Inferences developed on study areas.
7.	March 2011	• Presentation of the third review.
8.	April 2011 – May 2011	• Preparation of maps. • Report Writing. • Preparation of integrated planning and design guidelines and strategies for the study areas and the entire city. • Preparation of policy recommendations for making Indian cities pedestrian-oriented.
9.	June 2011	• Finalization of plan proposals, recommendations, report and submission.

2 LITERATURE REVIEW

2 LITERATURE REVIEW

This chapter deals with the very basic need to walk and what are the numerous benefits derived from walking. The characteristics of pedestrians like space occupied, walking speed, walking distance etc. have been explained. The chapter also discusses the concept of streets, the various attributes of streets and the components that make up a successful pedestrian environment or a pedestrian space. The concept of pedestrianization, its advent and its various strategies have further been elaborated. Further on, the chapter discusses the pedestrian design standards and guidelines from various Pedestrian Design Manuals to draw a comparative study and some useful guidelines to be implemented in the final design proposals. The chapter ends with discussing the legislations and initiatives that are prevalent in the West and in India and analyses the implementation gap between both.

2.1. Benefits of Walking

A well-designed city is one that is designed for people. The quality of the 'street' is viewed with respect to the movement of people on it, rather than vehicles. When cities are motor-friendly, the very basic question that comes to a person's mind is "Why Walk, when you can Drive?". This is on account of the numerous benefits that are associated with walking. Walking is enjoyable and healthy and is the most efficient mode for many trips, either alone or in conjunction with motorized modes (Litman, 2010). Listed below are some of the benefits of walking.

2.1.1 Health benefits

1. Walking increases the levels of physical activity, thereby reducing the risks of coronary heart diseases, diabetes, hypertension, obesity, osteoporosis and some forms of cancer. It reduces the risk of developing coronary heart disease, non-insulin dependent diabetes and obesity by 50%. In 2020 AD, 2.6 million Indians are predicted to die due to coronary heart disease which constitutes 54.1 % of all CVD deaths (Ministry of Health and Family Welfare and WHO, 2006).
2. Walking has an overall positive impact on the body's immune system (Tommy Boone, 2006) and removes the plaques that have built up in the vessel walls of the heart.
3. Surveys in India reveal that about 10 % of adults suffer from hypertension (Press Information Bureau, 2010). Walking reduces the risk of developing hypertension by 30%, also resulting in a decline in blood pressure.
4. Walking helps in maintaining bone mass and protects against osteoporosis. It improves the balance, coordination, mobility, strength and endurance.
5. People from breathing disorders like asthma, bronchitis, etc. will have a great relief.

6. Digestion related problems like lack of hunger, indigestion, heavy stomach and constipation can be eliminated by regular walking.
7. It increases self-esteem and promotes an overall psychological wellbeing (World Health Organization Report, 2002).

2.1.2 Environmental benefits

1. Bicycling and walking are the two major non-fuel-consuming, non-polluting forms of transportation. They enable the society to reduce consumption of fossil fuels and the associated pollution and other environmental damage (U.S. Department of Transportation, 1993).
2. As per Environmental Protection Agency US, transportation is responsible for nearly 80 percent of carbon monoxide and 55 percent of nitrogen oxide emissions. The Medical Journal of Australia quoted - *"The transport sector is a major contributor to climate change. Transport emissions – already responsible for 28% of total greenhouse emissions in New Zealand and 16% in Australia – are increasing more rapidly in both countries than those from any other sector* (Woodward.A., 2002)." It is estimated that bicycling and walking together can displace annually - 0.4%-1.6% of CO2 emissions from passenger vehicles, 1.4%-5.0% of CO emissions from passenger vehicles and 0.3%-1.2% of NO2 emissions from passenger vehicles (Fig. 2.1).
3. Every day cars and trucks burn millions of barrels of oil, a non-renewable energy source, leading to their rapid depletion. Walking reduces the overall carbon footprint. Noise is another associated aspect with the vehicles and excessive noise is detrimental to health and productivity (Directorate of Urban Land Transport, 2008) (Fig. 2.2).

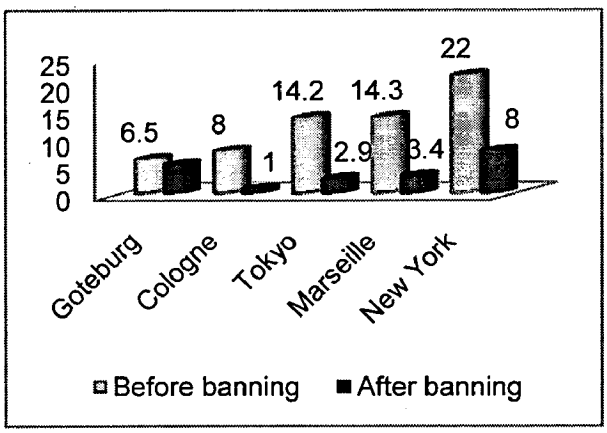


Fig. 2.1: Noise Pollution levels in dB before and after banning of vehicular traffic in certain cities

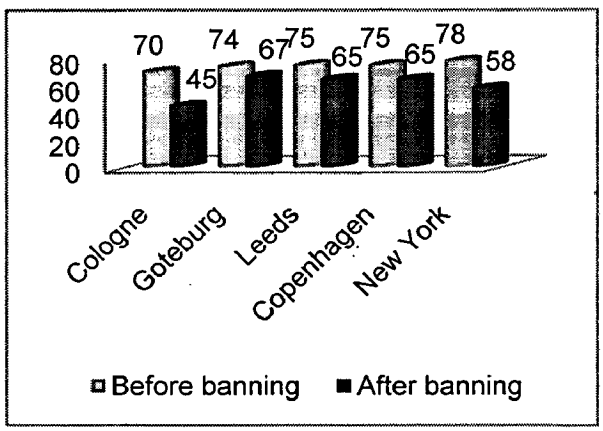


Fig. 2.2: Air Pollution levels in ppm before and after banning of vehicular traffic in certain cities

Source: Planning and Design for Pedestrians, John J. Fruin, 2003

2.1.3 Transportation benefits

1. More than half the trips less than 5 km that could be commuted through walking or cycling are made by car. Walking is an easier mode of travel and it would gradually reduce the traffic congestion on the streets, when more and more people adopt walking.
2. Encouraging pedestrian movement will enable environmentally and effective means of transport decreasing the demand for motorized transport.
3. Walking will indirectly also influence people to use public transport rather than personalized vehicles, since every public transport has a component of walk at its both ends and make our cities transit-oriented (Institute for Transportation and Development Policy, 2008).

2.1.4 Economic benefits

1. Walking is an affordable form of transport. Vehicle ownership is expensive and consumes a large part of the income. Walking would result in reduced consumption of fuel. This would lead to savings and reduced energy dependence as urban transport consumes some 30% of fuel consumption.
2. Walking would also subsequently affect the health expenses and reduce them in the long run (walkinginfo.org, 2010).
3. A pedestrian area has the potential for helping central business districts to remain viable commercially, as investors and traders find a pedestrian district give large returns and they reap better economic benefits (California Department of Health Services, 2005).

2.1.5 Social benefits

1. Walking can be done by people from all age-groups and genders.
2. The provision of an appropriate pedestrian environment creates a convenient and a socially just forum of mobility.
3. Walkable communities create a more equitable society that provides transportation choice for all (J.Fruin, Pedestrian Transportation, 1983). It removes the socially unjust barrier to mobility for people who cannot afford to own a vehicle, or people with disabilities or adolescents.
4. Walking helps in maintaining the spiritual and mental well-being of people.

2.1.6 Quality of life benefits

1. Increased vehicular traffic has reduced the quality of life on the streets. Walking helps in instilling back the lost vibrant character of streets, where people can meet, socialize, interact and appreciate the overall urban environment.

2. Walking helps in revitalizing the community spirit back to the streets. As quoted rightly by Jan Gehl, "A good pedestrian environment contributes to creating a diverse, lively and safe city for *walking, talking, watching and experiencing* (Gehl Architects, 2002)."

2.1.7 Visual benefits

1. It is on foot that one can observe people's faces and expressions, observe the visual environment around in detail, which is not possible when one is driving. Eyes respond well when one *walks* through light, darkness, shadows and changes in color (Watson.D., 2003).
2. The use of pedestrian space is an experience by itself, through the application of well planned sensory gradients of colors, light, sound, surface texture, ground slope and other interested features (Pawan Kumar, 2009).

2.2 Pedestrian characteristics

Four important pedestrian characteristic namely, walking speed, pedestrian space requirements, pedestrian volume and the comfortable walking distances need to be studied to help in pedestrian planning and design in cities and these are discussed below.

2.2.1. Pedestrian Space requirements

A pedestrian forms a simplified body ellipse of 50cmX60cm for standing areas occupying an area of only 0.3 sq.m. A body buffer zone of 0.75 sq.m. for walking is recommended (N. Rouphail, 2005). In contrast, a bicycle occupies 1-1.2 sq.m., a two-wheeler occupies 1.25 sq.m. and a car occupies 13.75 sq.m. space (Fig. 2.3).

2.2.2. Pedestrian Walking Speeds

Walking speeds have been found to vary over a wide range depending on personal physical condition, age and gender, including such factors as trip purpose, environmental conditions, and traffic density. Normal walking speeds unrestrained by pedestrian crowding vary between 46m/min. to 107m/min. with an average of 82m /min. (Watson.D., 2003). A male walks at an average speed of 80m/min. and the average walking speed of a female is 77m/min. The walking speed of elderly people reduces to 60m/min.

2.2.3. Pedestrian Volume

Pedestrian volume, or the number of persons passing a given point in a unit of time, is the most important walkway design parameter. The maximum average peak flow volumes range from 23-26 persons per foot of walkway width per minute (PFM) (J.Fruin, Planning and Design for Pedestrians , 2003). The walkway capacity usually lies between 4000-5000 pedestrians/hr/meter (N. Rouphail, 2005).

2.2.4. Walking Distance

Walking distance is of great significance since it determines the effective service area of transportation systems. The range of walking distance is also extremely variable and dependent upon the trip purpose, available time and the walking environment. The normal walking distance is 0.4 km or 0.25 mile, however, longer walking distances are accepted in large cities. According to the National Survey of Pedestrian and Bicyclist Attitudes and Behaviors conducted in 2002, it was found that 67% of people preferred to walk in the range of less than 0.5 km to 1km distance (Fig. 2.4).

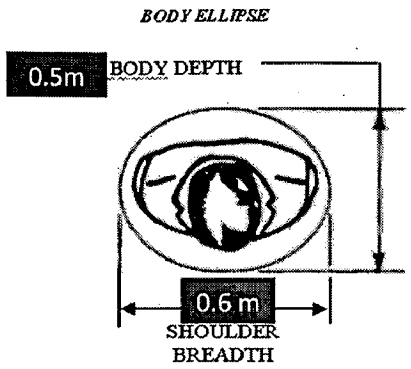


Fig. 2.3: Recommended Pedestrian Body Ellipse

Source: Draft Report on Capacity Analysis of Pedestrian & Bicycle Facilities, National Roundabout Conference 2005

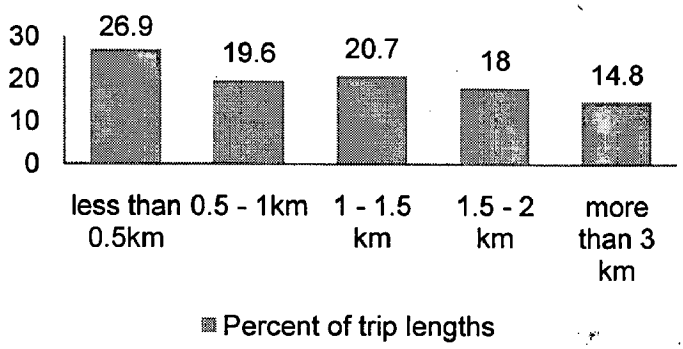


Fig. 2.4: Pedestrian walking distances

Source: National Survey of Pedestrian and Bicyclist Attitudes and Behaviors — Highlights Report, 2002

2.3. Concept of Streets

Streets rank amongst the most valuable assets of a city besides being the most important public spaces (Shreya Gadepalli, et. all, 2010). The street and the square remain the main elements of the city and its centre; the street is the place of passage and the square is the point of rest and as far as possible both should be given over to pedestrian movement (Epstein, 1995). Streets are not merely conduits of traffic; they comprise of well-designed pedestrian facilities and have a vibrant character. Streets are places where one meets different people from different socio-economic backgrounds and various walks of life. It is a very basic public space and a part of what is called as the urban realm. Streets define cities; they have individual characters and qualities and are distinguishable from each other (Commission of Architecture and Built Environment, 2001). Its main functions are –

- Circulation for vehicles as well as pedestrians.
- Access to buildings, and the provision of light and ventilation for the buildings.
- A route for utilities.
- Storage space, especially for vehicles.
- Public space for interaction.

A successful street is the one that is used the most because it connects vital points and the more it fulfills this function of liaison, the more interesting and lively it will be as a place in its own right. (Epstein, 1995). A pedestrian street is a key to making sustainable and walkable communities, which would make the streets people-oriented and enhance the quality of life of the people. This involves certain attributes which create a successful pedestrian environment. The attributes further include various design aspects and components. The various attributes and design components have been discussed in the forthcoming paragraphs.

2.3.1. Attributes of a Pedestrian Environment

Creating a successful pedestrian street or an ideal pedestrian environment requires making walking a safe, convenient, comfortable and an attractive journey (R.Shankar, 2008). There are nine attributes which contribute to a successful pedestrian environment (Fig. 2.5 & 2.6).

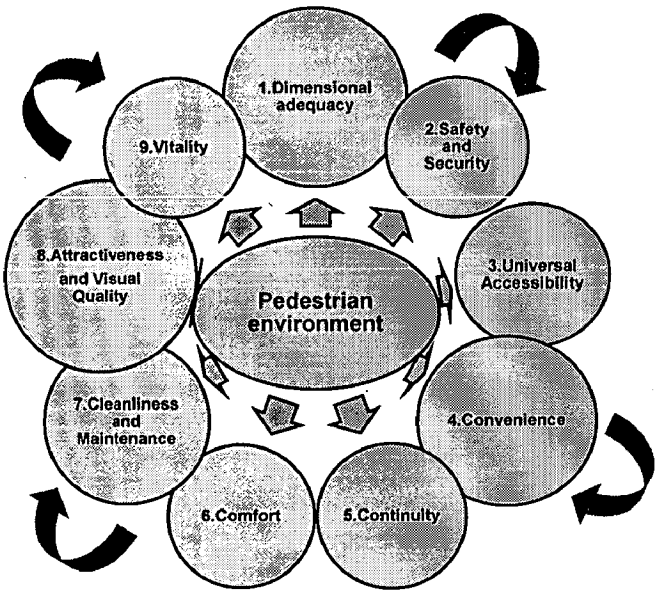


Fig. 2.5: Attributes of a pedestrian Environment

Source: By Author

Fig. 2.6: An ideal Pedestrian Environment in mid-town Manhattan

Source: By Author

2.3.1.1. Dimensional adequacy

The elements of a street must be dimensionally adequate and convenient for the pedestrians including the wheel-chair users. The curb ramps for the wheel-chair users, the curb radius, the crosswalks and mid-block crossings etc. must have proper dimensions to improve their functionality for the pedestrians. The adequacy can be ensured by providing sidewalk width as per the land use and the pedestrian volume generated. Informal sector like hawkers and vendors can be accommodated in the furniture zone, keeping the walking zone free of encroachments (UTTIPEC, Delhi Development Authority, November, 2009).

The comparisons drawn from various standards and guidelines indicate that the minimum width of sidewalk can vary between 3.75m to 4.75m for a commercial street and 2m to 2.5m for a

residential street. The recommended widths for various zones, especially in a commercial node must be:

- Curb zone – 0.15m minimum
- Furniture zone – 0.9m to 2.5m
- Walking zone – 1.8 to 2m
- Frontage zone – 0.9m minimum

Cities like Copenhagen, Munich and Manhattan have very wide sidewalks to accommodate large number of pedestrians (Fig. 2.7).

2.3.1.2. Safety and Security

Safety and security deals with the risks involved in terms of accidents and conflicts with vehicles. Pedestrian safety can be improved by reduction of pedestrian and vehicle conflicts through space separation (B.Jacobs, 2003) which can be in the form of pedestrian street, or subways or skywalks. Safety and security can also be strengthened by standardization of signals, delineation of crosswalk zones, introducing pedestrian signals, illuminated signage and refuge islands at intersection and improving motorist line of sight and by installing television surveillance cameras at major street locations to prevent crime (Fig. 2.8).

Fig. 2.7: A wide sidewalk in Manhattan

Source: By Author

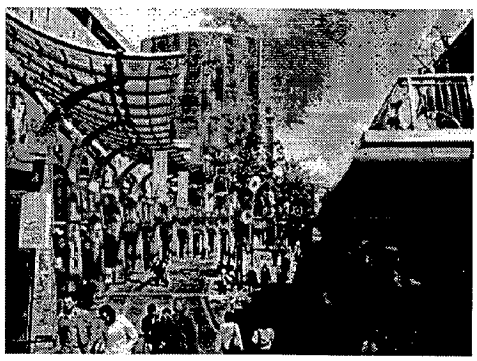


Fig. 2.8: Pedestrian Underpass, Rotterdam

Source: By Author

2.3.1.3. Universal Accessibility

Universal accessibility deals with providing access for all, including the disabled and visually impaired, at all times. Special ramps for the wheelchair users may make the sidewalks universally accessible. Curb ramps allow users to make grade transition from street to sidewalk. The curb ramp dimensions, slope and surface treatment are of utmost importance (Office of Transportation, Engineering & Development, Portland, 1998) (Fig. 2.9).

2.3.1.4. Convenience

Convenience deals with the amenities that can improve the expediency of the sidewalks and create an ideal pedestrian environment. The sidewalks must be provided with public amenities like street furniture, open-air dining, litter bins, sand bins, water fountains, clocks, post boxes,

utility boxes telephone booths and bicycle racks to ensure pedestrian convenience. Area map boards and information kiosks prove very useful in giving information about the entire precinct to any user (Shreya Gadepalli, 2010). Benches and café-tables should be placed where there is enough shade. Restrooms must be located in close vicinity of the sidewalks (Fig. 2.10).

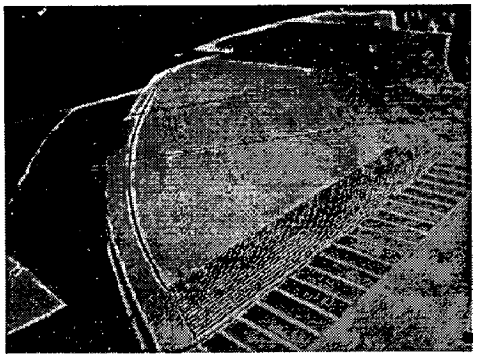


Fig. 2.9: Curb Ramp installed at Salt Lake city, Utah

Source: By Author

Fig. 2.10: A convenient sidewalk with amenities in New York

Source: By Author

2.3.1.5. Continuity

Sidewalks must be continuous and wherever access to a building needs to be provided, there must be provision for a smooth transition of the sidewalks (Pawan Kumar, 2009). The continuity is a matter of careful detailing and in cities abroad, the sidewalks have been designed so well that the pedestrians hardly feel any discomfort at the transitional space for an access to a building (Fig. 2.11). Continuity also is an important factor, which will facilitate comfortable movement for wheel-chair users and visually impaired.

2.3.1.6. Cleanliness and Maintenance

Sidewalks must be swept and maintained clean regularly and it is useful to provide, as in Paris, water points at frequent intervals for the streets to be hosed down (Fig. 2.12). Sidewalks should be free of any litter, spitting, breakage, potholes and garbage dumps. They must have an attractive paving surface, with special attention given to the choice of texture, color and the surface finish of the pavers. The urban local bodies must ensure a daily cleaning regime of the sidewalks, which are assets of the public.

Fig. 2.11: Sidewalk continuity at San Francisco

Source: By Author

Fig. 2.12: Cleaning of sidewalks in Paris

Source: By Author

2.3.1.7. Comfort

Comfort is a matter of people feeling sheltered and protected. Trees add comfort, provide shade, add scale and also humanize the streets. Selection of trees is a matter of concern. Arcades and covered walkways also provide comfort and give relief during rains, heat or snow (Fig. 2.13).

2.3.1.8. Attractiveness and Visual Quality

Landscaping, pavement color and texture, well-designed street furniture, fountains and water bodies, innovative street lighting, vibrant building facades and intermediate plazas for people to rest and relax, increase the visual variety of the street and make the walking experience attractive (Fig. 2.14). In many European cities, sidewalks are provided with outdoor dining cafes to make the street look lively and improve the quality of life (Brambilla, 1977).

Fig. 2.13: A well-landscaped sidewalk in central area of Chicago

Source: By Author

Fig. 2.14: An attractive sidewalk at Helsinki

Source: By Author

2.3.1.9. Vitality

The quality of vitality is in terms of diversity of use – ideally at all times – including religious, cultural, business, recreational and civic uses. Vitality is related to achieving sufficient variety of activities throughout the day. One way of imbibing vitality element is by encouraging residence within inner cities including incentives to broaden the 'living above the shop' initiative (Fig. 2.15); encouraging enlivening of city centers, particularly in the evening and by providing uses for heritage buildings (Landscape Institute , 1996) . Street vending zones can be provided by widening the furniture zone of the sidewalk (Fig. 2.16).

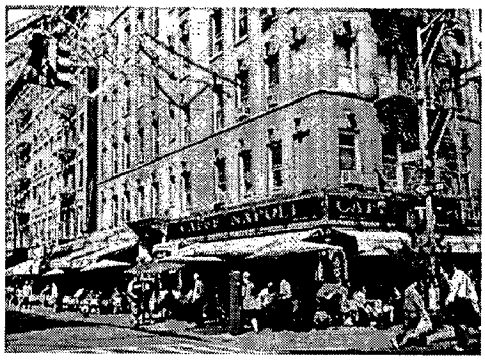


Fig. 2.15: Living above the shops in Helsinki

Source: By Author

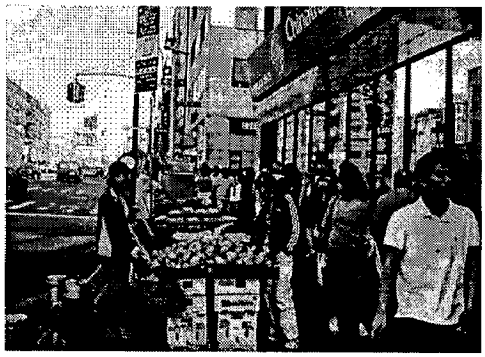


Fig. 2.16: Street vending in Chicago

Source: By Author

2.3.2. Design of street spaces for pedestrians

Streets cannot be planned just for traffic but also need to be places of leisure with amenities that allow users to choose healthier and more sustainable lifestyles (Pradeep Sachdeva, 2010). They need to consist of barrier-free and wide sidewalks, with amenities like street furniture, adequate landscaping and provisions for public toilets and drinking water fountains. The major design components that make up an interesting and attractive pedestrian path in streets are -

(1) Sidewalks (2) Street Furniture (3) Landscaping
(4) On-grade and grade-separated crossings (5) Curb ramps (6) Pedestrian refuges
(7) Street lighting (8) Utilities (9) Signage (10) Paving

2.3.2.1. Sidewalks

Sidewalks or footpaths are pedestrian's portion of the street space. No pedestrian system is complete without sidewalks (North Carolina Department of Transportation, 2009). Sidewalks or footpaths must be wide and free of obstructions like unplanned trees and planters, utility boxes, hawkers and vendors, etc. to favor un-interruptible continuous movement (Fig. 2.17). Sidewalks must be planned into various zones, with sufficient space allocated for frontage infront of building, for walking and wheel-chair users, for amenities and facilities and for hawkers and vendors.

2.3.2.2. Street Furniture

Street furniture is amenities that could be provided for enhancing a pedestrian's convenience and comfort (R.Shankar, 2008). Street furniture and lighting equipment have a major impact on the appearance of a street and should be planned as part of the overall design concept (Department of Transport of London, 2007). These could be seating and benches (Fig. 2.18), telephone booths, garbage bins, vending machines and bus shelters. However, care must be taken to deduct their space from the width of the footpaths while designing sidewalks, which is a matter of careful design. Benches help people stay on the streets; they invite our presence by permitting rest, conversation, waiting for a friend, passing the time. They help to make community (B.Jacobs, 2003).

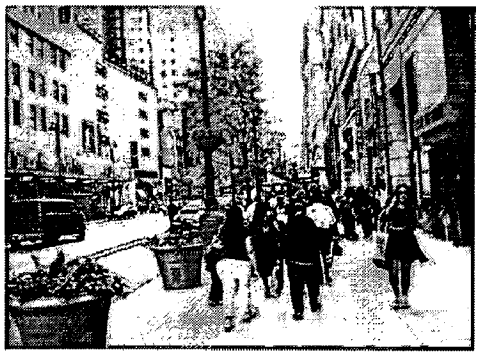


Fig. 2.17: Sidewalk at Manhattan

Source: By Author

Fig. 2.18: Benches on sidewalk at Netherlands

Source: By Author

2.3.2.3. Landscaping

Trees and planting have a vital role to play in the air quality of cities. Planting is desirable – visually and functionally. Trees give a lot of variety to a street; they humanize the street in contrast with the hard shapes of the buildings and it is a joy to walk under them (Fig. 2.19). Species should be chosen to withstand the adverse climatic conditions of the street, including the possible water-shortages. The kind of trees to use, their placement, their planting, and their maintenance are all important matters to be decided. Deciduous trees are more often appropriate than evergreens. The most effective tree spacing could be from 15 to 25 feet (4.5 to 7.6 meters) apart (B.Jacobs, 2003). The paving in the vicinity of the streets must be slab paving and not tarmac to allow water and oxygen to reach the roots (Epstein, 1995).

2.3.2.4. On-grade and grade-separated crossings

Every effort must be made to ensure the safety of locations where pedestrians and vehicles will cross paths. On-grade crossings are zebra-crossings and mid-block crossings. Whether marked or unmarked, legal crosswalks exist at all legs of all intersections where sidewalks normally exist (Minneapolis City Council, 2009) to ensure a safe crossing experience for pedestrians. Grade-separated arrangements like underground pedestrian subways or skywalks are preferred more as they ensure greater degree of safety, than on ground crossings, but they must be supported with suitable arrangements especially for elderly and the wheel-chair users (Fig. 2.20).

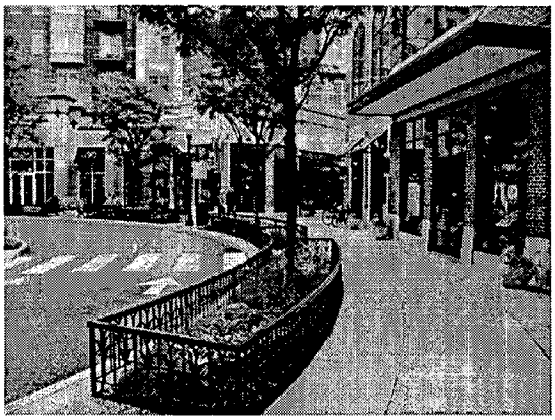


Fig. 2.19: Landscaped sidewalk, North Carolina

Source: By Author

Fig. 2.20: Wide zebra-crossing, Helsinki

Source: By Author

2.3.2.5. Curb Ramps

Curb ramps are provisions made for the wheel-chair users and they must be compulsorily installed in sidewalks at convenient locations, for making the streets universally accessible. The ramp width, slope, surface treatment and locations must be planned properly and special attention must be given to their detail while designing (Washington State Department of Transportation, 1997) (Fig. 2.21).

2.3.2.6. Pedestrian Refuges

Medians improve safety for pedestrians by functioning as refuge islands, which allow pedestrians to cross safely a street (Fig. 2.22). Pedestrian refuges can accommodate other elements such as landscaping, pedestrian and cycling boulevards, and sometimes parking.

Fig. 2.21: Curb ramp in sidewalk, Chicago

Source: By Author

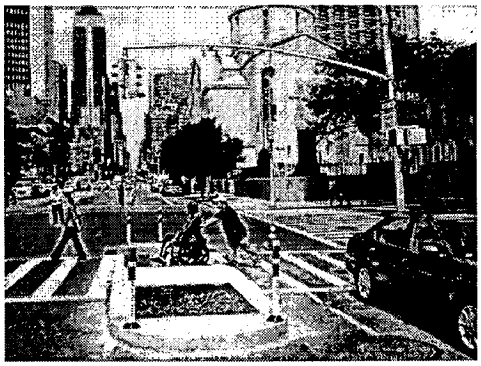


Fig. 2.22: Pedestrian refuge island, New York

Source: By Author

2.3.2.7. Street Lighting

Street lighting becomes an important criterion of designing pedestrian environment after dark. High levels of illumination would definitely reduce pedestrian accidents, and improve pedestrian safety and security (Fig. 2.23). Street lighting can be enhanced with floodlighting of pedestrian crosswalk areas and lighting with luminaries like cobra head, stad, fulton, flushing meadows, round top head, LED lamp etc. (New York City Dept. of Transportation, 2009).

2.3.2.8. Utilities

Utilities are something that is always neglected in footpath designing. Existing and proposed services and in particular, access points, manholes etc. must be effectively integrated into the streetscape. The footpaths must have drainage outlets designed in such a way, to drain the storm water and at the same time be aesthetically appealing (Fig. 2.24). Falls to gullies or channels should be sufficiently steep to cause quick run-off of rainwater, absence of puddles, and quick drying of the surface, once the rain has stopped with the degree of fall being not less than 1:50. Slightly rounded channels leading to gullies are easy to sweep and maintain.

Fig. 2.23. Sidewalk lighting, Sydney

Source: www.flickr.com

Fig. 2.24. Planned utilities, Pondicherry

Source: By Author

2.3.2.9. Signage

Signs of all kinds proliferate. However, it must not lead to visual confusion. Clarity of expression and quality of information on signs is very important (Fig. 2.25). Pedestrian signage can be a lot more individualistic and interesting as pedestrians have more time to read than drivers. They may also add to the vitality of a street if judiciously placed and properly maintained.

2.3.2.10. Paving

The comfort and appearance of a pedestrian street is also largely characterized by the paving. Good maintenance-free paving materials must be used, of which natural stone or brick paving is the best. Nowadays, many innovative prefabricated pavers have come in various sizes and colorful designs, which enhance the beauty of a walkway immensely and make the pedestrian experience pleasant (Fig. 2.26). The choice of texture, color, material of pavers must be carefully made. Pavers must have a regularity of size, rectilinearity of shape and evenness of texture. Well designed paving, street furniture and lighting make the street a place where people want to be (Crandall, 2002).

Fig. 2.25: Signage on a street in Paris

Source: www.flickr.com

Fig. 2.26: Paved sidewalk in Portugal

Source: www.flickr.com

2.4. Concept of Pedestrianization

Pedestrianization is a concept that originated first in the European countries after the post war period, when the cities were getting affected by traffic congestion, environmental pollution, swarming vehicles on the roads and the increasing risk to the lives of people who walk. Pedestrianization means "to restrict vehicle access to a street or area for exclusive use of pedestrians" (Iranmanesh, 2008).It can be achieved essentially by banning the cars completely or partially and declaring strict pedestrian zones from which motorized traffic is either excluded or under restricted access (Landscape Institute , 1996). The importance of pedestrianization in developing countries is increasing since the roads have become the domain of the vehicle-users, with pedestrian space disappearing slowly from the streets. As stated earlier, pedestrianization has numerous positive impacts on an area as it helps alleviate air and noise pollution, save fuel, improve the retail income in the district, improve the quality of life and provide safety to people.

2.4.1. Advent of Pedestrianization

Pedestrian streets have been there from historical times. Even Mesopotamian and Egyptian streets served as spaces for people to gather. The streets in the core areas of many cities were narrow, pedestrian-oriented and vibrant and lively spaces. They responded to the local needs and interests of people. Islamic and Indian cities had a culture of people on foot and the use of street as a public space in the past.

With the advent of the industrial era, the urban street started becoming chaotic. As early as 1910 and for more than half a century thereafter, the motor car was embraced by progressive urbanists everywhere as a remarkable invention (Wolf, 1974). The motorcar brought the inherent opportunity for increased speed of travel. Danger to the pedestrian became implicit and separation of pedestrian travel and auto routes became essential. By 1950, the motorcar had made a universal travel almost impossible on the streets (Fig. 2.27).

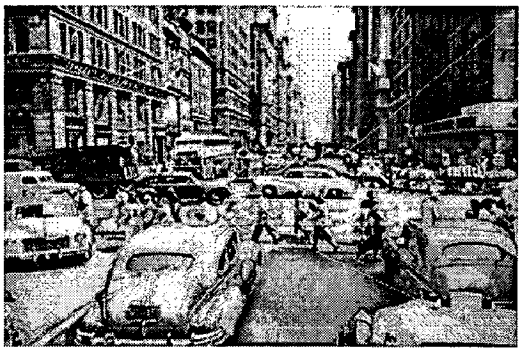


Fig. 2.27. Chaotic streets in 1950s in New York

Source: www.photobucket.com

A changed viewpoint, which emerged in the 1950's, gained strength in the 1960's, and is now a central planning theme in many European and American cities – urban transport without the motor car or with least emphasis to the motor car. The first attempt was implemented in the 1940s in European cities. In North America, this revolution started a little late. By 1975, nearly every major city in Europe had realized pedestrianizing its streets and had banned cars from significant portions of its historic district and retail areas (Fig. 2.28). Europe set a benchmark and other countries started to follow subsequently.

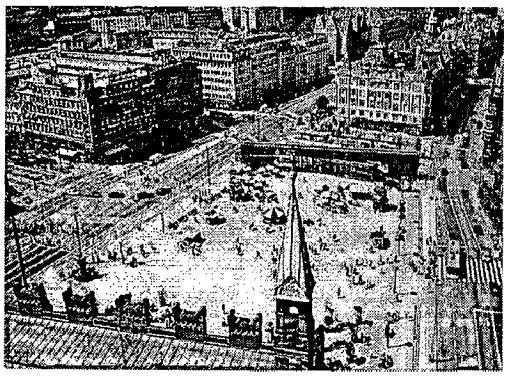


Fig. 2.28. Pedestrianized Sqaure in Copenhagen in 1960s

Source: www.flickr.com

In terms of implementing pedestrianization and enhancing the commercial health of city centers, there are great examples to look up to from the continent of Europe. West Germany, Netherlands, Denmark, Sweden, France and Finland have achieved great environmental and commercial improvements by the development of traffic-free areas. Germany was one of the few first countries to convert the existing trafficked streets to pedestrian-only use. The first identifiable conversion of a street into a pedestrian mall occurred even before the war when Limbecker Strasse in Essen was closed to vehicular traffic in 1927 and Hohe Strasse and Schildergasse in

Cologne were converted to foot streets in 1949 (Fig. 2.29 & Fig. 2.30). By 1960, 35 West German cities had pedestrian malls and by 1966 the figure had reached 63 (Hajdu, 1988). There are some 200 towns and cities in West Germany today which have adopted pedestrianization in practise. Another early example in Europe was Lijnbaan in Rotterdam which was a purpose-made pedestrian precinct in 1953 (Fig. 2.31). Central Copenhagen has the famous example of Stroget street pedestrianization (Fig. 2.32).

Fig. 2.29: Hohestrasse, Cologne

Source: www.flickr.com

Fig. 2.30: Schildergasse, Cologne

Source: www.flickr.com

Fig. 2.31: Lijnbaan, Rotterdam

Source: www.flickr.com

Fig. 2.32: Pedestrian square, Copenhagen

Source: www.flickr.com

The pedestrianization of shopping streets in Britain can be traced back as far as 1923 when Coventry implemented some ideas but it was not until the late 1960s that that British cities began to pedestrianize their 'high streets' like in Norwich (Fig. 2.33) and in Reading (Robertson, 1993). In UK, the first pedestrianized shopping centre was in Stevenage in 1959 (Fig. 2.34).

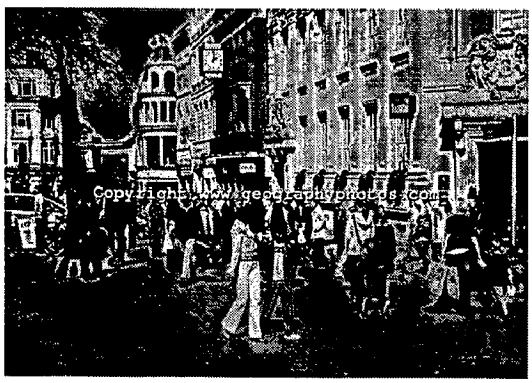


Fig. 2.33: Norwich city centre

Source: www.flickr.com

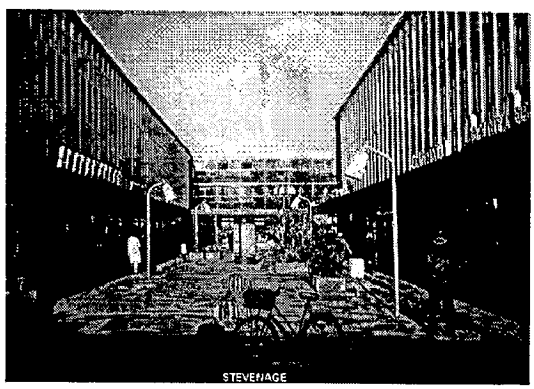


Fig. 2.34: Stevenage Shopping Centre

Source: www.flickr.com

In the 1960s and early 1970s, many mid-sized U.S. cities installed pedestrian malls in their downtown areas, as a response to the commercial success of self-contained edge-of-town shopping malls. In 1959, Kalamazoo, Michigan, became the first American city to adopt a pedestrian mall for their downtown area, closing two blocks of Burdick Street to automobile traffic (Robertson, 1993) (Fig. 2.35). By 2000, there were 75 pedestrian malls in the U.S. Another notable experiment in the U.S. is that of the Nicollet Mall in 1960s, wherein the major shopping street was closed to traffic for 8 blocks and the right-of-way was shared by wide pedestrian walks and a narrow transit way for buses and taxis (Fig. 2.36). It has resulted in considerable amount of pedestrian activity on the street because of its pleasant quality and active surroundings.

2.35: Burdick Street, Kalamazoo
Source: www.flickr.com

Fig. 2.36: Nicollet Mall, U.S.
Source: www.flickr.com

Taking lessons from the European, American and British experiments, many other countries throughout the world like Colombia, Brazil, Argentina, China, Japan, South Korea, Singapore, Malaysia and Australia followed suit and implemented the strategy of pedestrianization in many of the core areas of their cities, to give back the deteriorating and congested core to the people.

2.4.2. Pedestrianization Terminologies and Typologies

The following are some of the typologies and terminologies related to the concept of pedestrianization.

2.4.2.1. Pedestrian Streets and Malls

Pedestrian streets are individual streets from which traffic has been eliminated. Emergency vehicles usually have access and service and delivery trucks are allowed during restricted hours. Pedestrian mall is synonymous to Pedestrian street and is a term that originated in North America to describe traffic-free zones where all vehicles are banned in a central street (Fig. 2.37).

Fig. 2.37: Pedestrian street, Moscow
Source: www.flickr.com

2.4.2.2. Semi-Pedestrian Streets

Semi-pedestrian streets are becoming more popular. These are areas where the speed of vehicles is very low and where the larger part of the surface is reserved for the pedestrians, with parking limited to some restricted spaces. It is an arrangement with many advantages; those who are unable to walk or handicapped can take the vehicles at low speeds. There is no rigid separation between pedestrians and vehicles, since pedestrians have the larger priority and vehicles are tamed (Fig. 2.38).

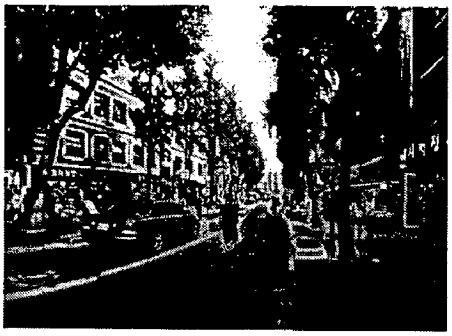


Fig. 2.38: Semi-pedestrian street in Jimbocho, Tokyo

Source: www.flickr.com

2.4.2.3. Pedestrian Zone

Pedestrian zones (also known as auto-free or car-free zones) are areas of a city or town reserved for pedestrian only use and in which some or all automobile traffic may be prohibited. They are instituted by communities who feel that it is desirable to have pedestrian-only areas (Fig. 2.39).

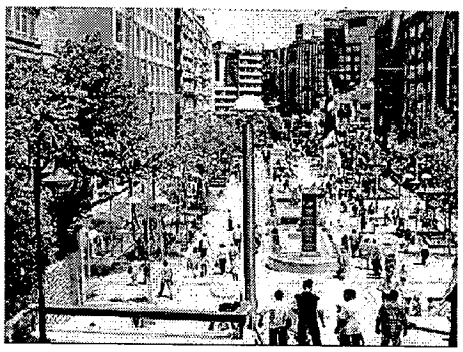


Fig. 2.39: Pedestrian Zone in Leon

Source: www.flickr.com

2.4.2.4. Pedestrian Precinct

Pedestrian commercial districts or precincts are essentially the city's core area or the central business district or the downtown area, a part of which is pedestrianized, to prevent heavy problems of traffic chaos and give more priority to pedestrian movement (Fig. 2.40). Main streets constitute the core street of the pedestrian commercial district, which is essentially a retail street or a shopping street. Some cities have sought to revitalize their downtowns by banning cars from the Main Street, altogether or during some time periods, such as weekends and evenings, and turning it into a pedestrian mall (Boyd, 1998).

Fig. 2.40: Pedestrian Precinct in Tokyo

Source: www.flickr.com

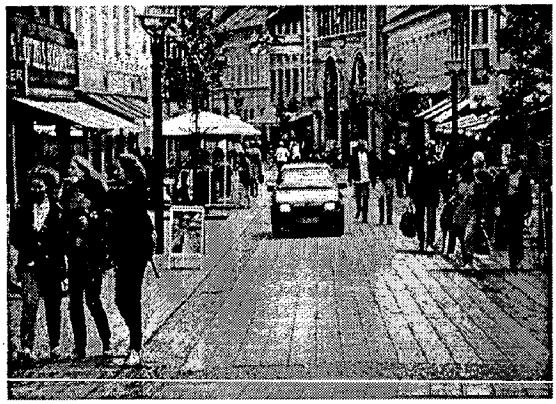
2.4.2.5. Woonerf

Woonerf, a term used in the Netherlands and Flanders, is a street where pedestrians and cyclists have legal priority over motorists (Fig. 2.41). The techniques of shared spaces, traffic calming, and low speed limits are intended to improve pedestrian, bicycle, and automobile safety. In 1999 the Netherlands had over 6000 woonerfs. Under Article 44 of the Dutch traffic code, motorised traffic in a woonerf or "recreation area" is restricted to walking pace. In Germany, similar zones

are termed *Verkehrsberuhigter Bereich* (meaning traffic calming area), where the speed limits is restricted to 7 km/hr (Baker, 2006).

2.4.2.6. Pedestrian Village

A pedestrian village is a compact, pedestrian-oriented neighborhood or town, with a mixed-use village center, that follows the tenets of New Urbanism. Shared-use lanes for pedestrians and bicyclists are generally in front of the houses and businesses and the streets for motor vehicles are at the rear. Venice, Italy is essentially a pedestrian village with canals (Fig. 2.42).



2.41: Woonerf, Netherlands

Source: www.flickr.com

Fig. 2.42: Pedestrian village, Venice

Source: www.flickr.com

2.4.2.7. Copenhagenization

Copenhagenization is a concept in urban planning and design relating to the implementation of better pedestrian facilities and segregated bicycle facilities within the city. The term originated with Danish urban design consultant Jan Gehl. It does not support the use of car and stresses on the concomitant benefits for street life and the natural environment, the health and fitness of citizens, and the level of amenities in cities.

2.4.3. Pedestrianization Strategies

Pedestrianization can be achieved by adopting many innovative techniques to make the streets as a pedestrian's paradise or a pedestrian's domain. Some of these innovative solutions used in countries abroad are put forth as under:

2.4.3.1. In terms of space

a) By widening the sidewalks and narrowing the carriageway width. This has been successfully implemented in cities like Manhattan, New York, Chicago and Minneapolis in U.S (Fig. 2.43).

b) By grade separation of pedestrians. The spatial grade separation of pedestrians and vehicles is through elevated skywalks or underground pedestrian subways (eg, Hong Kong skywalk) (Fig. 2.44).

c) By improvement of sidewalks and other pedestrian infrastructure like better street lighting, street furniture, signage, pedestrian signals, adequate landscape and wide crossings.

d) By creating shared street spaces called woonerfs (eg. woonerfs in Germany and Netherlands).

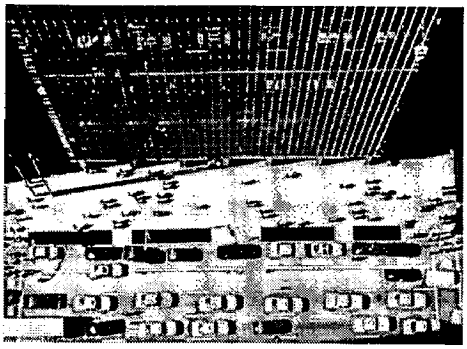


Fig. 2.43: Wide sidewalks in Manhattan

Source: www.flickr.com

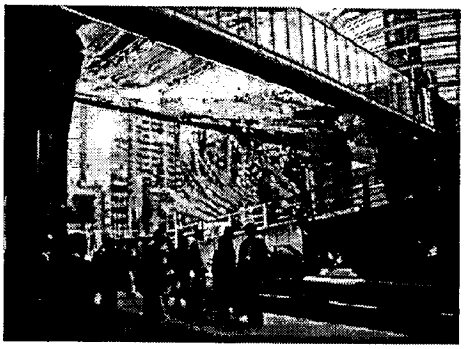


Fig. 2.44: Hong Kong Skywalk

Source: www.flickr.com

2.4.3.2. In terms of time

Fig. 2.45: Part-time Pedestrian street in GuildFord, UK

Source: www.flickr.com

a) By creating part-time pedestrian streets where vehicular access is allowed only in specific time-slots (eg. GuildFord, UK) (Fig. 2.45).

b) By choosing only certain days in a week to allow entry of vehicles on a street (eg. Ireland).

c) By allowing access to delivery-vehicles only during non-peak hours (eg. Copenhagen).

2.4.3.3. In terms of speed

d) By adopting traffic calming measures like speed humps, curb extensions, raised crossings etc. and imposing speed restrictions on vehicles, while they enter into a pedestrian precinct (eg. Krakow, Poland).

2.4.3.4. In terms of visual elements

e) By using varied textures, colors, pavers etc. and reminding drivers that they are in a pedestrian zone (eg. Causeway Bay, Hong Kong).

2.4.3.5. In terms of Traffic Management

f) By creating full-time pedestrian streets which are completely car-free; the entry of vehicles is fully forbidden and only emergency vehicles are allowed. The delivery vehicles serve the shops from the back of the street during non-shopping hours (eg. Sauchiehall Street, Glasgow) (Fig. 2.46).

g) By creating pedestrian streets where cars are banned but public transit way is allowed to run (preferably a tram or a bus service at the centre.) Public transport could be bus, subway, or elevated metro (eg. Bogota) (Fig. 2.47).

h) By diverting vehicles through the rear streets and making the main streets pedestrian-only (eg., Essen, Germany).

i) By allowing only para-transit services in a pedestrian precinct like car-sharing, shared taxis and a dial-a-ride services (eg. Times Square, New York).

Fig. 2.46: Sauchiehal Street, Glasgow

Source: www.flickr.com

Fig. 2.47: City Centre, Bogota

Source: www.flickr.com

2.4.3.6. In terms of legislations

j) By imposing regulation on the number of parking spaces, increasing parking rates and instituting time restriction in parking.

k) By introducing congestion tax on vehicles in the roads (eg. Stockholm, Sweden).

l) By regulations like restricting entry of cars with odd license plate numbers on a street on a day or on few days in a week (eg., Bogota, Colombia).

m) Through bonus zoning, wherein building setbacks can be obtained from developers in lieu of extra FAR, to create arcades and pedestrian plazas (eg. Chicago).

n) Introducing innovative programs like 'one day without my car' to encourage people to adopt walking (eg. Berkley, California).

o) Introducing laws in new residential developments not to have any right to own a car and make the development easily accessible and foot-friendly and have an emergency parking for a few cars (eg. Germany).

p) By adopting regulations like carbon-emissions, which restricts and limits the amount of carbon released from a car; a more emission would mean paying a heavy fine to the local body (eg. Sweden and Netherlands).

q) By enacting laws for pedestrianization, for example, in California (1960) and Minnesota (1962) these laws were enacted to segregate the pedestrians and protect public safety in the core areas and shopping precincts of the city.

2.5. Pedestrian Standards and Guidelines

Some important and relevant pedestrian standards and guidelines available in different countries are hereby studied under this section, for understanding the design aspects of pedestrian facilities and amenities on streets, and make a comparative analysis of them to draw certain relevant conclusions for further application in planning proposals. The following standards have been studied in detail from US, UK, Australia and India.

2.5.1. Design standards and guidelines in US

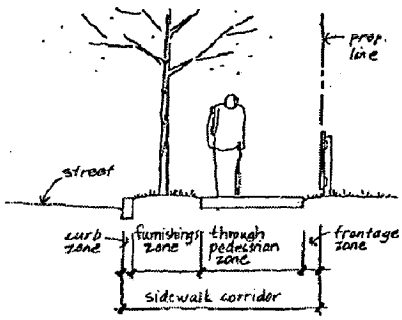
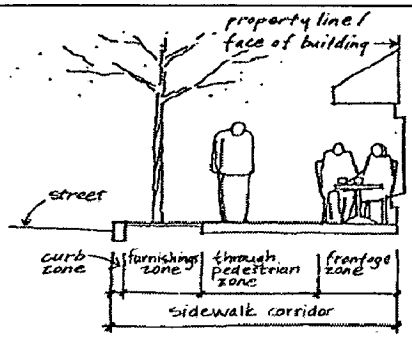
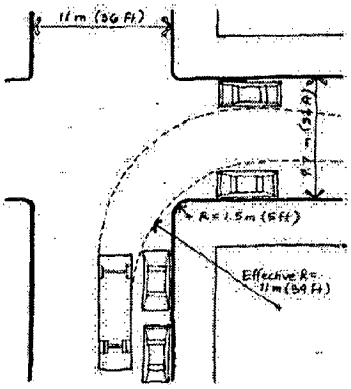
Talking about American standards, many cities like San Diego, Portland, New York, Manhattan, Minneapolis, Albemarle etc. have their own official manuals for pedestrian facility design. To understand the design standards and guidelines followed in US, two design guides are selected here.

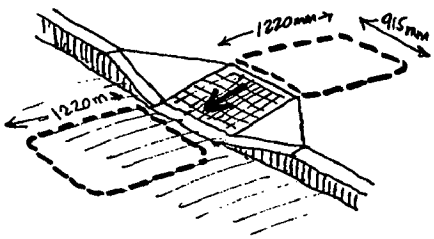
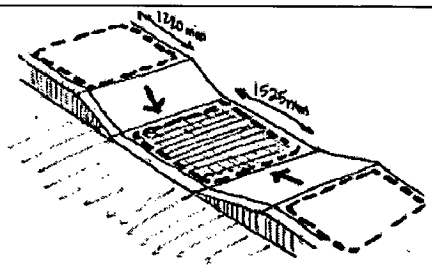
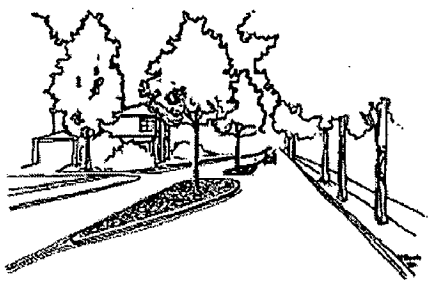
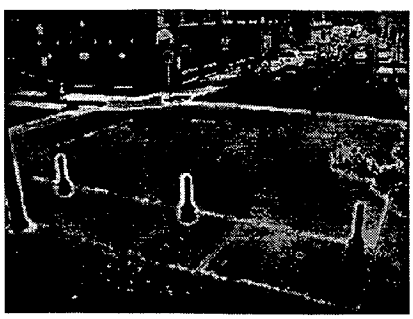
2.5.1.1. Portland Pedestrian Design Guide

Portland, a city in the state of Oregon in U.S., came up with design standards and guidelines to promote an environment conducive to walking (Office of Transportation, Engineering and Development, Portland, 1998). These guidelines are a part of the pedestrian master plan prepared for the overall city. The initial process of assessing and documenting existing practices started in 1995 and by 1998, the final guide was made. The following is a summary of the standards prescribed under it (Table 2.1).

Table 2.1: Summary of guidelines prescribed under Portland Pedestrian Design Guide

S. No.	Name of Component/Facility	Description
1.	Sidewalks	A minimum width of 1.8m is prescribed. The sidewalk is divided into four zones – frontage zone, through pedestrian zone, furnishing zone and curb zone (Fig. 2.48 & 2.49). The Frontage Zone is the area between the Through Pedestrian Zone and the property line and can vary between 450mm-750mm. The Through Pedestrian Zone is the walking zone and it can vary between 1500mm-2500mm. The Furniture Zone is the paved area adjacent to Through pedestrian zone for furniture and amenities and its width can vary between 600m-1200mm. The curb zone is additional width for curb and its width can be 150mm. As per the American Disability Act, for a wheelchair, a minimum clear passage of 915 mm is required. A maximum cross-slope of 1:50 is suggested for the sidewalk.

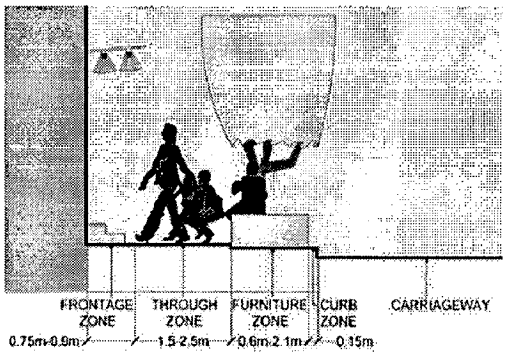
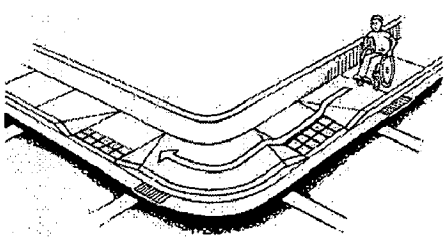
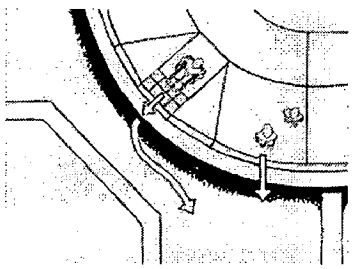
		 **Fig. 2.48: Sidewalk zone in commercial area**  **Fig. 2.49: Sidewalk zone in residential area**
2.	Curb Radius	The curb radius is an important consideration at the corners. In comparison to a large curb radius, a tight curb radius provides more pedestrian area at the corner and makes vehicles slow more at the corners. The radius may be as small as 900 mm (3'-0") where there are no turning movements, or 1.5 m (5'-0") where there are turning movements and there is adequate street width (Fig. 2.50 & 2.51).  **Fig. 2.50: Curb Radius at street corner**  **Fig. 2.51: Double curb line in South Carolina**
3.	Curb Ramp	The guide suggests two kinds of curb ramps - perpendicular ramps and parallel ramps. The first has a ramp into a crosswalk, while the second has a ramp into a landing that is flush with the street surface, sometimes called a 'dropped landing (Fig. 2.52 & 2.53). The suggested ramp slope is 1:12 and the recommended width is 915 mm (3'-0"). Minimum landing width recommended is 1220mm (4'-0").

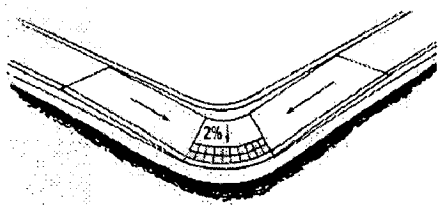
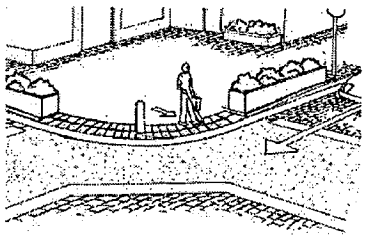
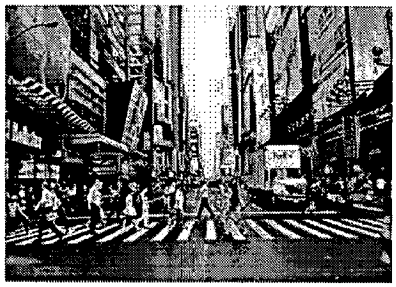
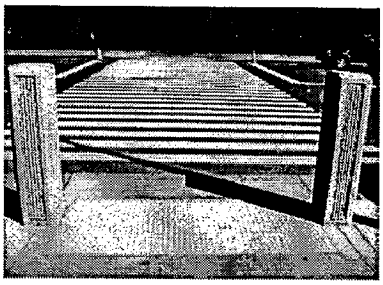
		 **Fig. 2.52: Perpendicular ramp**  **Fig. 2.53: Parallel Ramp**
4.	Curb Height	A curb height of maximum of 175 mm is recommended for new sidewalks.
5.	Crosswalks and mid-block crossings	The guide suggests that in pedestrian districts and main streets, the crosswalks must be provided between every 45-90m. In other city walkways, they could be at a distance of 45m-120m. The crosswalk width can vary between 2.5-3.7m.
6.	Pedestrian Refuge Islands	Refuge islands allow pedestrians to cross one segment of the street to a relatively safe location out of the travel lanes, and then continue across the next segment in a separate gap. It is appropriate to provide it where the roadway to be crossed is greater than 15 m (fifty feet) wide or more than four travel lanes. The size suggested is 1.8m x 6m.
7.	Pedestrian signals	 Pedestrian-only traffic control signals are used at midblock location as well as at intersections, where pedestrian volumes are high (Fig. 2.54). The minimum length for the WALK interval on a pedestrian signal indication is 4 to 7 seconds, just long enough for a pedestrian to step off the curb and begin crossing. **Fig. 2.54: Pedestrian signals**
8.	Traffic calming	Traffic calming measures suggested involve curb extensions, modern roundabouts, traffic circles, slow points, raised crosswalks and traffic diverters (Fig. 2.55 & 2.56).  **Fig. 2.55: Slow Points**  **Fig. 2.56: Raised Crosswalk**
9.	Shared use path	Shared bicycle/pedestrian facilities should have a clear passage width of at least 3.7 m (12'-0").

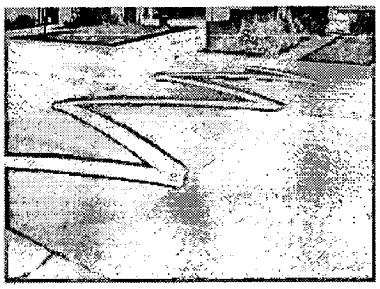
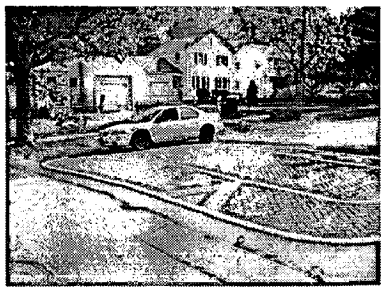
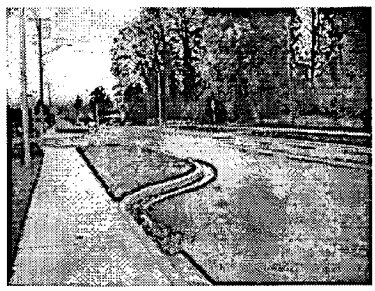
2.5.1.2. Best Practices Design Guide, U.S. Dept. Of Transportation

This guidebook is the second part of a two-phase project focused on designing sidewalks and trails for access. It was created to provide planners, designers, and transportation engineers with a better understanding of how sidewalks and trails should be developed to promote pedestrian access for all users, including people with disabilities. This guidebook is a compilation of data and designs gathered during a comprehensive literature search and site visits conducted throughout the United States (Axelson et al., 1998). Many of the recommendations provided in this guidebook are based on research gathered during Phase I (U.S. Dept. of Transportation, 1998). The following is a summary of the standards prescribed under it (Table 2.2).

Table 2.2: Summary of guidelines prescribed by U.S. Dept. of Transportation

S. No.	Name of Component/Facility	Description
1.	Sidewalks	The sidewalk is divided again into four zones – frontage zone, pedestrian zone, planter/furniture zone and curb zone. The widths recommended are shown in Fig. 2.57.  **Fig. 2.57: Various zones of sidewalk** At least 915 mm (36 in) of clear space is necessary for people who use assistive devices such as wheelchairs, walkers, and crutches to maneuver along the sidewalk. Sidewalk grades ideally should not exceed 5.0 percent, and the most gradual possible slope should be used at all times.
2.	Curb Radius	Curb radius can vary between 5m-15m depending on the street width.
3.	Curb Ramp	Recommended ramp width is 1.22m. The curb ramps could be perpendicular curb ramps, diagonal curb ramps, parallel curb ramps, combination curb ramps or built-up ramps (Fig. 2.58, 2.59, 2.60 & 2.61).  **Fig. 2.58: Perpendicular ramp**  **Fig. 2.59: Diagonal ramp**

		 **Fig. 2.60: Parallel ramp**  **Fig. 2.61: Depressed Corners**
4.	Curb Height	A 153mm (6") height is desirable though it can vary between 101-203 mm.
5.	Crosswalks and mid-block crossings	The crossing distance of mid-block crossings can vary between 10.8m to 22m. The line markings should be approximately 305 mm to 610 mm (12 in to 24 in) wide and spaced 305 mm to 610 mm (12 in to 24 in) apart (Fig. 2.62 & 2.63). Width recommended is 2.5m.  **Fig. 2.62: Mid-block crossing in San Francisco**  **Fig. 2.63: Crosswalk in New York**
6.	Pedestrian Refuge Islands	Guide suggests that it is appropriate to provide it where the roadway to be crossed is greater than 15 m (fifty feet) wide or more than four travel lanes. The refuge islands must have a minimum width of 1.22m, though 1.83m width is preferred.
7.	Pedestrian signals	Flashing signals can help maximize pedestrian safety when drivers are aware of the crosswalk location and when a pedestrian crosses.
8.	Traffic calming	Traffic calming is an innovative technique which can be beneficial to the pedestrians as they are vulnerable to excessive speed on the roads leading to high toll of pedestrian accidents. The code describes techniques like speed humps, speed tables, raised intersections, roundabouts, chicanes, lateral shifts and chokers, curb extensions and roadway narrowing (Fig. 2.64, 2.65, 2.66 & 2.67).

		 Fig. 2.64: Speed Humps  Fig. 2.65: Speed tables  Fig. 2.66: Chicanes  Fig. 2.67: Curb extensions
9.	Shared use path	The tread of a shared-use path should be at least 3.05 m (10 ft) wide. A minimum of 2.44 m (8 ft) may be used on shared-use paths that will have limited use. Shared use paths should also have graded areas at least 610 mm (2 ft) on either side of the path. On shared-use paths with heavy volumes of users, tread width should be increased to a range from 3.66 m to 4.27 m (12 ft to 14 ft).
10	Signage	In US, as per the American code, the pedestrian crossing street signs are written in black on a yellow background and these signs are diamond shaped or rectangular in shape.

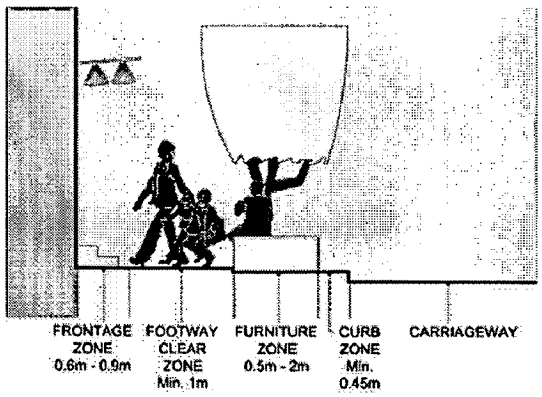
2.5.2. Design standards and guidelines in UK

Talking about standards in UK, two sets of standards were studied to understand the pedestrian design standards and guideline followed in general in the country. One is the Design Guide followed in London and the other is a research study conducted to understand the pedestrian safety in UK.

2.5.2.1. Streetscape Guidance, 2009, A guide to better London streets

The Streetscape Guidance report was prepared to give advice and information to Transport for London staff who look after the design, appearance and upkeep of London's streets and roads. This document provides information on the design criteria and good practices to be followed when developing and implementing works on the Transport for London Road Network. The following table shows a summary of the guidelines prescribed in the guidebook (Table 2.3).

Table 2.3: Summary of guidelines prescribed under Streetscape Guidance for London

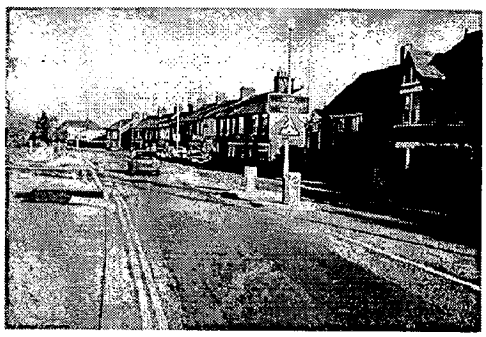
S. No.	Name of Component/Facility	Description
1.	Sidewalks	The sidewalk is divided again into four zones – frontage zone, footway clear zone, furniture zone and kerb zone. The widths recommended are shown in Fig. 2.68.  **Fig. 2.68: Various zones of sidewalk**
2.	Curb Radius	Curb radius can be a maximum of 12m.
3.	Curb Ramp	Width of curb ramp recommended is 1.2m.
4.	Curb Height	A kerb face (or upstand) of between 125mm and 140mm normally delineates the boundary of a carriageway. Kerbs should typically have a height of 125mm. Kerb heights at bus stops should preferably be 140mm. Widths of kerb should be generally 150mm and can vary to a maximum of 300mm.
5.	Crosswalks and mid-block crossings	Zebra, pelican and puffin crossings must have a minimum crossing width (between two rows of studs) of 2.4m. Toucan crossings should have a minimum crossing width of 4m.
6.	Pedestrian Refuge Islands	Guide suggests that a refuge island of 1.2m wide and 3m long minimum. The nominal length could be 4.8m.
7.	Pedestrian signals	Duration of 20 secs has been suggested as the minimum time duration of a pedestrian signal.
8.	Traffic calming	Traffic calming techniques have not been mentioned in the guide, as it focuses more on the design aspects and the amenities for the pedestrian paths.
9.	Shared use path	Shared use path concept is not mentioned in the guide.
10.	Signage	Information signs on streets are usually supplied by local authorities to help locate local facilities and amenities. Wall mounted information boards with timetables and maps should be centered approximately 1400mm from the footway surface.

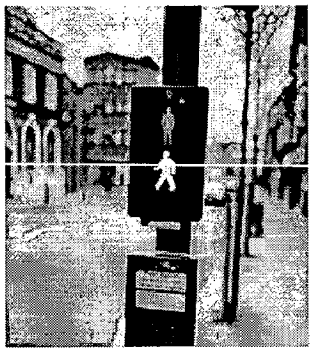
11.	Tactile Paving	Commonly used one is the blister surface paving used for pedestrians who are visually impaired. Corduroy hazard warning surface, lozenge warning surface, ladder and tramline warning surface can be used to indicate appropriate warnings. Blister paving size suggested is 400mx400mm (Fig. 2.69 & 2.70).  **Fig. 2.69: Tactile Paving**  **Fig. 2.70: Blister Paving**
12.	Utilities	Inspection covers, chambers and stop taps etc. must be located in the carriageway (Fig. 2.71). For drainage, a suggested option is Precast concrete trapped gully pots, installed along the channel, are connected to 150mm diameter pipe connections that discharge either directly to the nearest appropriate sewer or via a highway drainage pipe system.  **Fig. 2.71: Inspection Chamber**
13.	Amenities	The guide recommends that the street must have supporting amenities like benches, litter bins, recycling bins, telephone boxes, post boxes, smoke vents, open air cafes, roadside cameras, planting, bollards, guard rails, salt bin and public art, to make it a popular people-friendly space.

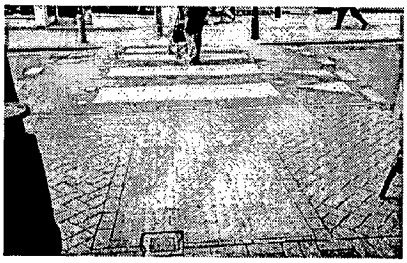
2.5.2.2. Research Study in UK

A research study was conducted by the David Davies Associates in UK for the Federal Highway Administration, U.S. Department of Transportation. The study titled 'Research, Development, and Implementation of Pedestrian Safety Facilities in the United Kingdom', aimed at the evaluation of existing pedestrian facilities and traffic control devices and it basically may help in getting a general overview of the pedestrian standards in UK (G.Davies, 1999). The following table shows a summary of the standards covered as a part of the research work (Table 2.4).

Table 2.4: Summary of the standards evaluated in the Research Study in UK

S. No.	Name of Component/Facility	Description
1.	Sidewalks	Transport in the Urban Environment, UK recommends that all pedestrian footways should have a minimum width of 1.8 m (6 ft) but should be wider wherever possible. The overall width can vary between 2.7m to 4.5m (Fig. 2.72). The gradients of ramps for wheelchairs should be not greater than 8 percent (1:12).  **Fig. 2.72: Sidewalk in UK**
2.	Curb Radius	Not mentioned.
3.	Curb Ramp	In UK, for wheelchairs and prams which need to cross, the gradient should not be more than 1:12, though the gradient preferred is 1:20.
4.	Curb Height	The kerb height can range between 150mm to 175mm.
5.	Crosswalks and mid-block crossings	In UK, crosswalks were introduced by the name of zebra crossings in 1950s. Eight-foot to ten-foot wide crosswalks are recommended, with 6 feet being the absolute minimum (most likely in neighborhoods) (Fig. 2.73). In main streets and pedestrian precincts, traffic signals must be surely employed to ensure safety of the pedestrians across the crosswalk.  **Fig. 2.73. Crosswalk in UK**
6.	Pedestrian Refuge Islands	Pedestrian refuges can provide a series of crossing points along a road where it would be impractical to install Zebras or Pelicans at each crossing location. The minimum recommended width (across the road) for a refuge is 1.2 m, but

		2 m is preferred to accommodate wheelchairs, pushchairs, and cycles. Where pedestrian flows are high, this may need to be increased.
7.	Pedestrian signals	Pelican crossing is a pedestrian light controlled crossing. It is activated by pedestrian pushing the button. A "red/green man" signal on far side of the carriageway shows pedestrian when to cross (Fig. 2.74). Puffin crossing is a pedestrian User-Friendly intelligent crossing (Fig. 2.75). It is activated by the pedestrian pushing a button. Intended as a replacement for the Pelican, it monitors the presence of pedestrians waiting and crossing and lengthens or shortens the crossing time accordingly. The "red/ green man" signal is located on the near side to the pedestrian.  **Fig. 2.74: Pelican crossing**  **Fig. 2.75: Puffin crossing**
8.	Traffic calming	Traffic calming measures like curb build-outs, flat top road hump, curb extensions, traffic circles and roundabouts. 32 km/h (20 mi/h) speed limit zones have been introduced where the lower speed limit is enforced by physical measures (Fig. 2.76).  **Fig. 2.76: 32 km/hr (20 miles/hr) zone in UK**
9.	Shared use path	Not mentioned.
10.	Signage	Not mentioned.

11.	Tactile Paving	Tactile paving is now widely used to help alert and guide visually-impaired pedestrians on the footway (Fig. 2.77). It covers surfaces to guide visually-impaired people at crossings (blister paving), hazard warning surfaces (corduroy paving), tactile lines to segregate cyclists and pedestrians on shared-use routes, and other forms of warning and information surfaces.  **Fig. 2.77: Tactile warning in a curb ramp**

2.5.3. Design standards and guidelines in Australia

Talking about standards in Australia, a research study titled, 'Pedestrian Safety in Australia', has been studied to understand the pedestrian design standards and guideline followed in general in the country.

2.5.3.1. Study on Pedestrian Safety in Australia

The research study was conducted for the benefit of interest of the state and local pedestrian and bicycle coordinators, transportation engineers, planners, and researchers involved in the safety and design of pedestrian facilities within the highway environment (Cairney, 1999). The research study comprises of standards for improving the pedestrian safety in general in Australia. The following table shows a summary of the standards covered as a part of the research work (Table 2.5).

Table 2.5: Summary of standards suggested under Pedestrian Safety research in Australia

S. No.	Name of Component/Facility	Description
1.	Sidewalks	The minimum width of sidewalk must be 1.2m. The total width of sidewalk usually can range between 2.5 – 4m.
2.	Curb Radius	Not mentioned.
3.	Curb Ramp	The curb ramp width must be ideally 0.9-1m with a slope of 1:10.
4.	Curb Height	Not mentioned.
5.	Crosswalks and mid-block crossings	A crosswalk width of 3.5m is recommended.

6.	Pedestrian Refuge Islands	A 1.2m width is recommended for the pedestrian refuge islands.
7.	Pedestrian signals	The minimum pedestrian green time specified is 6 s,
8.	Traffic calming	Traffic calming measures involve humps and raised platforms, 25 to 30 km/hr speed limits imposed and roundabouts and traffic circles.
9.	Shared use path	Not mentioned.
10.	Signage	The pedestrian crossing sign in Australia unlike in US is a circular sign and is yellow with black symbol and lettering, a color combination otherwise reserved for warning or roadwork signs.

2.5.4. Design standards and guidelines in India

For many years in India, there has been no proper guideline for pedestrian facility planning except the Indian IRC Code (IRC 108:1988 - Guidelines for Pedestrian Facilities). In the past 3-4 years, efforts have been made, and these can be seen in the Pedestrian Design Guidelines, framed by UTTIPEC, Delhi Development Authority and Street Design manual prepared by ITDP (Institute for Transportation and Development Policy). These have been studied in the following section.

2.5.4.1. IRC Code Guidelines for Pedestrian Facilities

These guidelines consist of the requirements for pedestrian facilities with a paramount consideration to reducing their conflicts with vehicular traffic, improving their convenience and ensuring a continuous pedestrian flow. The following table shows a summary of the standards prescribed in the guideline (Table 2.6).

Table 2.6: Summary of standards suggested under IRC (Indian Road Congress) code

<table>
<tr><th>S. No.</th><th>Name of Component/Facility</th><th>Description</th></tr>
<tr><td>1.</td><td>Sidewalks</td><td>Minimum width must be 1.5m, though it is related with pedestrian flows (Table 2.7).
Table 2.7. Capacity of persons vs. width of sidewalk as prescribed in Indian Road Congress Manual
<table>
<tr><th rowspan="2">Width of sidewalk (in metres)</th><th colspan="2">Capacity in number of persons per hour</th></tr>
<tr><th>All in one direction</th><th>In both directions</th></tr>
<tr><td>1.5 m</td><td>1200</td><td>800</td></tr>
<tr><td>2.0 m</td><td>2400</td><td>1600</td></tr>
<tr><td>2.5 m</td><td>3600</td><td>2400</td></tr>
</table></td></tr>
</table>

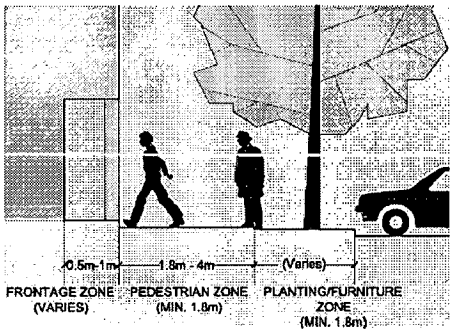
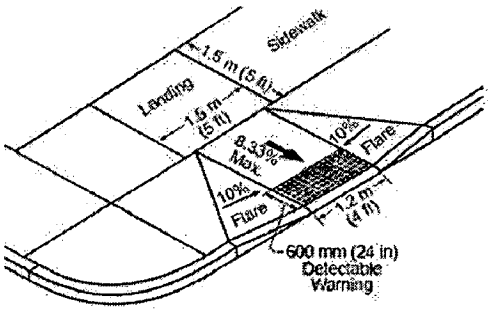
		<table><tr><td>3.0 m</td><td>4800</td><td>3200</td></tr><tr><td>4.0 m</td><td>6000</td><td>4000</td></tr></table> Source: Indian Road Congress code For sidewalks in shopping areas, the width should be increased by 1m which is treated as the 'dead width'. In other situations, for sidewalks passing adjacent to buildings and fences, the dead-width can be taken as 0.5m.
2.	Curb Radius	Not mentioned.
3.	Curb Ramp	Not mentioned.
4.	Curb Height	Not mentioned.
5.	Crosswalks and mid-block crossings	A zebra crossing must be always followed with a "Stop" line in paint as per IRC 35-1970 Code of Practice for Road Markings. Width of the zebra crossing must be adequate and should lie in a range of 2.0 to 4.0 m. Signalized zebra-crossings are more preferable as it has time slots for movement of cross-pedestrian traffic.
6.	Pedestrian Refuge Islands	Not mentioned.
7.	Pedestrian signals	Not mentioned.
8.	Traffic calming	Not mentioned.
9.	Shared use path	Not mentioned.
10.	Signage	Not mentioned.
11.	Grade-separated crossings	Foot-over bridges and pedestrian subways can be provided for grade-separation. Foot over bridges must be provided not far from the intersection and across a straight portion of any approach arm. Subways are underground straight tunnels connecting both sides of a typical carriageway. A rectangular subway can have a minimum width of 2.5m and a vertical clearance of 2.5m, though a 4m width and where possible a 6m width, can help in reducing the tunneling effect.

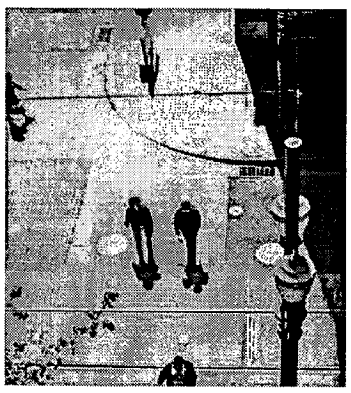
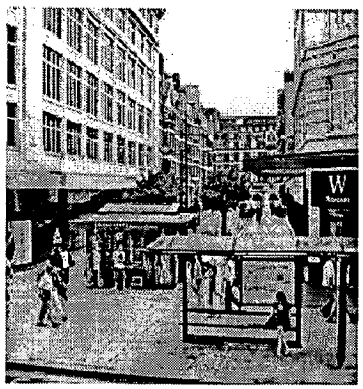
2.5.4.2. Pedestrian Design Guidelines, 2009, UTTIPEC, DDA

These guidelines were framed by the Unified Traffic and Transportation Infrastructure (Plg. & Engg.) Centre (UTTIPEC), formed under Delhi Development Authority (DDA), for immediate implementation, enforcement and uniform adoption of these by all the road owning agencies. The guidelines consist of ideal footpath width for various street widths and the various supporting

amenities that are essential for a comfortable walking experience (UTTIPEC, Delhi Development Authority, November, 2009). The following table shows a summary of some of the standards prescribed in the Guideline book (Table 2.8).

Table 2.8: Summary of the standards prescribed in the Pedestrian Design Guidelines, UTTIPEC

S. No.	Name of Component/Facility	Description
1.	Sidewalks	The guideline describes pavement in terms of three zones – frontage zone, pedestrian zone and planting/furniture zone, with a recommended width of 2.5m to 4m. Significantly, the curb zone is not included as a separate sub zone. The figure illustrates the widths prescribed (Fig. 2.78).  **Fig. 2.78: Sidewalk zones** The sidewalk slope must possess a slope of 5% (1:12).
2.	Curb Radius	The guideline suggests 1.5m for roads less than 30m wide, 3m for most intersections and 4.5m for streets with lot of truck traffic.
3.	Curb Ramp	Width of the kerb ramp should not be less than 1.2m. Standard kerb ramps are cut back into the footpath (flush with roadway), at a gradient no greater than 1:12 (Fig. 2.79). Tactile warning strip of 300mx300m must be laid to be provided on the kerb side edge of the slope.  **Fig. 2.79: Curb ramp detail**

4.	Curb Height	Curb height must be a maximum of 150mm. Maximum height of Median curb is about 220mm.
5.	Crosswalks and mid-block crossings	Crossings should be no less than 3m in width (Fig. 2.80). A more desirable width is 5m. Distance between zebra-crossings suggested is 80m-250m for residential areas and 80m-150m for commercial areas. Foot-over bridges must have a width of 3m.  **Fig. 2.80: A 3m wide sidewalk at Delhi**
6.	Pedestrian Refuge Islands	Refuge islands must be atleast 1.5m wide minimum.
7.	Pedestrian signals	Pedestrian initiated traffic lights may be installed at mid-block crossings to make traffic stop for pedestrians, cyclists and the physically handicapped. Pelican crossings were suggested.
8.	Traffic calming	Traffic calming measures like raised table-top crossings, slip road treatment, paving variations at crossings and intersections, chicanes, mini-traffic calming circles and full closures (Fig. 2.81 & 2.82).  **Fig. 2.81: Paving variations**  **Fig. 2.82: Full closure**
9.	Shared use path	Not mentioned.
10.	Signage	Information boards and map boards must be installed at appropriate places for the aid of pedestrians.
11.	Pedestrian amenities	Pedestrian amenities listed to increase the convenience factor

		for pedestrians were street lighting, underground utilities, public toilets, dustbins, hawker zones, public art, street furniture, educative signage, boundary wall art, map boards and street furniture.

2.5.4.3. Street Design Manual – Better Streets, Better Cities, ITDP

The Manual titled, 'Better Streets, Better Cities – a manual for street design in urban India', was prepared by Environmental Planning Collaborative and Institute for Transportation and Development Policy (India), with an objective for setting a design book for better street design (Shreya Gadepalli, 2010). It discusses the various elements that make up a street and standards regarding them. The same has been summarized in Table 2.9.

Table 2.9: Summary of the standards prescribed in the Design Manual – Better Streets, Better Cities, ITDP

S. No.	Name of Component/Facility	Description
1.	Sidewalks	The guideline suggests an unobstructed minimum width of 2m for the sidewalks. The guide suggests three zones – pedestrian zone with a width of 2m, furniture zone of width 1.5-2m and frontage zone of width 1m, a total width of 2.2 to 4.2m of the total sidewalk.
2.	Curb Radius	A 4m curb radius is recommended in the guideline.
3.	Curb Ramp	Not mentioned.
4.	Curb Height	Curb height must be a maximum of 150mm.
5.	Crosswalks and mid-block crossings	A minimum width of 2m is required for zebra-crossings. The distance between two zebra crossings is recommended as 50m.
6.	Pedestrian Refuge Islands	Refuge islands must be minimum 1m wide. A 2m width is very much desirable though.
7.	Pedestrian signals	Not mentioned.
8.	Traffic calming	Not mentioned.
9.	Shared use path	Not mentioned.
10.	Signage	Not mentioned.
11.	Street furniture and Pedestrian amenities	Street furniture can help make a street an attractive place to spend time. Benches, tables, street vending spaces, way-

		finding signs and bus stops, signposts, vending tables, water points, garbage bins, etc. must be provided to make the street attractive.

2.6. Legal Provisions and Initiatives Abroad

2.6.1. American Disability Act

The Americans with Disabilities Act (ADA) was signed into law on July 26, 1990. This civil rights law assures that a disabled person will have full access to all public facilities—primarily to public transit, public buildings and facilities, and along public rights-of-way. Generally, this involves removing barriers to wheelchairs and installing accessible wheelchair ramps. Thus it is essential that the design of pedestrian facilities take into account the abilities and disabilities of all pedestrians. In accordance with the Act, provision for the handicapped in the form of curb ramps must be installed at major locations, especially near intersections and mid-block crossings. ADA accessibility requirements most often help to create a better pedestrian environment, particularly for seniors, as well as for those with disabilities (Community Design and Architecture, San Diego, June, 2002).

2.6.2. Initiatives towards popularizing pedestrianization

Many initiatives have been take up in countries abroad, especially in Europe and United States, to popularize the concept of closing the streets to traffic and making people as well as the local authorities realize the benefits derived it. Voluntary organizations, non-profit organizations, semi-public bodies and people's groups and volunteers play a huge role in initiating such movements. The following section discusses examples of some such initiatives.

2.6.2.1. Summer Streets

In August 2008, Department of Transport, New York, opened a seven mile car-free route from the Brooklyn Bridge to the Central Park to bicyclists and pedestrians for three Saturdays in a row. This program, known as Summer Streets, gained attention not only by the New Yorkers but also by various cities across the globe (Department of Transportation, New York, 2008) (Fig. 2.83).

2.6.2.2. Weekend Pedestrian Streets

In 2008, the Department of Transport, New York, partnered with local merchants and traders and community groups to launch several temporary pedestrian streets. The Montague Street Business Improvement District hosted "Summer Space" for four Sundays in July along three blocks in Brooklyn Heights. Similarly, in Williamsburg, Brooklyn, the Northside Merchants Association organized "Williamsburg Walks" on Bedford Avenue for four Saturdays from mid-July to mid-August (Fig. 2.84)

Fig. 2.83: Summer Streets

Fig. 2.84: Weekend Pedestrian Streets

Source: World Class Streets: Remaking New York City's Public Realm

2.6.3. Initiatives towards safe pedestrian routes for all

Pedestrian projects were taken in New York city to make it more hospitable to school children and the elderly. The Department of Transport, New York, started Safe Streets for Seniors and Safe Routes to School programs, identifying high risk areas for these two population groups and suggesting improvements in those areas.

2.6.3.1. Safe Streets for Seniors

In January 2008, 'Safe Streets for Seniors' program was launched. Department of Transport, New York, identified 25 neighborhoods across the city that have a large number of senior citizens and a significant number of pedestrian crashes. Improvements in these areas included retiming pedestrian signals for seniors, constructing pedestrian refuge island, sidewalk extensions, shorten crossing distances and upgrading street markings for better visibility.

2.6.3.2. Safe Routes to School

Department of Transport, New York, started with a Priority Schools Program as a large-scale effort to improve pedestrian safety around the City's elementary and middle schools. After analyzing the crash data in 2003, 135 schools were identified for top priority and in 2006, operational improvements were undertaken which included new signals, new crosswalks, increased crossing time, better signage and speed humps. In 2007, long-term improvements were undertaken which included neck-downs, medians and new sidewalks. Constructional improvements were thus executed at all the priority schools.

2.6.4. Certain Policies available abroad

Cities like New York, Copenhagen, Melbourne, Lyon, London and Barcelona have formulated some policies, which are in favor of creating more space for people and opening up some of the streets completely to the people.

2.6.4.1. Unified Policy for high-quality streets in Melbourne, Australia

While other cities were redesigning their streets to accommodate the automobiles and develop indoor shopping malls, Melbourne invited people to celebrate streets as the city's most important public spaces. The city renovated its pavements and street furniture and developed a policy for active building facades to make walking an enjoyable experience. The results were that between 1995 to 2005, Melbourne experienced a 40% increase in pedestrian traffic and the economic vitality of the city as well improved proportionally (Fig. 2.85).

2.6.4.2. Coordinated Public Space Policy, Lyon

The Coordinated Public Space Policy was formulated in 1989 to create more space for people. In order to create a human face to the city, the traffic policy is aiming at putting car parking underground. Many of the renovated spaces in the centre of the city have 4 to 6 stories of parking spaces under the car-free surface of the public space, which is been run by a semi-public semi-private firm (Jan Gehl, 2005). This made efficient use of space and also hid a visually unappealing land-use (Fig. 2.86).

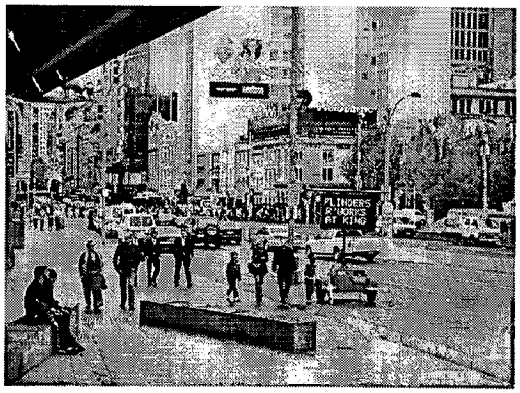


Fig. 2.85: Sidewalks in Melbourne

Source: www.flickr.com

Fig. 2.86: Place des Terreaux, Lyon

Source: www.flickr.com

2.7. Rules and Regulations in India

Pedestrian is the most vulnerable road user in India. Even then there is no legislation in India exclusively governing the rights and duties of the pedestrians (Bhardwaj, 2010).Starting with the Indian Penal Code, 1860 to the Motor Vehicle Act, 1988 to the recent National Urban Transport Policy, 2006; India has a rich variety of road legislations and policies. Though, in spite of the quantum of legislations the rights of the pedestrian have always remained hazy. This is primarily due to the fact that most of the legislations cater for the motorized road user (Roychowdhury.A., 2009). The Rules of Road Regulation, 1989, do mention pedestrians' right of way at unregulated crossings. But none of these are followed (Alok Gupta, On two legs and a prayer, Apr 2009).

2.7.1. The Noise Pollution (Regulation and Control) Rules, 2000

Noise Pollution (Control and Regulation) Rules, 1999 was published under the notification of the Government of India in the Ministry of Environment. As per the Rules, limits on the noise levels are enforced for different land use areas, which are as follows –

- Industrial area – 75 dB
- Commercial area – 65 dB
- Residential area – 55 dB
- Silence Zone – 50 dB

Inspite of these regulations, the noise levels on the streets abutting these land uses exceed the specified limits, making the walking experience very unpleasant and uncomfortable.

2.7.2. Other Acts and Laws

Though there is no Act present as such which directly aims for pedestrian safety, there are few Acts and Codes, which are indirectly in the interest of the pedestrians. The Indian Penal Code, for example, punishes - acts of rash or negligent driving (S. 279), causing of death due to negligence (S. 304), an act either endangering life or personal safety of others (S. 336) or causing hurt (S. 337) or grievous hurt (S. 338) by endangering the life and personal safety of others. The Motor Vehicles Act, 1988 and the Rules framed under it aim at regulating motorized traffic and the penalties are with reference to the acts on part of the Motor vehicle. Both the legislations recognize the need to safeguard the interests of the pedestrian but in an indirect manner.

The provisions of the IPC aim at protecting the public (which includes pedestrians) from getting hurt or being injured. The Motor Vehicles Act recognizes the interests of the pedestrian by providing penalties for exceeding the speed limits, licensing regulations etc. [S. 7 to 38 and S.112]. Furthermore, the Act under S. 138 cl. (h) and (i) empowers the State Government to make Rules prohibiting the motor vehicles from using foot paths and pavements and the prevention of danger, injury or annoyance to the public or any person, or of danger or injury to property or of obstruction to traffic.

Apart, from these two legislations the Municipal Corporation Acts also provide a degree of protection by making obstructions on a public street illegal unless created with the prior approval of the Collector. The only legislation in which the term pedestrian is found is the Rules of the Road Regulation, 1989. Under these rules certain obligations are imposed on the driver of a Motorized vehicle with respect to the pedestrian; they include:

(a) the duty of the driver to slow down when approaching a pedestrian crossing (Rule 8).

(b) Not to drive on the footpath or the cycle lane (Rule 11).

(c) No driver shall park a motor vehicle near a traffic light or on a pedestrian crossing or a footpath (Rule 15).

This is the only regulation that addresses the pedestrian directly. Though, some laws and regulations exist in India, none of these are followed by the people; they have developed a tendency to break the rules and the careless attitude of the people is to be blamed.

2.8. Findings and Inferences

The findings and inferences drawn from the literature study are summarized as follows.

1. Walking has numerous benefits, which justifies it as a sustainable and an efficient mode of transport and the need to make our cities walkable.
2. An average pedestrian finds it comfortable to walk a distance of 1.5km as per the National Survey of Pedestrian & Bicyclist Attitudes and Behaviors – Highlights Report, US, 2002.
3. The various attributes that make a successful pedestrian environment are – dimensional adequacy, safety and security, universal accessibility, convenience, continuity, comfort, cleanliness and maintenance, attractiveness and vitality.
4. While designing a street, the pedestrian components like sidewalks, street furniture, landscape, on-grade and grade-separated crossings, curb ramps, pedestrian refuges, street lighting, utilities, signage and paving must be carefully detailed and designed to make walking a convenient and an attractive journey.
5. The concept of pedestrianization, which originated in Europe, is a very effective strategy to eliminate vehicles from streets, make the street available for people on foot, improve the quality of life of the people and also convert the area from a car-oriented dull space to a people-oriented lively space.
6. The various strategies of pedestrianization in terms of space, time, speed, visual elements, traffic management and legislations can be suitably adopted and applied to an area or a street.
7. The comparative analysis of pedestrian design guidelines and standards from US, UK, Australia and India results in the final acceptable standards as shown in Table 2.10.

Table 2.10: Comparison of standards as prescribed in various Pedestrian Design Manuals

S.No.	Compponents	American standards From the U.S. Federal Highway Adminis-tration	Portland Pedestrian Design Guide	Streetscape Guidance 2009, A guide to better London streets	Indian IRC Code	Pedestrian Design Guidelines 2009, UTTIPEC-DDA, New Delhi	Better streets, better cities, A manual for street design in urban India	Australian standards (A study on Pedestrian safety in Australia)	Final Dimensions followed for evaluation
1	Sidewalk Dimension and adequacy (inclusive of space for universal accessibility)	**Min. Stds.** *Curb Zone – 0.152m *Furniture Zone – 0.6m (1.22m for trees) *Pedestrian Zone – 1.525m *Frontage Zone – 0.75m **Total width – 3.10m (min.)**	* 4.6m for arterial streets * 3.7m for city walkways where ROW is 18m * 3.4m for for city walkways where ROW is 15m * 3m for walkways where ROW is less than 15m *** 2.7m minimum**	Can vary from 2.95 – 4.05m * Kerb Zone – 450mm * Furniture/ Planting zone – 500-2000mm * Footway clear zone – 1000-2000mm * Frontage zone – 0.6m-0.9m *** 4.1m wide**	*1.5m for 1200 persons/hr *2m for 2400 /hr * 2.5m for 3600 /hr * 3m for 4800/hr * 4m for 6000/hr ***1.5m minimum** *** 2.5m in comm. areas.**	* 3.55-4.05m for 60m arterial * 4.1m for 45m arterial * 1.8m for 40m collector *2.85m for 30m collector *2m for 20m local street *3.2m for 12m local street *** In general – 2.5 to 4m for comm. Land-use**	* An unobstruc-ted min. width of 2m *Pedestrian zone – 2m wide * Furniture zone – 1.5m – 2m *Frontage zone – 1m *** 2.2m to 4.2m**	1.2m min. **Usually 2.5-4m wide**	*Curb zone – 0.15m * Furniture zone – 0.9m to 2.5m * Walking zone – 1.8 to 2m * Frontage zone – 0.9m **Total width – 3.75m to 4.65m** (For comm. areas/city centre area)
2	Sidewalk slope	5% max. Cross slope – 2% max.	1:20 Cross slope – 1:50	NA	NA	5% (1:12)	NA	NA	**5% max.** **Cross slope - 2% max.**
3	Curb ramp width as per	1.22m min.	0.915mm minimum	1.2m	NA	1.2m wide minimum	NA	0.9-1m	**1.2m**
4	Curb ramp slope as per standard	Slope – 1:10 to 1:12 Cross slope - 2% max. (1:50)	1:12 Cross slope – 1:50	NA	NA	1:12 (max.)	NA	1:10	**1:10 or 1:12** **Cross slope – 1:50**
5	Curb ramp surface treatment as per	610mm detectable warning strips	Textures and tactile warning	NA	NA	Tactile strip of 300X300 pavers to be laid for blind	NA	NA	**Tactile strip of 300x300 pavers to be installed**
6	Zebra-crossing width	2.5m	2.5m – 3.7m 15m long maximum	2.4m minimum * Toucan Crossing width – 4m * above 5m in largely congested areas	2 - 4m	* 3m width minimum. * 5m width desirable.	2m minimum	3.5m	**A min. 3m width** **5m width desi-rable**
7	Subway width	NA	3.7m	NA	2.5m – 4m	NA	NA	NA	**3.5m**

8	Width of foot-over bridge	NA	3.7m	2.4m – 3m wide	NA	3m	NA	NA	**3.0m**
9	Distance between two crossings	NA	45.7m (150'); Can vary from 60-90m	NA	NA	* 80m-250m for residential areas. * 80m-150m for commercial areas.	50m	NA	**90m – 120m**
10	Width of refuge islands	1.22m minimum; 1.83m preferred.	1.8m x 6m	1.2m wide; 3m min. long; 4.8m long nominal	NA	1.5m minimum	1m minimum; 2m desirable	1.2m	**1.5m wide, 4.5m long**
11	Traffic signal time duration for pedestrians to cross	NA	60 seconds (maximum)	20 seconds	NA	NA	NA	Bare min. – 6 sec to change light	**20 seconds**
12	Height of Guard rail	1010 mm	1000mm	1100mm; 1200mm preferred	1210mm	850-900mm	NA	1m	**900mm**
13	Curb Height	101-203mm 152mm (6") is desirable.	150 mm; 175mm in comm. areas.	125mm - 140mm	NA	150mm maximum	150mm	NA	**150mm**
14	Curb Radius	5m – 15m	Vary from 0.75m - 9m; 4.6m desirable	12m max.	NA	* 1.5m for roads less than 30m wide * 3m for most intersections* 4.5m for streets with lot of truck traffic	4m	NA	**4.5m**
15	Paving design quality (texture, color and surface finish)	Firm, stable, slip-resistant; Concrete, asphalt, tile, stone, pavers, brick, cobblestone.	Portland cement concrete, unit pavers, asphalt, crushed rock	Paving units(precast concrete), concrete, asphalt paving,	NA	NA	NA	NA	**Precast concrete pavers or finished concrete in different colors and textures**

8. The recommended minimum sidewalk dimensions are shown in Table 2.11.

Table 2.11: Recommended minimum sidewalk dimensions

Location	Minimum pedestrian flow	Zone				Total
		Curb	Street and furniture	Through route	Frontage zone	
Arterial roads in pedestrian districts	80 p/min.	0.15m	1.2m	2.4m	0.75m	4.5m
CBD						
Alongside parks, schools and other major pedestrian generators						
Local roads in pedestrian districts	60 p/min.	0.15m	1.2m	1.8m	0.45m	3.6m
Commercial/industrial areas outside the CBD						

Collector roads	60 p/min.	0.15m	0.9m	1.8m	0.15m	3.0m
Local roads in residential areas	50p/min.	0.15m	0.9m	1.5m	0.15m	2.7m
Absolute minimum*		0.15m	0.0.m	1.65m	0.0m	1.8m
* only acceptable in existing constrained conditions and where it is not possible to relocate road space.						

9. The study of legal provisions and initiatives taken abroad in countries like US, Australia etc. indicate that these countries give a lot of priority to walking and implement many smart and innovative techniques to bring down people, to walk rather than promote the usage of cars. Separate initiatives are taken up to provide a safe walking environment for the elderly and the school children. Even policies are evolved and successfully implemented, which indirect aim for the benefit of the street's most vulnerable users.
10. The Indian regulations, though do not have a law directly for the pedestrians, have some laws indirectly on pedestrian safety. The Noise Control regulations, the Motor Vehicles Act regulations, the Municipal Corporation Act regulations and the Rules of the Road Regulation have to implement restrictions on motorists and prevent encroachment of footpaths and thereby give topmost priority to pedestrians indirectly. However, these regulations are hardly enforced strictly in Indian cities, resulting in unsafe and inadequate pedestrian environment.

3 CASE STUDIES

3.1. Case Study 1: Pedestrianization in Copenhagen

3.1.1. Background

3.1.2. How did Pedestrianization start?

3.1.3. Pedestrianization scheme

3.1.4. Street Characteristics

3.1.5. Street Design

3.1.6. Main features and Merits of the scheme

3.1.6. Demerits of the Scheme

3.2. Case Study 2: Pedestrianization in Causeway Bay, Hong Kong

3.2.1. Background

3.2.2. How did Pedestrianization start?

3.2.3. Pedestrianization scheme in Causeway Bay

3.2.4. Planning and Implementation Process

3.2.5. Merits of the Scheme

3.2.6. Demerits of the Scheme

3.3. Pedestrian Environment Improvement, Mid-town Manhattan

3.3.1. Background of Midtown Manhattan

3.3.2. Pedestrianization Background

3.3.3. Pedestrian Environment Improvement Scheme in Study area

3.3.4. Merits of the Scheme

3.3.5. Demerits of the Scheme

3.4. Findings and Inferences

that housing and employment should be located as close as possible to the main lines of communication so that daily journeys to and from work can be confined to public transportation connections, thereby reducing travelling time to the minimum. This emphasis on the public mass transit prepared the way for pedestrian zoning in the central city years later (Brambilla, 1977).

Copenhagen residents relied on tramways and bicycles greatly in the 1950s. But by the beginning of the next decade, the private automobile had begun to replace the bicycle in such numbers that the city had to think of some serious controls to be instituted to ease the traffic congestion and the environmental degradation (Fig 3.1). Controls such as one-way street designations and restricted downtown parking proved only partially effective, but the vehicle numbers continued to increase (Fig. 3.2). Pedestrian traffic became more dangerous and less comfortable and many trades started to suffer, as visitors reduced their access due to lack of safety. There was also no tradition for use of public outdoor spaces for meeting and staying. People would be walking on the narrow sidewalks of the inner city squeezed between parked cars; so walking was not a great pleasure (Gemzøe, 2001).

Fig. 3.1: Copenhagen in 1955 with cars and bicycles sharing the road space

Source: www.gettimages.com

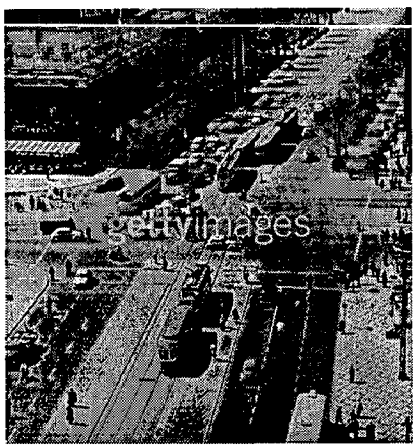


Fig. 3.2: City roads congested with vehicles

Source: www.gettimages.com

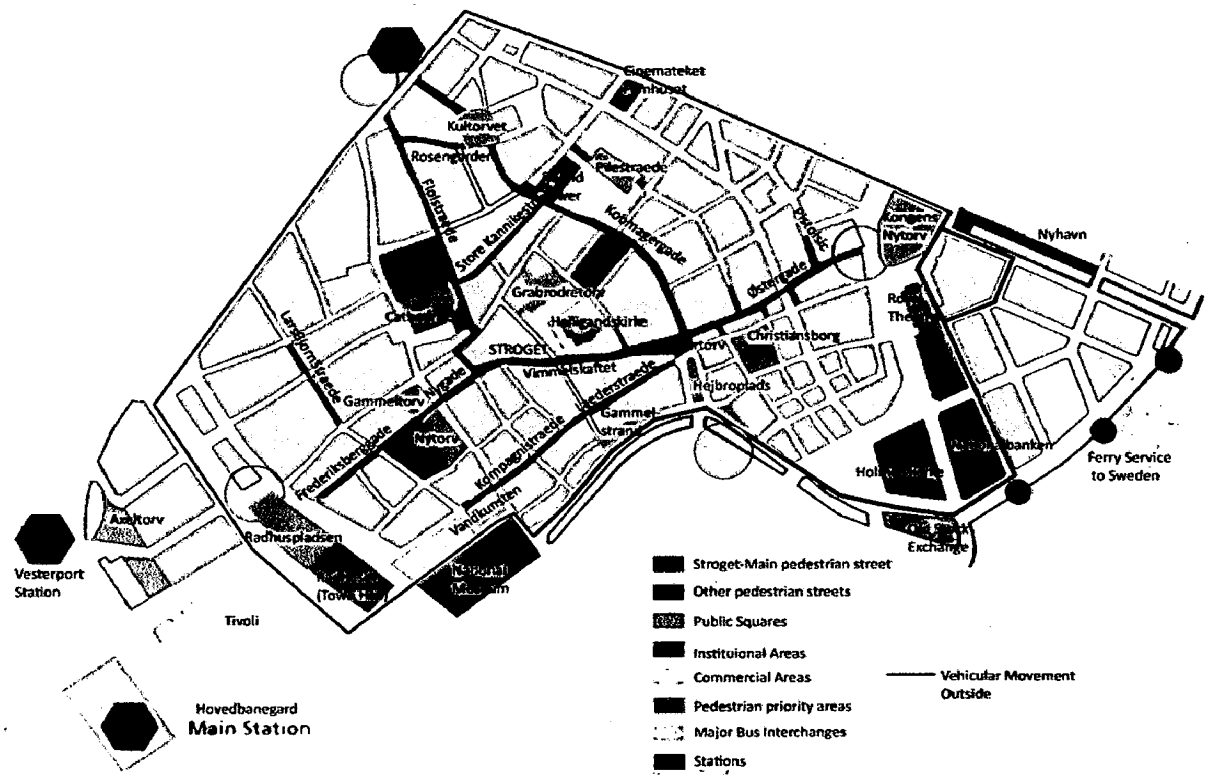
3.1.2. How did Pedestrianization start?

When the volume of traffic increased in the beginning of the 60s in the inner part of the old narrow streets and the expanding shopping areas around central Copenhagen and the sidewalks became more and more crowded with busy pedestrians, who were bumping in to each other and blocking the way, Copenhagen's City Council decided in 1962 to establish a car free pedestrian zone at Stroget. The study area is the centre of Copenhagen, where the majority of city's commercial and cultural activities are located. The core of this area is the old medieval city. The area studied extends beyond the historic city, including the public spaces. The city centre is one kilometer by one kilometer which corresponds a comfortable walking distance (Brambilla, 1977).

Original Stroget consisted of three contiguous streets, running from the Town Hall Square in the west to the Kings New Square (Kongens Nytorv) in the east, which includes a maze of small streets and historical squares fanning out from Stroget. An experimental traffic ban was put in 1962, and in 1964, the area was declared a permanent pedestrian zone. The streets were finally repaved in 1967. There was an initial opposition to the banning of cars as merchants feared that the banning of cars would hit their business. In spite of this, the city administration went ahead with the pedestrianisation. The traffic ban later on made the merchants and shopkeepers in Stroget realize that pedestrianization indeed increased their sales tremendously (Tan, 2006).

3.1.3. Pedestrianization scheme

The pedestrianization initiative in 1962 was experimented in Stroget by putting a traffic ban on vehicles entering the streets. After its success, other streets were also taken up to be completely pedestrianized (Map 3.2).



Map 3.2: Study area – The City Centre of Copenhagen

Source: By Author (base map derived from Public Spaces - Public Life, Jan Gehl, 1996)

The following section discusses the various pedestrian streets of Copenhagen and further discusses the impact of pedestrianization on the area.

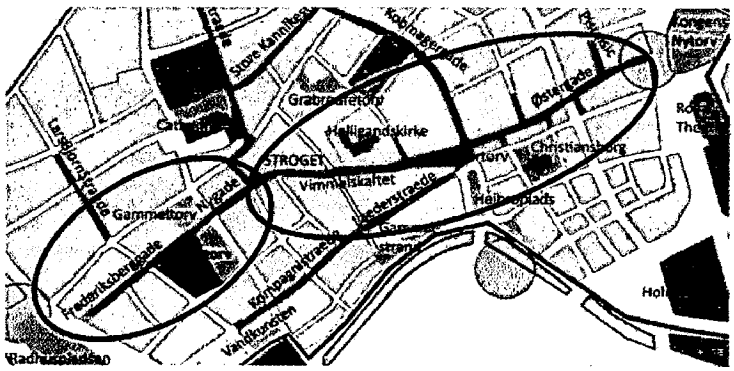
3.1.3.1. Stroget Street

Stroget is the main link in the pedestrian system, handling east-west connections in the city centre. Stroget is the **world's largest** pedestrian shopping street. It is the old main street through

the Inner city- the street to see and be seen, the major city promenade. It is estimated that some 80,000 people walk on the street on a nice summer day and night through a rather narrow street of 10-12m width. Stroget is 1.1 km long and is actually made up of several streets with different names like the streets Frederiksberggade, Nygade, Vimmelskaftet and Østergade and Nytorv square, Gammeltorv Square and Amagertorv Square (Map 3.3). Various sections of this sequence of streets have different functions and character. The stretch was originally called Routen, before in 1962, it was converted to a pedestrian street (Jan Gehl, 1996).

On ordinary winter days, main sections of Stroget carry some 25,000 pedestrians between the hours of 10.00 a.m. to 18.00 a.m. On summer days the pedestrian traffic reaches 55,000 people a day, with a peak of 80,000 during seasons and these figures have been remarkably stable since then. With a width of 10-12 meters and a length of approx. 1,115m, Stroget can handle some 145 pedestrians per minute (Fig. 3.3).

The street consists of commercial uses like shops, department stores, as well as major architectural, cultural and historical buildings. It is closed to all vehicular traffic except ambulance, police and fire vehicles from 11.00 a.m. to 4.00 p.m. In morning hours from 4.00 a.m. to 11.00 a.m., delivery vans are allowed to go into the streets for the servicing of the shops (Jan Gehl, 1996).



Map 3.3: Location of Stroget

Source: By Author

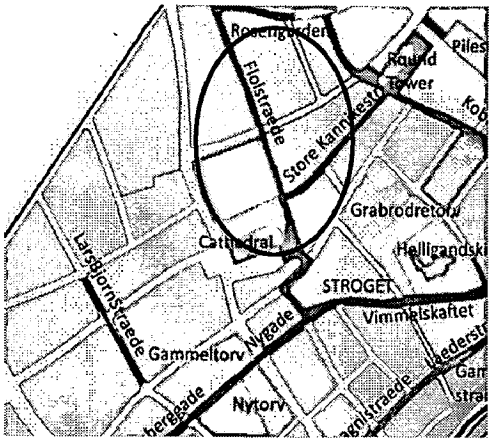
Fig. 3.3: Stroget Street

Source: www.flickr.com

3.1.3.2. Fiolstraede Street

Fiolstraede was pedestrianized in 1968. This street is unique in Copenhagen street network, as it carried almost the same number of pedestrians in summers and winters – some 11,000 to 12,000 daily. This is on account of the University and the street right in the middle of the University quarter. Therefore, once the summer traffic is over and most tourists have left down, students begin returning to the city to start the autumn term – along the Fiolstraede (Map 3.4). On weekends and holidays, as well as in the evening throughout the year, Fiolstraede is comparatively quiet. Very few people pass this way outside shopping and University hours. The

street is 400m long with a width of 8m to 12m and carries some 104 pedestrians per minute (Jan Gehl, 1996) (Fig. 3.4).



Map 3.4: Location of Fiolstraede street

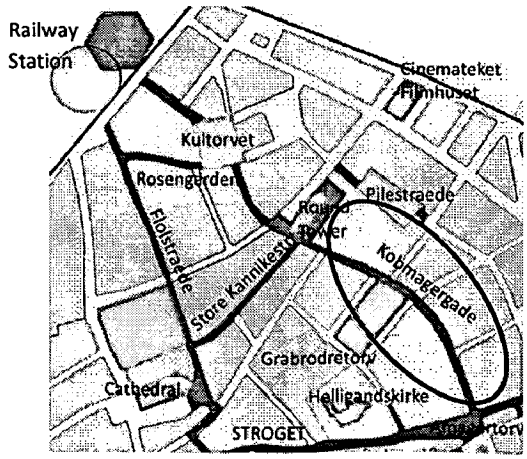
Source: By Author

Fig. 3.4: Fiolstraede street at dawn

Source: www.flickr.com

3.1.3.3. Kobmagergade Street

Kobmagergade is the second most important shopping street in the city (Map 3.5). This street also links the city's commuter railway station and connects the Stroget to Norrenport. This link creates brisk pedestrian traffic at all seasons of the year during shopping hours. Traffic is particularly heavy both early and late in the day, as many people use Kobmagergade to make their way between the train station and the central parts of the city. The daily traffic on Kobmagergade does not change drastically from season to season. On winter days, some 24,000 pedestrians walk along the street, while the summer traffic is about 33,000 on average. Winter pedestrian traffic is about similar to that of Stroget's, underlining Kobmagergade's important role as a transit route to and from the city center (Fig. 3.5). This street is 525m long with a width of 9 to 15m and carries some 156 pedestrians per minute (Jan Gehl, 1996).



Map 3.5: Location of Kobmagergade

Source: By Author

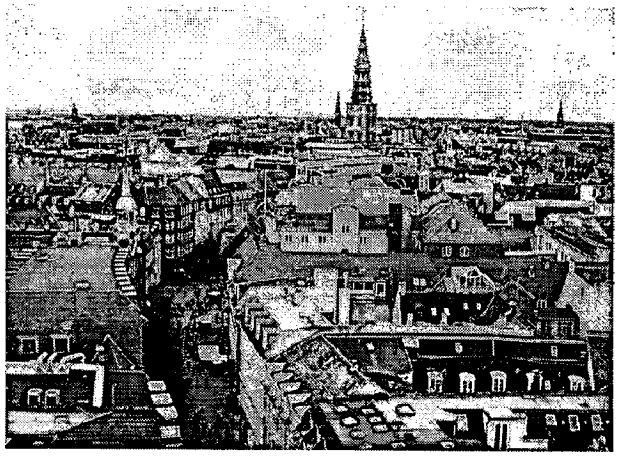


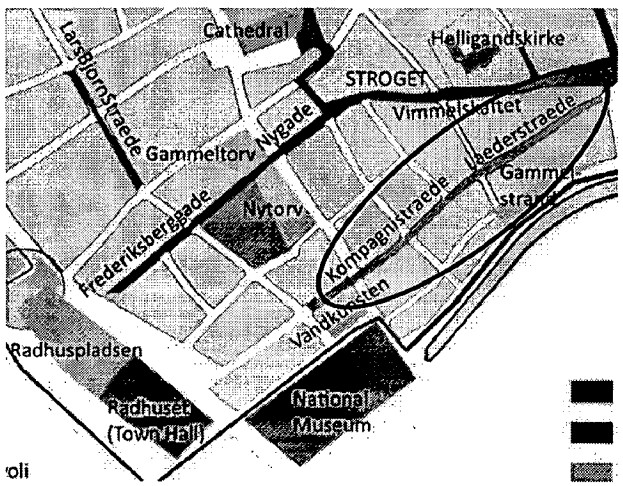
Fig. 3.5: Aerial view of Kobmagergade

Source: www.flickr.com

3.1.3.4. Straede Street

This street carries some rather heavy traffic, including several bus lines. In 1989, it was experimentally reclassified as a pedestrian priority street, meaning a street where pedestrians and bicycles have priority, but where cars may enter at a very low speed (Map 3.6). The street is divided into short one-way sections, in order to prevent through car traffic. Bus routes were relocated on streets at the edge of the old city area. The experiment worked well and in 1992, the street was re-paved and the sidewalks eliminated as in the rest of the pedestrian street system. This kind of a mix of cars, pedestrians and bicycles on the same street is the concept of 'Shared Street' system.

Straede runs parallel to Stroget but has a decidedly different character. The street is lined with small, specialized shops selling antiques, handicrafts and similar items. There are several cafes and restaurants, many of which have outdoor seating on the street. Unlike Stroget, this street has fewer pedestrians – 3000 to 5000 per day, depending on the time of the year. One possible reason for this could be that it doesn't connect any important nodes; it could also be that the mixture of traffic modes discourages some users. Nevertheless, the light traffic and the resulting relaxed atmosphere of this street are definitely part of its charm. The street is 460m long with a width of 8m to 11m and carries some 106 pedestrians per minute (Fig. 3.6).



Map 3.6: Map showing the whole Straede

Source: By Author

Fig. 3.6: Kompagnistraede street

Source: www.flickr.com

3.1.4. Street Characteristics

Some of the streets in the city centre of Copenhagen are called "summer streets" while others are called "winter streets". Summer streets are more than doubling the number of pedestrians in the summer in relation to the winter period. Winter streets are streets that have almost the same number of people summer and winter. Most winter streets are streets that are well connected to the major traffic terminals for public transit and thus linked to walking, out of necessity. The summer streets are used more to walking for pleasure.

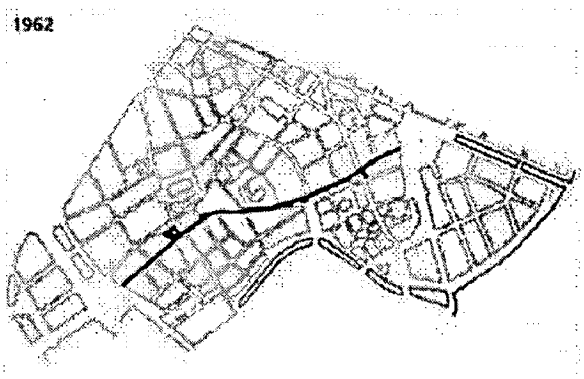
3.1.5. Street Design

The paving design is simple and is gray, with dark mid-stripes indicating service routes (open to delivery vehicles from 4 a.m. to 11 a.m.). Street signs are modest and not too flashy. Shops give careful attention to their window displays, which are designed to capture the interest of the strollers. The narrow pedestrian streets with lack of seating open up to provide a relief into the plazas, where there are benches and opportunities to meet and talk. Even in nights, the streets are bustling with some activity by people who are attracted to the space and view what the streets and plazas offer (Brambilla, 1977).

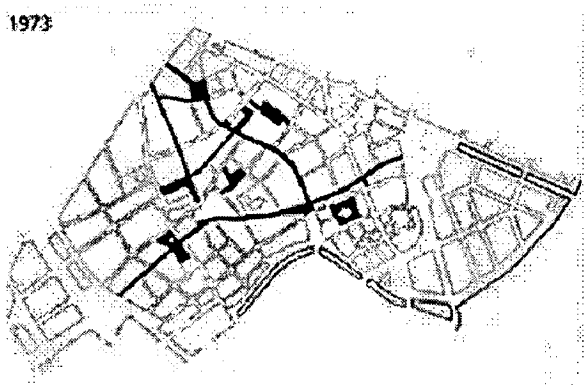
3.1.6. Main features and Merits of the scheme

The most important features of the decades long pedestrianization process of Copenhagen can be summed up as under:

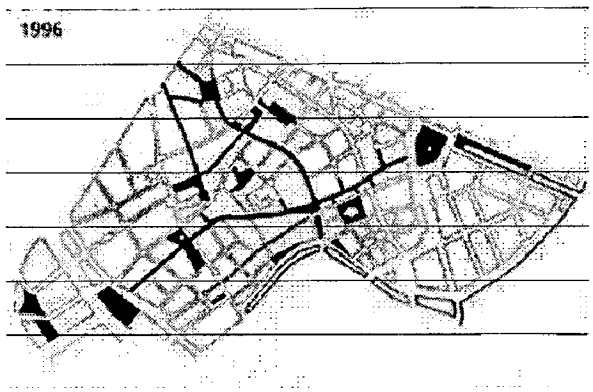
- Since 1962 people in Copenhagen have got six times more square meters for pedestrian use. By 1996 a total of 96.000 car free square meters were available.
- Practically all of the pedestrian streets were made between 1962 and 1973. After that it has been the development of squares that has dominated (Fig. 3.7 & 3.8).
- 40% of the square meters of pedestrian areas are streets for walking and 60% are squares for resting and enjoying life.
- Walking in the city has been remarkable stable since the first pedestrian streets were introduced as they have been full to capacity on any good summer day since then.
- What has changed most dramatically is the development of intensity of activities. Staying in the Inner City has increased 3-4 times since the first study in 1968 (Fig. 3.9).
- Today the inner city as a whole is dominated by pedestrian traffic as much as 80% of all traffic on foot.
- The number of parking places of 2500 in 1996 came down to 1900 by 2001, marking a 600 reduction.



a. Development of pedestrian streets in 1962



b. Development of pedestrian streets in 1973



c. Development of pedestrian streets in 1996

Fig. 3.7: The development of pedestrian streets and squares in the city centre of Copenhagen in 1962, 1973 & 1996

Source: Public Spaces – Public Life, Jan Gehl, Lars Gemzoe, 1996

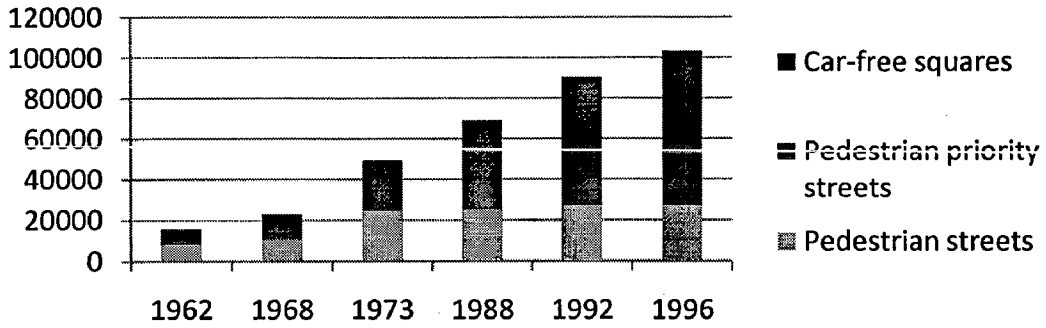


Fig. 3.8: Growth of Pedestrian streets and squares from 1962 to 1996 (area in sq.m.)

Source: Public Spaces – Public Life, Jan Gehl, Lars Gemzoe, 1996

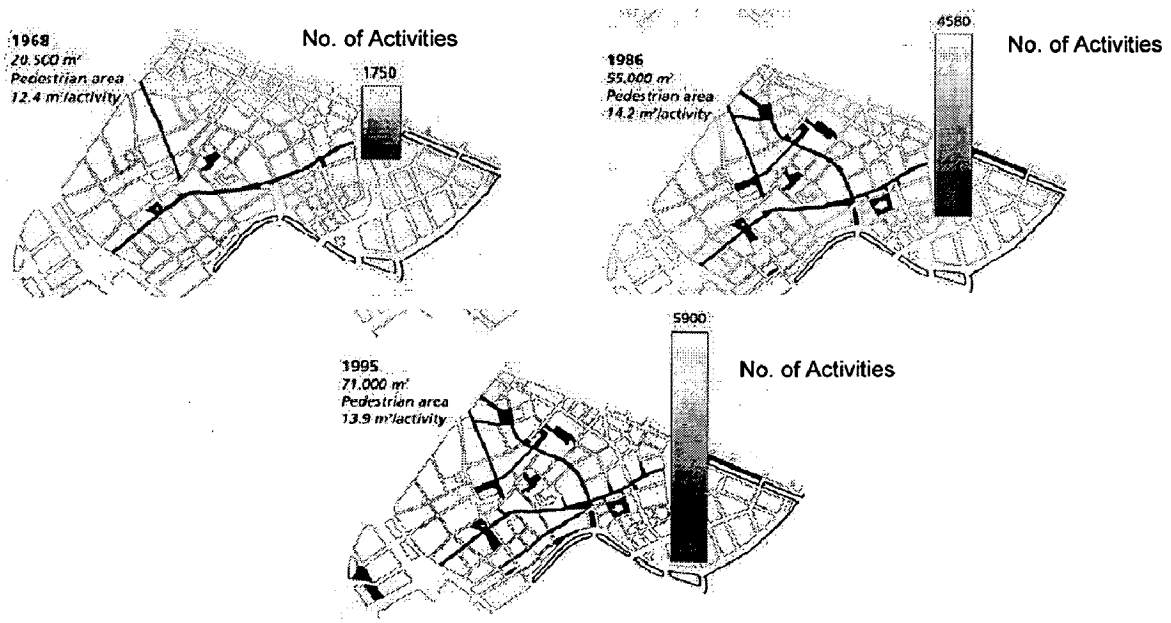


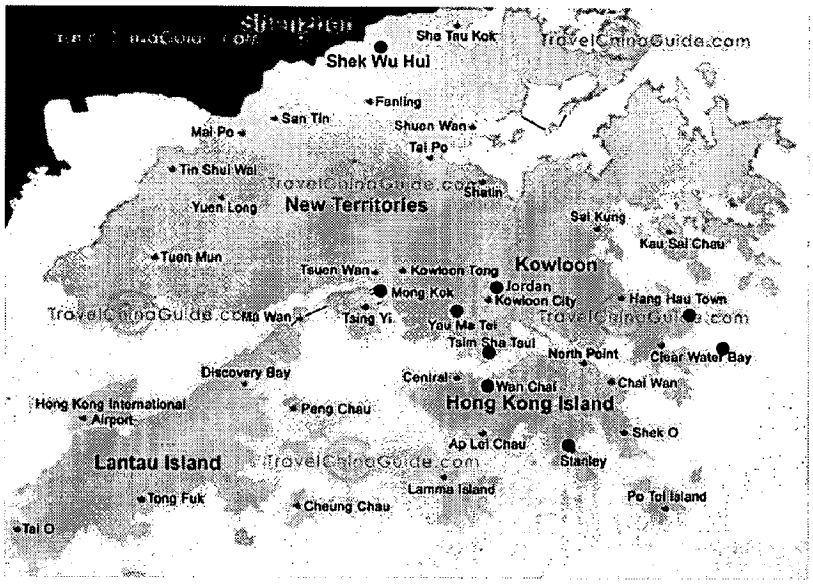
Fig. 3.9: Proportional growth of staying activities in relation to the growing number of car-free sq.m. of pedestrian area

Source: Public Spaces – Public Life, Jan Gehl, Lars Gemzoe, 1996

3.1.6. Demerits of the Scheme

One of the demerits of the scheme is that the pedestrian volume has increased greatly on the streets in the recent times with the street widths remaining constant. Thus this sometimes leads to overcrowding of pedestrians on certain streets like Stroget, especially during peak hours.

3.2. Case Study 2: Pedestrianization in Causeway Bay, Hong Kong



Hong Kong is one of the two special administrative regions of the People's Republic of China (other being Macau) and is well-known for its expansive skyline and deep natural harbor. Hong Kong has the inherent characteristics of a compact urban form, high density development, mixed land use pattern and good public transport services (Map 3.7).

Map 3.7: The entire island of Hong Kong

Source: www.travelchinaguide.com

3.2.1. Background

Earlier attempts of pedestrianization in Hong Kong started right from the 1970s, though they met with little success. Pedestrian streets were incorporated in the Zoning Plans of Wanchai and Yau Ma Tei in 1972 and 1974, though were not implemented successfully and still had traffic on the streets. In 1982, two pedestrian precincts Ice House Street and Queens Road Central started being opened up even on Sundays and public holidays completely as a pedestrian-only street. Later in 1983, the three shopping streets of Li Yuen, Tung Choi and Temple Street were pedestrianized. There were further plans to pedestrianize a number of streets in Wanchai, the prominent being the O'Brian Road, Thomson Road and Kingston Street. These plans of closing the road traffic required to be gazetted under the Roads Traffic Ordinance and the entry of emergency vehicles used to prove a problem since the streets were narrow in this period. Pedestrian footbridges, pedestrian ways and pedestrian precincts were incorporated in the fast developing commercial centre of East Tsim Sha Tsui. Even in the early comprehensive development plan made for Tsim Sha Tsui in 1970 (Phyllis, 1983), 28.26% of the area was reserved for pedestrian circulation (Fig. 3.10). Pedestrian bridges also linked the Wo Che Shopping Complex very effectively in the 1980s, which was a venue for public and private events for nearby estates (Fig. 3.11).

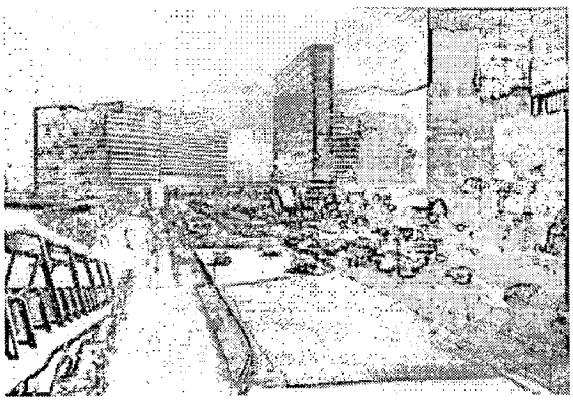


Fig. 3.10: Pedestrian precinct under landscaping at East Tsim Sha Tsui, a business and shopping core

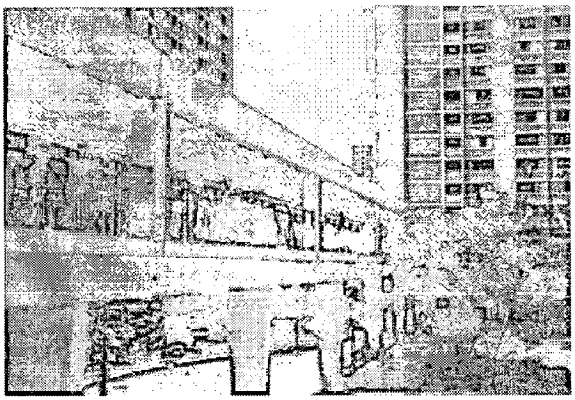


Fig. 3.11: Wo Che Shopping Complex, a venue for public and private events well-linked by pedestrian bridges

Source: A Feasibility Study of Pedestrianisation in Shopping Areas of Hong Kong, Li Chi Miu Phyllis, 1983

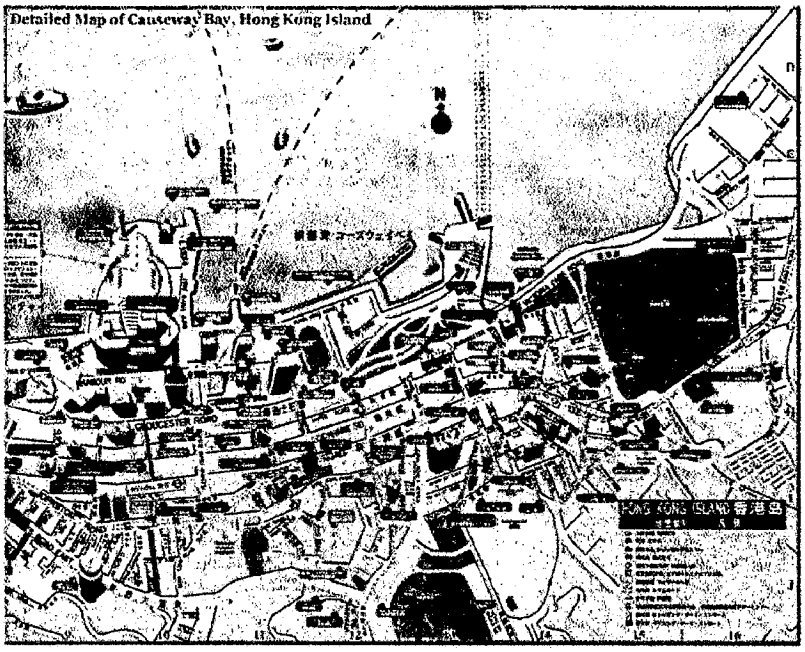
3.2.2. How did Pedestrianization start?

Pedestrian circulation is one of the fundamental planning considerations in transport and land use planning. However, walking is an unpleasant experience. Streets are often overcrowded, footpaths are narrow and roads are difficult to cross. in many areas there are not enough places to sit and they are not adequately protected from the weather. It is with this regard that walking as a key mode of transport needs to be promoted and be integrated with mixed land use and high density, to achieve a sustainable development.

The Planning Department, Govt. of Hong Kong has been proactive in supporting separation of pedestrians from vehicles through pedestrian schemes and grade-separated pedestrian walkway systems. In order to promote walking and to improve the overall pedestrian environment, the Planning Department and the Transport Department, Govt. of Hong Kong is following an environmentally friendly approach in managing traffic and transport matters and is committed to putting more emphasis on the interests of pedestrians (Transport Deptt., Govt. of Hong Kong, 2010). Since year 2000, Transport Department has been implementing pedestrian schemes in several areas, including **Causeway Bay, Central, Wan Chai, Mong Kok, Tsim Sha Tsui, Jordan, Sham Shui Po, Stanley and Shek Wu Hui** (Map 3.7) with the following objectives:

- To improve pedestrian safety and mobility.
- To promote walking as a sustainable transport mode.
- To discourage access for non-essential vehicles.
- To reduce air pollution.
- To improve overall pedestrian environment (Transport Deptt., Govt. of Hong Kong, 2010).

3.2.3. Pedestrianization scheme in Causeway Bay



Causeway Bay or East Point is a heavily built-up area of Hong Kong, located on the northern shore of Hong Kong Island, and covers parts of Wan Chai and Eastern districts. Causeway Bay is one of Hong Kong's major shopping districts (Map 3.8). The rent in the shopping areas of Causeway Bay is ranked the second in the world, with the Fifth Avenue (Manhattan) of New York being the first.

Map 3.8: Causeway Bay area in Hong Kong

Source: http://www.chinatouristmaps.com/city/hong-kong/hong-kong-island-maps

It includes high-rise and medium-rise departmental stores, shopping complexes, malls, trendy shops of fashion and other products, notable hotels and modern service apartments, thus making it one of the most crowded areas in Hong Kong (Dept. of Planning, Govt. of Hong Kong, 2000). As one of the most popular shopping/entertainment areas in Hong Kong, Causeway Bay is crowded with shoppers and tourists most of the time. The streets are also congested with heavy local and thorough traffic (Fig. 3.12). The congested footpaths, pedestrian-vehicular conflicts, traffic noise, air pollution and monotonous streetscape make the walking environment not enjoyable. Thus, there was an intention to turn Causeway Bay into a "Pedestrian's Paradise" for shopping. The Transport Department and the Planning Department have made a **Pedestrian Plan for Causeway Bay** and implemented the pedestrian schemes in the crowded parts of Causeway Bay from 2000, in order to improve the pedestrian environment and safety (Fig. 3.13).

Fig. 3.12: Causeway Bay in 1970

Source: www.gettyimages.com

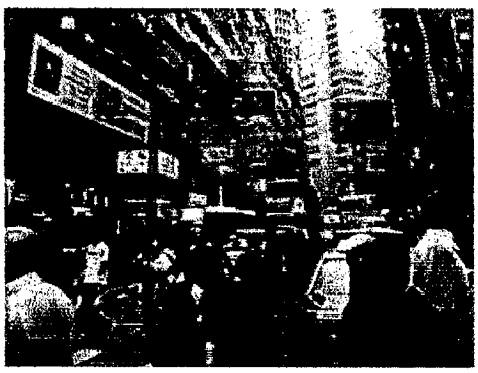
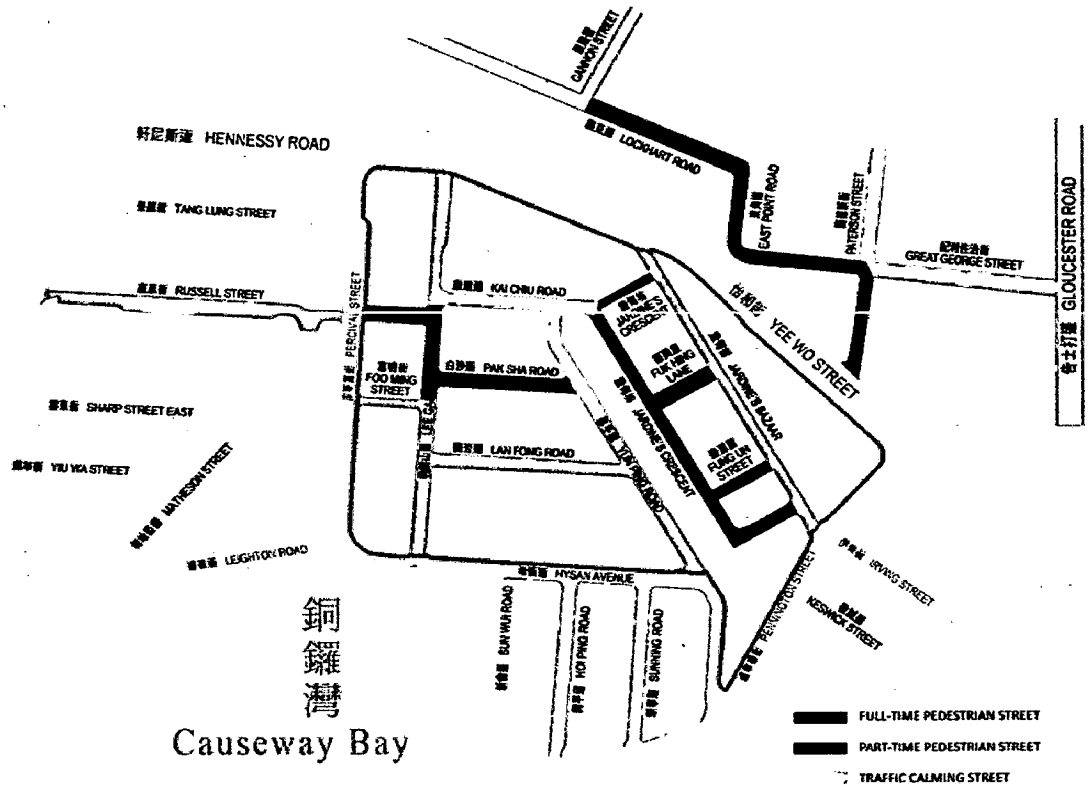


Fig. 3.13: Causeway Bay in 2000

Source: www.flickr.com

A total area of 0.5 sq.km. was pedestrianized. A total of 14 streets were undertaken for pedestrianization (Map 3.9). The plan proposal involved creating full-time and part-time pedestrian streets. In certain streets, where traffic banning was not possible, traffic calming technique was employed to give maximum priority to the pedestrians. Certain time restrictions were imposed on heavy vehicles and trucks, which cater to the commercial and retail outlets. Some streets were made transit-oriented by allowing only trams and pedestrians to move along the stretch. Innovative paving techniques were employed to make a motorist identify that they are in a pedestrian district and need to reduce their speed. Street furniture were added at many places to improve pedestrian convenience.



Map 3.9: Area taken up for pedestrianization in Causeway Bay

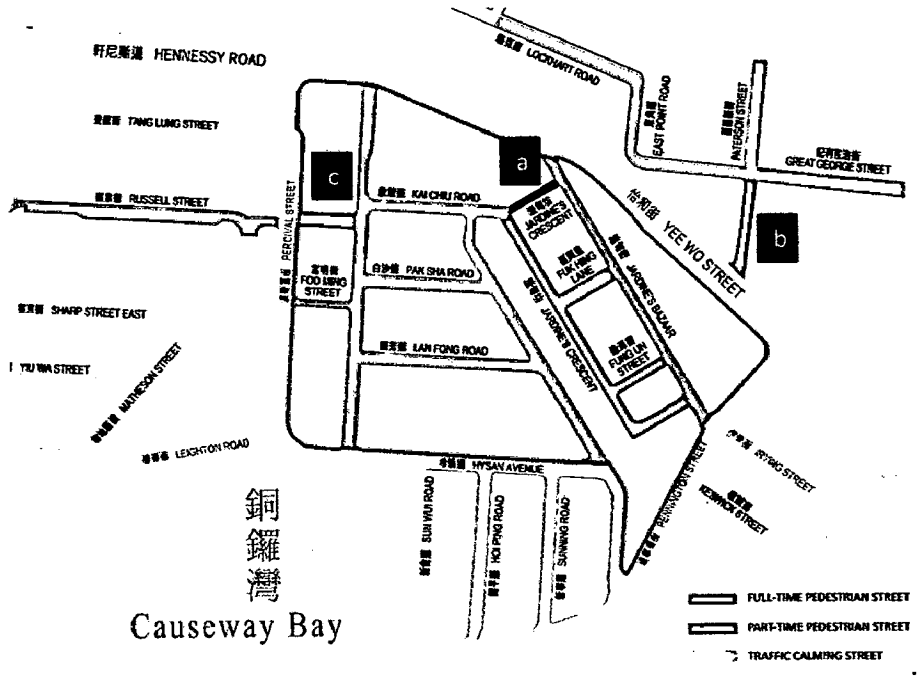
Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

3.2.3.1. Full-time Pedestrian Streets

In full-time pedestrian streets, the traffic is permanently blocked for entry in the streets (Map 3.10). Table 3.1 shows particulars on full-time pedestrian streets of the Causeway Bay area (Transport Dept., Govt. of Hong Kong, 2007).

a) Pedestrianization of Jardine's Crescent has been implemented since October 2000 (Fig. 3.14 & 3.15) and that of Paterson Street, between Great George Street and Yee Wo Street, has been implemented since June 2001.

b) Russell Street (between Lee Garden Road and Percival Street) pedestrianization scheme has been implemented since April 2000.



Map 3.10: Full-time Pedestrian streets in Causeway Bay

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

Table 3.1: Full-time Pedestrian Streets- their lengths and widths

S.No.	Name of Street	Street width	Street length
a.	Jardine's Crescent	10m	106m
b.	Paterson Street	10m	276m
c.	Russell Street	15m	62m

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

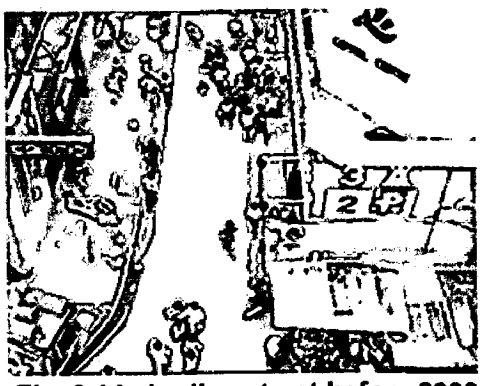


Fig. 3.14: Jardine street before 2000

Fig. 3.15: Jardine street after 2001

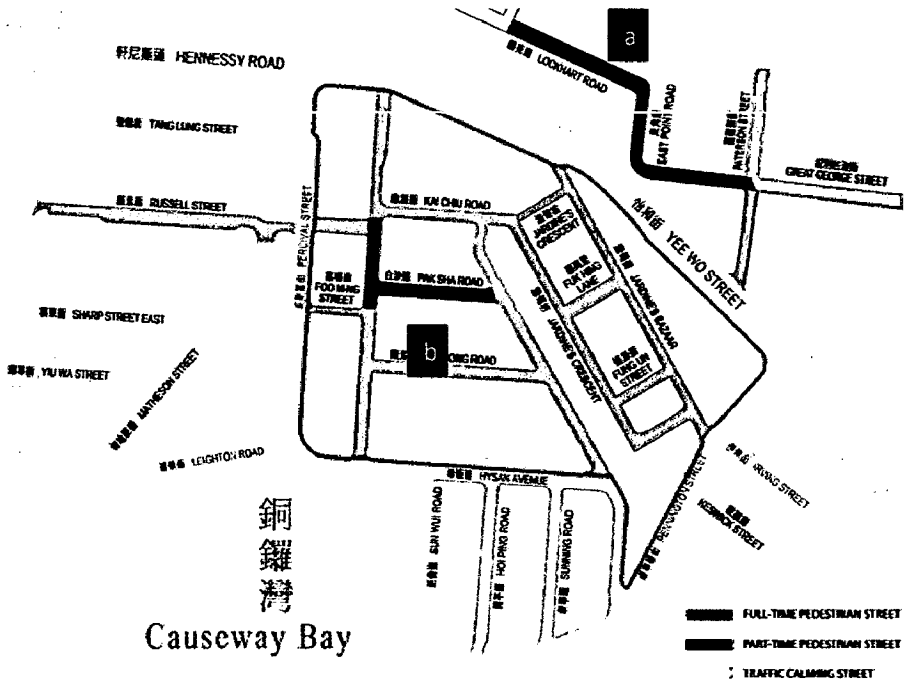
Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

3.2.3.2. Part-time Pedestrian Streets

In part-time pedestrian streets, the traffic is allowed only for a fixed duration of time in the day and the street for the rest of the day is pedestrian-only (Map 3.11).

Table 3.2 shows particulars on part-time pedestrian streets of the Causeway Bay area (Transport Dept., Govt. of Hong Kong, 2007). The following part-time pedestrian streets have been implemented daily during the peak shopping hours, since June 2001 (Transport Dept., Govt. of Hong Kong, 2007).

a) The part-time pedestrianization of Lockhart Road, East Point Road and Great George Street (Fig. 3.16 & 3.17)) is executed on Saturdays, Sundays and Public Holidays between 12 p.m. to 12 a.m. in the midnight. The rest of the time, the vehicles are allowed to move and delivery vehicles are given access to servicing.
b) The part-time pedestrian scheme of Pak Sha Road and Lee Garden Road (between Kai Chiu Road and Pak Sha Road) had been implemented in June 2004. The closure hours after 2005 have been changed from 7 p.m. to 12 a.m. in the midnight on Weekdays and 12 p.m. to 12 a.m. in the midnight on Saturdays, Sundays and Public Holidays (Transport Dept., Govt. of Hong Kong, 2007) (Fig. 3.18 & 3.19).



.Map 3.11: Part-time Pedestrian streets in Causeway Bay

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

Table 3.2: Part-time Pedestrian Streets- their lengths and widths

S.No.	Name of Street	Street width	Street length
a.	Lockhart Road,	15m	160m
	East Point Road and	12m	80m
	Great George Street	15m	125m
b.	Pak Sha Road and	12m	132m
	Lee Garden Road	15m	100m

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

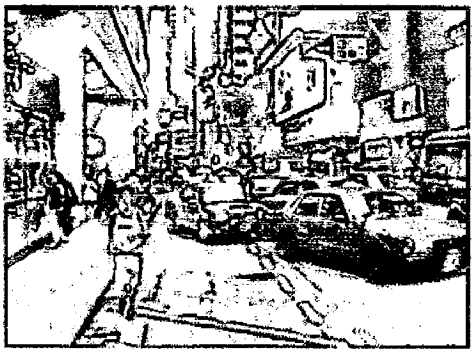


Fig. 3.16: Great George Street before 2001

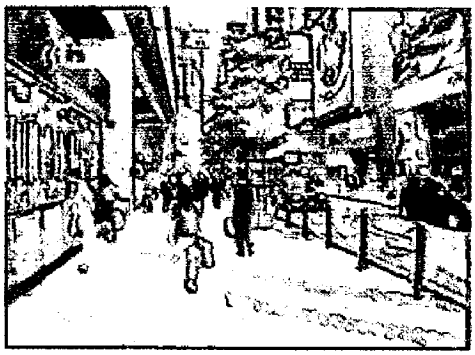


Fig. 3.17: Great George Street after 2001

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

Fig. 3.18: Pak Sha Road before 2003

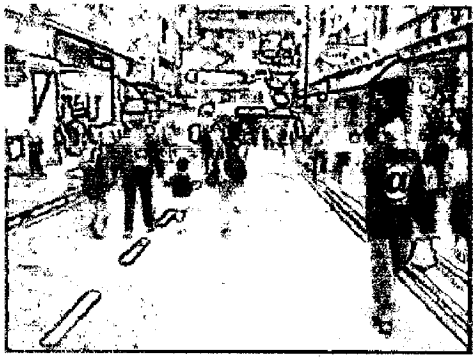


Fig. 3.19: Pak Sha Road after 2004

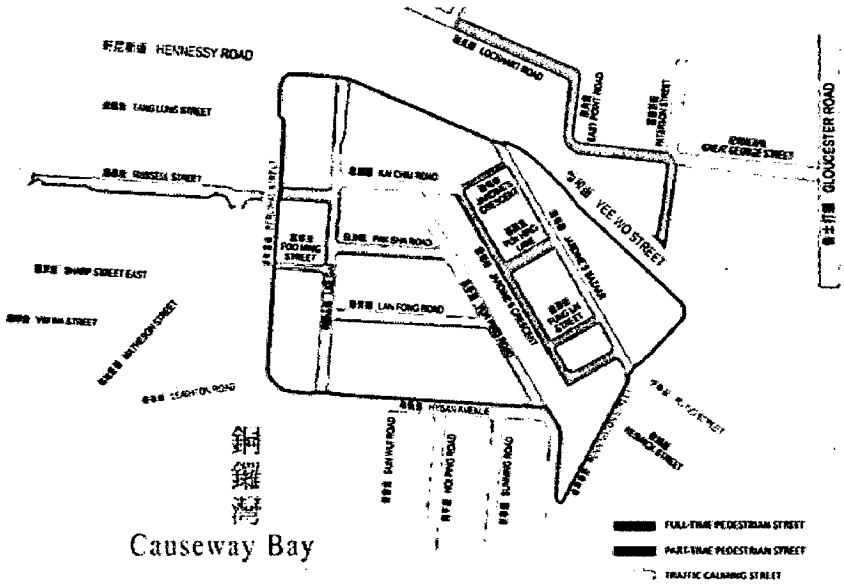
Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

3.2.3.3. Traffic Calming Streets

Traffic calming streets include traffic movement but at a very low pace as per the speed table restrictions that they are bound to follow on such a street (Map 3.12). The footpaths would be widened to improve pedestrian circulation. Traffic calming strategies were implemented in the following streets of Causeway Bay (Transport Dept., Govt. of Hong Kong, 2007).

a) Foo Ming Street
b) Great George Street (between Paterson Street and Gloucester Road)
c) Kai Chiu Road (Fig. 3.20 & 3.21)
d) Lan Fong Road
e) Lee Garden Road (between Foo Ming Street and Hysan Avenue; and between Kai Chiu Road and Hennessy Road)
f) Russell Street (in front of Times Square)
g) Yun Ping Road (between Kai Chiu Road and Hysan Avenue)
h) Paterson Street (between Kingston Street and Great George Street)

As part of the strategy, the on-street parking was removed. The taxi-stands and green mini-buses stands were relocated. Sidewalks were widened. Trams were being operated in certain streets. Vehicle access has been restricted to taxis only at Russell Street, in front of Times Square, from 12 p.m. to 12 a.m. daily (Transport Dept., Govt. of Hong Kong, 2007).



Map 3.12: Traffic calming streets in Causeway Bay

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

Fig. 3.20: Kai Chiu Street Before 2000

Fig. 3.21: Kai Chiu Street After 2001

Source: http://www.td.gov.hk/en/transport_in_hong_kong/pedestrianisation/pedestrianisation/causeway_bay

3.2.4. Planning and Implementation Process

The Causeway Bay Scheme had been implemented in two phases. Phase I mainly consisted of one section of full-time pedestrianized streets and two sections of part-time pedestrianized streets. Initially, the authorities tested it by closing the street to vehicular traffic on Sundays and public holidays on a trial basis. Once it was successful, they implemented it on permanent basis on all-days in a week. Phase II of the pedestrian scheme consisted of a number of mixed priority streets together with the removal of on-street parking spaces and the relocation of taxi stands and green minibus (GMB) termini away from the core of Causeway Bay. Footways were widened to allow equitable use of street space between motorists and pedestrians. Vehicular traffic was further also subjected to traffic calming measures.

The planning department commissioned the proposal in March 2001. Public Consultation meetings were held from January to April 2002, right on the streets, with local community groups,

professional bodies, green groups and other interested parties, as well as the flocks of passers-by. All the stakeholders were invited to provide their comments and feedback for the implementation of such a proposal. The feedbacks received were then posted on the Planning Department's website for the people to see. The comments received were very encouraging and positive. The disabled groups had put forward their considerations in the planning of the pedestrian environment. Based on the planning framework, the Pedestrian Plan was prepared and implemented for Causeway Bay.

3.2.5. Merits of the Scheme

The implemented pedestrian schemes improved the general pedestrian environment of the public of Causeway Bay. The schemes were finalized and implemented only after consultation and opinion-seeking from professional bodies, community groups, green groups and the people – the pedestrians. The implementation process of the scheme was very fast and since it was based on public consultation, hence, the administrative loopholes and time-lag were much lesser. It has also benefitted the environment by reducing the air and noise pollution and improving the quality of life of the commercial precinct.

3.2.6. Demerits of the Scheme

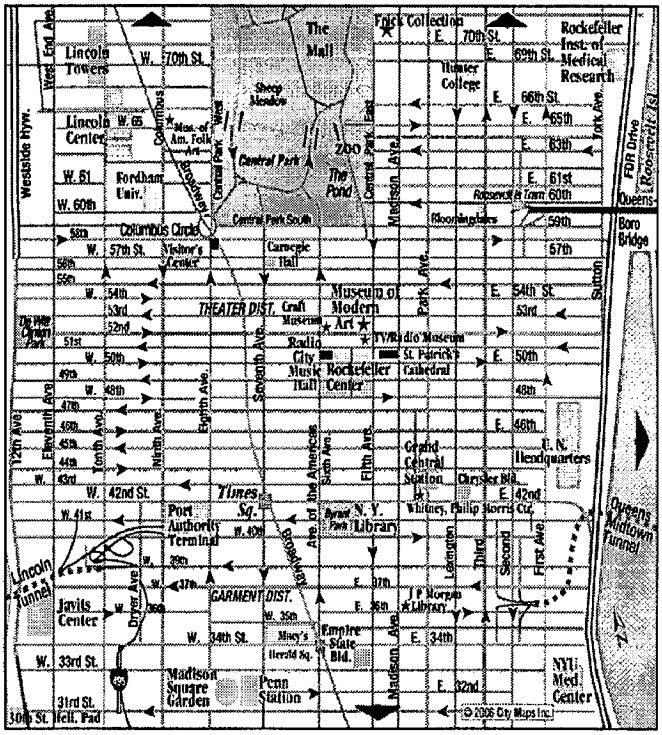
Though the pedestrian environment was greatly improved, they have entailed some costs in terms of causing inconvenience to certain sectors, e.g. more restrictions on the delivery of goods to shops in the pedestrianized areas; cancellation of on-street parking spaces in the area; and relocation of pickup/ drop-off points for public transport (Legislative Council Panel on Transport, Hong Kong, 2000). However, these costs are negligible in comparison with the socio-economic and environmental benefits arising out of pedestrianization.

3.3. Pedestrian Environment Improvement, Mid-town Manhattan

Fig. 3.22: Aerial View of the business precinct

Source: www.gettyimages.com

Midtown Manhattan is New York's historic core, the heart of NYC, one of the wealthiest cities in the world and nowhere else do utilities, transportation and services function under such a great stress. One of the densest, busiest, and most vibrant places in the world, Midtown Manhattan is the largest business district in the country (Fig. 3.22).



Map 3.13: Midtown Manhattan, New York

Source: www.aaccessmaps.com

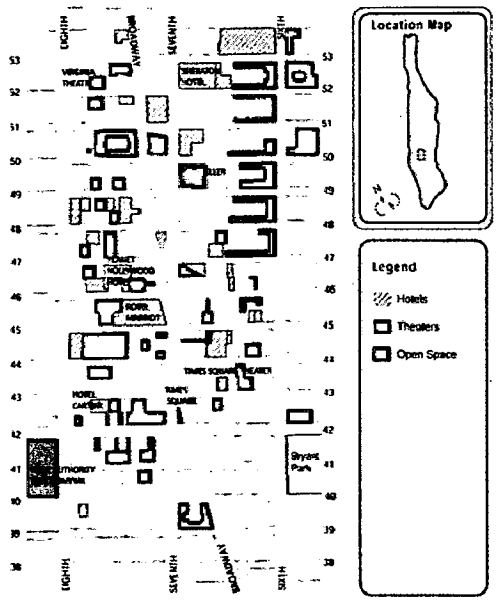
It is a global business centre accommodating 340,000 workers daily. It is a major tourist attraction, a civic centre, with institutions and entertainment uses and a growing residential community of 14,000 people. Three regional transportation hubs and an outstanding mass transit system are used daily by millions of people to access the area. As the area functions as an office cum commercial district, downtown patterns are determined by a nine to five weekday schedule. Midtown's core is an area of approximately four square miles (Map 3.13).

3.3.1. Background of Midtown Manhattan

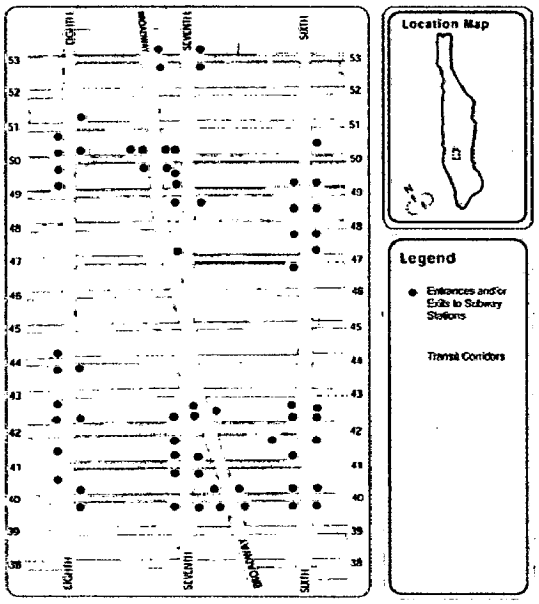
The predominant land uses within Midtown Manhattan are **commercial and office buildings.** Other commercial uses include **theaters, hotels, retail, and tourist attractions.** The Empire State Building, Times Square, the Theater District, Rockefeller Center, Fifth Avenue, Bryant Park, the New York Public Library, and Central Park are among the tourist attractions in Midtown (Map 3.14). There are residential buildings also in the district. There are **46 open spaces** in or on the edge of the study area including Central Park, Bryant Park, Rockefeller Center, and **11 mid-block building plazas** (Deptt. of City Planning, Deptt. of Transportation, 2000).

Daily, approximately 800,000 people journey to work in Midtown Manhattan. Approximately 80 percent of these workers rely on transit as their primary commute mode, because of which pedestrian volumes are very high in the streets. Integrated within these complexes are connections to New York Transit subways (Map 3.15). There are also dedicated bus routes catering the area (Deptt. of City Planning, Deptt. of Transportation, 2000).

The streets follow a grid pattern. Avenues are north-south corridors, usually wide streets carrying one-way traffic. In general, the avenues are 100 feet wide, with 60-70 foot roads and 15-20 foot sidewalks. Streets are east-west corridors and carry two-way traffic and the major ones are 100 feet wide, with 55-60 foot roads and wide sidewalks of 20-22.5 feet. All other cross-town streets are narrow one-way streets having 30-35 foot roadbeds and 13-15 foot sidewalks.



Map 3.14: Map showing predominant land-uses in the business precinct



Map 3.15: Map showing entrance/exits to Subway Stations

Source: Midtown Manhattan Pedestrian Network Development Project Report, 2000

3.3.2. Pedestrianization Background

The grid system of mid-town streets and avenues was designed many years ago, but for a smaller scale of development (Fig. 3.23). With increase in population – number of vehicles also increased but the streets and sidewalks have remained the same. The result was unbearable congestion, noise and stress and massive inefficiency (Fig. 3.24). The competition for space was intense and the resulting pedestrian environment was impeded by obstructed sidewalks, conflicts with traffic, and poor directional and informational signs (Deptt. of City Planning, Deptt. of Transportation, 2000). Some of the transportation and access issues were important considerations in maintaining and strengthening the City's core areas and in this regard, the Department of City Planning and the Department of Transportation, city of New York, came up with the 'MIDTOWN MANHATTAN PEDESTRIAN NETWORK DEVELOPMENT PROJECT' in 2000. The project aimed to improve the pedestrian and vehicle circulation, reduce their conflicts, reduce congestion and to improve safety, access, convenience and the urban environment.

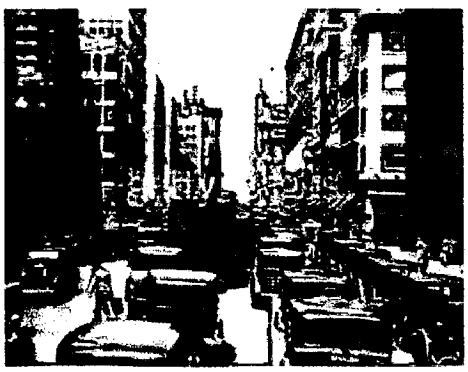


Fig. 3.23: Midtown Manhattan in 1930

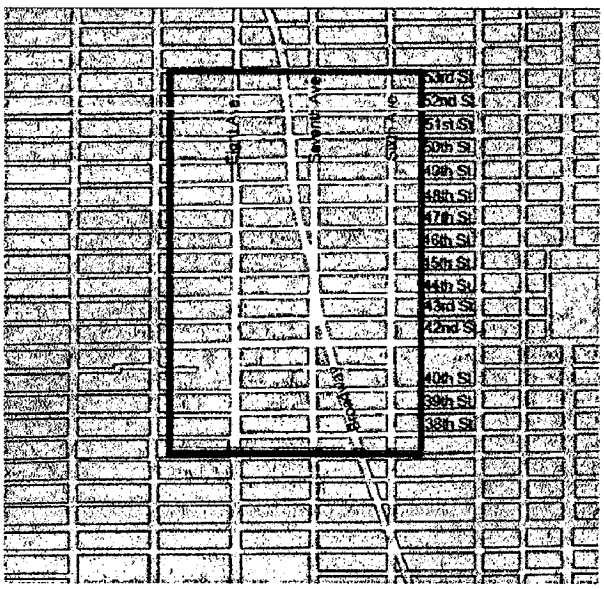
Source: www.gettyimages.com

Fig. 3.24: Midtown Manhattan in 2000

Source:

3.3.3. Pedestrian Environment Improvement Scheme in Study area

As a part of the Pedestrian Network Development Project, a sample area was chosen starting from 38th street to 53rd street and covering Sixth, Seventh and Eighth Avenues. The major problem identified were the conflicts between vehicles and pedestrians, both of which are in large volumes in the area. Pedestrian and vehicular congestion is a common problem in the area. Encroaching vehicles, protruding signage, illegally parked vehicles and lack of appropriate street markings add to the problems of pedestrian movement. The pedestrian safety is affected. The quality of pedestrian environment is affected due to lack of public amenities, including, seating, public toilets, landscaping, and pedestrian lighting. The urban streetscape is affected. Moreover, due to the presence of a large number of offices and theatres in the vicinity, the curbside loading hours of 7 a.m. to 7 p.m. conflict with the morning and evening peak hours and the Wednesday matinee peak hours.



Map 3.16: Study area under Midtown Manhattan Pedestrian Network Development Project

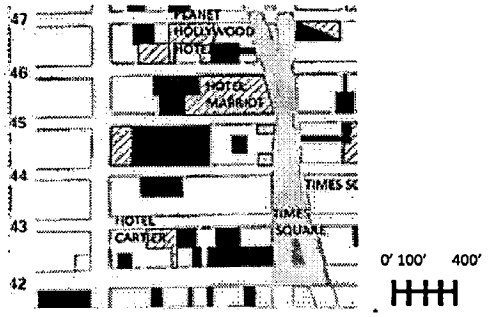
Source: Midtown Manhattan Pedestrian Network Development Project Report, 2000

3.3.3.1. Priority areas

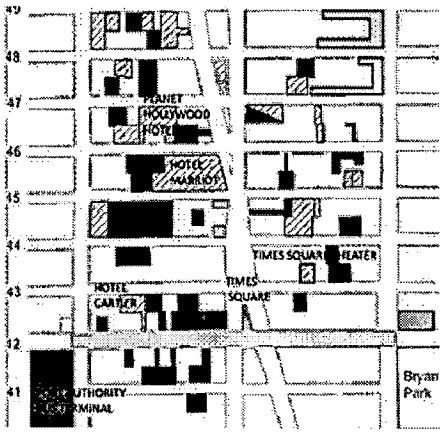
The first phase of the Midtown Manhattan Pedestrian Network Development project focuses on West Midtown, from West 38th Street to West 53rd Street and between Sixth to Eighth avenues. The study location is 1.2 sq.km. in area (Map 3.16). This area has an enormous volume of pedestrian and vehicular traffic. This is due to the Port Authority Bus Terminal and 15 subway Lines, tourist volumes, Times Square, and the growth of commerce, theaters and hotels (Deptt. of City Planning, Deptt. of Transportation, 2000).

Four priority sub-areas within the study boundaries have been selected based on their critical importance to pedestrians and the identification of multiple problems. These are –

1. Seventh Avenue and Broadway from West 42nd to 47th Street in the Times Square Bow Tie (Map 3.17);
2. West 42nd Street between Sixth Avenue and Eighth Avenue (Map 3.18);
3. Times Square Plaza (Map 3.19); and
4. West 50th Street between Sixth and Eighth avenues (Map 3.20).

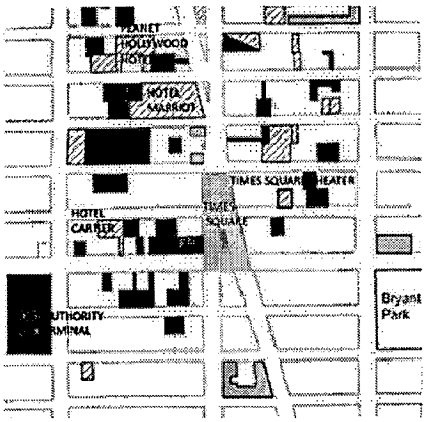


Map 3.17: Seventh Avenue and Broadway from West 42nd to 47th Street in the Times Square Bow Tie

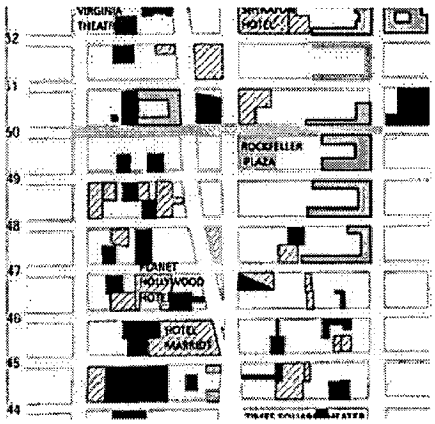


Map 3.18: West 42nd Street between Sixth Avenue and Eight Avenue

Source: By Author (based on Midtown Manhattan Pedestrian Network Development Project Report, 2000)



Map 3.19: Times Square Plaza



Map 3.20: West 50th Street between Sixth and Eighth Avenues

Source: By Author (based on Midtown Manhattan Pedestrian Network Development Project Report, 2000)

3.3.3.2. Measures undertaken under the scheme

1. Curb lines were changed to widen sidewalks and street corners (Fig. 3.25(a), 3.25(b) & 3.26).
2. Sidewalk surfaces were improved and pedestrian boulevards introduced (Fig. 3.27).
3. A new crosswalk and traffic signal was installed on West 42nd Street (Fig. 3.28).
4. Corners were cleared and the street furniture that obstructs pedestrian circulation was relocated.
5. Signal time for pedestrians was increased, especially in the Bow Tie, especially during the evening hours.
6. Traffic was channelized through new lane markings and signage (Fig. 3.29).
7. Truck delivery hours were limited to off-peak hours i.e. 10 a.m. to 4 p.m.
8. Bus stops were extended and new bus shelters were constructed (Fig. 3.30).
9. No stopping/parking regulations were enforced in 42nd street.

10. Sidewalks were widened at the Times Square Bow to solve the poor traffic circulation problems and conflicts (Fig. 3.31).
11. Times Square pedestrian Plaza was added, offering people 2 acres of traffic-free space for relaxation and leisure (Fig. 3.32).
12. Traffic calming measures were adopted by providing vehicle-users with speed limits to drive in the area, especially during peak-hours of pedestrian traffic.
13. The crosswalks were widened, their visibility to the motorists increased by marking them properly at accident-prone locations.

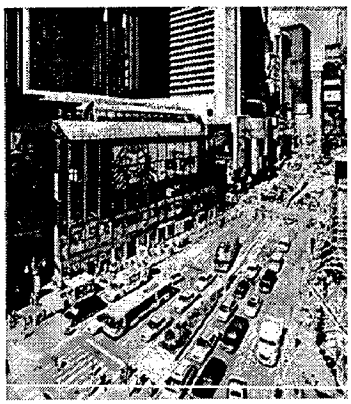


Fig. 3.25(a) 7th Avenue before improvement

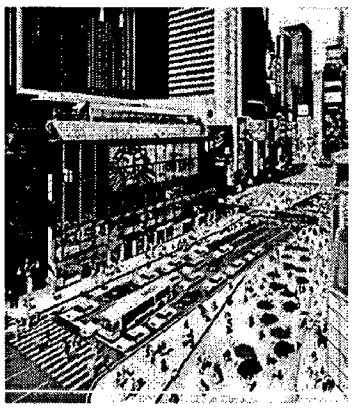


Fig. 3.25(b) 7th Avenue After improvement

Source: http://www.streetsblog.org/

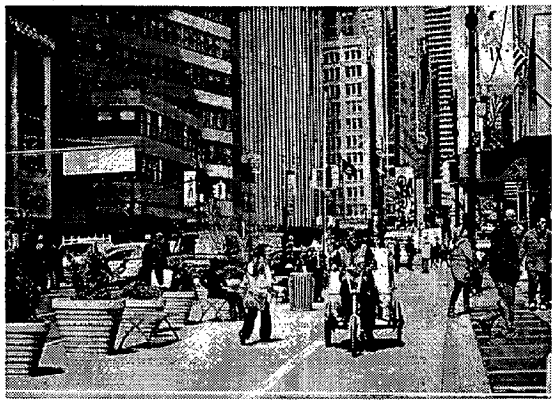


Fig. 3.26: Widened sidewalks at Broadway

Source: http://www.streetsblog.org/

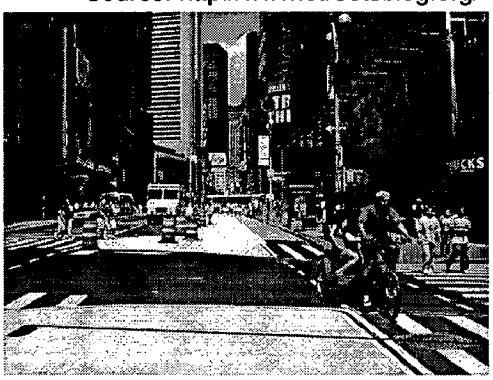


Fig. 3.27: Pedestrian Boulevard introduced

Source: http://www.streetsblog.org/

Fig. 3.28: Traffic signal installed at West 42nd Street

Source: http://www.streetsblog.org/

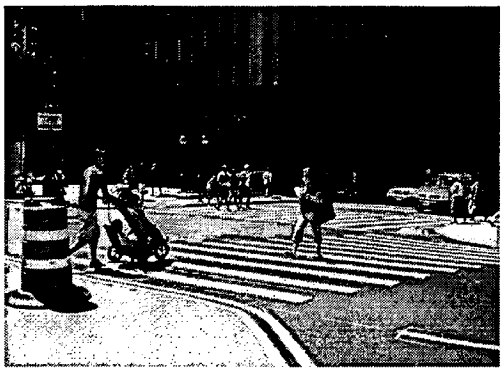


Fig. 3.29: New lane markings introduced

Source: http://www.streetsblog.org/

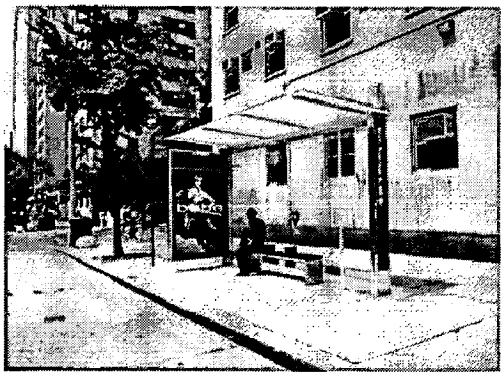


Fig. 3.30: New bus shelter introduced

Source: http://www.streetsblog.org/

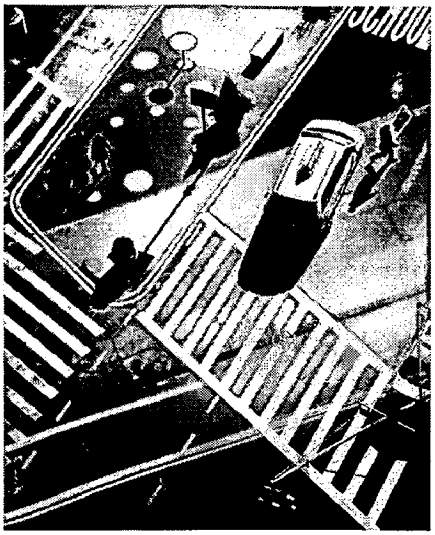


Fig. 3.31: Sidewalks widened at Times Square

Source: http://www.streetsblog.org/

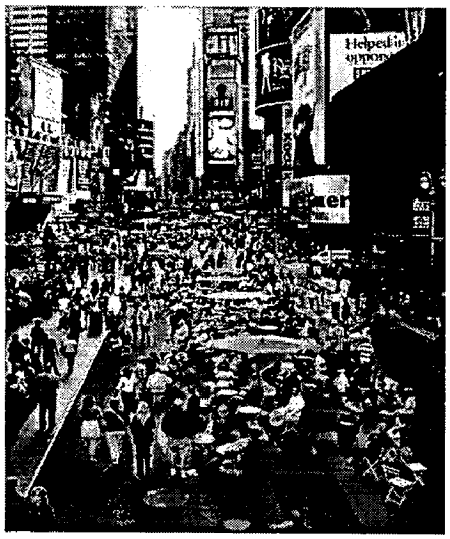


Fig. 3.32: Times Square Plaza

Source: http://www.streetsblog.org/

3.3.4. Merits of the Scheme

It has improved the general pedestrian environment of the area by increasing the convenience aspect of the pedestrians. Traffic conflicts reduced due to traffic calming and street widening. More street activity took place, especially at Time Square. This can be taken as an example of how to improve and bring changes in the overall pedestrian environment, in cases where it cannot be practically closed to traffic.

3.3.5. Demerits of the Scheme

The scheme could have implemented more diverse measures on few other stretches too. The area has a scope for the provision of grade-separated crossings, especially skywalks, which can not only increase the safety aspect of pedestrians but also serve as a connecting channel for movement between buildings at an overhead level. Pedestrian automated signals can be installed at intersections, where the risk factor is comparatively high.

3.4. Findings and Inferences

The findings and inferences drawn from the case studies are summarized as follows

Table 3.3: Findings and Inferences drawn from the Case Studies

Case Study-1 Copenhagen	Case Study-2 Causeway Bay	Case Study-3 Midtown Manhattan
1) Banning of cars completely on a street – an innovative technique to minimize the conflict of cars and pedestrians.	1) A mix of complete pedestrianization, part-time pedestrianization by allotting time slots for entry of vehicles and adopting traffic calming by reducing	1) A practical example that can be employed on major arterial roads of a city, where banning may not be feasible, as they may be serving as major

2) Initial objections by the public may be solved in the long run, once they come to know its advantages. 3) Can be effectively employed on streets in commercial areas, core areas of the city which has a huge amount of pedestrian traffic. 4) Re-routing of the vehicular traffic through other streets in the vicinity, however, needs to be taken care of and worked out. 5) Concept of shared street system – a useful technique where banning is not practical. 6) The local bodies also took efforts to introduce a lot of seating spaces, improve the art and architecture, introduce spaces for various recreational activities, thereby concreting the urban realm of the city centre. 7) The pollution levels in the city centre reduced drastically due to pedestrianization. 8) Safety and security in the city centre improved greatly, and it used to be populated with people even in late night hours.	their speed in a pedestrian district is a better method to approach the problem, looking at the practical feasibilities of the project. 2) A good example of how public participation is important in a pedestrianization project. 3) A good example of the mixing of public transport (streetcars) along with pedestrians. 4) Can be effectively employed in areas like congested commercial precincts, which have a high toll of shoppers. 5) Other measures like re-locating the mini-buses and taxi stands, altering the paving design at certain places to help the motorists realize that they are in a pedestrian district, etc. are also supporting strategies to make pedestrianization successful in the precinct.	transport corridors. 2) Footpath widening is an innovative low cost solution to improve the pedestrian environment. 3) Traffic calming may prove a useful solution to reduce the speeds of vehicle, thus reducing the pedestrian-vehicle conflict. 4) Pedestrian boulevard can be designed on a busy street, to facilitate an environment with cafes, and open sit-outs. 5) Creating plazas in the middle of a busy street is another useful inference drawn from the case study. 6) Installing pedestrian automated signals alongwith improving the existing traffic lights and installing new traffic lights at many places, could have served as an added benefit to secure pedestrian safety. 7) Creating attractive bus stops and enforcing strict no parking regulations in certain stretches also prove to be a stringent action that can be taken in cases where pedestrian flow is more and safety issue is a major concern.

4 GENERAL PEDESTRIAN SCENARIO IN INDIA

4 GENERAL PEDESTRIAN SCENARIO IN INDIA

Walking is still a basis for urban mobility in most of the Indian towns and cities. In fact, walking is the single most important means of transport even in large cities like Delhi and Mumbai. A 2008 study of 30 cities showed that 16-57 percent of all trips, involve no vehicles at all. Smaller cities and hill towns, where walking commands a greater share of trips, figured at the higher end of this classification (Alok Gupta R. M., 2009). The modal split of walking is quite high in many of the large Indian cities as seen from Fig. 4.1 (Ministry of Urban Development, Govt. of India, 2008).

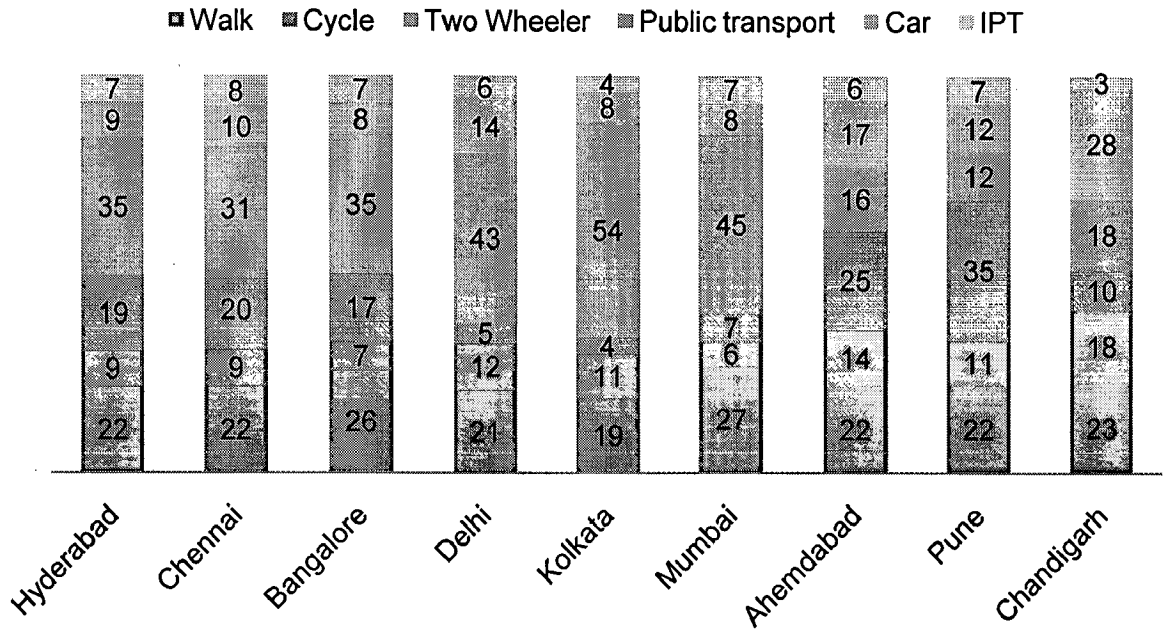


Fig. 4.1: Modal Split of Transport modes in large Indian cities (in %)

Source: Report of Study on Traffic and Transportation Policies and Strategies in Urban Areas, Ministry of Urban Development of India, 2008

A study conducted by Wilbur Smith Associates which assessed the walkability index of Indian cities based on availability of footpaths and overall infrastructure, found that the national average of walkability was just 0.52. Chandigarh came up on the top with 0.91; cities such as London score 1.5 to 1.7 (Roychowdhury.A., 2009). Studies have also shown that more than 40 to 50 per cent of the daily trips in many of our cities have distances less than 5 kilometers. Walking has major contribution in urban mobility as vast majority of people i.e. urban poor who have no access to personalized mode or cannot afford public transport for daily commuting, are pedestrians and they walk (Pawan Kumar, 2009).

The sad story is that the pedestrians have always been missing from the 'Great Urban Plan' (Sanyal.S., 2009). Inspite of such a high share of people who commute by walk, a pedestrian is shunned away in the planning process and not taken into account whereas the major emphasis is laid on easing out the movement of the vehicular traffic (Rakesh, 2007). Walkers remain invisible in the maze of motorized traffic that choke our roads (Fig. 4.2). Pedestrians walk in hostile conditions, in constant conflict with motorized traffic and are easy victims to crashes and accidents (Fig. 4.3).

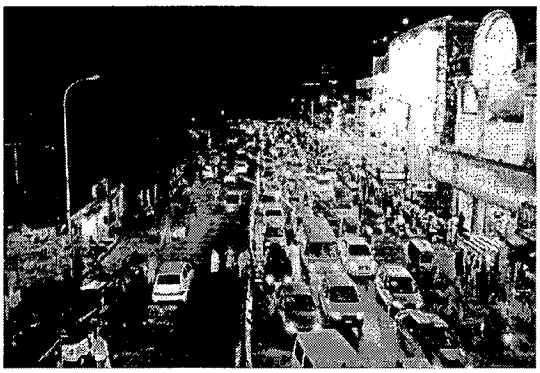


Fig. 4.2: Maze of motorized traffic at Chennai

Source: Inception Report, Urban Re-development Project for Thyagaraya Nagar, Chennai, 2010

Fig. 4.3: Pedestrian safety hindered at Lucknow

Source: www.flickr.com

The pedestrian's need for a safe and convenient infrastructure continues to be ignored. Pedestrians are present on the roads despite hostile infrastructure designs. Inspite of investments in road infrastructure and plans for land use and transport development, cities still face the problem of congestion, traffic accidents and air pollution and the problems continue to grow. Large cities are facing a rapid growth of personal vehicles (two wheelers and cars); and in medium & small cities, different forms of intermediate public transport provided by informal sector are struggling to meet the mobility demands of city residents. (Tiwari, 2010). State authorities and 'experts' continue to plan infrastructure which ensures fast movement of car traffic at the expense of pedestrians and non-motorized vehicles. The basic needs of pedestrians are not recognized as a key part of the urban transport infrastructure (Tiwari, Pedestrian infrastructure in the city transport system: A Case Study of Delhi, 2001).

With the exception of few cities, most of the major road networks have not been provided with footpaths. The civic authorities have very little concern to the numerous obstacles on the footpaths, the potholes and construction debris lying on sidewalks and the footpath width lost in road widening schemes. The existing pedestrian environment of Indian cities offers a grim situation, though in the recent times, some of the urban local bodies have come up with policies and design guidelines to improve the situation. In the following paragraphs, these relevant policies and guidelines proposed by some urban local bodies and authorities and some key projects undertaken to improve the pedestrian environment are discussed. The existing picture of

the general pedestrian infrastructure prevalent in Indian towns and cities and a summary of the inferences and findings are given in the concluding pages of this chapter.

4.1. National Urban Transport Policy, 2006

The National Urban Transport Policy was formulated in 2006 by the Ministry of Urban Development, Government of India to provide a vision to meet the challenging demands of urban transport in Indian cities and promote a sustainable transport solution for the future. The policy was framed on account of India's rapid development and urbanization and in order to support the booming economic activities, an easy and sustainable flow of goods and people is essential, which has in recent times been facing problems like increased time consumption, increase in travel cost, increase in accidents and environmental degradation of the cities (Ministry of Urban Development, 2005).

4.1.1. Vision of the Policy

a) To recognize that people occupy center-stage in our cities and all plans would be for their common benefit and well being.
b) To make our cities, one among the most livable in the world and enable them to become the engines of economic growth that power India's development in the 21st century.
c) To allow our cities to evolve into an urban form that is best suited for the unique geography of their locations and is best placed to support the main social and economic activities that take place in the city (Ministry of Urban Development, 2005).

4.1.2. Objectives of the Policy

The objectives of the NUTP are aimed to ensure safe, affordable, quick, comfortable, reliable and sustainable access for the growing number of residents to jobs, education, recreation and other such needs. Some of the important objectives were:

a) Incorporating urban transportation as an important parameter at the urban planning stage.
b) Encouraging integrated land use and transport planning.
c) Bringing about a more equitable allocation of road space for all the users.
d) **Encouraging greater use of public transport and non-motorized modes.**
e) Enabling the establishment of quality focused multi-modal public transport systems that are well integrated.

Thus, the policy clearly laid stress on non-motorized modes of transport to be a sustainable solution for the future. The policy stated to allocate an equal share of road space to all the users and give a high priority to non-motorized means of transport. This has been further elaborated in the following section.

4.1.2.1. Equitable Allocation of road space

The policy focuses on allocating the road space on a more equitable basis to all users, with people on foot as its main focus. This on account of the reason that users who walk or cycle have been squeezed out of the roads in terms of their space allocation on a road, rendering serious threats to their safety. To solve these problems, the policy laid emphasis on dedicated lanes and corridors, reserved exclusively for the non-motorized modes of travel and public transport. In order to facilitate better enforcement of such lane discipline, suitable provisions must be introduced in the Motor Vehicles Act and other instrumentalities to enable stringent penalties for violation. Similarly, city roads must be allocated with wide footpaths for the pedestrians.

4.1.2.2. Priority to non-motorized transport

The policy aimed to give a lot of priority to NMTs, which are losing importance due to the rising income levels and the uncontrolled urban sprawl. The risk of accidents have taken a toll and NMTs being environmentally friendly, have to be given due share in the transport system. With this in view, the National Urban Transport Policy suggested that first of all, the safety concerns of cyclists and pedestrians have to be addressed by encouraging the construction of segregated rights of way for bicycles and pedestrians. This would also further increase the use of public transport. Secondly, many of the footpaths are not used much on account of the bad design and poor maintenance. Encroachment of footpaths too affects pedestrian safety adversely and requires strict enforcement coupled with public participation. Pedestrian safety is also adversely affected by the lack of safe crossing facilities at busy intersections of many traffic corridors (Ministry of Urban Development, 2005).

The Central Government is going to give priority to the construction of cycle tracks and pedestrian paths in all cities, under the Jawaharlal Nehru National Urban Renewal Mission (JNNURM), to enhance pedestrian safety and thereby enhance use of non-motorized modes. Cities would also be encouraged to explore the possibility of a public bicycle program, where people can rent a bicycle for use in specially designated areas. The Central Government would also take up pilot projects, in a sample set of cities, to demonstrate the improvements that are possible through the enhanced used of walking and cycling, for possible replication in other cities (Ministry of Urban Development, 2005).

The study of the NUTP, 2006 indicates that the government has recognized the importance of walking and emphasized the need to encourage walking by improving the existing facilities and the urban environment for walking. It also states the serious need to upgrade our pedestrian environment to make urban transport more sustainable in the future.

4.2. Study on Traffic and Transportation Policies and Strategies in Urban Areas in India

This study was conducted by the Ministry of Urban Development in 2008 with an objective to establish a comprehensive baseline of the traffic and transport scenario in urban areas in India, separately for all million plus cities and for a second level of cities with a population range of 0.5 to one million and also establish an independent and reliable basis for the formulation of future policies and programs for the management of urban transport in India (Ministry of Urban Development, Govt. of India, 2008). There were 87 cities that qualified for this study. Data through primary and secondary surveys was collected for 30 sample cities to understand the existing urban transport scenario. Under the surveys executed for understanding the pedestrian facilities scenario, pedestrian opinion surveys were conducted to evaluate the current conditions and existing available facilities for pedestrians. Pedestrian opinion/ranking on the following parameters were collected:

1. Availability of foot path
2. Foot way width
3. Presence of obstruction
4. Maintenance of Footpath
5. Street lights & other amenities
6. Security from crime
7. Walking path conflicts
8. Availability of Pedestrian crossing
9. Safety in crossing

Within each city, several important corridors with high pedestrian intensities were selected for the survey. Opinion of pedestrians on the listed nine parameters was ranked on a 1 - 5 scale.1 indicated the worst and 5 indicated the best.

To normalize Level of Services inputs, each Level of Services was multiplied by the length of the surveyed road and the pedestrian count. The results were summed up across the rows and average by the number of the stretches surveyed (Fig. 4.4). A final average was derived from the sum of the un-weighted averages for each survey area, divided by the total number of survey areas. A final average was calculated and used in the derivation of the final rank. A low rank indicates inadequate and substandard pedestrian facilities while a high rank indicates fairly better facilities (Ministry of Urban Development, Govt. of India, 2008).

The results indicated that Chandigarh scored the highest rank of 4.1, as it has well-planned pedestrian facilities while cities like Raipur, Patna, Kanpur, Surat etc. scored low ranks. In general, it was found that higher the city category, the better was the rank (Table 4.1) The lowest

rank was 1.1 of Gangtok and the highest was 4.1 of Chandigarh, with the average being 2.5 in general.

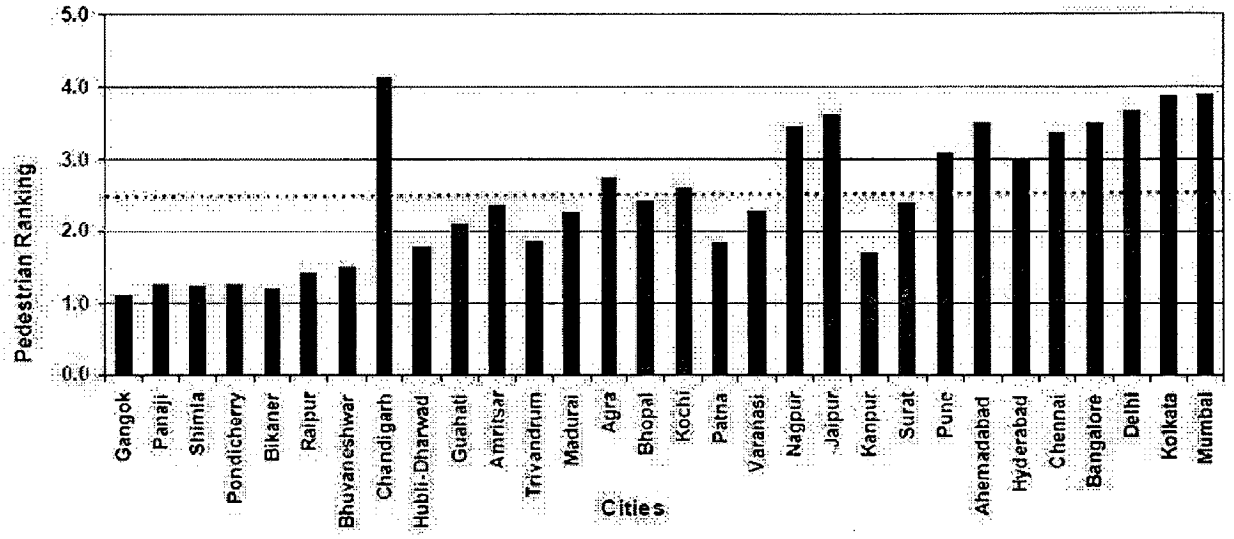


Fig. 4.4: Pedestrian Facility Ranking for selected cities

Source: Report of Study on Traffic and Transportation Policies and Strategies in Urban Areas, Ministry of Urban Development of India, 2008

Table 4.1: Average Pedestrian Facility Rank for various categories of cities

City Category	Population of City Category (in lakhs as per 2001 census)	Average Rank
Category 1a	0.92	1.3
Category 1b	0.97	1.2
Category 2	5.08 – 9.68	1.9
Category 3	10.60 - 18.95	2.3
Category 4	21.13 – 30.90	2.8
Category 5	42.00 – 70.14	3.1
Category 6	86.25 – 177.02	3.7

Source: Report of Study on Traffic and Transportation Policies and Strategies in Urban Areas, Ministry of Urban Development of India, 2008

The study of the Traffic and Transportation Policies and Strategies in Urban Areas indicates that the pedestrian facilities in Indian cities are quite poor than cities abroad. The pedestrian infrastructure ranks quite poorly, except for in a few metro cities and it is high time that the urban local bodies and other organizations chalk out plans for their improvement and prioritize the pedestrians the most, in the upcoming urban plans.

4.3. Study of City Development Plans (CDPs) of select cities

The Ministry of Urban Development, Govt. of India, launched the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in December, 2005. The mission aimed to create economically productive, efficient, equitable and responsive cities in an integrated framework with focus on economic and social infrastructure and in implementing urban sector reforms for strengthening the urban local bodies (Pawan Kumar, 2009). The mission covers some 63 cities and it was launched to lend a helping hand to the urban local bodies to undertake a massive city modernization scheme (Ministry of Urban Development, Govt. of India, 2006).

One of the pre-requisites for availing financial assistance was to prepare City Development Plans (CDPs), Detailed Project Reports (DPRs) and Urban Reform Agenda for the development projects to be executed in the city. The CDP seeks to address the needs and challenges of the City in a systematic manner with the participation of all its stakeholders and citizens (Ministry of Urban Development, Govt. of India, 2006). A study of city development plans of 12 cities has been undertaken to understand the development proposals prepared for various cities and whether there are some proposals for the improvement of the pedestrian facilities or for the pedestrianization of a small area in the city. The study of the CDPs would give a clear picture of the budget allocations also in this regard. The findings have been summarized in the following table (Table 4.2).

Table 4.2: Summary of Findings from Study of City Development Plans

S.No.	City	Have pedestrian needs been identified?	Short/ Mid/Long-term proposals and measures identified	Budget Allocation for the proposals	Detailed Projects identified/ approved in DPR on pedestrian facilities	Proposals for widening of footpaths	Any ideal cross-sections for streets	Are there any proposals for pedestrianization under JNNURM scheme?
A	B	C	D	E	F	G	H	I
1.	Delhi	Consider-ation for pedestrian amenities on roads identified	i) Strengthening and improvement of footpaths along major roads ii) Construction of foot over bridges/ subways at ten critical locations iii) Modernization of Street Lighting	150 cr 10 cr 125 cr	Construction of 25 foot-over bridges (1750 lakh)	No	No	No
2.	Mumbai	Pedestrian safety improve-ment programs identified	Short Term measures like encroachment free footpaths, provision of pedestrian grade separators, safe and well-designed crossings and pedestrian subways	As a part of the Mumbai Urban Transport Project (MUTP – 4024 cr.)	No	No	No	No

3.	Ahmedabad	Lack of pedestrian facilities like footpaths, zebra crossings subways etc. identified	Appropriate pedestrian facilities to be developed on the major roads having significant pedestrian cross traffic	3685 cr (work under Urban Tran-sport Project)	No	No	No	No
4.	Hyderabad	Inadequate subways, footpaths and pedestrian crossings identified	Pedestrian facilities – Pedestrian Subways/ FOBs Infrastructure/ signage for pedestrian crossings	36 cr 20 cr	No	No	No	Charminar Pedestria-nization Project under implement-tation
5.	Pondicherry	Inadequate infrastructure facilities for pedestrians and cyclists identified	Pedestrian Sub Ways/ Foot Over Bridge	800 lakh	No	No	No	No
6.	Agra	Hardly any footpaths for safe pedestrian movement identified	i) Pedestrian footpath improvement ii) Foot-over Bridges/ Pedestrian underpasses	12.47 cr 24.32 cr	No	No	No	No
7.	Lucknow	Not identified	---	---	No	No	No	No
8.	Guwahati	Pedestrian safety identified	No measures identified	No funds allocated	No	No	No	No
9.	Trivandrum	Pedestrian counts recorded in 2004 indicating heavy pedestrian movement	Footpaths along roads (widening and rehabilitation), foot-over bridges, subways and at-grade pedestrian road crossing facilites at 12 locations	72 cr.	No	No	No	No
10.	Jabalpur	Footpaths not present in most of the stretches	Development of subways	250 lakh	No	No	No	No
11.	Madurai	Roads lacking footpaths identified	i) 3km Mada Street Pedestrianization ii) 3 Pedestrian subways	12 lakh 450 lakh	No	No	No	No
12.	Mysore	Need for pavements identified	i) Footpaths ii) Development of pedestrian/cycling zones	38cr 12cr	No	No	No	No

Source: JNNURM website (http://jnnurm.nic.in/nurmudweb/missioncities.htm)

The above table indicates that some cities like Lucknow and Guwahati have not even mentioned about pedestrian facility improvement in their transport vision for the future. Most of them speak about either provision of subways and foot-over bridges or footpath surface improvement. Funds have been worked out in the city development plans, but the detailed project reports (DPRs) of the implemented works do not reflect any work carried out on pedestrian footpath improvement or their widening. Except Delhi, none of the CDPs have got approved any projects on footpath improvement, footpath widening etc. None of the DPRs speak about any guidelines prepared for ideal cross-sections of streets or any Design Manuals for sidewalk improvement. Though only Madurai and Hyderabad CDPs mentioned about Pedestrianization (Mada Street Project and Charminar project), even the proposal for the Madurai project has not yet been prepared and the Charminar project is at a halt mid-way, due to some clashes between court orders and the municipality's implementation process. Thus this indicates that the mention of pedestrian facility improvement can be seen as a way to avail the JNNURM funds but these funds are not used for the purpose. This also reflects the lack of interest by the ULBs and other development agencies to consider the improvement of the existing pedestrian facilities as a priority-based issue.

4.4. Pedestrian Environment in Chandigarh

The first sincere effort to provide pedestrian facilities and a good walking environment for the people was made in Chandigarh by Le Corbusier, one of the best known architects in the world, when he made the plan for Chandigarh city. A dream of Pandit Jawaharlal Nehru, Chandigarh was the first planned city in the country. Careful planning and proper civic amenities have helped the city remain one of the cleanest cities in the country.

4.4.1. Pedestrian Planning in City Plan

Le Corbusier designed Chandigarh having neighborhoods or sectors on a gridiron format, but free access was discouraged to the sectoral roads by making them discontinuous, wavy and smaller in width. The roads have been planned in seven categories i.e. from V-1 to V-7 and the hierarchy has been worked out considering their functional utility in the overall network. The V-7 is a completely independent pedestrian system, which runs within the residential sectors providing an inter-sectoral linkage as well as connecting the residential areas to the community facilities in the sector. Though there was this thought of providing an integrated pedestrian network, but it lacks the desired continuity of flow. The arterial roads of the city are also designed with wide pedestrian footpaths (Fig. 4.5 & 4.6). Upgrading of the overall network has not been regularly done though and therefore some of the pedestrian routes have been destroyed and a few others lack maintenance (Mishra, 1998).

Fig. 4.5: Pedestrian sidewalk on a local street in Chandigarh

Source: www.flickr.com

Fig. 4.6: A tree-lined pedestrian footpath on a collector street in Chandigarh

Source: www.flickr.com

4.4.2. Pedestrianization of Sector- 17 Commercial Market

One of the major efforts that have been taken in the city towards creating a pedestrian precinct is the Sector-17 commercial market. Sector-17 is the major shopping and commercial sector of Chandigarh. Planned around four pedestrian concourses meeting at a Central Chowk, the whole area is pedestrianized. It has a series of inter-linked pedestrian-only accessible squares, courtyards and streets (TNUDF, JLLM, September 2010). The sector comprises of Inter-state Bus Terminus, Parade Ground, District Courts, etc. in the periphery while the core shopping area which is pedestrianized, is located in the centre (Fig. 4.7). The plaza is very successful and is being upgraded to accommodate the changing requirements of the present times. One can simply shop, lounge around or relax in the beautiful surroundings, gazing the crowd (Mishra, 1998). The public space has an integrated landscape design with pedestrians in mind, by providing street furniture, fountains, sculptures, and trees (Fig. 4.8).

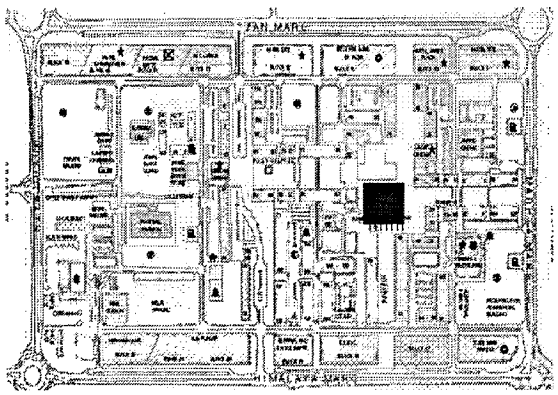


Fig. 4.7: Plan of Sector-17

Source: http://www.gooddealrealtors.com/chandigarh.htm

Fig. 4.8: Pedestrianized Plaza

Source: www.flickr.com

Chandigarh thus, serves to be a good example from which useful lessons can be drawn about the positive impacts of city planning over the city and its residents and how innovative planning

and design has benefitted an entire area (Sector-17) in terms of improving the quality of the space as well as quality of life of the people.

4.5. Pedestrian situation in Delhi

Delhi is the Capital city of the largest democracy & one of the fastest growing economies. In the realm of urban transport, Delhi has achieved tremendous success in terms of the Metro Rail and the BRTS but the present transport is also characterized by congestion on roads with declining ambient air quality, also accompanied by a rising trend in road accidents. The focus of all efforts need to be on reducing congestion, improving air quality and enhancing road safety by improving amenities for the commuters, especially the pedestrians. There are city level laws framed towards pedestrian safety, some guidelines specified in the master plan and pedestrian design guidelines framed by UTTIPEC, DDA, all of which have the same goal – to enhance the pedestrian safety and make walking safer, convenient and comfortable. These laws and design guidelines have been discussed in the preceding section.

4.5.1. Laws for Pedestrian Safety

Many City level Laws exist in Delhi, which converge to safeguard the safety of pedestrians. Some of them are as follows:

- Central Motor Vehicles rules (CMVR) 1989 Safety Rules state that motorists cannot enter pedestrian way and are liable to penalty, providing passive protection to pedestrians.
- Indian Penal Code (sec 283), sec. 34 of Delhi Police Act state that obstruction in public space is punishable.
- The National Policy on Urban Street Vendors, 2009, approved by the central government, to protect livelihood rights of vendors recommends guidelines for properly demarcated vending zones, as they are service providers to sidewalks.

Inspite of such laws existing pro-pedestrians, these are not being enforced and regulated strictly. The fault also lies with both the pedestrians as well as the motorists towards not following the road safety rules because of their careless and casual attitudes (UTTIPEC, DDA, 2009).

4.5.2. Delhi Master Plan Recommendations

Master Plan of Delhi 2021 specifies the following guidelines towards pedestrian facilities:

- All roads should be made pedestrian-friendly, universally accessible and bicycle-friendly.
- Adequate pedestrian facilities must be provided and they must be kept free of encroachments.
- In urban extension, cycle tracks should be provided at the sub-arterial and local level roads and streets.

- In specific areas, like the Walled City / Chandni Chowk / Sadar Bazar / Karol Bagh / Lajpat Nagar and Trans Yamuna Area, the use of cycles/rickshaw as a non-motorised mode of transport should be consciously planned along with pedestrianization (complete pedestrian streets).
- On all roads with ROW greater than 30 m exclusive bus lanes will be planned to implement the Bus Rapid Transit System (BRTS) in a phased manner to cover the whole city, which would be supplemented with proper pedestrian facilities like footpaths, bus shelters and other amenities (Delhi Development Authority, 2001).

Thus the Master Plan also recognizes the urgent need to make our cities more pro-pedestrian and walkable and design schemes for pedestrian facilities improvement.

4.5.3. Pedestrian Design Guidelines, UTTIPEC, DDA

Unified Traffic & Transportation Infrastructure Planning & Engineering Centre (UTTIPEC), under Delhi Development Authority, framed pedestrian design guidelines in 2009 for immediate implementation, enforcement and uniform adoption by all the road owning agencies, to develop integrated streets in Delhi. These guidelines have already been discussed at length under the section covering design standards and guidelines in India (Refer Section 2.5.4.2.). Some of the newly constructed sidewalks in Delhi, constructed during the Commonwealth Games, were built taking into consideration these guidelines (Fig. 4.9 & 4.10).

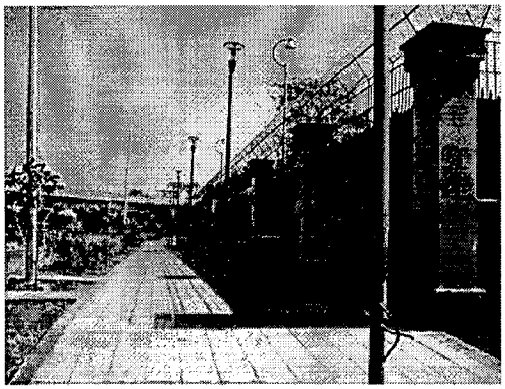


Fig. 4.9: Well-lit sidewalk

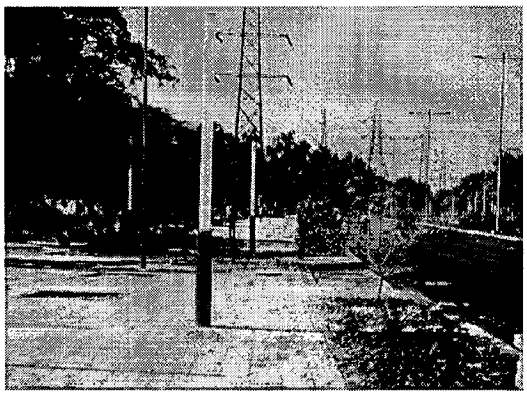


Fig. 4.10: Well-landscaped and wide sidewalk

Source: http://forums.bharat-rakshak.com/viewtopic.php?f=2&t=4776&start=120

The guidelines are an attempt to suggest as to what makes an ideal pedestrian environment and encourages people to walk. The guidelines further also stressed on the need for the road-owning agencies to formulate a regime to ensure regular upkeep of footpath surfaces, lighting, signage, amenities, etc. The local community must also be encouraged to get involved in the maintenance and upkeep of footpaths (UTTIPEC, DDA, 2009).

4.5.4. Some good Examples in Delhi

Connaught Place and Khan Market Plaza in New Delhi are some good examples of pedestrian-dominated precincts and High Streets in India. Connaught Place is an example of a CBD-linked arcaded shopping mall located in the heart of the city (Fig. 4.11). It is one of the oldest areas of Delhi and has a very wide pedestrian arcade along the shops, which makes the pedestrian experience very comfortable and convenient (Fig. 4.12). Khan Market plaza is a High Street that emerged by virtue of being in neighboring posh localities of a resident affluent population, which have a better provision for the pedestrians (JLLM, India) (Fig. 4.13).

Fig. 4.11. Connaught Place, Delhi

Source: www.flickr.com

Fig. 4.12: Pedestrian arcade, Connaught Place

Source: www.flickr.com

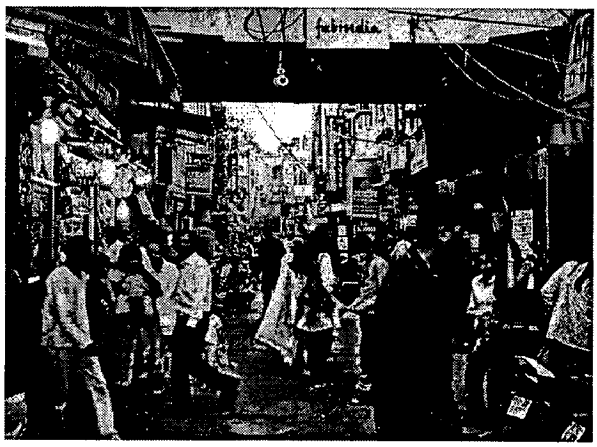


Fig. 4.13: Pedestrian street, Khan Market

Source: www.flickr.com

4.6. Pedestrian situation in Mumbai

Mumbai has the highest number of walking population among the Indian cities – 55% of people walk in Mumbai (Sanyal.S., 2009). In contrast to this, however, the pedestrian facilities don't speak very high of the city. The pedestrian situation is grim in general in the city. Most streets here have no footpaths. The sidewalks that do exist are bursting from a gridlock of walkers, street vendors and squatters (Arlene Chang, 2010). To lift the pedestrians that power this city above the fray, Mumbai is building more than 50 elevated walkways. The skywalks will sprout from train stations across the city and snake over the traffic for up to two miles to create a pedestrian express lane. Another interesting project was the MG Road Streetscape Revitalization. These have been discussed in the following section.

4.6.1. Kalanagar Skywalk, Mumbai

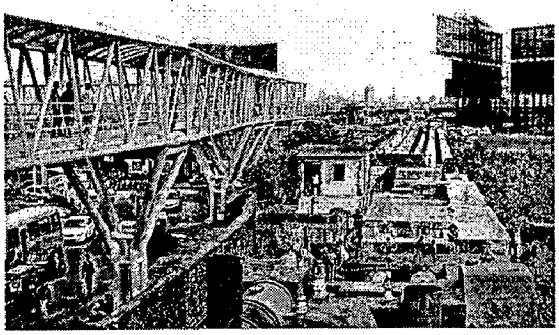


Figure 4.14. Kalagnagar skywalk

Source: www.flickr.com

Mumbai Metropolitan Region Development Authority (MMRDA) had initiated the project of skywalks under the Station Area Transit Implement Scheme (SATIS). Bandra Skywalk or Kalanagar Skywalk (from Bandra Station (E) to Kalanagar) covers 1.3 km (Fig. 4.14), having 4 m wide walkway (Mumbai Metropolitan Region Development Authority, 2008).

The Skywalk has been constructed to serve the commuters traffic between Banda Kurla Complex and the Station. This Skywalk is covered by multi wall polycarbonate sheet for weather protection to the pedestrian. The Skywalk has been constructed for a peak hour capacity of 5500 commuters per day.

4.6.2. MG Road Streetscape Revitalization

MG road is known for its beautifully detailed Victorian architecture, however, its beauty had been hidden behind unsightly hoardings for many years. The pedestrian arcades along the shopping area had been encroached by hawkers and informal commercial activities to such an extent that the pedestrians were left with no other option than to navigate their way through the busy traffic on the street. It was then that architect Abha Narain Lambah in late 2000 was able to convince several shop owners to follow the urban design guidelines that she had developed (TNUDF, JLLM, September 2010). The encroachments were cleared and the lost public space was returned to the people for continuous movement. The vitality of the area was restored by adding more visitors to the area (Fig. 4.15).

Fig. 4.15: Pedestrian arcade along MG Road

Source: Inception Report, Urban Re-development Project for Thyagaraya Nagar, Chennai, 2010

The lessons learnt from the Mumbai experience are that grade-separated crossings definitely prove very beneficial for the pedestrians since it solves the safety issue of the pedestrians (pedestrian-vehicle conflicts). However, one of the problems with Mumbai skywalks are that many people feel that the skywalks mindlessly sprout; there entry and exit points are not planned at the required locations and aesthetically it should have been designed better. On account of

this, the skywalks which were constructed for a peak hour capacity of 5,500 are being used only by some 100 people many a times (Alok Gupta R. M., 2009). Another observation is the lack of amenities and informal activities on the skywalk which makes such a walking experience extremely dull and boring. Projects like MG road Revitalization are of genuine interest for the people and more such private initiatives must be encouraged.

4.7. Pedestrian situation in Bangalore

Being the 'Silicon Valley of India', Bangalore has been experiencing a steady increase in population and on the front of urban transport, it has been progressing with a lot of emphasis given on improving the road and rail infrastructure of the city. New flyovers, ROBS, RUBs, commuter rail, metro etc. are seeing the light of the day in the city but the pedestrian infrastructure has been neglected completely. In terms of any recent proposals worked out for improving the pedestrian situation, the Directorate of Urban Land Transport, Bangalore in 2008 came up with a policy guideline for improving the pedestrian movement in the city. Under the Comprehensive Traffic and Transportation Plan prepared for Bangalore by the Karnataka Urban Infrastructure Development and Finance Corporation along with RITES in 2007, there was a proposal for pedestrianization in two areas of the city. These have been discussed briefly in the following section.

4.7.1. Pedestrian Policy for the Bangalore Metropolitan Region

This policy was devised with the intent of creating a framework for regulating and coordinating programs by various stakeholders, so that there is increased comfort, convenience and safety for the pedestrians (Directorate of Urban Land Transport, 2008). The policy identifies the key issues related to pedestrian movement in Bangalore as:

- Need for integration of land use and transportation.
- Need for strengthening the public transport.
- Lack of statutory backing (no clauses for provision of pedestrian facilities).
- Undue bias in investment towards developing the road surface for traffic with pedestrian facilities taking a backseat.
- Poor maintenance of the existing pedestrian infrastructure.
- Sidewalks at many places not designed to meet the pedestrian demand.
- Carriageway expansion given more priority.

The intent of developing the policy guidelines was to help design, provide, manage and maintain pedestrian infrastructure in such a manner that walking becomes a significant transportation choice for short distances. The target is to increase the modal share to 20% from an 8% as estimated in 2008. All development plans must be made mandatory to incorporate pedestrian

movement in their planning and design. Mixed land-use development would facilitate more people to take a walk, due to nearby proximities (Directorate of Urban Land Transport, 2008).

4.7.1.1. Engineering and Technological Aspects

The guidelines prescribed some standards for designing the pedestrian infrastructure and these engineering principles have been listed as follows:

- **Sidewalks and Footpaths** – The minimum clear usable width must be at least 36 inches (3') at every point along their length with a slope of 1:50.
- **Shelters and Protection** - In order to make the transit smooth and enable smooth mobility, it will be necessary to have protection structures against rain, wind and sun.
- **Sign posts and signals** - The sign posts and signals play an important role in the guiding directions. Language may create a problem sometimes for a certain section of people but sign and signals are universally accepted and known.
- **Subways** - For provision of the Subway, it is necessary to have subways with adequate lighting and ventilation and they must be free from encroachments.
- **Pedestrian Cross Over** - The Pedestrian cross over must be limited and must be provided with lifts rather than escalators or stairs to favor universal accessibility.
- **Refuge Island** - This component assists in creating a temporary waiting area for the pedestrian while crossing the road. The IRC stipulates the various refuges required.
- **Railing guards** - The guard railing is necessary part of the infrastructure as they segregate the pedestrian from traffic movement. Continuous railing can be proposed which will prevent the motorists trying to get on the sidewalks as alternate path/road.
- **Dust Bin** - Aesthetically designed and functional litter bins are part of the Street furniture. All pedestrian paths must be kept clean and well managed.
- **Lighting** - The issue of lighting plays an important role as a design element for the pedestrian. The shape of fixtures, the height at which it is placed, intensity, color of lighting characterizes the visual quality of a pedestrian space.

4.7.1.2. Other Aspects Prescribed in the Policy

- Motor vehicle tax, parking charges and the levy of congestion tax may be useful sources to indirectly finance the simultaneous improvement of pedestrian infrastructure.
- Holding awareness and sensitization programmes to make people understand the benefits of walking must be executed by local groups and civic authorities.
- Local resident groups, Citizens and locals/ users and associations must participate in the public consultation process, to express their suggestions to a proposal (Directorate of Urban Land Transport, 2008).

4.7.2. Comprehensive Traffic and Transportation Plan

The Comprehensive Traffic and Transportation Plan was prepared by Karnataka Urban Infrastructure Development And Finance Corporation and RITES India Ltd. in 2007. The study included various transport surveys based on which urban transport proposals were identified for the city in the future. Based on the surveys, the CTTP included the following two proposals for the pedestrians:

1. Pedestrian Facilities - Footpaths along 350km of road length would be taken up for repairs and up-gradation, alongwith with curb ramp facilities for the disabled and pedestrian priority signals would be installed at major road intersections.
2. Pedestrian Zones - Some of the areas inside the core ring road which are either commercial or mixed land use streets, will be converted to pedestrian zones. This initiative was taken on account of the public transport facilities that are coming up here like three metro links, an elevated core ring road and adequate park and ride facilities.

There are also proposals for pedestrianization outlined in two of the commercial areas of Bangalore and these have been stated as under.

4.7.2.1. Gandhi Nagar and Chickpet Areas

The area surrounded by Seshadri Road, Kalidas Marg, K.G. Road, Dist. Offices Road, N.R. Road, Mysore Road, Bhashyam Road, Tank Bund Road & Dhanvantri Road can be converted into two pedestrian zones I & II on either side of K.G. Road (Fig. 4.16).

Fig. 4.16: Gandhi Nagar and Chickpet area pedestrianization

The total area is around 2 sq.km. The two Zones can be inter-connected through a semi depressed under pass and all the private vehicles will be required to move along the outer route (indicated in yellow in Fig. 4.16) along Seshadri Road, Kasturba Road, NR Road and Bhashyam Road, while K.G.Road and District Offices Road (marked in magenta in Fig. 4.16) can be used by Public Transport – Buses & Trams. In the surrounding areas 5 mechanical parking spaces with a capacity of 500 vehicles each is further proposed to be provided.

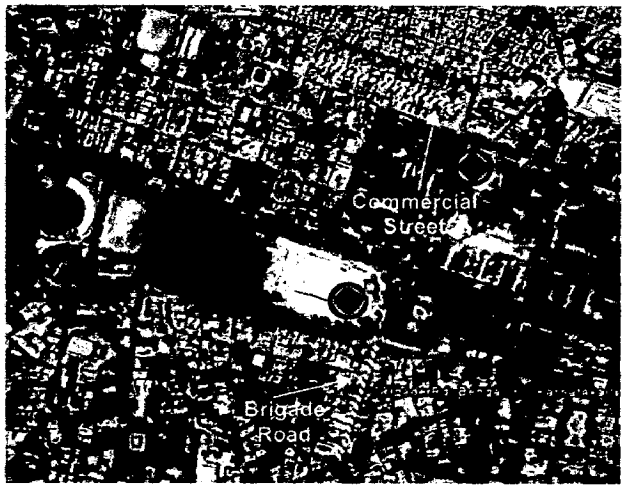


Fig. 4.17: Commercial Street and Brigade road Pedestrianization
Source: CTTS 2007, Bangalore

4.7.2.2. Commercial Streets

Commercial Street in Bangalore near M.G. Road is proposed to be closed for vehicles from 10 a.m. to 9 p.m. and supported by parking near Kamaraj Road (Fig. 4.17). The stretch is some 450m long. The Brigade Road is also proposed to be closed for vehicles from 10 a.m. to 9 p.m. and supported by parking near M.G. Road. This stretch is 350m long (Fig. 4.17).

The lessons that can be learnt from the Bangalore experience is that though efforts can be seen in terms of framing of policy guidelines and proposals for improvement in the city, these are still to see the light of the day. The policy guidelines are hardly being referred by the road owning authorities and other civic bodies while drafting new plans for footpath improvement (Fig. 4.18). Recent footpath improvements in the city still lack many components which make a footpath pedestrian-friendly and universally accessible, though the city also has very few good examples to its credit (Fig. 4.19).

Fig. 4.18: Unusable footpaths in Serpentine Road
Source: www.flickr.com

Fig. 4.19: Universally accessible sidewalks in Whitefield area
Source: www.flickr.com

4.8. CG Road Development Project, Ahmedabad

An approximately 3.5 km stretch of CG Road in Ahemdabad was addressing issues like uncontrolled vehicular movement, shopping, residential access, electric and telephone cabling and parking. To solve the issues, architect Hasmukh Patel in 1997 took up the work of retrofitting the street to put the street environment in order. The objective of the project was to resolve conflicts in street use in the most efficient manner possible, through careful detailing. Detailed design inputs included providing parking for 400 cars and 1200 scooters, a 22 ft wide two lane

carriageway on both sides of the road median, a 17.5 ft wide pedestrian footpath and street utilities (Fig. 4.20 & 4.21). The project not only led to the improvement of the pedestrian environment but also the whole street environment at large (TNUDF, JLLM, September 2010).

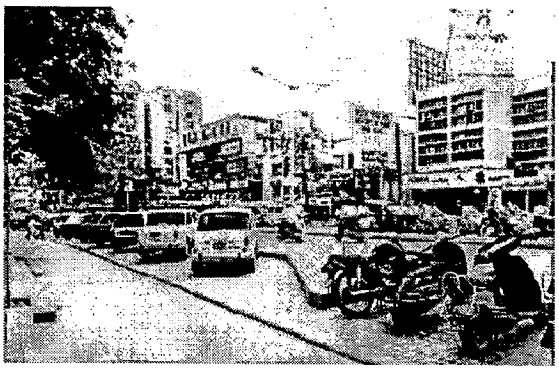


Fig. 4.20: Cycle Track along parking

Fig. 4.21: Pedestrian footpath along CG road

Source: Inception Report, Urban Re-development Project for Thyagaraya Nagar, Chennai, 2010

4.9. City Beautification, Nanded

The pedestrian footpath improvement was conceived under the JNNURM programme in 2006 by some private firms. A major initiative to improve the streets was undertaken. About 50 kms of the street in Nanded was redesigned, improved and built. The whole street section was planned and designed carefully allotting proper space to the pedestrian sidewalks, cycle tracks and multi-use zone for hawkers, bus stops and parking, so that they don't encroach the sidewalks (Fig. 4.22). Pedestrian crossings, refuge island and pedestrian signage were properly planned. Nanded serves as a beautiful example of how a small town can also take sincere efforts towards such a priority issue such as the deteriorating pedestrian environment (Pawan Kumar, 2009).

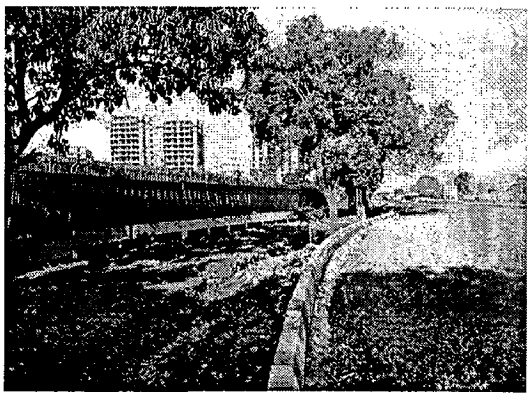


Figure 4.22. Wide Walkway under Construction at Nanded

Source: www.flickr.com

4.10. General Pedestrian Experience

As already discussed, the Indian pedestrian experience is far from satisfactory. The existing pedestrian infrastructure are pathetic and in a state of neglect. The width of the sidewalks is usually inadequate and they are a case of poor design and maintenance. They are often encroached by hawkers, unauthorized parking and pavement dwellers and are obstructed with utility boxes, electric poles, garbage dumps and construction debris. There are no provisions made for the wheel-chair users in the sidewalks. Amenities like street furniture, street lighting, landscaping, litter bins, telephone booths and post boxes are usually absent. Utilities are ill-

planned and often one can observe problems like broken manholes, water logging and broken cables blocking the sidewalks. These are further evident from the following photographs which reflect the state of the pedestrian environment in a few towns and cities in India (Fig. 4.23, 4.24, 4.25, 4.26, 4.27, 4.28, 4.29 & 4.30).

Fig. 4.23: Ill-maintained sidewalk, Mumbai

Fig. 4.24: Obstructed sidewalk, Agra

Fig. 4.25: Encroached sidewalk, Lucknow

Fig. 4.26: Missing sidewalk, Madurai

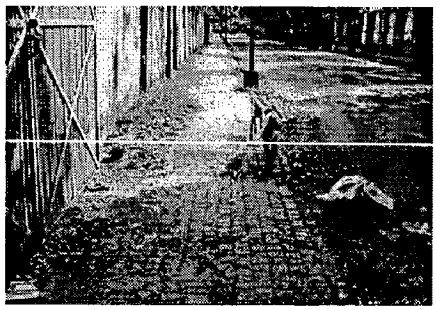


Fig. 4.27: Unclean sidewalk, Cochin

Fig. 4.28: Broken sidewalk, Mysore

Fig. 4.29: Sidewalk with debris, Noida

Fig. 4.30: Encroached sidewalk, Kolkata

Source: www.flickr.com (for all photographs)

4.11. Summary

Inspite of such a majority of people who tend to walk as compared to other modes of travel, the existing pedestrian infrastructure is depressing. The Indian towns and cities are auto-centric and the transport plans hint only at the enormous amount of funds and resources pumped into road improvement and road widening, in the light of which, the pedestrians are completely lost. Many small towns are not provided with even the basic necessity as a sidewalk in many of their areas

and in the larger cities, the existing sidewalks are in a state of breakage, repair and reflect the ill-maintenance of the civic authorities. Most of the cities have not yet implemented the concept of Pedestrianization, except hill towns like Shimla and Gangtok (Mall Road). The increasing pedestrian fatalities indicate how unsafe the roads have become for the walking population and how some serious efforts need to be undertaken to make the streets walker-friendly. The findings drawn, from the study of some major policy guidelines, city development plan proposals and some efforts and initiatives taken up my civic authorities and other private organizations towards improving the pedestrian infrastructure, are summed up as under (Table 4.3).

Table 4.3: Summary of relevant findings from the general pedestrian scenario in India

S.No.	Study Particulars	Findings
1.	National Urban Transport Policy	The NUTP though recognizes the need for non-motorized means of transport and lays emphasis on improvement of pedestrian facilities, it has not suggested in detail of how to achieve it; how to make streets more pedestrian-friendly and how to pump more funds and finances towards repairing the footpaths and the overall environment of the street. Though it suggests the state governments to take up pilot projects, most of the cities have not implemented any such projects. It also suggested some alterations in the Motor-Vehicles Act and other laws, to make them pro-pedestrian, but it has not yet seen the light of the day.
2.	Study on Traffic and Transportation Policies and Strategies in Urban Areas in India	The study only indicates about an all-India level pedestrian opinion survey conducted for 30 cities. The survey talks clearly about the low pedestrian walkability index in many of the cities surveyed, indicating fairly well about the poor pedestrian facilities in the country. Though the study did indicate investments to be made in non-motorized urban transport and pedestrian footpaths, subways and pedestrian zones, no details were worked out. The study offers tremendous amount of data that can be put further in transportation research and in making pedestrian project models, but nothing of this sort can be seen as happening practically.

3.	Study of City Development Plans	The study of CDPs of 12 cities indicates that though funds are being allocated for pedestrian facilities improvement, no projects have been implemented so far or are at halt mid-way. None of the DPRs speak about any successful implementation of footpath widening projects or pedestrianization proposals. Delhi had undergone some footpath retrofitting project during Commonwealth Games, but apart from that none of the other cities have used the funds availed by them in this regard. Charminar Pedestrianization proposed in Hyderabad was a bold attempt but it has currently come to a halt due to some administrative loopholes. Thus it reflects the sorry state of affairs of the implementing agencies to bring about a massive change to the streets.
4.	Sector-17 Commercial Market Chandigarh	Sector-17 commercial market in Chandigarh is a very good example of a pedestrian precinct which is pollution-free, lively, active and a bustling area. The quality of life of both the people and the space has greatly improved. Pedestrianization in a commercial precinct also leads to a drastic increase in the sales.
5.	Pedestrian design guidelines by UTTIPEC	The pedestrian design guidelines framed by UTTIPEC are a good example of design standards prescribed for improving the existing pedestrian situation. One of the loopholes of the guidelines is that it is not complete in terms of not exploring pedestrianization and its strategies and how they need to be planned for an area.
6.	Delhi Master Plan recommendations	The Master Plan though, identifies the need for the betterment of the non-motorized transport and prescribes very few guidelines for the pedestrian facilities, not much is being seen implemented in the city except in a few stretches.
7.	Mumbai Skywalks	Mumbai skywalks are an exceptional example of how grade-separated crossings are a noble idea to demarcate vehicular and pedestrian movement separately and due to improper planning and lack of innovative design, they are not very popular in the city except a few stretches.

8.	Pedestrian Policy for the Bangalore Metropolitan Region	The pedestrian policy prepared for BMR is again a very broad guideline which does not discuss or recommend any detailed guidelines for designing the sidewalks or other pedestrian amenities. The scope of the guideline should have been larger, highlighting the design parameters
9.	Comprehensive Traffic and Transportation Plan for Bangalore	The CTTP prepared for the city does identify pedestrians and has come up with proposals for improving footpath condition and for converting some streets into pedestrian-only streets. The CTTP also includes proposals for pedestrianization in three stretches of the city. The sad part is that these proposals have not yet been implemented and are still on paper.
10.	CG Road Development Project, Ahmedabad	The CG road project indicates a good sign that a pilot project has been undertaken in the city and been implemented successfully by a private firm. Though the proposal is a Complete Streets proposal, the sidewalks have been given importance and have been constructed wide with a very good quality bestowed in the overall public space.
11.	Nanded Project	The city beautification project at Nanded is another positive example of the proper utilization of the JNNURM funds to be put to the right purpose of designing wide sidewalks alongwith pedestrian crossings, refuge islands and signage.

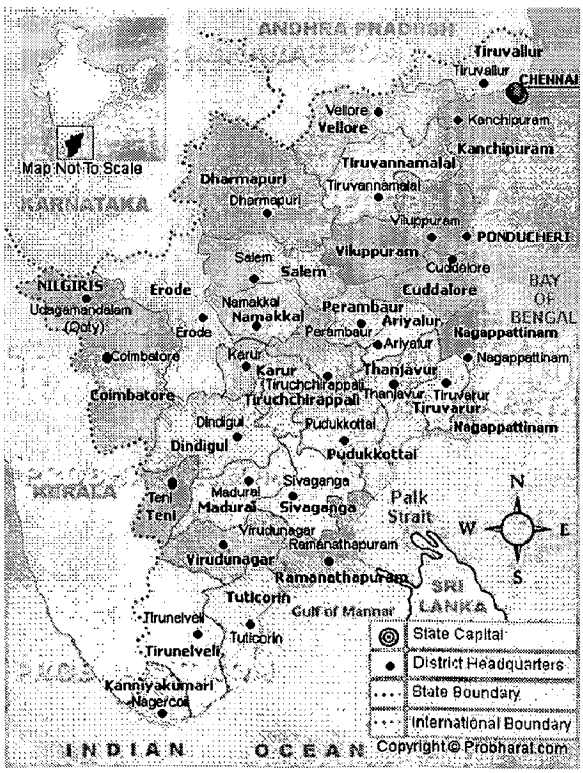
This study hence indicates a very strong and an urgent need to improve the walking environment drastically through careful planning and designing and thereby executing a detailed proposal. There is also the need to employ the strategy of pedestrianization in especially, the core areas of the city, to relieve the residents of traffic congestion and air pollution and improve the public realm.

5 STUDY AREA PROFILE : CHENNAI

This chapter gives a general outline of Chennai city and its area, land-use, population and other demographic characteristics. The chapter further discusses about the existing transport scenario of the city in general and the master plan proposals for transport in the future. It also states about the traffic statistics, the problems of the astronomical increase in motor-vehicles in the city in the past years and the pollution and accident statistics. The chapter finally discusses the proposals identified in the master plan and the Chennai Comprehensive Transport Study for pedestrians and the dilemma of the pedestrian scenario in the city and how the pedestrian infrastructure is unattended and in a state of wreck.

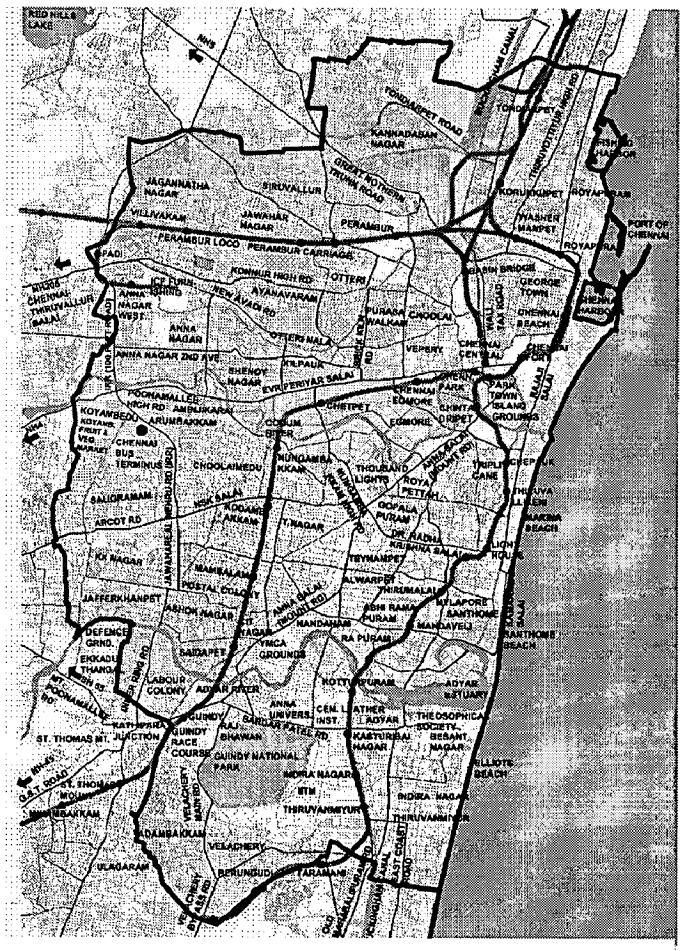
5.1. General Profile

Chennai is the fourth largest metropolis and the capital of Tamil Nadu state (Map 5.1). It is situated on the shores of the Bay of Bengal (Map 5.2). It is a key economic hub in south India. Its older name' Madras' was officially changed to 'Chennai' in 1996 (Chennai Metropolitan Development Authority, 2006).



Map 5.1: Location of Chennai in Tamil Nadu

Source: www.mapsofindia.com

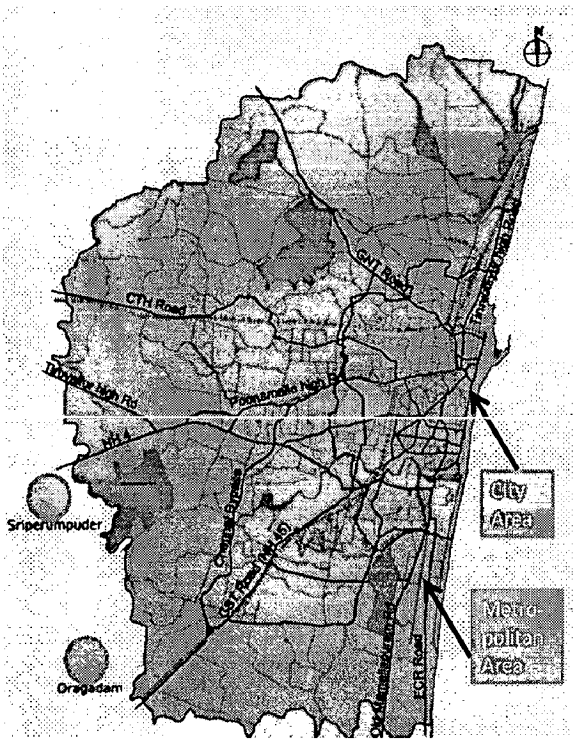


Map 5.2: Chennai city map

Source: By Author

5.1.1. Physical Setting

Chennai Metropolis [with latitude between 12°50'49" and 13°17'24", and longitude between 79°59'53" and 80°20'12"] is located on the Coramandal coast in southern India and the land is a flat coastal plain. Three rivers viz. Kosasthalaiyar, Cooum and Adyar pass through the metropolitan area and these rivers are placid and meander on their way to the sea. Buckingham Canal, a man made canal, is another large waterway which runs north-south through the Metropolis.



Sholavaram lake, Red Hills lake and Chembarambakkam lake are the three large lakes in the metropolitan area (Highways Department, 2008).

5.1.2. Area Profile of the city

CMA comprises the area covered by Chennai City Corporation, 16 municipalities, 20 town panchayats and 214 villages forming part of 10 panchayat unions in Thiruvallur and Kancheepuram Districts (Map 5.3 & Table 5.1). The metropolitan area extends over 1189 sq.km. (Chennai Metropolitan Development Authority, 2006)

Map 5.3: City and CMA boundary

Source: Chennai Comprehensive Transport Study, 2008

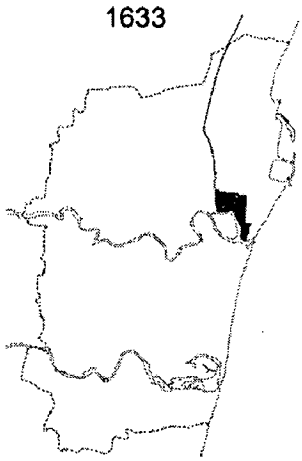
Table 5.1: Area Profile and Population of the city

S.No.	Description	Area in sq.km.	Population in lakhs (2001 census)	Gross Density per Ha.
1.	Chennai City (Municipal Corporation) area	176	43.43	247
2.	16 municipalities	240	15.81	66
3.	20 town panchayats	156	3.86	25
4.	214 villages (in Thiruvallur and Kancheepuram districts)	617	7.31	12
5.	**Total CMA area**	**1189 sq.km.**	**70.41**	**59**

Source : Second Master Plan of Chennai, 2026

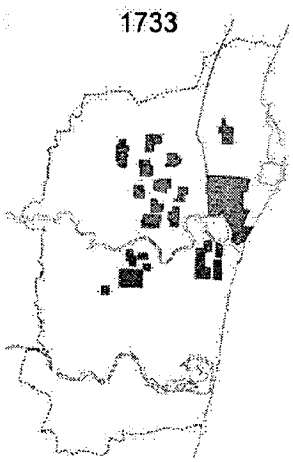
5.1.3. Growth of the city

The region around Chennai has served as an important administrative, military and economic centre since the 1st century. The city was known as Madras Patnam and was located in the province of Tondaimandalam in the 2nd century A.D. The city was established in the 17th century by the British, who developed it into a major urban centre and naval base (Map 5.4). It was in 1639 that the British established Fort St. George on a waste piece of land for business considerations. Starting with the nucleus of the fort, the city gradually grew incorporating old settlements and villages like George Town, Chintadripet, Triplicane and Purasawalkam (Map 5.5 & 5.6). These older sections of the city, which formed the residential zones, are now stagnating and George Town has changed its basic character from residential to commercial (Chennai Metropolitan Development Authority, 2006).



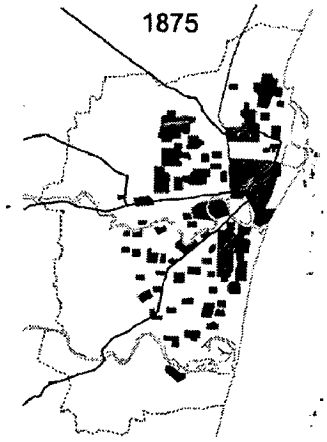
Map 5.4: City in 1633 with earliest area being Mylapore

Source: Chennai Master Plan



Map 5.5: City in 1733 with George Town and Egmore

Source: Chennai Master Plan



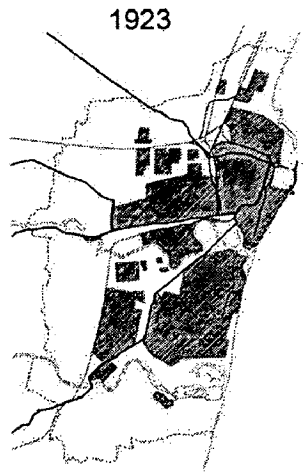
Map 5.6: City in 1875 with Royapuram and Chetpet

Source: Chennai Master Plan

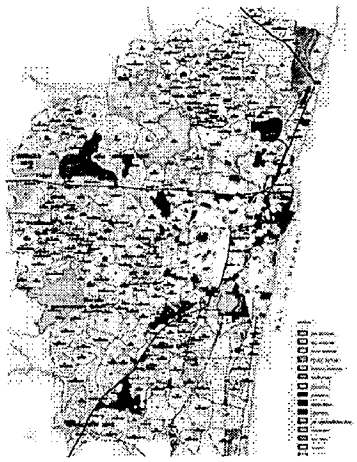
The next residential ring comprising Nungambakkam, Egmore and Kilpauk in the West, and Mylapore and Adyar in the South were the areas in which the British built their "garden houses" (Chennai Metropolitan Development Authority, 2006) (Map 5.7). These areas have also changed character from areas of single-family residential houses and bungalows to ones of multi-family apartments and commercial complexes. The "Central Business District" has moved southwards from George Town/Esplanade to the commercial areas around Anna Salai, Nungambakkam and Teynampet.

There is an inexorable move towards sub-urbanization mainly along the road and rail transport corridors. The locus of new residential development is the south and the west, with the center gradually moving southward (Map 5.8). There is no doubt that spiraling land value has pushed residential construction further and further outside the city. On the other hand public sector intervention in the form of residential layouts such as Anna Nagar, K.K. Nagar, Besant Nagar,

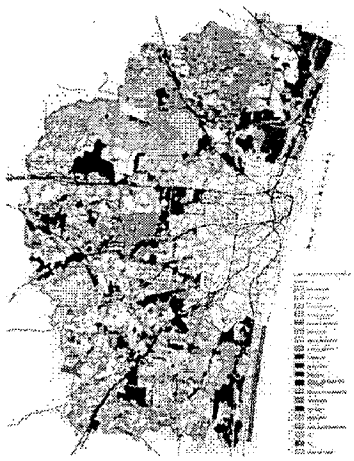
Indira Nagar and Thiruvanmiyur as well as in terms of road construction has also served to disperse residential development. Today, Chennai has been growing predominantly on the south side. Old Mahabalipuram Road has attracted most of the real estate commercial activity in the last few years after being declared as the IT Corridor and this has led to a fast development of nearby residential areas like Velachery (TNUDF, JLLM, 2010) (Map 5.9).



Map 5.7: City in 1923 with major growth in the centre
Source: Chennai Master Plan



Map 5.8: City in 1973 with growth towards the suburbs
Source: Chennai Master Plan



Map 5.9: City in 2006 with fast development along IT corridor
Source: Chennai Master Plan

5.1.4. Population Growth

The City extending over an area of 68 sq.km in 1901 had a population of 5.40 lakhs. Since 1941, the population has grown rapidly and in 2001, the population reached 43.43 lakhs, with a city area of 176 sq.km. (Table 5.2). The Municipalities and Town Panchayats have experienced higher growth rate than that of the City (Fig. 5.1). The density pattern indicates that the City has the highest gross density of 247 persons/ha, whereas that in the metropolitan area is only 59 persons/ha. The gross density in most of the municipal areas and Town Panchayats is very low, indicating that these areas offer high potential for growth and would be acting as the receiving residential nodes in future (Chennai Metropolitan Development Authority, 2006).

Table 5.2: Growth of Population in Chennai Metropolitan Area

S. No.	Description	Population (in lakhs)				Annual Rate of growth (%)			Area in sq.km.	Gross Density per Ha. in 2001
		1971	1981	1991	2001	71-81	81-91	91-01		
1.	Chennai City	26.42	32.85	38.43	43.43	2.20	1.58	1.23	176	247
2.	Municipalities	4.84	8.14	11.84	15.81	5.24	3.80	2.91	240	66
3.	Town Panchayats	1.11	1.64	2.71	3.86	4.43	4.94	3.62	156	25
4.	Village Panchayats	2.67	3.38	5.20	7.31	2.40	4.38	3.58	617	12
5.	**CMA Total**	**35.04**	**46.01**	**58.18**	**70.41**	**2.76**	**2.37**	**1.93**	**1189**	**59**

Source : Census of India, Second Master Plan of Chennai, 2026

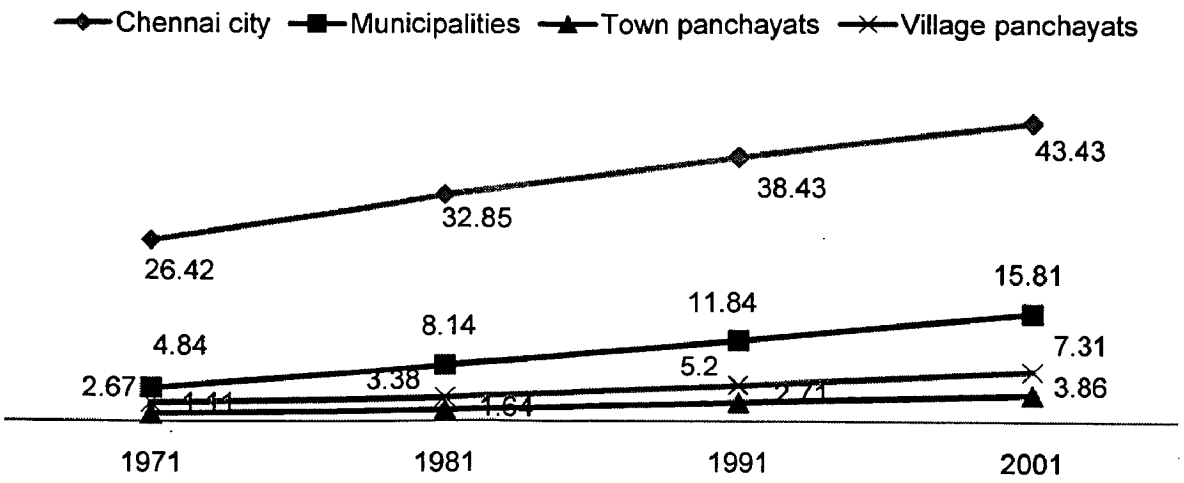


Fig. 5.1: Growth in Population between 1971 to 2001

Source: Chennai Master Plan

5.1.5. Migration

Chennai is a city of migrants like any other metropolitan city in India. The cosmopolitan nature of Chennai is a result of its attractiveness to migrant groups from all over India. Migrants came not only predominantly from the surrounding Tamil and Telugu speaking areas, but also from northern India. According to 2001 Census, migrants to Chennai City from other parts of Tamil Nadu State constitute 74.5 % and from other parts of India constitute 23.8% while the remaining 1.71 % are from other countries (Chennai Metropolitan Development Authority, 2006).

Table 5.3: Migration trends in Chennai from 1961 to 2001

Year	Total population in lakhs (2001 census)	Total Migrants to the city from		% of Total Migrants to total population
		From other parts of Tamil Nadu (in lakhs)	From other parts of India (in lakhs)	
1961	17.29	4.47	1.71	37.24
1971	24.69	5.51	2	31.59
1981	32.84	7.19	2.55	30.7
1991	38.43	6.44	2.42	23.9
2001	43.44	6.98	2.23	21.57

Source : Second Master Plan of Chennai, 2026

Table 5.3. shows a downward trend in the migration to the City from 37.24% in 1961 to 21.57% in 2001. The reason for decreasing in-migration and increasing out-migration maybe due to the conversion of residential premises into non-residential use mostly for shopping, hotels and other commercial purposes and this trend is estimated to continue in the metropolis.

5.1.6. Birth and Death Rates

The registered birth rates in Chennai City in 1981 were 31.20 and varied from 38.6 to 24.06 during 1981-91 and have reduced to 22.62 in the year 2003. Similarly the death rate also

reduced to a considerable extent from 9.20 in 1981 to 8.01 in 2003. The rate of natural increase declined from 22.00 in 1981 to 14.61 in 2003 (Chennai Metropolitan Development Authority, 2006).

5.1.7. Sex Ratio

Sex ratio is denoted by number of females per 1000 males. The sex ratio in CMA increased from 936 in 1991 to 956 in 2001 and is presented in Table 5.4.

Table 5.4: Sex Ratio in Chennai city area and Metropolitan area

Year	Chennai City	CMA	Urban TN
1961	901	909	992
1971	904	907	978
1981	934	927	977
1991	930	936	972
2001	957	956	987

Source : Second Master Plan of Chennai, 2026

5.1.8. Literacy rate

Census figures indicate that the literacy rates in Chennai City and the CMA are more or less equal and these figures compare favorably with the overall literacy rate in urban Tamil Nadu (Chennai Metropolitan Development Authority, 2006) (Table 5.5).

Table 5.5: Literacy Levels in Chennai Metropolitan Area in %

S.No.	Description	1961	1971	1981	1991	2001
1.	City	59.47	62.01	68.68	72.54	76.81
2.	CMA	54.82	58.64	66.56	70.32	76.09
3.	Urban TN	21.06	30.92	40.43	51.33	73.51

Source : Second Master Plan of Chennai, 2026

5.1.9. Age Structure

Age structure of a population in a city / metropolis plays a major role in urban planning. It gives an idea about dependent population, working population, jobs to be created, the present and future requirements of educational, health and other facilities and amenities. It depends on birth rate, death rate, migration trends and age-sex composition (Chennai Metropolitan Development Authority, 2006) (Table 5.6).

Table 5.6: Age Structure in Chennai Metropolitan Area in %

Age Group	1961	1971	1981	1991	2001
0-4	13.2	12.51	11.03	8.68	7.31
5-9	12.39	11.74	10.35	9.56	7.97

10-14	10.64	10.97	11.37	10.51	8.95
15-19	8.66	9.97	10.61	10.22	9.55
20-24	10.73	11.05	10.68	11.14	10.47
25-29	10.21	9.29	9.61	10.20	10.33
30-34	7.98	7.15	7.46	8.06	8.46
35-39	6.69	6.99	6.66	7.48	8.04
40-44	5.49	5.14	5.36	5.68	6.19
45-49	4.15	4.33	4.70	4.98	5.50
50-54	3.65	3.51	3.70	3.92	4.37
55-59	2.10	2.46	2.73	2.90	3.10
60-64	2.06	2.30	2.40	2.64	2.83
65-69	1.10	1.15	1.37	1.51	1.96
>70	1.20	1.65	1.97	2.33	3.02
not stated	0.00	0.00	0.00	0.18	1.93
Total	100.00	100.21	100.00	100.00	100.00

Source : Second Master Plan of Chennai, 2026

5.1.10. Population Projection

It is estimated that CMA would house a population of 126 lakhs by 2026, of which Chennai City alone would account for 58 lakhs (Table 5.7).

Table 5.7: Projected Population for City and Metropolitan area (in lakhs)

S.No.	Description	Actual population	Projection					Gross density Persons / Ha.
		2001	2006	2011	2016	2021	2026	2026
1	Chennai City	43.44	46.28	49.50	52.39	55.40	58.56	333
2	Municipalities	15.81	18.52	21.75	25.60	30.20	35.69	149
3	Town Panchayats	3.86	4.73	5.89	7.41	9.45	12.22	78
4	Village Panchayats	7.31	8.70	10.59	12.96	15.99	19.88	32
5	**CMA [total]**	**70.41**	**78.96**	**88.71**	**99.66**	**111.97**	**125.82**	**105**

Source : Second Master Plan of Chennai, 2026

5.1.11. Land use and Master Plan

Except for some detailed town planning schemes, no comprehensive plan was prepared till 1973. In 1973, CMDA was formed and the first master plan for Chennai was prepared in 1975. The second master plan was approved in 2007 (projected for 2026). The existing land-use in 2006

and the proposed land use for 2026 have been shown in Table 5.8 & 5.9 (Chennai Metropolitan Development Authority, 2006). The proposed land use for 2026 for Chennai city has also been shown in Map 5.10.

Table 5.8: Existing Land Use of Chennai (as in 2006)

S.No.	Land use	Chennai City		Rest of CMA	
		Extent in Ha.	%	Extent in Ha.	%
1.	Residential	9523	54.25	22877	21.87
2.	Commercial	1245	7.09	390	0.37
3.	Industrial	908	5.17	6563	6.28
4.	Institutional	3243	18.48	3144	3.01
5.	Open space & recreation	366	2.09	200	0.19
6.	Agricultural	99	0.57	12470	11.92
7.	Non urban	82	0.47	2433	2.33
8.	Others (Vacant, Forest, Hills, Water bodies etc.,)	2087	11.89	56507	54.03

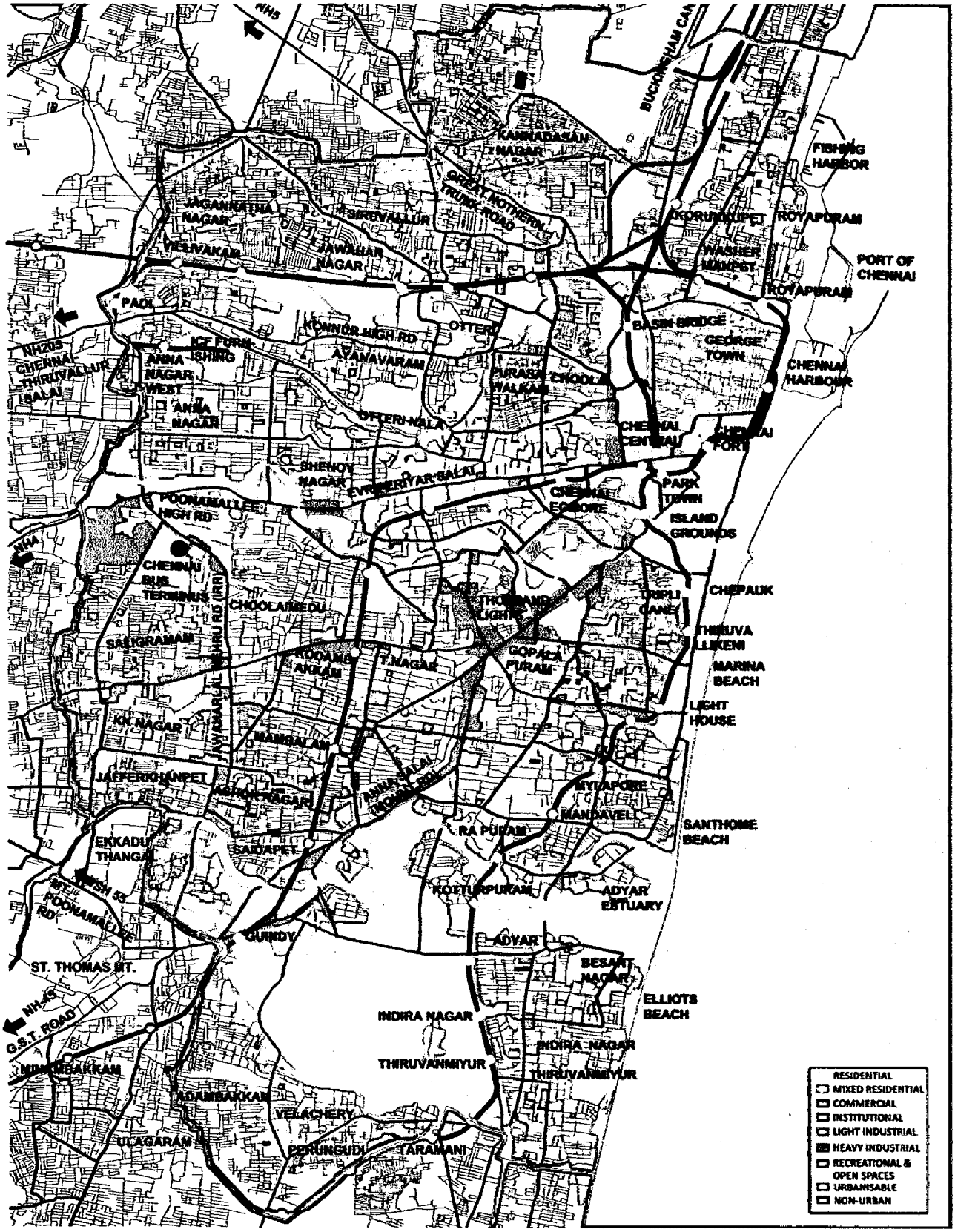
Source : Second Master Plan of Chennai, 2026

Table 5.9: Proposed Land Use for Chennai (for 2026)

S.No.	Land use	Chennai City		Rest of CMA	
		Extent in Ha.	%	Extent in Ha.	%
1.	Primary Residential	5916.35	33.58%	31090.68	31.68%
2.	Mixed residential	2426.90	13.78%	13503.10	13.34%
3.	Commercial	714.24	4.05%	880.35	0.86%
4.	Industrial	691.83	3.93%	7274.33	7.18%
5.	Special & hazardous industrial	130.67	0.74%	3416.08	3.38%
6.	Institutional	2868.97	16.28%	3888.85	3.83%
7.	Open space & recreation	100.65	5.68%	392.86	0.38%
8.	Agricultural	0	0	7295.81	7.2%
9.	Non urban	113.31	0.64%	2332.92	2.3%
10.	Urbanisable	0	0	2075.89	2.05%
11.	Others (Vacant, Forest, Hills, Water bodies etc.,)	3754.79	21.31%	28147.55	27.79%

Source : Second Master Plan of Chennai, 2026

It can be seen that the metropolitan area is going to be explored for meeting the additional demands of land for various uses for the population proposed for 2026. The surplus agricultural land would meet up the requirement of land for various other land-uses in 2026.



Map 5.10: Proposed Land use map of Chennai City for 2026

Source: Second Master Plan of Chennai, 2026

5.1.12. Economic Profile

Chennai has a diversified economic base anchored by automobile industries, software services, hardware manufacturing, healthcare, railway coach buildings, petro chemicals, fertilizers, tyres, electricals, machinery and leather products and financial services industries along with other activities like fisheries, tourism and informal sector. Chennai City alone accounts for 10.94 percent of the State income and CMA accounts for 16.21 percent (Chennai Metropolitan Development Authority, 2006). The growth potential of Chennai is marked by Export Processing Zone, Industrial Estates, SEZs and Bio-Technology Park. The city has been showing a trend of shifting from primary to secondary and tertiary occupations since 1971 (Fig. 5.2).

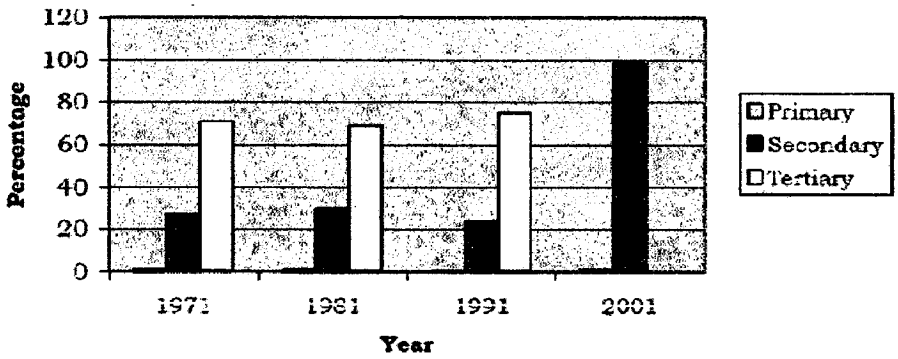


Fig. 5.2: Trend of Occupational Structure in Chennai City

Source: Second Master Plan of Chennai, 2026

5.2. Transport Profile

Chennai's economic development has been closely tied to its transport infrastructure. Chennai being a major hub is well-connected by roadways and railways and an international airport and well-equipped with sea ports.

5.2.1. Road Network

The total length of road network in Chennai city is 2780 km. Chennai has radial and ring pattern of road network. Prime radial network comprises –

1. Anna Salai (NH45) (Fig. 5.3)
2. Periyar EVR Salai (NH4) (Fig. 5.4)
3. Chennai-Kolkotta salai (NH5) and
4. Chennai-Thiruvallur salai (NH205).

Other radial roads include Kamarajar salai, East Coast Road, Rajiv Gandhi Salai (OMR), NSK Salai (Arcot Road) and Thiruvottiyur High Road. Orbital road network implemented as per the First Master Plan comprises Jawaharlal Nehru Road (Inner Ring Road) and Chennai By-pass Road (Fig. 5.5). The orbital road network has improved the accessibility and reduced the

congestion on the radial network particularly Anna Salai and Periyar EVR Salai. Radial roads in and around CMA for a length of 250 km have also been improved (Highways Department, 2008). The entire road network of the city has been shown in Map 5.11.

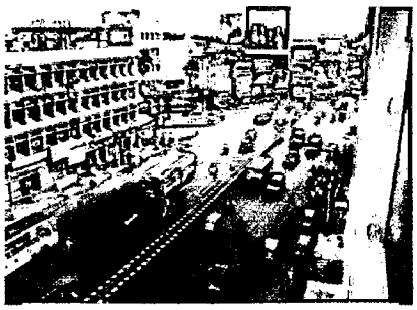


Fig. 5.3: Anna Salai
Source: www.wikipedia.com

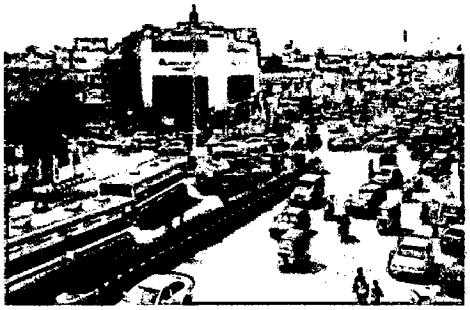


Fig. 5.4: EVR Periyar Salai
Source: www.wikipedia.com

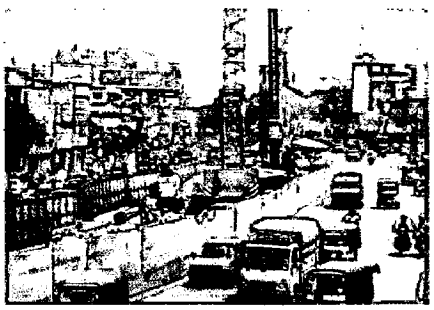
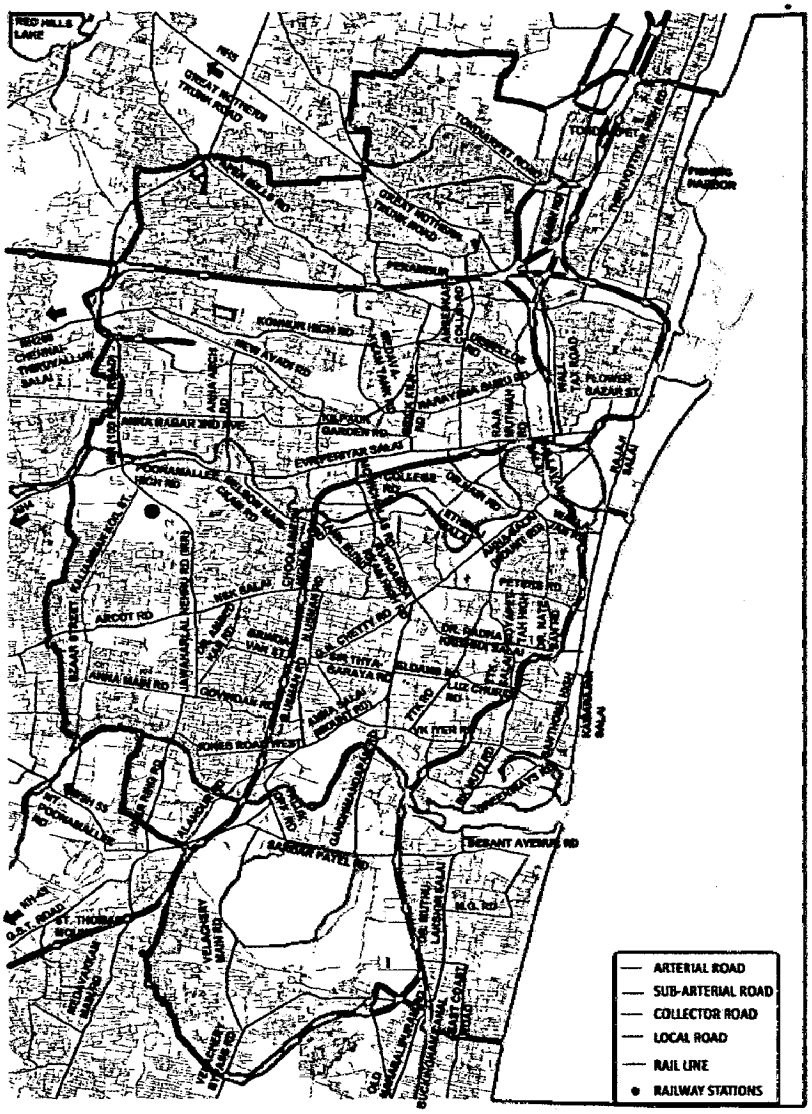


Fig. 5.5: Jawaharlal Nehru Road
Source: www.flickr.com



Map 5.11: Road network map of the city
Source: By Author

5.2.2. Bus network

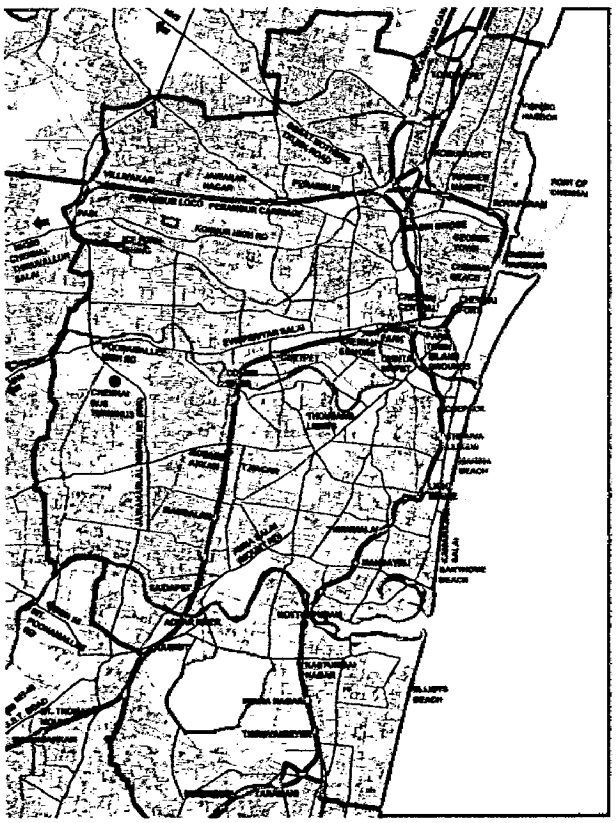
The bus service is run by the government-owned Metropolitan Transport Corporation, which covers the city and its suburbs. Metropolitan Transport Corporation (MTC) with a fleet size of 3093 buses is operating along 585 routes (Highways Department, 2008). The buses however, are running with a crush-load and the overcrowding is as high as 150%. The demand far outstrips supply leading sometimes to inhuman conditions of travel. MTC has therefore, extended its coverage up to 50 km beyond the CMA. During 2007-08, MTC had purchased about 1000 new buses. It has also introduced a new service known as deluxe bus at a premium with an

objective to encourage those who use personal modes to shift to bus transport. The growth of bus transport is shown in Table 5.10.

Table 5.10: Growth of Bus Transport in Chennai

Year	Routes	Fleet	Passengers per day in lakhs
1992-93	489	2325	36
1993-94	523	2336	36.8
1994-95	509	2356	38.95
1995-96	492	2540	37.85
1996-97	518	2701	39.4
1997-98	570	2894	40.13
1998-99	568	2806	42.81
1999-2000	564	2845	41.83
2000-01	580	2816	39.7
2001-02	571	2834	35.93
2002-03	547	2773	35.09

Source: Report on Identified Parking Demand Locations, Chennai, 2007



Map 5.12: Rail network map of the city
Source: By Author

5.2.3. Rail Network

Commuter rail system in CMA is operated by Southern Railways. It essentially consists of the following 3 lines:

1. Chennai Beach to Tambaram, running south-west
2. Chennai Central to Thiruvallur, running west and
3. Chennai Central to Gummidipoondi, running north.

The rail network of Chennai city has been shown in Map 5.12. The first 2 lines have dedicated tracks for commuter trips. The 3rd line, however, caters to both suburban and inter-city passenger movement.

In addition phase I and phase II of MRTS are currently in operation traversing a length of more than 20 km covering the residential and IT corridor in the south-eastern part of the City (Highways Department, 2008).

5.2.4. Trends in growth of vehicle population

Motor vehicle population has increased at a phenomenal rate during the last few decades. Average growth rate per annum is about 9.7% (Highways Department, 2008). The growth since 1978 till 2002 has been shown in Fig. 5.6. The number of buses remained almost stagnant while two wheelers and cars experienced a sharp increase, indicating that the number of private vehicles have drastically rose in the city. The percentage share of two wheelers to the total registered vehicles in Chennai and other metropolitan cities have been shown in Table 5.11. and the distribution of vehicles in the city in 1984, 1992 and 2007 has been depicted in Fig. 5.7.

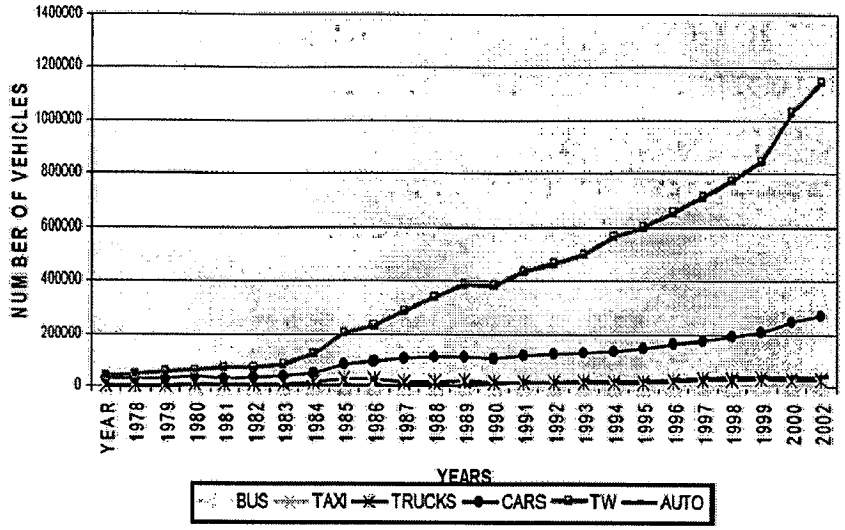


Fig. 5.6: Growth of Vehicles in Chennai between 1978-2002

Source: Report on Identified Parking Demand Locations, Chennai, 2007

Table 5.11: Percentage share of Two-wheelers to Total Registered Vehicles (2008 stats.)

S.No.	Name of city	% share of two-wheelers
1.	Chennai	77
2.	Hyderabad	80
3.	Bangalore	75
4.	Delhi	64
5.	Kolkata	45
6.	Mumbai	42

Source: Highlights on the Recommendations of the State Level Committee on Road Connectivity and Traffic improvements in Chennai, August 2008

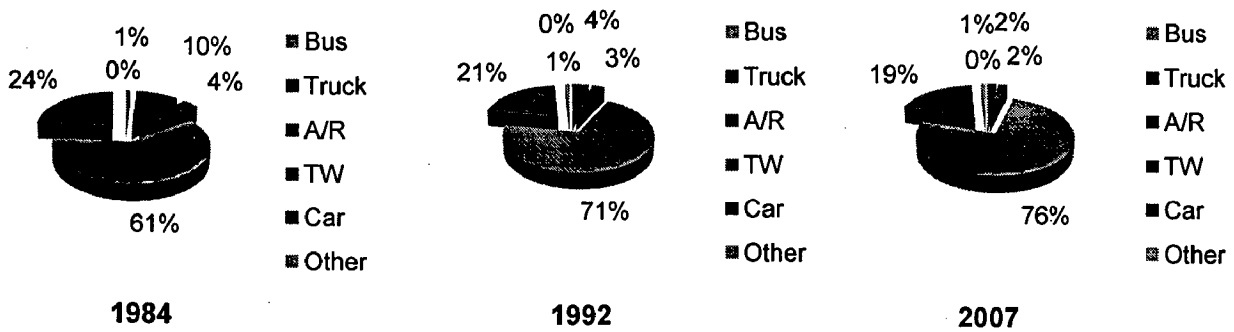


Fig. 5.7: Distribution of vehicles in the city in 1984, 1992 and 2007

Source: Second Master Plan of Chennai. 2026

5.2.5. Per Capita Rate

Per Capita trip rate was 1.30 per day and trip rate per household was 5.88 per day, as per the Comprehensive Traffic and Transportation Study of 1992-95 done in 1995. It increased to 1.32 in 2004 and has been projected to increase to 1.5 in 2011 (MMDA, RITES, et all., 1992) (Fig. 5.8). The per capita mechanized vehicular trip rate has increased in Chennai, again indicating the large vehicle ownership of people and their frequency to commute through private transport. The per capita trip rate for other cities has also been indicated in Table 5.12.

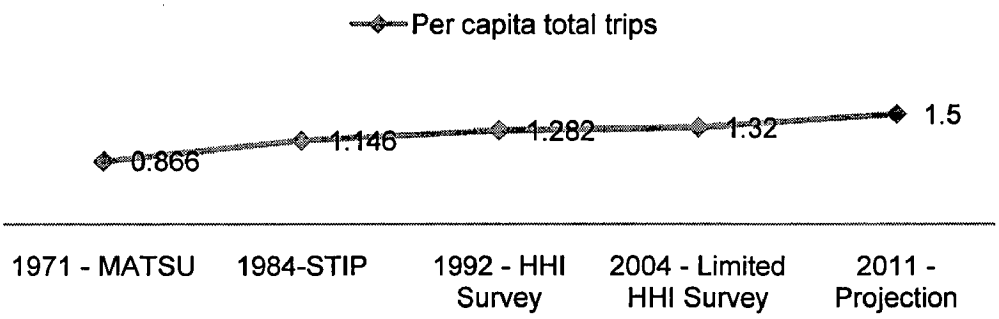


Fig. 5.8: Growth in Per Capita Trip Rate in transport in CMA (2006 statistics)

Source: Report on Identified Parking Demand Locations, Chennai, 2007

Table 5.12: Per capita trip rate in other cities (2008 statistics)

S.No.	Name of city	Per capita trip rate
1.	Hyderabad	1.45
2.	Bangalore	1.41
3.	Delhi	1.56
4.	Kolkata	1.55
5.	Mumbai	1.67

Source: Study on Traffic and Transportation Policies and Strategies in Urban Areas in India, Ministry of Urban Development, Govt. of India, 2008

5.2.6. Modal split of Transport

The present modal preferences of the commuters in the CMA as of 2008 are best characterized, that in a group of 100, 26 travel by bus, 2 by train, 33 by walk, 13 by cycle, 19 by two wheeler, 4 by car and 3 by other modes (Fig. 5.9).

The distribution of modal split in 1970, 1984, 1992 and 2004, shown in Fig. 5.10, indicate that the share of public transport, cycle and IPT have declined over years (CMDA, 1968-69) (MMDA, Kirloskar Consultants Ltd., 1984) (MMDA, RITES, et all., 1992) (CMDA, RITES, et all., 2004). This dismal trend can be attributed to the increasing vehicular ownership, the declining quality of public transport service and the lack of provision for cyclists.

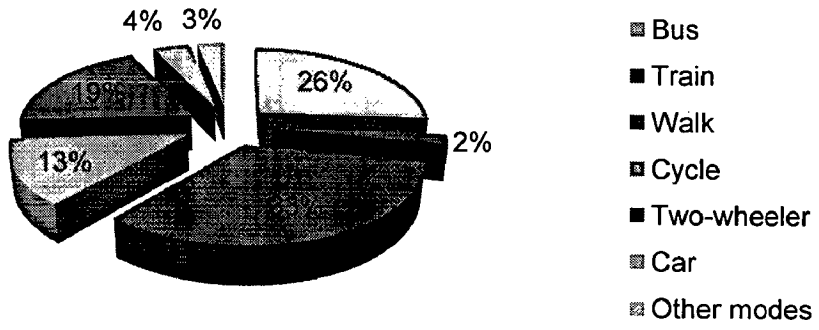


Fig. 5.9: Modal Share of Travel modes in 2008

Source: Highlights on the Recommendations of the State Level Committee on Road Connectivity and Traffic improvements in Chennai, August 2008

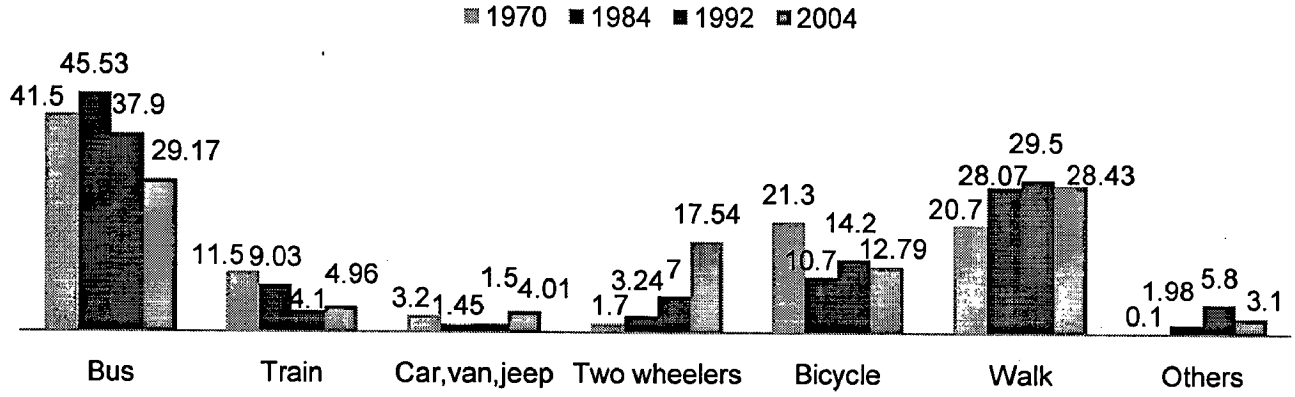


Fig. 5.10: Trend in Modal Split of Transport in Chennai

Source: Highlights on the Recommendations of the State Level Committee on Road Connectivity and Traffic improvements in Chennai, August 2008

5.2.7. Traffic Volume

Arterial roads leading to the CBD carry heavy traffic and are congested. Level of congestion on arterials and other major roads has increased seven-fold between the period of 1984 to 2004 leading to heavy traffic volume. The average volume carried by Anna Salai during 2006 was about 1.58 lakh PCU as against its capacity of 60,000 PCU per day (Table 5.13.)

Table 5.13: Traffic Volume in Major stretches of Chennai (2006 statistics)

S.No.	Name of the Roads / Intersections	Traffic Volume *(in PCU)*	
		ADT	Peak Hour
1.	Anna Salai (NH45)	1,57,856	10743
2.	Periyar EVR Salai (NH4)	1,62,160	11,512
3.	Erukkanchery High Road (NH5)	69,765	4,542
4.	Jawaharlal Nehru Salai (IRR)	1,42,211	8,685
5.	Sardar Patel Road	NA	5065

Source : Second Master Plan of Chennai, 2026

On an average, 1,780 new vehicles are put on roads every day without corresponding increase in motorable road space. Establishment of multi-national car companies in the vicinity of the CMA and establishment of Tidal Park and other IT establishments contribute to increase car ownership in the CMA. With the financial institutions making easy finance available to own motorized vehicles by individuals, the problems of traffic congestion on city roads is escalating tremendously. Conflicts between fast moving vehicular traffic and bicycles and pedestrian traffic have reduced pedestrian safety greatly (Highways Department, Chennai, August, 2008).

5.2.8. Pollution levels in the city

Pollution due to vehicular emission has done a lot of harm to the environment. Periodical monitoring conducted by the Tamil Nadu Pollution Control Board (TNPCB) revealed the level of pollution in the city as shown in Table 5.14.

Table 5.14: Level of pollution in the city (2006 statistics)

S.No.	Pollutant	Load	Permissible level
1.	Carbon Monoxide (Co)	1908 to 4198 µg/m3	2000 µg/m3
2.	Suspend particulate Matter (SPM)	264 TO 451 µg/m3	200 µg/m3

Source : Second Master Plan of Chennai, 2026

Another study carried out by TNPCB has also shown that the emission from nearly half the vehicles in the City exceeded the permissible limit.

5.2.9. Accident Statistics

Accident data reveal that about 1125 persons died on City roads in 2008. Fatality rate works out to 40 persons per 10,000 vehicles (Traffic Police Records, 2008). Chennai has the highest fatalities next to which is Delhi. Other sources of data indicate that 42% of road accidents involve pedestrians and 10% involve cyclists. Trends of fatal accidents in Chennai and other metropolitan cities are shown in Table 5.15.

Table 5.15: Trends of fatal accidents in Chennai and other cities (2005 statistics)

S.No.	Name of City	% of fatal Accidents	Total accidents/ lakh population
1.	Chennai	23	58
2.	Hyderabad	19	87
3.	Bangalore	11	80
4.	Delhi	22	25
5.	Kolkata	13	57
6.	Mumbai	4	111

Source: Study on Traffic and Transportation Policies and Strategies in Urban Areas in India, Ministry of Urban Development, 2008

5.3. Study of Proposals for Pedestrians in Chennai

Though being a metropolitan city, Chennai has not witnessed too many proposals for pedestrians or pedestrian studies until recent times, which is also evident from the existing state of pedestrian infrastructure in the city. Though many transport studies have been conducted by organizations like RITES, Kirloskar Consultants Limited, Pallavan Transport Corporation and Chennai Metropolitan Development Authority in the past, there are not many major studies to have been taken up towards improving the pedestrian scenario in the city. Some of the relevant short-term proposals identified in earlier studies and Second Master Plan of Chennai have been studied to analyze the level of investment in pedestrian infrastructure and whether it has benefitted the city or not. The Chennai Comprehensive Transport Study carried out by Wilbur Smith Associates for Chennai Metropolitan Development Authority has been studied to analyze whether any major proposals have been identified for pedestrians in the future proposals for transport for the city. Some recent initiatives taken since last three years by private organizations and voluntary organizations to improve the public realm of the streets have also been studied to analyze the positive change that they have brought or would bring to the street environment.

5.3.1. Policies and Strategies for Pedestrians in Master Plan

The Second Master Plan of Chennai made reference to laying a major priority on non-motorized transport (pedestrians and bicyclists), following the objective stated in the National Urban Transport Policy and also appreciating the fact that the modal share of trips made by cyclists and pedestrians is more than 45% in the city (Chennai Metropolitan Development Authority, 2006).

Recommendations suggested were:-

1. Footpaths must be minimum 1.5m in residential areas and 3m in commercial areas.
2. Redeeming the existing footpaths from such encroachments as flag posts, hoardings, hawkers, places of worship, eat-outs, construction materials, parking of vehicles, milk booths etc.
3. Stringent penal actions for evicting the encroachments on footpaths.
4. Demarcating stretches of roads or areas exclusively for movement by pedestrians and cyclists.
5. Providing safe passage of pedestrians by sub-ways.

5.3.2. Integrated Transportation Program in 1976-81

Since the First Master Plan, there were some attempts undertaken. The Integrated transportation program: 1976-81 was carried in 1977 for the Madras Metropolitan area which indicated

transport projects funded by the World Bank (MMDA, January 1977). The program included many transport proposals and investments for them. Cost estimates were prepared under roads and traffic improvements and there was also an estimate prepared for improving pedestrian and cyclist facilities (Table 5.16). Though some of these were implemented, but the local authorities have hardly looked into the maintenance aspect of them since that period and the infrastructure lie in a neglected state.

Table 5.16: Pedestrian Facility Projects under World Bank (1976-81)

S.No.	Pedestrian and Cyclist Facilities	Estimated cost in lakhs
1.	**Pedestrian Subways**	
(a)	Anna Salai (5)	38.88
(b)	Poonamallee High Road (1)	10.99
(c)	City streets (3)	24.56
2.	**Footpaths and Cycle Tracks**	
(a)	Anna Salai (upto 3kms)	10.11
(b)	Poonamallee High Road (upto 1km)	3.68
(c)	Lighting of intersections (24)	23.88
(d)	City streets (100 km)	67.37
3.	**Land acquisition and Compensation**	7.18
	Total	**186.65**

Source: Report on Integrated transportation program 1976-81 for Madras Metropolitan Area, 1977

5.3.3. Transport Proposals in Second Master Plan Chennai

A comprehensive shelf of urban transport infrastructure projects is proposed to be taken up in the city (TNUDF, JLLM, 2010) as outlined under the medium and long term transport proposals in the Chennai Second Master Plan 2026. The major urban transport proposals are listed below in Table 5.17, along with some proposals identified for improving the pedestrian facilities.

Table 5.17: List of medium-term and long-term transportation schemes as proposed in Second Master Plan of Chennai, 2026

S.No.	Project Title	Estimated Cost (Rs. In Crores)
1.	Urban Rail Transit System	1126.02
a.	Augmentation of rail network	805.79
b.	Road/ Rail Crossings (ROBs / RUBs)	245.23
c.	Pedestrian facility at Railway Stations	75.00

2.	Urban Bus Transit System	1861.35
a.	Fleet Augmentation	733.00
b.	Depots and Terminals	395.00
c.	Other operational infrastructure	175.00
d.	Bus rapid transit ways	500.00
e.	Bus lay-byes and shelters	58.35
3.	Development of Road Network	14918.40
a.	Elevated highways	6200.00
b.	Development of freight corridors	1450.00
c.	Major Flyovers	775.12
d.	Mini Flyovers	850.12
e.	Widening of bridges and culverts	45.00
f.	New Link roads	1993.84
g.	Widening, strengthening and resurfacing of arterial, sub-arterial and collector roads to atleast 4 lane width	2338.59
h.	Concreting of city roads	233.00
i.	Improvements with white-topping and landscaping	75.00
j.	Utility duct and storm water drains along major roads	790.00
h.	Road works in outer-CMA	942.85
4.	Pedestrian Facilities	209.00
a.	Subways	111.00
b.	Escalators	50.00
c.	Footpaths	48.00
5.	Multi-level car parking	92.98
6.	Expansion of Port Facilities	26918.00
7.	Expansion of Airport Activities	2000.00
8.	Creating Traffic Data Base for city	10.00
9.	Air Quality monitoring system	1.00
	GRAND TOTAL	**47811.90**

Source: Second Master Plan of Chennai, 2026

Though pedestrian facilities improvement has been identified in the future transport proposals, except for new subway construction and footpath improvement in certain stretches, no other major proposals have been identified. Pedestrianization proposals still remain missing and no proposals have been identified for improving the basic street environment in terms of amenities and facilities for the pedestrians.

Moreover, these proposals have not yet met the purpose in terms of being successfully implemented and the pedestrian safety scenario improving slightly.

5.3.4. Chennai Comprehensive Transport Study, 2008

The Chennai Comprehensive Transport Study was carried out in 2008 by Wilbur Smith Associates to ensure an affordable, reliable, efficient and safe transport in future in the city. The objective of the study was to suggest policies, short-term and long-term strategies and programs and schemes for the improvement of urban transport in Chennai and to develop an Urban Transport Model for the future. The proposals framed under the report were a result of the enormous field surveys executed like screen line volume count, road network inventory, speed and delay survey, pedestrian crossing count, cordon count, parking survey etc. Under the pedestrian surveys executed, pedestrian crossing counts were recorded at major intersections on roads, at few subway locations and at few foot-over bridges. Pedestrian counts were recorded at 47 locations at major road junctions within and outside the city for a period of 12 hours. Pedestrians crossing the roads were found to be heavy in the CBD area – numbers ranging from 4,200 to 1, 20,000 in locations within the city while 3,800 to 41,100 outside the city area (Wilbursmith Associates, 2008). The following Table 5.18 and Fig. 5.11 show samples of some of the road junctions where the count were very high (Wilbursmith Associates, 2008).

Table 5.18: Sample Pedestrian count at few major road crossings

S.No.	Location	Time	Count
1.	Arcot road vs Jawaharlal Nehru Road	6.00 p.m. to 7.00 p.m.	4369
2.	Broadway	6.30p.m. to 7.30 p.m.	10037
3.	Lattice Bridge Road near Thiruvanmiyur bus stand junction	7.00 p.m. to 8.00 p.m.	8631
4.	Periyar EVR Salai Vs Mint Road	9.45 a.m. to 10.45 a.m.	6733
5.	South Usman Road Vs Duraisamy Road	4.30 p.m. to 5.30 p.m.	9346
6.	South Usman Road infront of T.Nagar Bus stand	6.30 p.m. to 7.30 p.m	11518

Fig. 5.11: Road crossing locations

Source: Chennai Comprehensive Transport Study, 2008, Wilbur Smith Associates

Pedestrian counts were recorded at 18 subway locations within and outside the city for a period of 12 hours. 24 locations were suggested for constructing the subways immediately based on pedestrian count recorded. Some additional 23 locations were suggested for having subways in

the future. The following Table 5.19. and Fig. 5.12 show samples of some of the subway locations where the count were very high (Wilbursmith Associates, 2008).

Table 5.19: Sample Pedestrian count at few subway locations

S. No.	Location	Time	Count
1.	Anna Salai near Guindy Railway station	10.45 a.m. to 11.45 a.m.	5424
2.	Anna Salai near Whites road signal	7.05 p.m. to 8.05 p.m.	2532
3.	Anna Salai near LIC Bus stop	8.00 a.m. to 9.00 a.m.	2344
4.	Anna Salai near Tarapore Towers	10.10 a.m. to 11.10 a.m.	1804
5.	Periyar EVR Salai near Park Railway Station	6.15 p.m. to 7.15 p.m.	8220

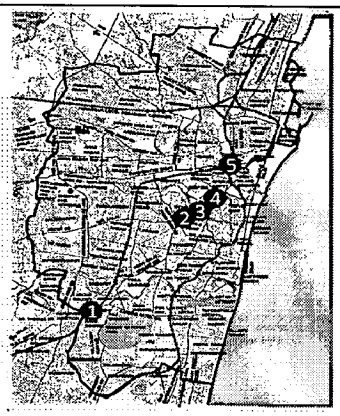


Fig. 5.12: Subway count locations

Source: Chennai Comprehensive Transport Study, 2008, Wilbur Smith Associates

Pedestrian counts were recorded at 11 foot-over bridges within and outside the city for a period of 12 hours. The following Table 5.20 shows samples of some of the foot-over bridges where the count was very high (Wilbursmith Associates, 2008).

Table 5.20: Sample Pedestrian count at few major foot-over bridges

S.No.	Location	Time	Count
1.	Mahatma Gandhi Salai near NABARD Bank	3.30 p.m. to 4.30 p.m.	615
2.	Haddows road near Shastri Bhawan	3.30 p.m. to 4.30 p.m.	512
3.	Rajiv Gandhi Salai near Tidal Park	4.15 p.m. to 5.15 p.m.	198
4.	Rajiv Gandhi Salai near Perungudi	9.30 a.m. to 10.30 a.m.	98

Source: Chennai Comprehensive Transport Study, 2008, Wilbur Smith Associates

Based on the surveys and the long-term goals and objectives of the study, the proposals that were identified were the provision of subways at some 47 locations and the Anna Nagar Cycle Track Project for favoring safe cycle movement in the area (Table 5.21). Apart from these, no proposals were identified to take up pedestrianization strategy in certain stretches or improving the existing footpaths and providing safe crossings. It also reflects the lack of such extensive studies to identify the basic importance of walking and cycling, as a sustainable solution for transport in the years to come and correspondingly design suitable schemes to encourage them.

Table 5.21: Proposals identified to facilitate pedestrian and cycle movement

S.No.	Project Title	Project type	No. of locations	Phasing	Cost	Implementation Period
1.	Subways	Medium - term	47	Phase-I, II & III	196 cr	2010-12

2.	Anna Nagar Cycle Track (a part of the Complete Streets Project)	Short-term	5 stretches	--	2.25 cr	2010-12

Source: Chennai Comprehensive Transport Study, 2008, Wilbur Smith Associates

5.3.5. L.B. Road Project, Chennai

The L.B. road project was initiated by a private organization called Chennai City Connect, which assists governmental agencies by providing the knowledge base and support to help the development on urban infrastructure and services. It is an urban infrastructure group that brings all the stakeholders on to a single platform to solve the urban infrastructure problems. The Lattice Bridge Road (LB Road) project has been taken up by the organization as a pilot project to create a stretch of road, conforming to international specifications with respect to pavements, drains and road intersections thereby making it safe for pedestrians and enabling smooth flow of vehicles (Chennai City Connect, 2009). It is an initiative towards creating a 'Complete Streets'. The project had a deadline of June 2010 and is rendered pending due to certain legal approval and other hassles.

5.3.5.1. Objectives

The objectives of the project were:

1. To make the stretch of 500 metres from Shastri Nagar junction upto MG Road junction safe for pedestrians with pavements and defined areas to cross the roads at the junctions.
2. Synchronize the traffic signals to ensure smooth flow of traffic thereby reducing travel time.
3. Pavements, drains, utility strip, road intersections to conform to international specifications.
4. Include upto 200 metres of roads leading into the 3 junctions on this stretch, in designing traffic islands/parking areas etc. (Chennai City Connect, 2009).

5.3.5.2. Key Features

Some of the key features of the project were:

1. Continuous and pedestrian friendly footpath.
2. Well designed ramps for wheel chair access.
3. Islands and raised crossing for pedestrian safety.
4. Utility strip along footpath for relocating utilities to have unobstructed footpath and landscaping.

5. Continuous two lanes for smooth traffic flow.
6. Right turn and left turn lanes where necessary.
7. Well designed bus bays for easy bus access and to prevent traffic obstruction.
8. Driveway controls to provide controlled access to vehicle into buildings while maintaining safety of pedestrians.
9. Thermoplast paint for lane and pedestrian crossing markings for enhanced visibility and safety.
10. Planned roadside parking wherever appropriate for bikes and cars
11. Well designed and synchronized traffic lights for pedestrian safety and better traffic flow.

5.3.5.3. Planning and Execution

The project is being executed in partnership with the Corporation of Chennai and CREDAI. A budget of Rs. 28 lakhs has been estimated of which, Chennai Corporation would contribute Rs. 25 lakhs and CREDAI would contribute Rs. 3 lakhs. The idea was to design a model road stretch since Chennai city has no standards for roads / pavements / traffic intersections. This idea was further discussed with the Commissioner of Municipal Corporation and L.B. Road stretch was chosen (Chennai City Connect, 2009) (Fig. 5.13 & 5.14). This comprehensive study involved detailed surveys of the road conducted by multiple stakeholders, wherein special care was taken to note the location of trees, existing storm water inlets, road width, existing footpath, driveways of shops and houses, etc. Detailed diagrams and of the road, footpath, junctions and other components of LB Road were made (Fig. 5.15 & 5.16).

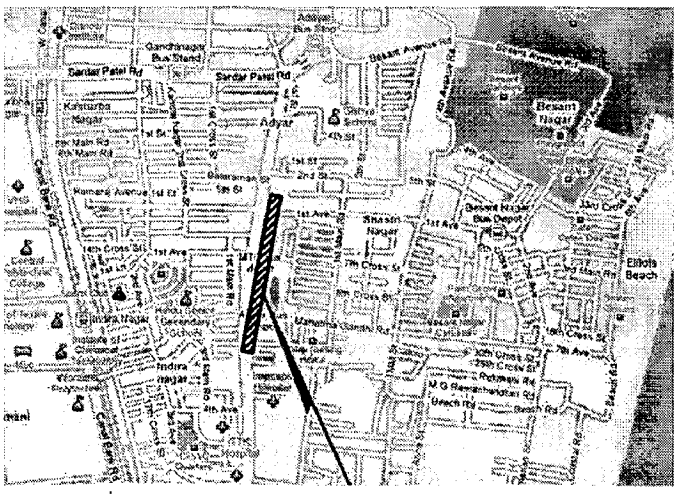


Fig. 5.13: Map showing model stretch on L.B. Road
Source: L.B. Road Improvement Plans, Chennai Corporation

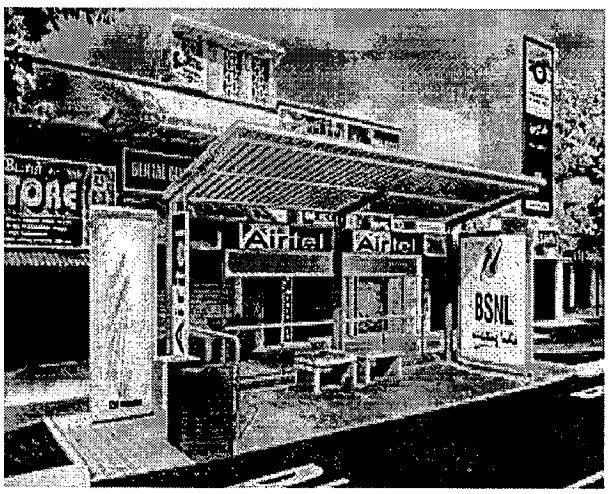


Fig. 5.14. Proposed bus-stop at L.B. Road
Source: www.chennaicityconnect.com

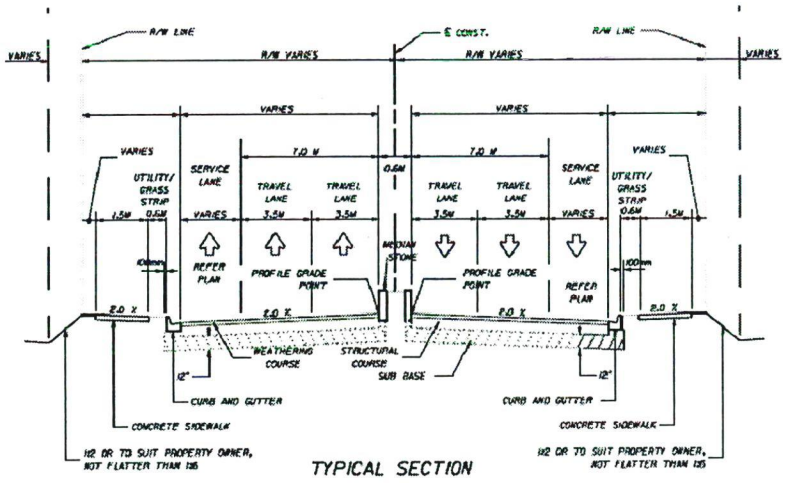


Fig. 5.15: Typical Section as proposed on L.B. Road

Source: L.B. Road Improvement Plans, Chennai Corporation

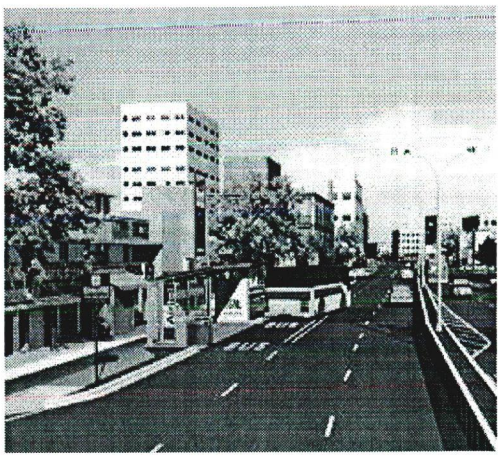


Fig. 5.16: Proposed View after development

Source: www.chennaicityconnect.com

Proposed improvements in road furniture, signage, location of trees and street hawker stalls were made. As the draft diagrams and surveys were completed, the team, in coordination with media and officials, further engaged the public to know their opinion. This iterative process of public participation helped them produce a consensus solution. A set of standards were prepared, based on the US Department of Transportation standards. Once the final design was made, a list of material was prepared for budgeting. Currently, demolition work of the shop encroachments on the footpath is in progress and the project is running late due to permission hassles from the Chennai Corporation (Fig. 5.17 & 5.18).

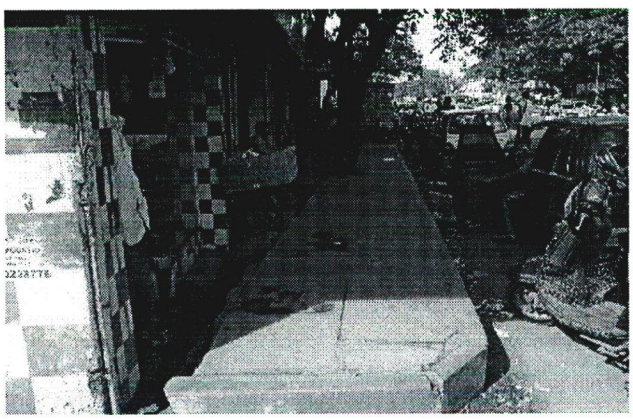


Fig. 5.17: Existing sidewalks on L.B. road

Source: By Author

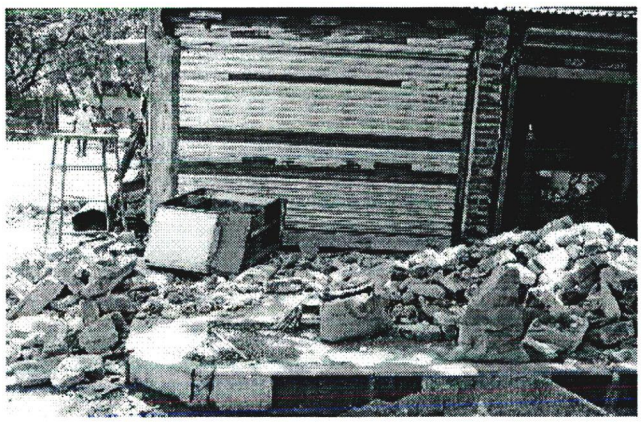


Fig. 5.18: Demolition of encroachments

Source: www.chennaicityconnect.com

The L.B. road project is worth appreciation in terms of a sincere effort taken by private consultants to bring about a change in the street; however, the project has not tasted the success of its final implementation till date. The governmental loopholes and lack of sincere interest shown by the civic authorities has been a major setback in the project. The project details reveal a sidewalk width of only 2m, with the total ROW of the road as 24m (approx.). The

5.4. General Pedestrian Scenario in Chennai

The general pedestrian scenario in Chennai is worse than even some of the other metro cities in India. The pedestrian infrastructure in the city is in a very bad shape and in some stretches; they are almost absent or unusable. Chennai's pedestrian environment reflects poorly designed footpaths, broken, narrow and encroached sidewalks; poorly planned utilities, absence of amenities and street furniture, unsafe crossings, unfriendly pavements for the handicapped and ill-maintained sidewalks. Though some innovative efforts are being taken up by organizations like City Connect and ITDP, the urban local bodies do not take up any efforts towards pooling funds to improve the pedestrian convenience and safety in the city. Though very few recent examples of stretches which have been retrofitted, do exist, the following photographs depict the sad scenario of the pedestrian infrastructure in the city (Fig. 5.20 to Fig. 5.43)

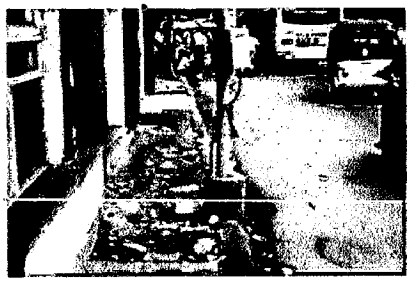


Fig. 5.20: Broken sidewalk R.K. Mutt Road, Mylapore
Source: By Author

Fig. 5.21: Encroachment North Mada Street, Mylapore
Source: By Author

Fig. 5.22: Narrow sidewalk Anna Salai, Saidapet
Source: By Author

Fig. 5.23: Narrow Pedestrian crossing at RUB, Mambalam
Source: By Author

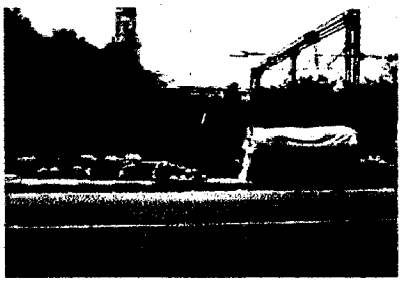


Fig. 5.24: Encroached sidewalk Egmore high road
Source: By Author

Fig. 5.25: Broken sidewalk, Sardar Patel Road, Guindy
Source: By Author

Fig. 5.26: Encroachments on RK Mutt Road, Myalpore
Source: By Author

Fig. 5.27: Encroachments by Temple, Taluk Road
Source: By Author

Fig. 5.28: No footpaths, G.S.T. Road, Crompet
Source: By Author

Fig. 5.29: Inaccessible Pavements, Nungambakkam

Source: By Author

Fig. 5.30: Unfriendly pavements, Nelson Manickam Road

Source: By Author

Fig. 5.31: Inadequate crossings, Crompet

Source: By Author

Fig. 5.32: No special zone for vendors, T.Nagar

Source: By Author

Fig. 5.33: Obstacles on sidewalk, Sardar Patel Road

Source: By Author

Fig. 5.34: Holes in sidewalk, Velachery Main Road

Source: By Author

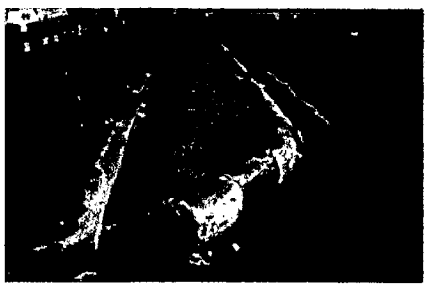


Fig. 5.35: Unplanned utilities, Kilpauk Garden Road

Source: By Author

Fig. 5.36: Discontinuous sidewalks, Nungambakkam

Source: By Author

Fig. 5.37: Unplanned parking Mylapore

Source: By Author

Fig. 5.38: Ill-planned street corners, South Avenue, Saidapet

Source: By Author

Fig. 5.39: Unattractive bus shelters, Mylapore

Source: By Author

Fig. 5.40: Encroachment, Lattice Bridge Road

Source: By Author

Fig. 5.41: No footpaths, Arya Gowda Road, Mambalam

Source: By Author

Fig. 5.42: Ill-planned side- Kalki Krishnamurthy road

Source: By Author

Fig. 5.43: Broken sidewalks Nungambakkam

Source: By Author

The very few good examples that exist in some stretches are shown in the following photographs (Fig. 5.44 to Fig. 5.49).

Fig. 5.44: Newly planned subway, Anna Salai

Source: By Author

Fig. 5.45: Well-planned bus shelter, Santhome Road

Source: By Author

Fig. 5.46: Well-planned sidewalk, Canal Bund Road

Source: By Author

Fig. 5.47: Wide sidewalk, Santhome Road, Beach

Source: By Author

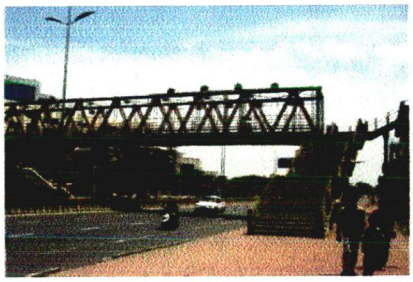


Fig. 5.48: Grade-separated crossing, near Tidal Park

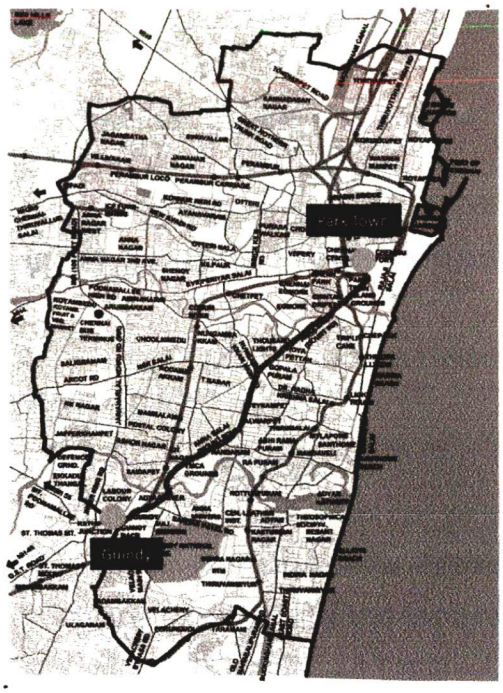
Source: By Author

Fig. 5.49: Properly planned sidewalk, Taluk Road

Source: By Author

5.5. Study Areas – Anna Salai and T.Nagar

For study and recommendation of proposals to improve the poor pedestrian environment existing in the city, two areas have been selected. These have been selected based on the studies and surveys conducted earlier by various organizations and field trips to the areas, which suggests a promising potential and scope for the improvement of pedestrian facilities and to integrate it with the land uses and the transport network. The profile of the two study areas have been discussed in the following paragraphs.



5.5.1. Study Area 1: Anna Salai

Anna Salai, also called as Mount road, is one of the most important arterial roads of Chennai. It is the longest road of the city (11 km in length approx.). It starts at Cooum Creek, south of Fort St George and extends till the Kathipara junction in Guindy (Fig. 5.50). Beyond the Kathipara Junction, the road branches into two, the Mount-Poonamallee Road and the Grand Southern Trunk Road to form NH-45. The road was a very important indicator of development, as the city of Chennai grew up mostly along its eastern and western sides (Shah, 2001). It is the only road in the city that follows the lane system (8 lane road). It is maintained by the National Highways Authority.

Fig. 5.50: Location of Anna Salai in Chennai

Source: By Author

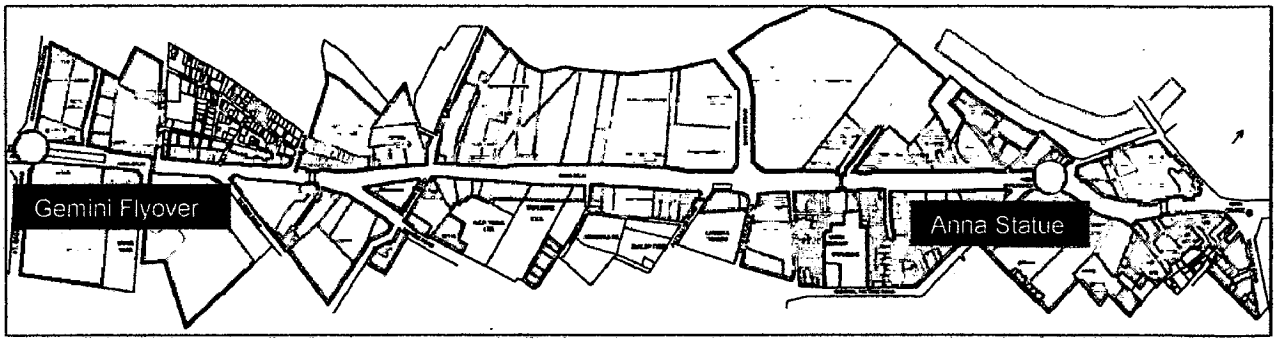
5.5.1.1. Growth of Anna Salai

Anna Salai is almost 400 years old and has its origins in a cart track which was used by the British East India Company officials, to travel from the factory at Fort St George to the holy town of St Thomas Mount. The road, in its present form, took shape during the time of Charles MaCartney who served as Governor of Madras. The route was further enhanced by –

- The purchase of hunting lodge in 1670.
- The construction of Marmalong Bridge in 1726.
- Development of new settlements like Chintadripet, Teynampet, Saidapet in 1700s.
- Many public buildings coming along the road.
- Many commercial and office buildings to have come up in the last decade.

5.5.1.2. Land-use

Anna Salai originates and runs through the largest and most expensive CBD of the city. It caters to a very heavy inter-city traffic. The intensity of commercial activities is very high along the stretch. It houses multi-national companies and large corporate houses and banks for their offices and outlets. It also possess large concentration of movie theatres, shopping arcades and important landmarks. The land-use is thus, predominantly commercial with some parts of institutional, light industrial and mixed land-use developments. The land-use along Anna Salai between Gemini Flyover and Anna Statue has been illustrated in Map 5.13.

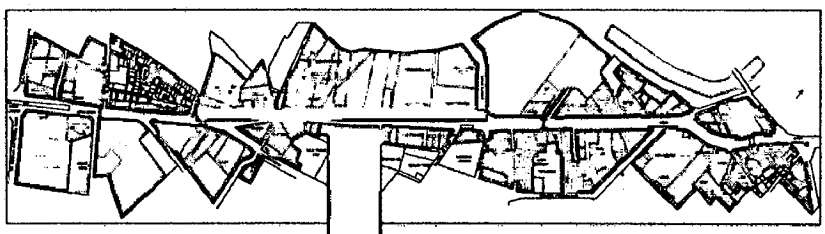


Map 5.13: Land-use map of Anna Salai between Gemini Flyover and Anna Statue

Source: By Author

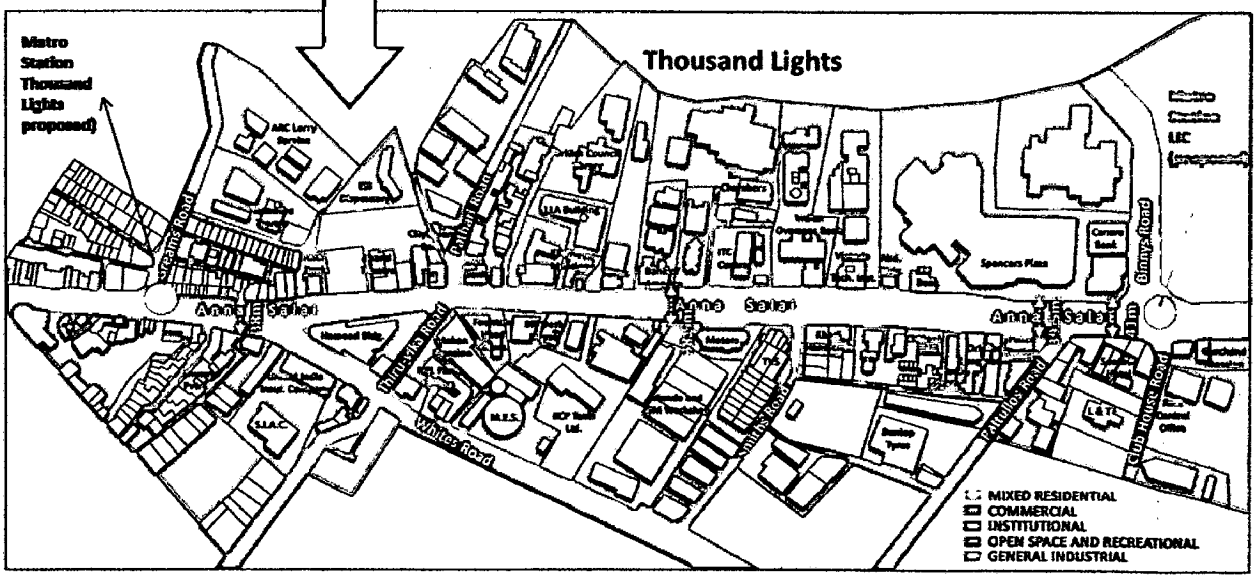
5.5.1.3. Study Area

A 1.1 km stretch of Anna Salai, across Thousand Lights area has been selected for study (Map 5.14 & 5.15). The land-use along the stretch is commercial, with some low-rise and many medium-rise and high-rise developments. Due to the commercial and institutional nature, a large number of commuters are on-foot and they use the public transport for commutation. The stretch is expecting underground metro in future, as a part of the metro rail project. The Phase-I of the project is already under construction, consisting of two corridors, one of which runs across Anna Salai, connecting different other areas of the city. The stations expected are proposed to come up at LIC junction and Thousand Lights junction (Map 5.14 & 5.15).



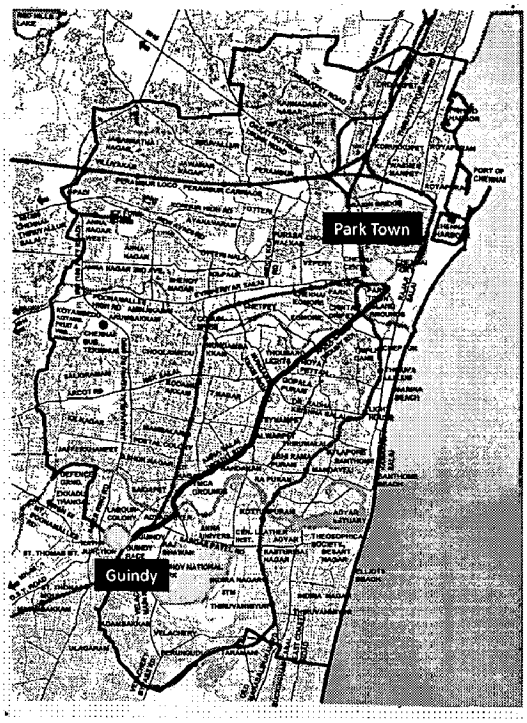
Map 5.14: Key map of Anna Salai indicating the stretch along Thousand Lights

Source: By Author



Map 5.15: Study Stretch of 1.1km in Thousand Lights along Anna Salai

Source: By Author



5.5.2. Study Area 2: T.Nagar

T.Nagar is one of the commercial hubs and a prime CBD area of Chennai city (Fig. 5.51). It lies to the west of Mount road and is loosely bordered by Saidapet and West Mambalam to the west, Nandanam to the south and Nungambakkam to the north (Fig. 5.52). T.Nagar provides some of the best shopping centres, business establishments, accommodation providers and other commercial enterprises (TNUDF, JLLM, 2010). Historically planned as a residential neighbourhood with Panagal Park at its centre, T.Nagar has shed its original character to change into an exclusive shopping area and a commercial centre for thousands of shoppers from across the country (Fig. 5.53 & 5.54).

Fig. 5.51: Location of T.Nagar in Chennai

Source: By Author

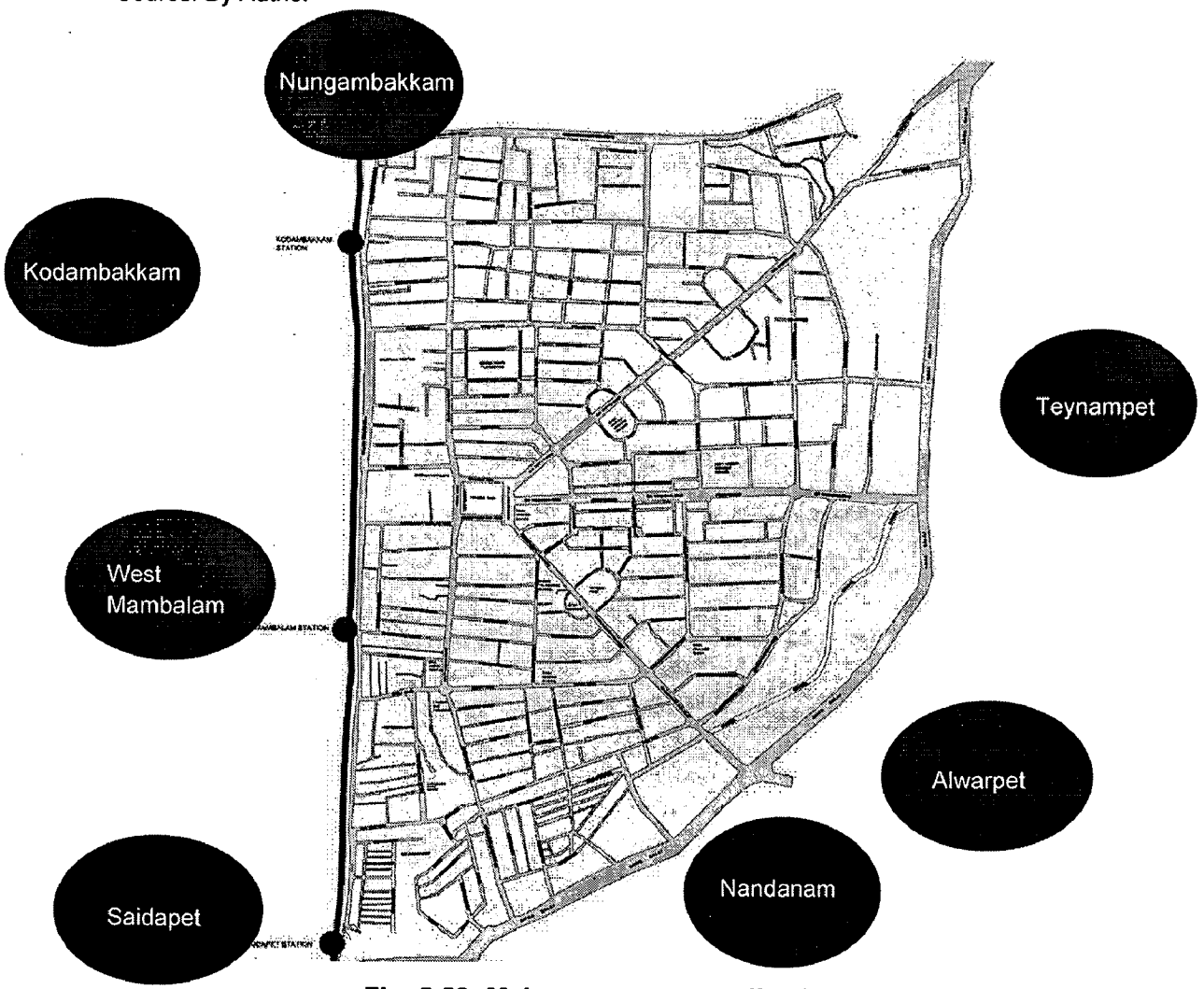


Fig. 5.52: Major areas surrounding T.Nagar

Source: By Author

Fig. 5.53: A busy scene at Nageshwar Rao road

Source: www.flickr.com

Fig. 5.54: A bustling Ranganathan Street

Source: www.flickr.com

5.5.2.1. Evolution of T.Nagar

T.Nagar was originally a low lying area with a tank surrounded by mostly government lands and 'patta' lands. As the city grew and expanded its limits, development schemes were started and T.Nagar was one of them. Before 1920, Mambalam was a sparsely populated area having few settlements around the Siva Vishnu Temple, surrounded by cultivable lands. Since this area was adjoining Mount road and nearer to the centre of the city. Town Planning Development Schemes were extended over this area under the name of Mambalam development scheme and was started in 1927 over 250 acres. The name was changed to Theygaraya Nagar (in the name of Sir Pitti Theagaraya Chetty, a stalwart of the Justice Party ruling Madras) (Gnanasekar, 1994). The residential area was planned with a park at the centre, called the Panagal Park, and radial roads originated from it, connecting the rest of the neighborhood (Fig. 5.55).

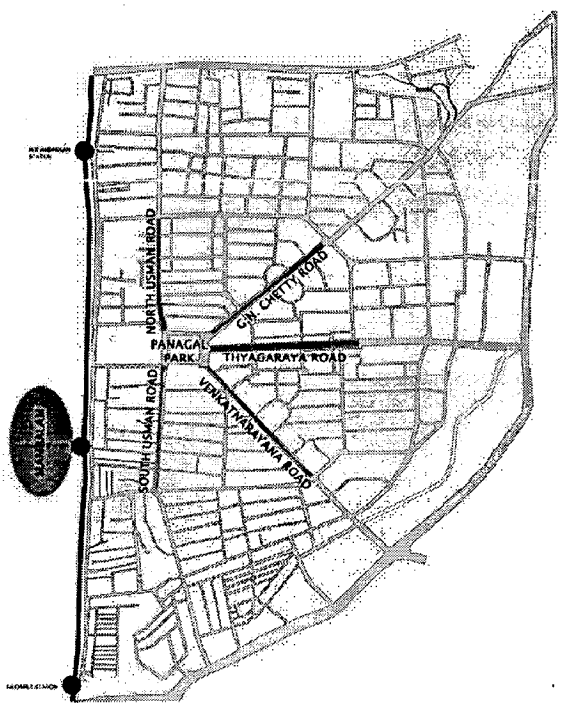


Fig. 5.55: Layout of T.Nagar

Source: By Author

5.5.2.2. Population Growth of T.Nagar

T.Nagar has witnessed a remarkable increase in population in the past decades, with people lured by the residential facilities and the nearby proximity to the commercial and institutional uses in the area. The population growth in the past decades has been shown in Table 5.22.

Table 5.22: Population growth in T.Nagar

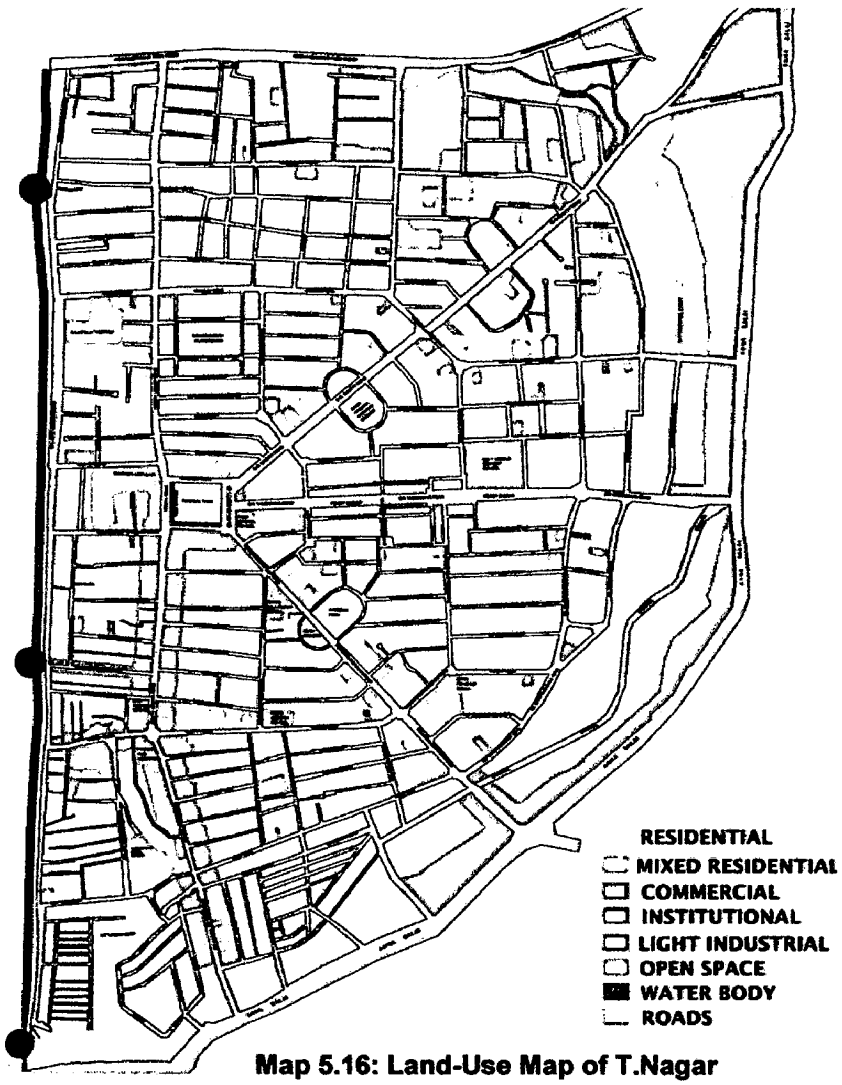
Year	Population
1931	2000
1941	15200

1951	56765
1961	86043
1971	127804
1981	156603
1991	172660
2001	214878

Source: Report by P. Xavier Gnanasekar, Shopping Study of T.Nagar, Anna University

5.5.2.3. Land-Use

As already stated, being planned as a neighborhood, the land use pattern was strictly residential. The road network had a strong hierarchy of radial roads originating from the central Panagal Park. The five radial roads all leading to open main central open space at the centre, divided the area into clear separate neighborhoods. It was planned as a walkable neighborhood. As the city started to expand, commercial uses penetrated and the character of the area started to change. Institutions came in followed by retail and business and T.Nagar has since then been changing its character, to a commercial and mixed-land use development (Map 5.16 & Table 5.23.).



Map 5.16: Land-Use Map of T.Nagar

Source: By Author

Table 5.23: Change of Land-Use in T.Nagar

Year	1964	1964	1991
Land - use	Area in Ha.	Area in Ha.	Area in Ha.
Residential	370.24	530.22	284.28
Commercial	19.24	27.34	49.73
Institutional	42.78	66.36	91.91
Industrial	2.75	2	1.58
Parks and playgrounds	42.86	99.56	94.26

Source: Report by P. Xavier Gnanasekar, Shopping Study of T.Nagar, Anna University

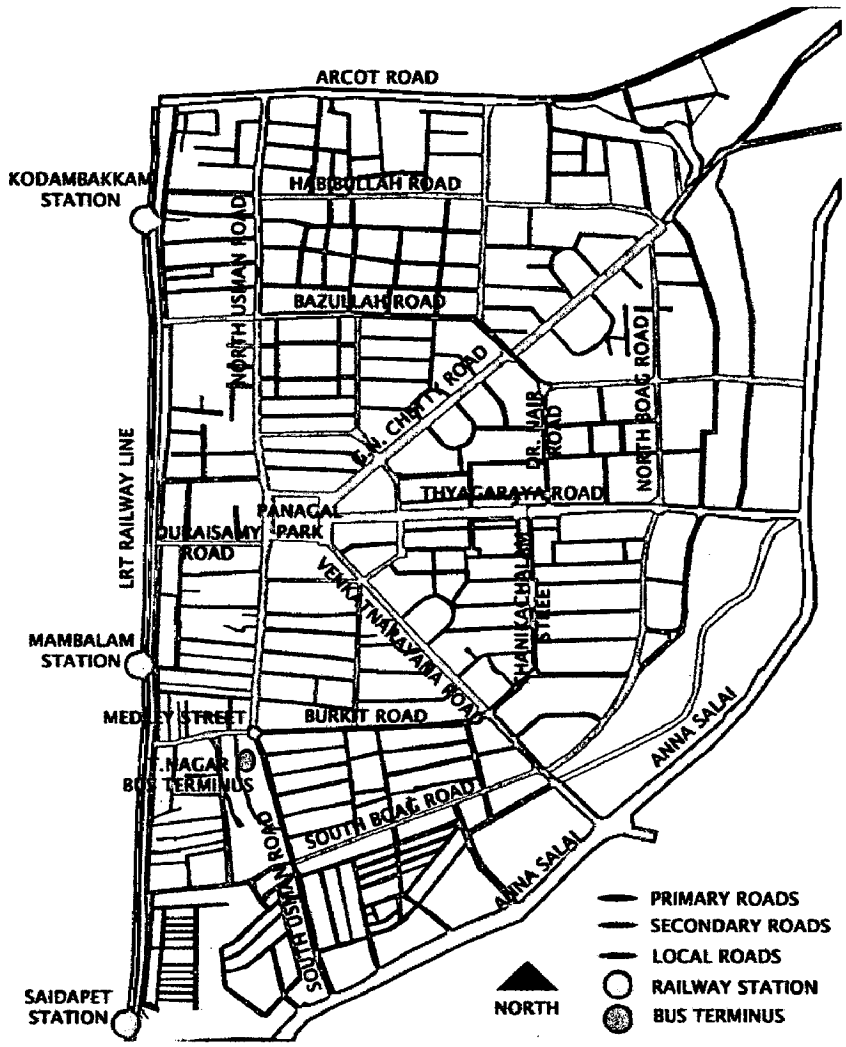
5.5.2.4. Transport in T.Nagar

1. Bus – T.Nagar is well-connected and easily accessible from most parts of the city by bus. T.Nagar has a Metropolitan Transport Corporation (MTC) bus terminus at the inter-section of the Usman Road and the Burkit Road which is a major hub, connecting the area with other places like Mylapore, Nungambakkam, Mambalam, Kodambakkam, Saidapet, Annanagar, Tambaram, Thiruvanmiyur etc. (TNUDF, JLLM, 2010)
2. Train – T.Nagar is served by two stations, Mambalam and Kodambakkam as indicated in the map. The LRTS connects the area with other major stations of the city. Even express trains from other destinations like Trichy, Madurai, Kanyakumari etc. stop at Mambalam station.
3. Proposed Metro stations – Metro stations are proposed to come up on Anna Salai, the major arterial connecting T.Nagar with the rest of the city. There are three stations proposed to come up, which may make T.Nagar an easily accessible shopping destination in the future.
4. Intermediate Public Transport – Intermediate public transport exist in the form of share autos which move through the route of Burkit road towards Anna Nagar. Share autos also move through the G.N. Chetty road and the Thyagaraya road and bring in the crowd of shoppers from various parts to T.Nagar.

5.5.2.5. Road and Rail Network in T.Nagar

T.Nagar is encompassed by two major arterial roads – the Anna Salai along the east and south-east and the Arcot road along the north. Off the western boundary, is the Inner Ring road (Jawaharlal Nehru Salai). The railway line runs along the north-south direction to the west of Panagal Park. Thyagaraya Nagar is divided by five major roads which radiate from the Panagal Park – the G.N. Chetty road, the Thyagaraya road, the Venkatnarayana road, North Usman road and south Usman road, which finally intersect the major arterials that encompass the whole T.Nagar (Map 5.17). Apart from these roads, there are ring roads that exist in T.Nagar namely,

Bazullah road, Dr.Nair road, Thanikachalam road and Burkit road, which encompass the area undertaken for the study (Map 5.17).



Map 5.17: Road Network Map in T.Nagar

Source: By Author

For the traffic movement along the railway line to and fro from T.Nagar, three subways (RUBs) are the preferred routes, with another flyover under construction. The total length of road network in T.Nagar is 79.64 kms with arterial roads measuring 8.19 kms and inner ring road measuring 9.16 kms (Table 5.24).

Table 5.24: Major roads in T.Nagar

S.No.	Road name	Length in km	R.O.W. in metres
1.	Usman road	1.35	24
2.	Burkit road	0.78	15
3.	Sir Thyagaraya Road	1.40	26

4.	Venkatanarayana Road	1.07	20.5
5.	Motilal Street	0.33	9.5
6.	Sarojini street	0.32	9.5
7.	Ramasamy street	0.33	9.0
8.	Venkatesan street	0.3	9.5
9.	Pinjala Subramanian street	0.33	12
10.	Medley road	0.32	14.5
11.	Natesan Iyer street	0.39	9.0
12.	Ranganathan street	0.34	7.5
13.	Ramanathan street	0.26	9.5
14.	Dandapani street	0.26	11.7
15.	Raja Bahadur street	0.52	8.0
16.	Raja street	0.51	7.5
17.	Habibullah road	1.65	14.0
18.	Bazullah road	1.20	12.0
19.	Vijayaragavachari road	0.75	9.6
20.	Govindan street	0.30	7.5
21.	Murugesan road	0.39	9.5
22.	South Boag road	0.92	16.0

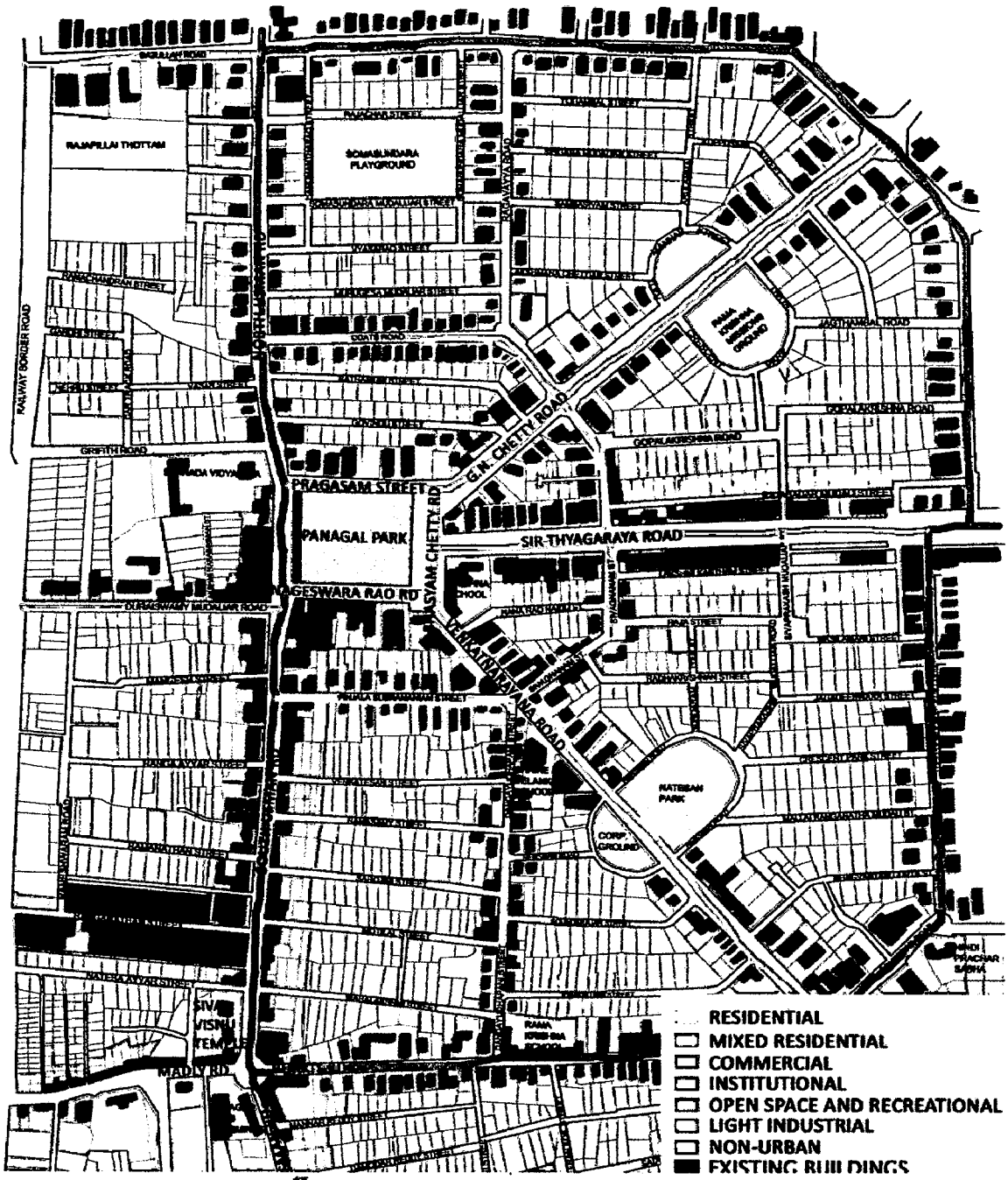
Source: Report by P. Xavier Gnanasekar, Shopping Study of T.Nagar, Anna University

5.5.2.6. Density Patterns

T.Nagar was not planned with a strong building height in mind. The houses initially were planned as small apartment buildings or independent buildings. The low FSI ensured that the individual dwellings had large open spaces. The density of population is not very high in the precinct. With time, lot of redevelopment has taken place. Building heights and open spaces have been altered, to meet the rising demands of commercial space requirements. The buildings have not been planned in a coordinated manner; the development control regulations have been violated and this calls for the need for a complete re-densification process in the precinct.

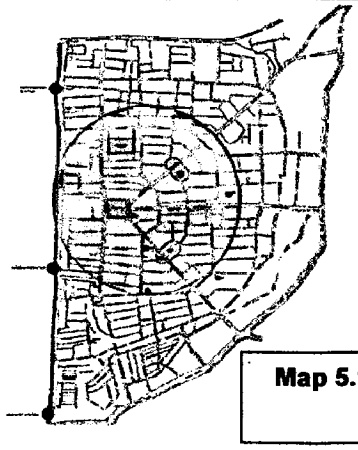
5.5.2.7. Study area

An area of 1.4 sq.km. has been demarcated for study,of an area of 6.86 sq.km. of T.Nagar. The study area is bound by Bazullah road to the north, Burkit road to the south, South Usman road to the west and Dr. Nair road and Thanikachalam road to the east, with the Panagal Park at its centre. The study area consists of the most crowded streets – Usman Road and Thyagaraya Road and hence, has a potential for pedestrianizing some of the streets and converting them into a car-free space. The study area demarcated has been shown in Map 5.18 & 5.19.



Map 5.18 : Study area in T.Nagar

Source: By Author



Map 5.19: Key Map showing the selected area in T.Nagar

Source: By Author

5.6. Summary

The city of Chennai has an extensive network of roads and bus services. The city has witnessed phenomenal increase in cars and two-wheelers in the last decade and the traffic volume on the roads has increased to such an extent that the roads are failing to cater to such a high volume, leading to enormous congestion on the roads. Pedestrian fatalities are increasing with each passing day and pedestrian safety has become one of the major issues of concern in the city. The strategies prescribed in the Second Master Plan of Chennai for the pedestrians are hardly reflected on the roads in the upcoming transport schemes being implemented in the city. Even the transport proposals identified in the Master plan do not involve very relevant improvements being suggested for the present pedestrian environment except the construction of subways and footpaths. It does not involve any proposals for pedestrianization of few important stretches.

Even the Chennai Comprehensive Transport Study, though was an elaborate study to have executed extensive field surveys in many parts of the city, did not speak about any relevant proposals for immediate implementation in future to improve the worse situation of pedestrian facilities in the city. The L.B. Road Pilot Project was a very innovative and a detailed attempt to bring a change to 0.5km stretch of the road, but it has not tasted a successful implementation till date due to governmental hassles and is at halt. Moreover, the project does not speak about a judicious footpath width. Anna Nagar Cycle Track project is another creative attempt to render equitable space on the streets for all its users, while giving more emphasis on non-motorized transport. Though the project is yet to take-off, it does seem very promising. Thus, looking at the poor condition of the existing pedestrian facilities in the city and a review of the very few on-going proposals in the city, one can make a strong case for proposing improvement in the pedestrian facilities and frame pedestrianization in some stretches of the city, together which can help in building a sustainable future of transport in Chennai.

6 PRIMARY SURVEY AND ANALYSIS

6.1. Pedestrian Count Survey

6.2. Questionnaire Survey

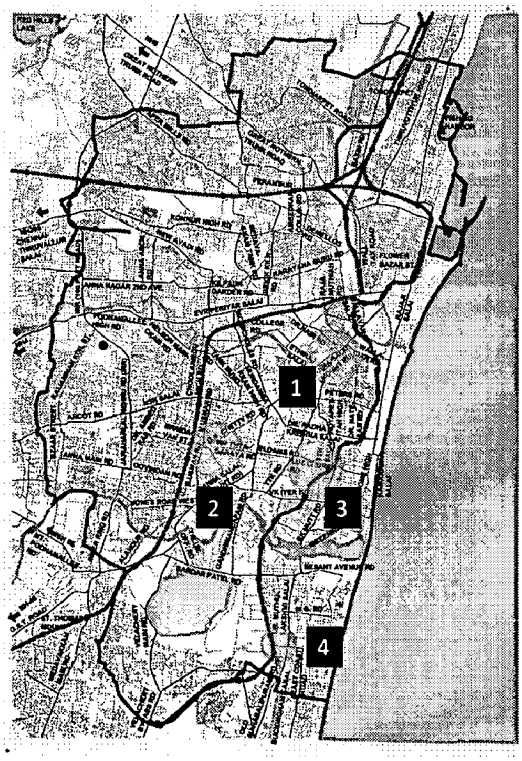
6.3. Visual Survey of Study areas

6.4. Pedestrian Environment Evaluation Matrix

6.5. Inferences

6 PRIMARY SURVEY AND ANALYSIS

The chapter deals with the primary survey and field study carried out in certain parts of Chennai city and the analysis and inferences drawn from it. The chapter includes pedestrian counts recorded at certain important locations of the city, where the pedestrian traffic is quite high. It further details a questionnaire survey carried out to draw inferences on pedestrian safety scenario in the city. It also includes visual and photographic survey of the study areas depicting a picture of the pedestrian environment and its various problems. The last segment of the chapter describes a pedestrian environment evaluation matrix and how it has been helpful to evaluate the pedestrian environment in certain stretches of the city and draw inferences from them.



Map 6.1: Locations were pedestrian counts were recorded

Source: By Author (based on land use map of Chennai)

6.1. Pedestrian Count Survey

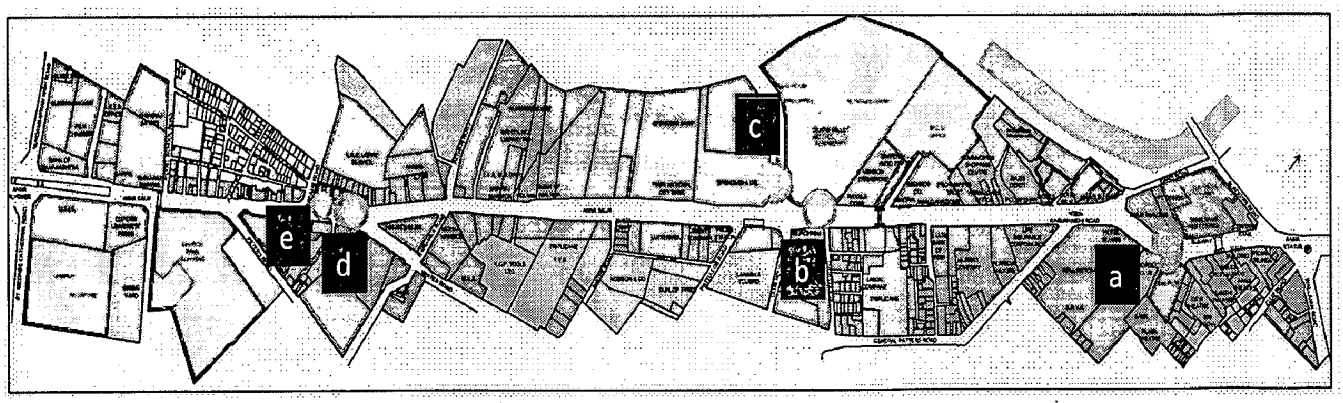
Traffic count and pedestrian count were recorded through field visits at 4 select locations in Chennai. These locations were identified based on the intensity of land uses, the density patterns, the commercial nature of the stretch and the future transport proposals along the stretch and the surrounding areas of the stretch. The stretches, where traffic and pedestrian count were recorded, have been shown in Map 6.1 and are listed as follows –

1. Anna Salai (Mount Road) along Thousand Lights
2. Usman Road in T.Nagar
3. Royapettah High Road in Mylapore
4. Canal Bank Road in Thiruvanmiyur

6.1.1. Pedestrian Count along Anna Salai

Anna Salai is a major arterial road and runs through some of the city's central business districts. It is a eight-lane road and the width varies between 37.5m to 42m. Thousand Lights is a commercial area, with major offices, shopping, and financial institutions setup, which leads to a high volume of pedestrian traffic generated daily in the area. Traffic as well as pedestrian counts were recorded along the stretch at 5 locations (Map 6.2) on 22, October, 2010. The findings are

elaborated in Table 6.1 and indicate that the commercial precinct has a high pedestrian as well as traffic count.



Map 6.2: Anna Salai stretch from Anna Statue to Gemini Flyover

Source: By Author (Based on Detailed Development Plans for Anna Salai)

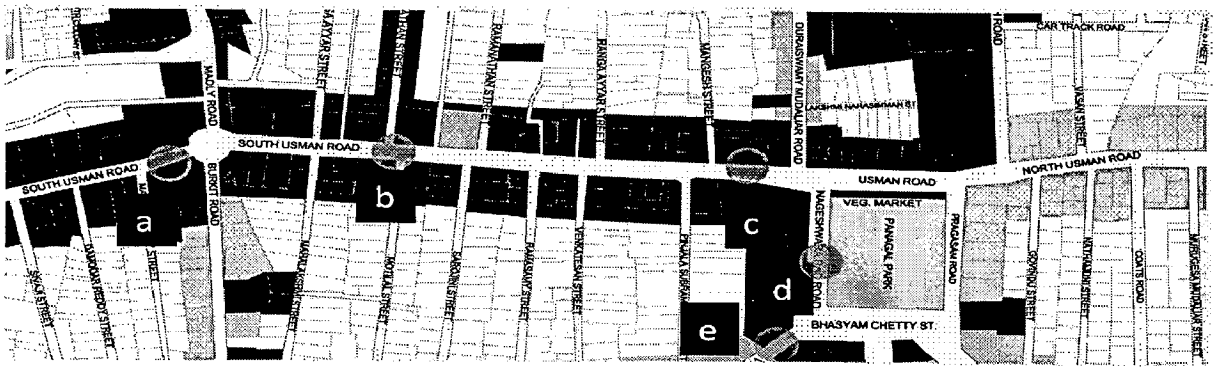
Table 6.1: Traffic and Pedestrian Count in Anna Salai

S. No.	Location	Time of survey	Pedestr-ians	Cyclists	NMTs	Two-wheelers	Autos	Cars/ Vans	Buses/ Trucks
a.	Karunanidhi Road	5.00-5.30 p.m.	938	130	10	2178	666	978	116
b.	Near Spencers Plaza	6.00-6.30 p.m.	1372	118	10	2964	1084	1306	124
c.	Binny Road	6.45-7.15 p.m.	648	216	8	2748	530	1112	20
d.	Near Creams road	7.45-8.15 p.m.	1350	144	7	2208	552	702	64
e.	Subway at Creams road junction	8.30-9.00 p.m.	Pedestrian Count – 608 Cyclists - 10						

Source: Primary Survey

6.1.2. Pedestrian Count along Usman Road

T.Nagar is a busy central business district of Chennai city. It has changed its character quickly from a residential area to a busy commercial and mixed land-use development, with hundreds of people commuting daily for shopping. The traffic and pedestrian count was recorded along Usman road, which is a busy sub-arterial road in the precinct. The sub-arterial is 24m wide. The count was recorded at 5 locations along Usman road, Nageswara Rao Road and Venkat narayana Road (Map 6.3) on 24, October, 2010 in T.Nagar. The findings are elaborated in Table 6.2 and indicate that the pedestrian count is extremely high in the shopping precinct.



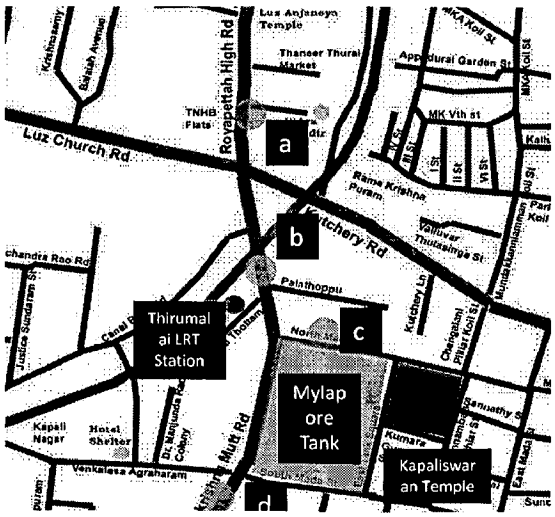
Map 6.3: South Usman Road stretch across T.Nagar

Source: By Author (Based on Detailed Development Plans for T.Nagar)

Table 6.2: Traffic and Pedestrian Count in South Usman Road

S. No.	Location	Time of survey	Pedestr-ians	Cyclists	NMTs	Two-wheelers	Autos	Cars/ Vans	Buses/ Trucks
a.	Near T.Nagar Bus Terminus	3.00-3.30 p.m.	5528	86	6	702	394	348	110
b.	Infront of Ranganathan Street	3.45-4.15 p.m.	Pedestrian Count was as high as 7350 persons.						
c.	Below the flyover	4.30-5.00 p.m.	8720	20	0	136	28	88	0
d.	Nageswara Rao Road (one-way street)	5.30-6.00 p.m.	2096	46	0	700	60	544	16
e.	Towards Venkat narayana Road	6.30-7.00 p.m.	1460	80	0	960	502	780	18

Source: Primary Survey



Map 6.4: Royapettah High Road along Luz Church area in Mylapore

Source: mapmychennai.com

6.1.3. Pedestrian Count along Royapettah High Road

Royapettah High Road is a major collector road of the city which passes through a major mixed land-use precinct of Chennai known as Mylapore. Mylapore, initially planned as a residential cum religious space with the Kapallishwar Temple and the Temple Tank, changed its character to become a commercial cum mixed land-use development. Pedestrian volume generated is high since a lot of people travel through

public transport to Mylapore and tend to walk. The Royapettah High Road has a varying width of 18m-21m. The count was recorded at 4 locations (Map 6.4) on 21, October, 2010 in Mylapore. The findings are elaborated in Table 6.3 and indicate that the pedestrian count is high in the precinct alongwith a very high traffic count.

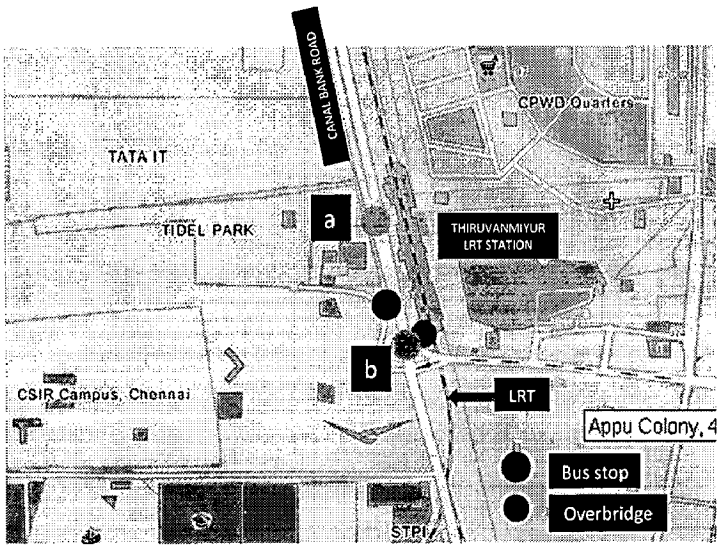
Table 6.3: Traffic and Pedestrian Count in Royapettah High Road

S. No.	Location	Time of survey	Pedestr-ians	Cyclists	NMTs	Two-wheelers	Autos	Cars/ Vans	Buses/ Trucks
a.	Near Royapettah High Road	6.00-6.30 p.m.	750	140	4	464	146	154	24
b.	Near Thirumalai station	6.45-7.15 p.m.	766	98	4	776	276	282	50
c.	At North Mada St.	7.30-8.00 p.m.	874	52	6	316	174	138	0
d.	At Ramakrishna Mutt Road	8.15-8.45 p.m.	1088	156	8	448	1172	558	98

Source: Primary Survey

6.1.4. Pedestrian Count along Canal Bank Road

Canal Bank Road, which further connects to the Old Mahabalipuram Road (connecting the city with the metropolitan area), was newly developed, during the inset of IT Parks through the corridor. The IT corridor houses the famous Tidal Park (a major IT Park of Chennai) and receives a lot of vehicular traffic. The count was recorded at 2 locations (Map 6.5) on 23, October, 2010. The findings are elaborated in Table 6.4 and indicate that the pedestrian count is low in the precinct during non-peak hours due to lack of commercial activities.



Map 6.5: Canal Bank Road along Tidal Park stretch

Source: www.wikimapia.com

Table 6.4: Traffic and Pedestrian Count in Canal Bank Road

S.No.	Location	Time of survey	Pedestr-ians	Cyclists	NMTs	Two-wheelers	Autos	Cars/ Vans	Buses/ Trucks
a.	Across Canal Bank Road	6.30-7.00 p.m.	816	118	10	2814	508	1522	146

b.	Across the Pedestrian Over-bridge	7.15-7.45 p.m.	Pedestrian count - 330

Source: Primary Survey

6.1.5. Findings

1. Anna Salai –

a) Survey readings indicate that the highest volume of vehicular traffic is generated at Anna Salai of the four locations, due to its arterial nature.

b) Two-wheelers are the major traffic generators, followed by cars.

c) A volume of more than 23-26 persons/footway width/minute generated is regarded as a high pedestrian count.

d) Pedestrian count is high at Anna Salai (as per the standard above) due to its commercial and institutional nature, since a majority of commuters travel to the area by public transport.

e) This implies that there is a strong need to work out an integrated strategy for both pedestrians as well as motorists, with major priority to be laid on improving the pedestrian convenience.

2. Usman road –

a) The pedestrian count at T.Nagar surpasses the count at Anna Salai. It is astronomically high since it is one of the most desired shopping destinations in Chennai city and people flock in thousands to shop at T.Nagar from various parts of the state and the country.

b) The volume of vehicular traffic generated is less as compared to Anna Salai, implying that there is a strong need to plan especially for the pedestrians.

3. Royapettah High road –

a) Connecting one of the oldest core areas of Chennai, Mylapore, to other areas, Royapettah High road experiences a high pedestrian count.

b) The vehicular traffic volume is not exceptionally high, due to the restricted road widths. The two-wheeler traffic is the highest amongst all the vehicle modes.

c) This implies a strong need for pedestrianization of certain streets and a strategy to revitalize the original character of the core with the present urban development.

4. Canal Bank road –

a. Being a prime arterial connecting the city to the metropolitan area, the traffic volume count is found to be very high, with two-wheelers forming the majority of the traffic, followed by cars.

b. Pedestrian count is observed to be high during the morning and the evening peak hour, apart from which the count is very low during the day.

c. This implies a strong need to introduce commercial activities in the institutional zone and integrate the existing Light Rail Transit with the land use, to bring about a transit-oriented development, which would generate a high volume of pedestrian traffic and convert the precinct into a lively, bustling pedestrian-oriented development.

6.2. Questionnaire Survey

Pedestrian safety is a very important aspect of road safety. Everyone is a pedestrian at some point of time in his or her journey. A pedestrian comes into contact with so many vehicles on day-to-day basis, which leaves him a very vulnerable traveler. The situation gets even worse when the pedestrian is physically handicapped or visually impaired. A questionnaire survey was conducted in the city in this regard to analyze how safe the pedestrians of Chennai feel to walk on the streets and what level of pedestrian amenities are available in the city. Through the survey, inputs from people were gathered, on how to bring about a desirable change in the existing pedestrian environment and increase the safety and security of people on foot. The questionnaire survey Performa has been depicted in Appendix 1.

6.2.1. Aim of the survey

The aim of the survey was to assess the degree of safety to walk in Chennai and analyze the difficulties faced by pedestrians and their suggestions to improve the pedestrian scenario.

6.2.2. Objectives of the survey

1. To know the difficulties faced by pedestrians when they walk.
2. To assess the knowledge of traffic rules amongst pedestrians.
3. To review the facilities provided for the pedestrians.
4. To gather inputs and recommendations from pedestrians to make walking a safe, secure and convenient mode of transport.
5. To compare the findings of this survey with a previous survey, executed in 1990 and to analyze the change in the pedestrian safety scenario.

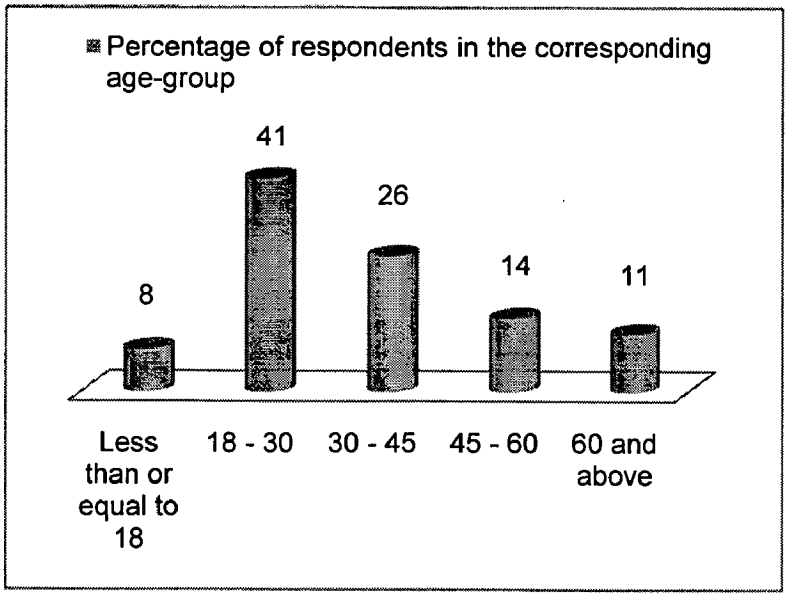
6.2.3. Methodology of the survey

The survey was executed between 23.12.10 to 28.12.10 in select stretches of Chennai like Anna Salai, T.Nagar, Anna Nagar, Crompet and Mylapore. The survey was carried out through Questionnaire method consisting of 20 questions in English, with multiple choices. The survey included respondents from various age-groups, to understand their difficulties as pedestrians.

6.2.4. Total number of pedestrians surveyed

Some 100 respondents were surveyed from diverse fields, professions and age-groups. Of the 100 respondents surveyed, 52% were males and 48% were females.

6.2.5. Age-Group of the respondents



Of the 100 pedestrians surveyed, more than two-fifth (41%) of them were in the age-group of 18-30. Slightly more than one-fourth (26%) of them were between 30-45 years of age. 14% were between 45-60 years of age and slightly more than one-tenth (11%) belonged to the age-group of 60 years and above. Less than one-tenth (8%) were 18 years of age or below. This has been illustrated in Fig. 6.1.

Fig. 6.1: Percentage of respondents in the respective Age-groups

Source: Primary Survey

6.2.6. City familiar to the respondents

Of the 100 respondents surveyed, all of them were residents of Chennai and were familiar with the city. One-tenth (10%) of the respondents were also familiar with Delhi and slightly less than one-tenth (8%) were also familiar with Mumbai. Many respondents were familiar with other cities and towns on account of their ancestral origin, nature of work, recreational visits etc. Table 6.5 shows the list of cities that the respondents are familiar with.

Table 6.5: List of cities familiar to the respondents

S. No.	List of cities familiar to the respondents	Number of respondents
1.	Chennai	100
2.	Delhi	10
3.	Mumbai	8
4.	Vishakapatnam	2
5.	Trivandrum	2
6.	Trichy	2
7.	Hyderabad	1
8.	Tanjore	1
9.	Pondicherry	1
10.	Kozhikode	1
11.	Durgapur	1
12.	Varanasi	1
13.	Madurai	1
14.	Indore	1
15.	Kolkata	1
16.	Pune	1
17.	Coimbatore	1
18.	Dubai	1

Source: Primary Survey

6.2.7. Occupation Category

Of the 100 respondents surveyed, slightly more than one-fourth (26%) of the respondents were students. A little less than one-fourth (23%) of the respondents were Professionals in various

fields. 16% were in service in the centre, state or the public sector. 11% were retired persons. Others were engaged in private sector companies and business while some others were self-employed and housewives. The percentage of respondents engaged in various occupations has been illustrated in Fig. 6.2.

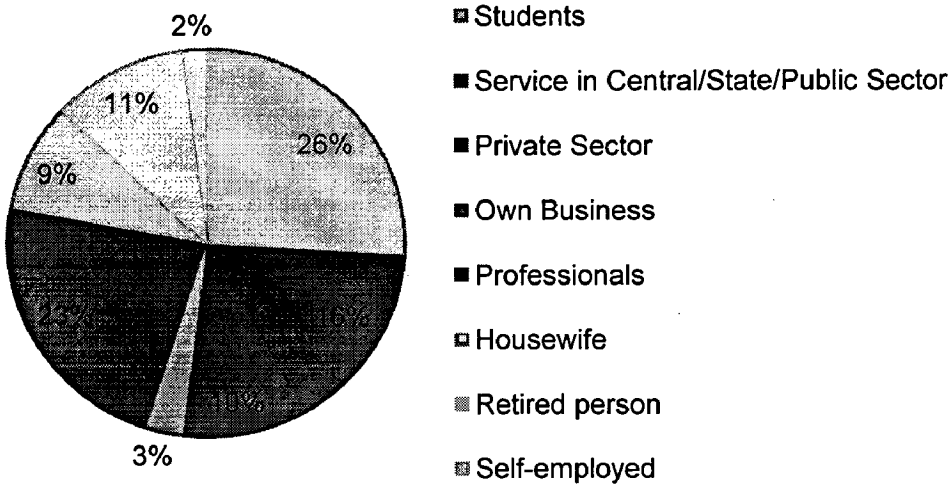


Fig. 6.2: Percentage of respondents in various occupations

Source: Primary Survey

6.2.8. Individual Driving Skills

Of the 100 respondents surveyed, slightly more than four-fifth (82%) of them knew driving. Of the respondents who knew driving, a little more than half (54%) of them knew to drive a gearless scooter. A little less than one-fifth (18%) of them knew to drive a scooter with gears. A little more than one-fifth (21%) knew to drive a motorcycle and slightly more than one-fourth (26%) knew to drive a car. None of the respondents surveyed drove a heavy vehicle or an auto. The percentage of respondents possess driving skills is illustrated in Fig. 6.3 and the percentage distribution of type of vehicles known by respondents to drive has been illustrated in Fig. 6.4.

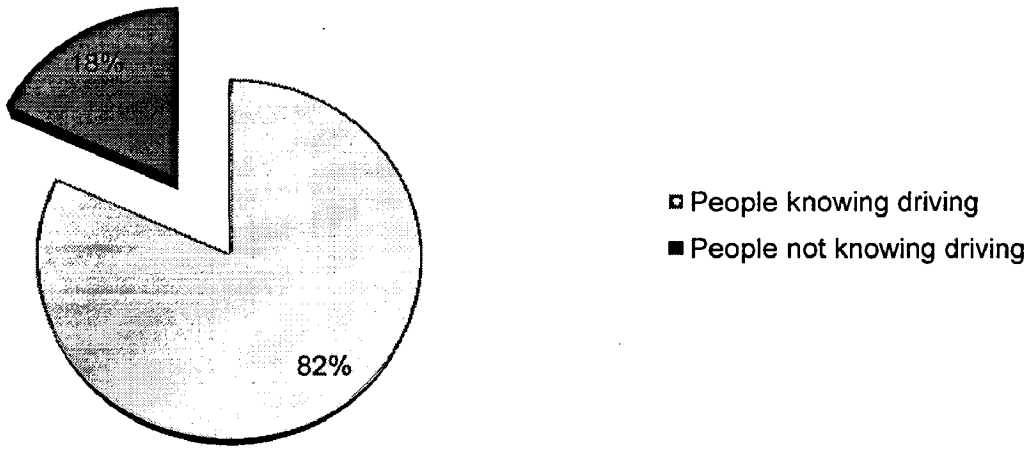


Fig. 6.3: Percentage of respondents to possess driving skills

Source: Primary Survey

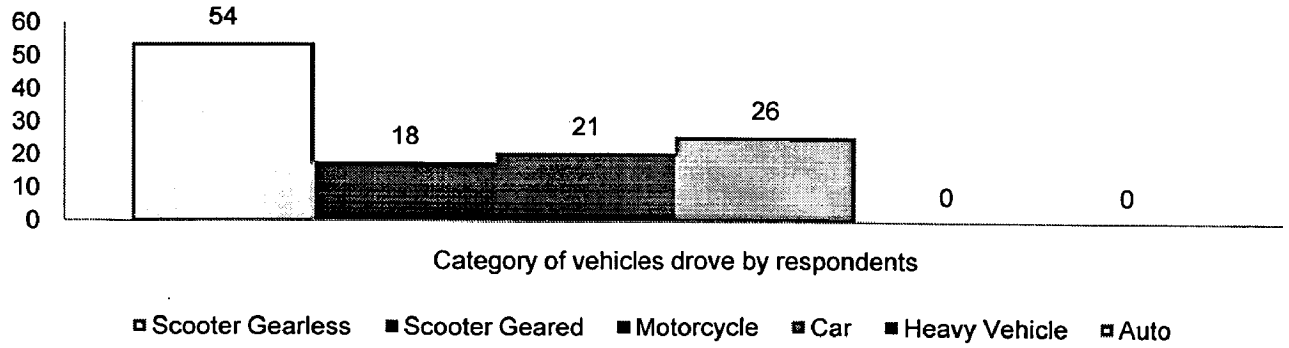


Fig. 6.4: Percentage Distribution of Type of vehicles known by respondents to drive

Source: Primary Survey

6.2.9. Ownership of Vehicles

Of the 100 respondents surveyed, slightly more than two-third (72%) of them owned a vehicle. Of the respondents who owned a vehicle, more than two-fifth (41%) of them had a gearless scooter. More than one-fifth (23%) of them owned cars. A little less than one-fifth (16%) of them owned motorcycles. One-tenth (10%) of them had scooter with gears. None of the respondents surveyed owned autos or heavy vehicles. The percentage of respondents owning vehicles is illustrated in Fig. 6.5 and the percentage distribution of type of vehicles owned by respondents has been illustrated in Fig. 6.6.

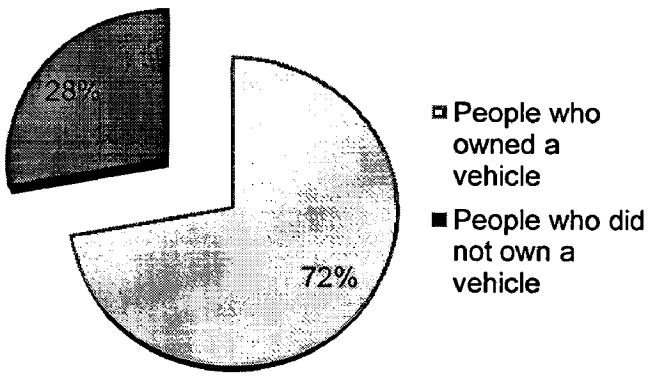


Fig. 6.5: Percentage of respondents to own vehicles

Source: Primary Survey

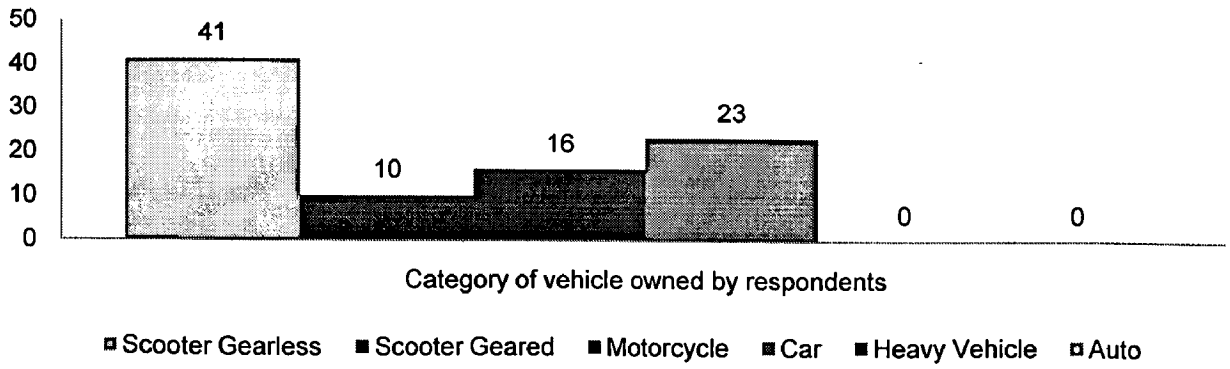


Fig. 6.6: Percentage Distribution of Type of vehicles owned by respondents

Source: Primary Survey

6.2.10. License to drive a vehicle

Of the 100 respondents surveyed, little less than three-fourth (73%) of them had license to drive a vehicle. Of the respondents who had license to drive, a little less than half (45%) of the

respondents had license to drive a gearless scooter. A little less than one-third (28%) of them had license to drive a car. One-fifth (20%) of them had license for a motorcycle. Slightly less than one-fifth (18%) of them had license to drive scooter with gears. None of them had a license for a heavy vehicle or an auto. The percentage of respondents to have license to drive is illustrated in Fig. 6.7 and the percentage distribution of type of vehicles with license to drive by respondents has been illustrated in Fig. 6.8.

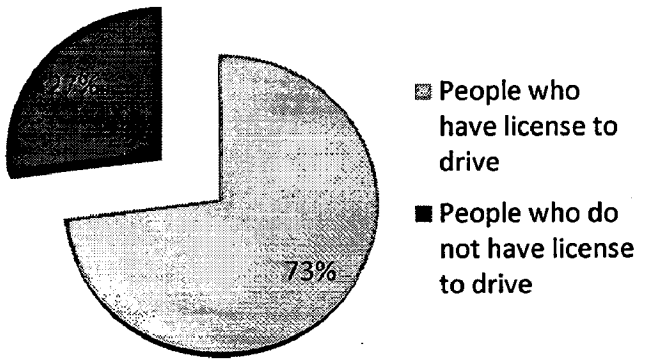


Fig. 6.7: Percentage of respondents to have license to drive a vehicle

Source: Primary Survey

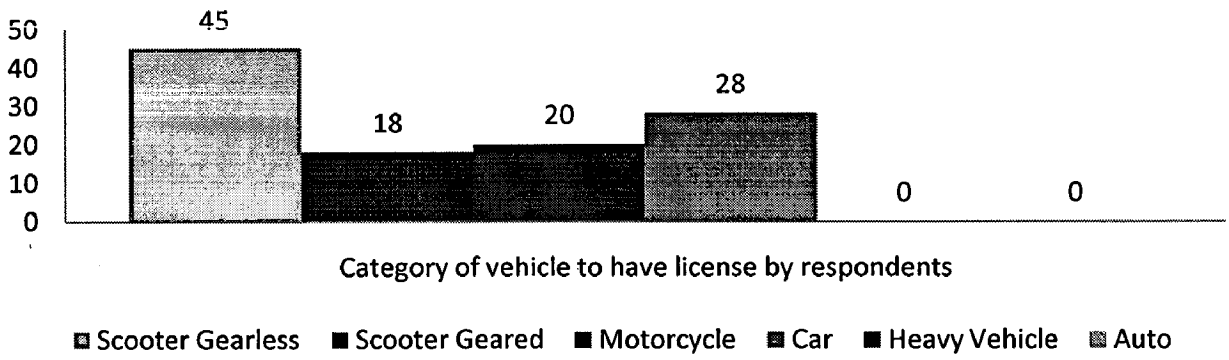


Fig. 6.8: Percentage Distribution of Type of vehicles with license to drive by respondents

Source: Primary Survey

6.2.11. Analysis of Questions

There were a total of 19 questions in the Performa. The last one dealt with suggestions that people want to recommend for improvement of pedestrian safety scenario in the city. The questions were designed to understand the condition of the existing pedestrian facilities, the knowledge of people towards road safety rules, the degree of safety a pedestrian feels while walking and the lack of facilities from the current pedestrian environment in the city. The results of the survey are discussed in the following paragraphs.

6.2.11.1. Major problem faced by pedestrians

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.9.

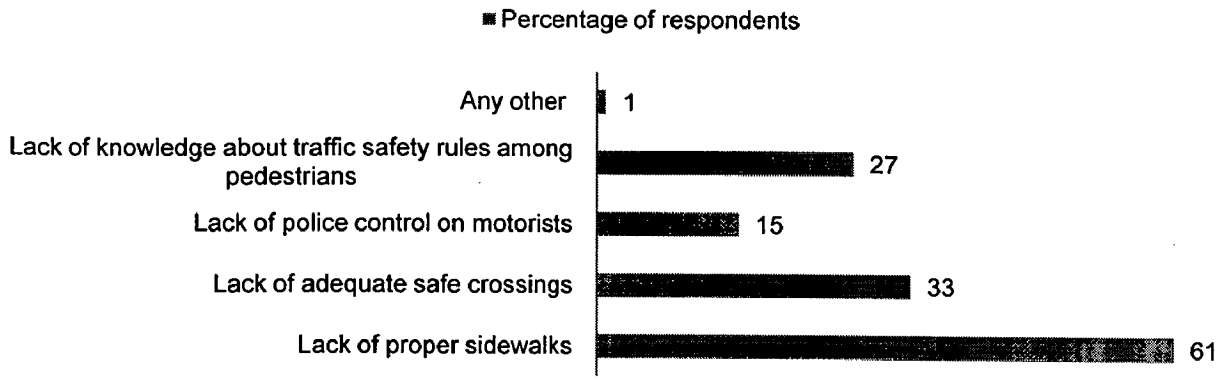


Fig. 6.9: Major Problem faced by Pedestrians

Source: Primary Survey

More than three-fifth (61%) of the people complained about lack of proper sidewalks. Some one-third (33%) of the respondents complained about lack of adequate safe crossings. A little more than one-fourth (27%) of the respondents complained about lack of knowledge about traffic safety rules among pedestrians. Less than one-fifth (15%) of the respondents complained about lack of police control on motorists. Only 1% of them complained about other problems like encroachments and lack of municipal control over encroachments.

6.2.11.2. Reasons for people walking on the road instead of the sidewalk

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.10.

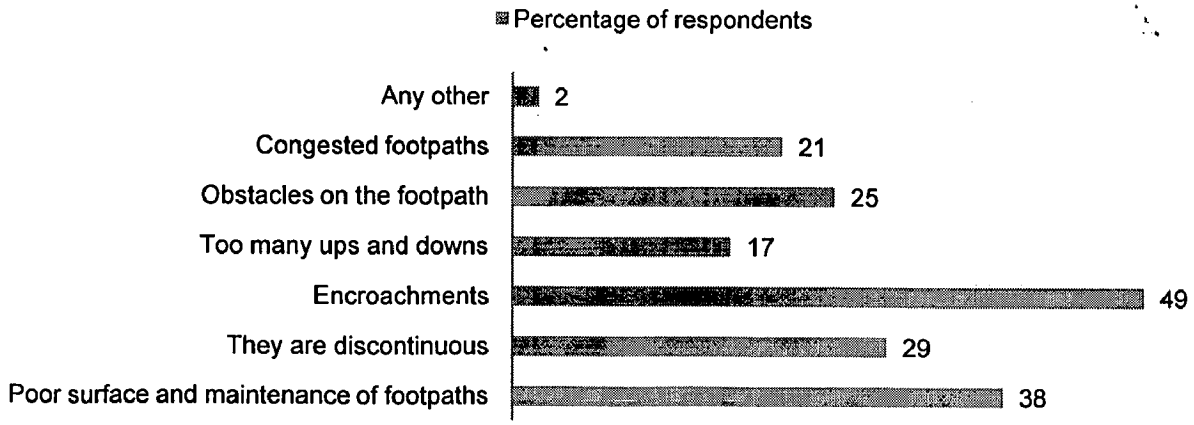


Fig. 6.10: Reasons for people walking on road instead of sidewalk

Source: Primary Survey

Nearly half (49%) of the respondents chose encroachments, followed by less than two-fifth (38%) of respondents complaining about poor surface and maintenance. Slightly less than one-third (29%) of the respondents complained about discontinuous sidewalks. One-fourth (25%) chose obstacles on footpath and almost one-fifth (21%) chose congested footpaths. Very few

complained about too many ups and downs (17%). 2% of the respondents stated other reasons to be people out of the basic habit to walk on footpaths.

6.2.11.3. Facilities that would be most acceptable as a pedestrian for crossing

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.11.

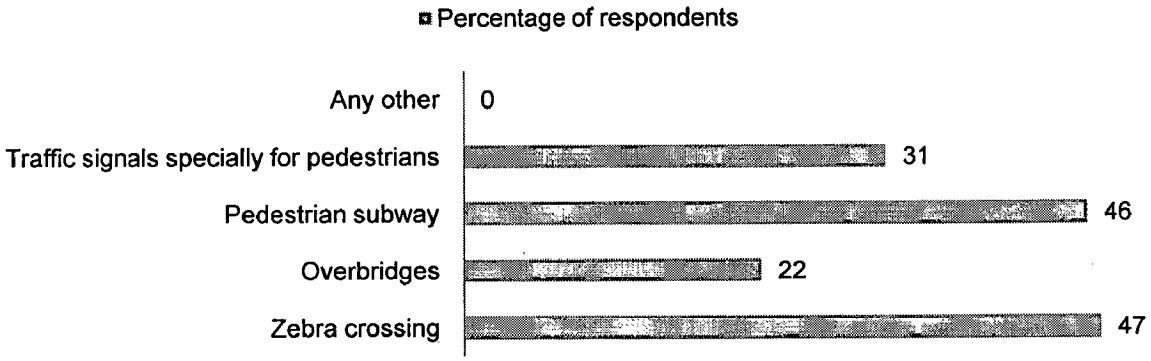


Fig. 6.11: Facilities that would be most acceptable as a pedestrian for crossing

Source: Primary Survey

More than four-fifth of the respondents have opted for zebra crossings and pedestrian subways. A little less than one-third (31%) opted for traffic signals specially designed for pedestrians with manually automated signals. Less than one-fourth (22%) suggested over-bridges.

6.2.11.4. Frequency of motorists to stop on their own to give way to pedestrians

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.12.

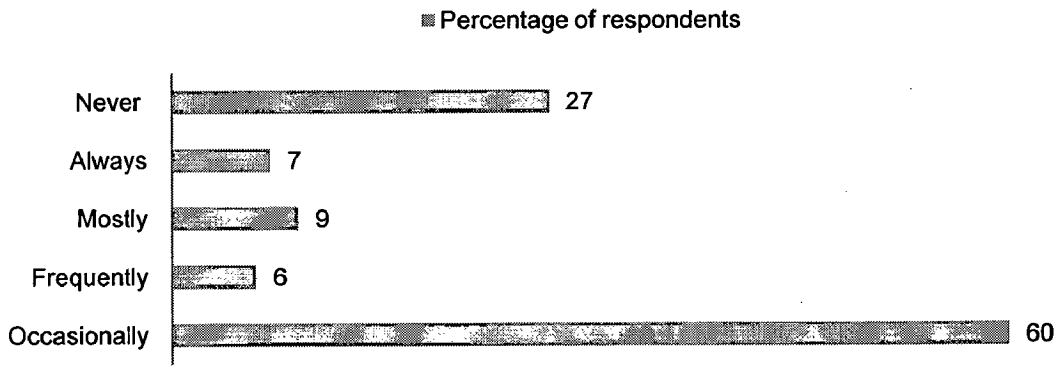


Fig. 6.12: Frequency of motorists to stop on their own to give way to pedestrians

Source: Primary Survey

More than three-fifth (60%) of people complained the motorists stopping occasionally on their own, to give way to pedestrians. Less than one-third (27%) opted for never. Some 9% opted for mostly. Some 7% opted for always. Some 6% opted for frequently.

6.2.11.5. Reasons for Pedestrians not using Pedestrian Crossing

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.13.

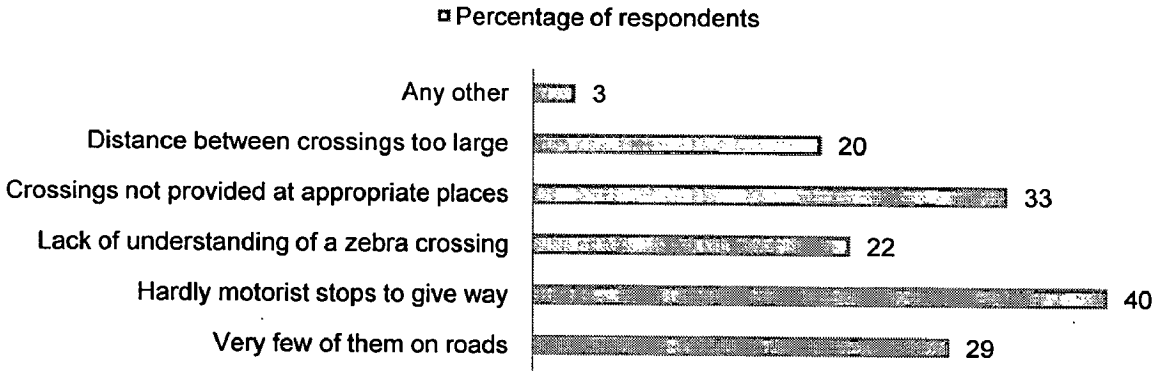


Fig. 6.13: Reasons for Pedestrians not using Pedestrian Crossing

Source: Primary Survey

Two-fifth (40%) of the people complained about motorists not stopping to give way. Another one-third (33%) complained of crossings not placed appropriately. A little less than one-third (29%) complained of lack of zebra-crossings. A little more than one-fifth (22%) complained of lack of people's understanding about zebra-crossings. Some one-fifth (20%) also complained of large distances between two crossings. Some 3% of the respondents stated other reasons too like people not walking an extra mile to reach a pedestrian crossing. People are out of practice to walk and some people want to cross intermediately at a traffic median.

6.2.11.6. Precautions taken before crossing by a pedestrian

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.14.

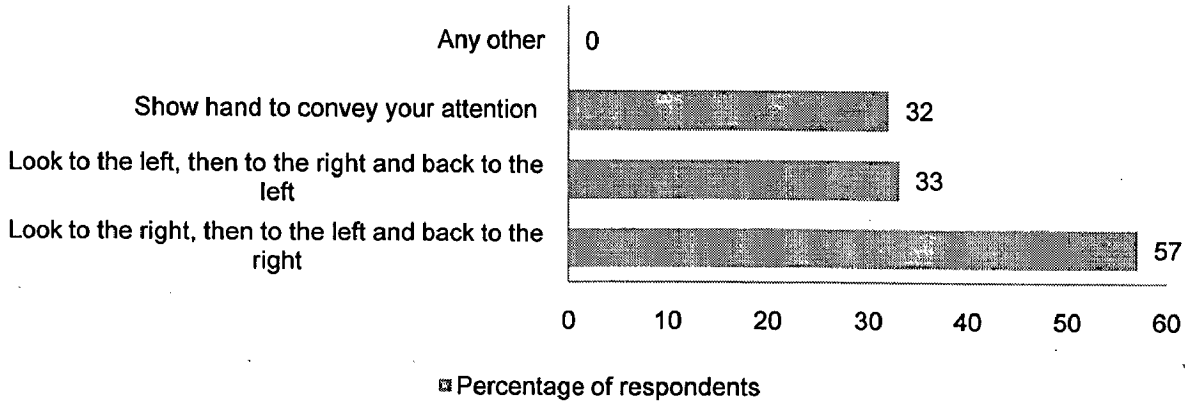


Fig. 6.14: Precautions taken before crossing by a pedestrian

Source: Primary Survey

More than half (57%) of the respondents chose to look right, then left and then again right.

One-third (33%) of the people chose to look left, then right and then again left. Less than one-third (32%) of the people chose to show hand to convey the attention to cross.

6.2.11.7. Pedestrian movement in case of no sidewalks

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.15.

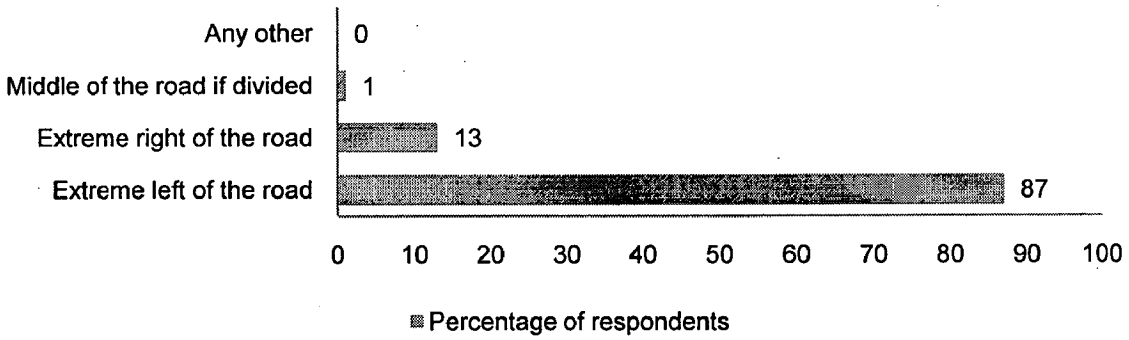


Fig. 6.15: Pedestrian movement in case of no sidewalks

Source: Primary Survey

More than four-fifth (87%) of the people chose extreme left of the road. Slightly more than one-tenth (13%) chose extreme right of the road to walk. Only 1% of the respondents chose to walk in the middle of the road, if it is divided.

6.2.11.8. Advisable position to cross in case of parked vehicles

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.16.

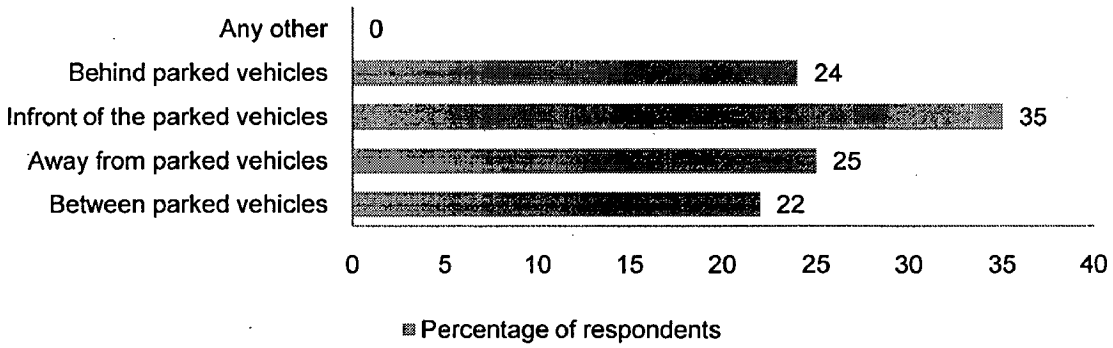


Fig. 6.16: Advisable position to cross in case of parked vehicles

Source: Primary Survey

More than one-third (35%) of people opted infront of parked vehicles. One-fourth (25%) of the people opted to cross away from parked vehicles. Slightly less than one-fourth (24%) of the people opted to cross behind parked vehicles. Slightly more than one-fifth (22%) of the people opted to cross between parked motor vehicles.

6.2.11.9. The correct place to cross the road

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.17.

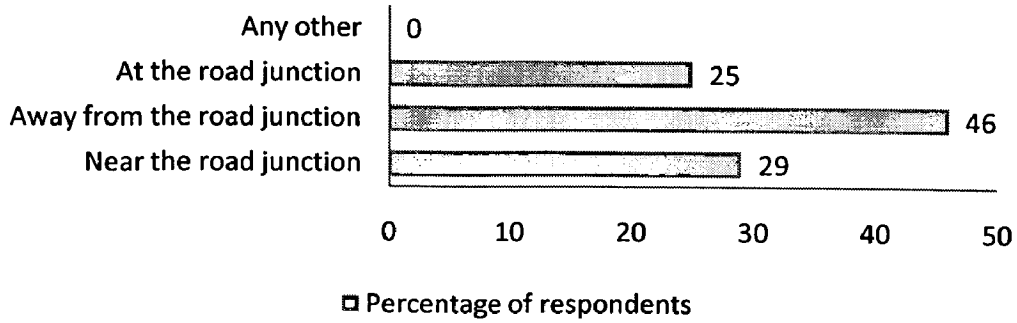


Fig. 6.17: The correct place to cross the road

Source: Primary Survey

Slightly less than half (46%) of the people opted to cross away from the road junction. A little less than one-third (29%) of the people opted to cross near the road junction. One-fourth (25%) of the people opted to cross at the road junction.

6.2.11.10. Problems faced most frequently while crossing junctions with traffic lights

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.18.

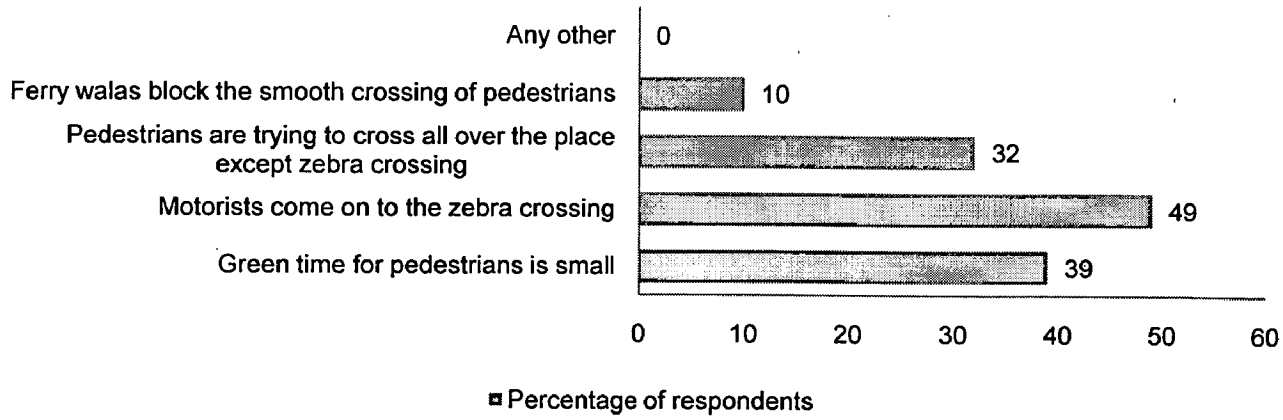


Fig. 6.18: Problems faced most frequently while crossing junctions with traffic lights

Source: Primary Survey

Slightly less than half (49%) people complained that motorists come on to zebra crossing. Slightly less than two-fifth (39%) people complained that the green time for pedestrians is too small for crossing. Slightly less than one-third (32%) people complained that pedestrians try to cross all over the junction except the zebra crossing. Some 10% people stated that the ferry walas block the smooth crossing of pedestrians.

6.2.11.11. Vehicles that care least for the pedestrians

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.19.

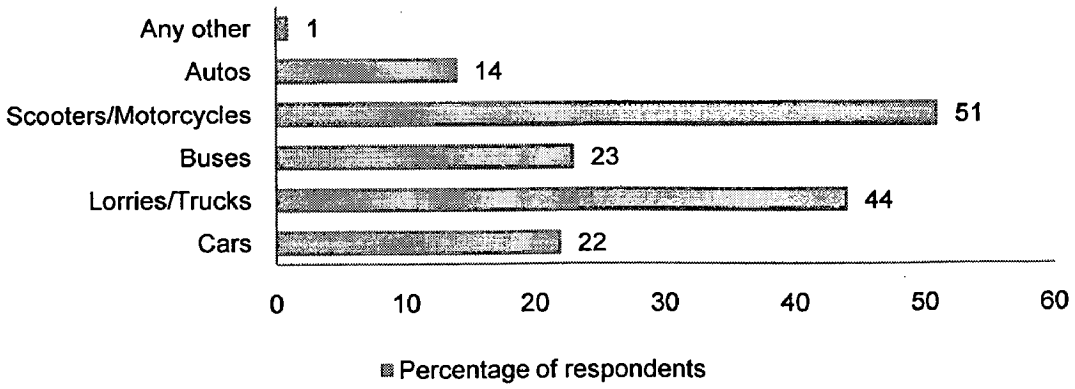


Fig. 6.19: Vehicles that care least for the pedestrians

Source: Primary Survey

Slightly more than half (51%) of the respondents chose scooters and motorcycles. Less than half (44%) of the respondents also chose lorries/ trucks. A little less than one-fourth (23%) of the respondents chose buses. A little more than one-fifth (22%) of the respondents chose cars. A little more than one-tenth (14%) of the respondents chose autos. Only one respondent chose **all of them**, under others if any.

6.2.11.12. Vehicle-users who are least considerate towards pedestrians

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.20.

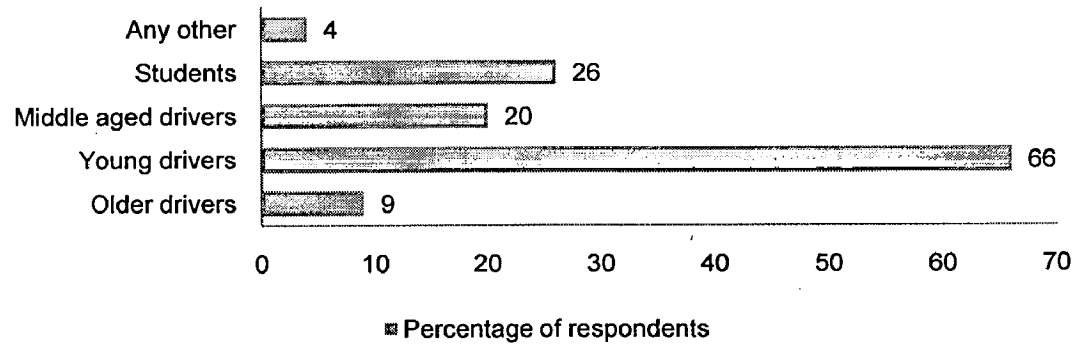


Fig. 6.20: Vehicle-users who are least considerate for the pedestrians

Source: Primary Survey

Two-third (66%) of the respondents complained about the young drivers. Slightly more than one-fourth (26%) of the people stated students to be the least considerate. Some one-fifth (20%) of the people stated the middle aged drivers to be the least considerate. Slightly less than one-tenth

(9%) of the people stated the older drivers to be the least considerate. Only some 4% suggested drunk drivers to be least considerate to pedestrians.

6.2.11.13. Consideration of Dangerous drivers on roads

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.21.

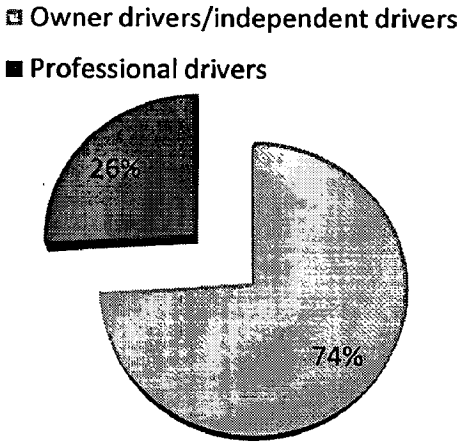


Fig. 6.21: Drivers who are more dangerous on roads

Source: Primary Survey

Nearly three-fourth (74%) of the respondents stated owner drivers/independent drivers to be more dangerous to professional drivers.

6.2.11.14. Reasons for many pedestrians getting killed in road accidents

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.22.

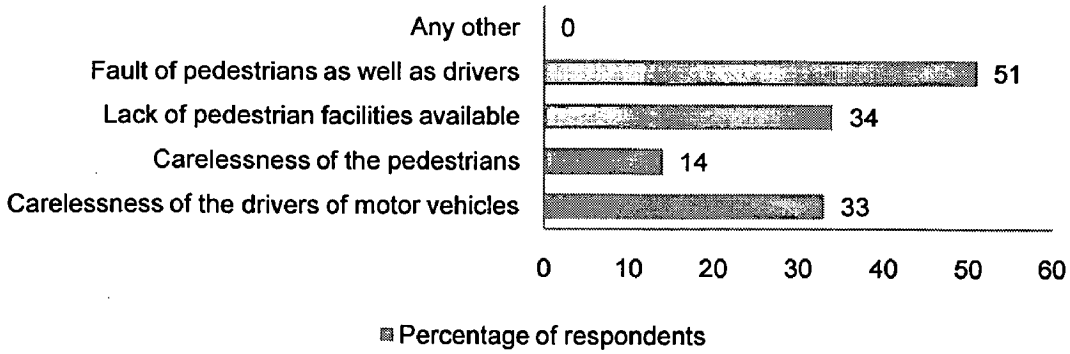


Fig. 6.22: Reasons for many pedestrians getting killed in road accidents

Source: Primary Survey

More than half (51%) of the people stated the fault of pedestrians as well as drivers. Slightly more than one-third (34%) of the people stated the lack of pedestrian facilities available. Some

one-third (33%) of the people stated the carelessness of the drivers of motor vehicles. Less than one-fifth (14%) of the people stated the carelessness of the pedestrians themselves.

6.2.11.15. Sources from which road safety rules were learned

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.23.

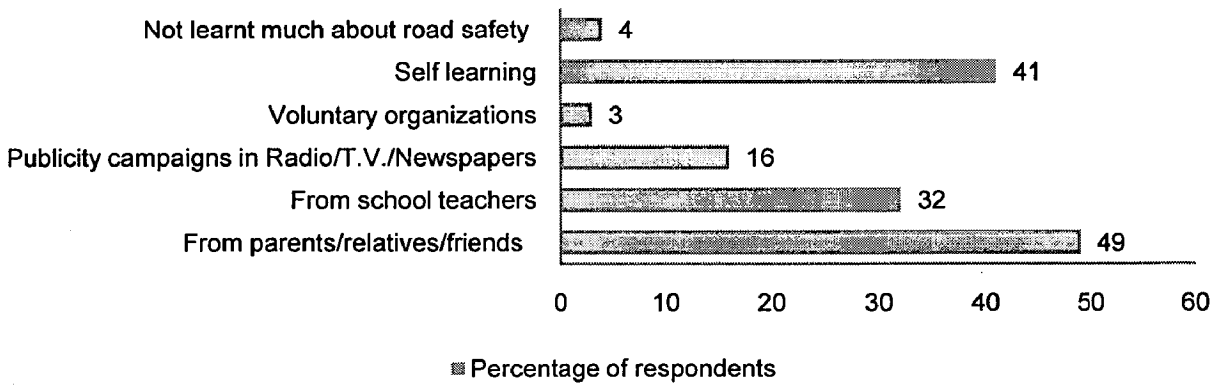


Fig. 6.23: Reasons for many pedestrians getting killed in road accidents

Source: Primary Survey

Slightly less than half (49%) of the people chose parents/relatives/friends. Slightly more than two-fifths (41%) of the people chose self-learning. Slightly less than one-third (32%) of the people chose school teachers. Less than one-fifth (16%) of the people chose publicity campaigns in radio/T.V./Newspapers. 4% chose not knowing much about road safety and 3% chose voluntary organizations.

6.2.11.16. Suitable media for educating about pedestrian safety

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.24.

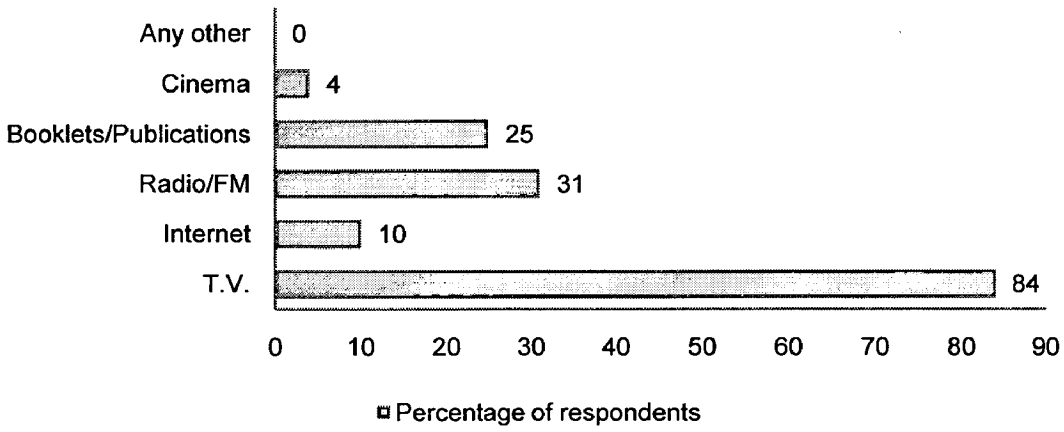


Fig. 6.24: Suitable media for educating about pedestrian safety

Source: Primary Survey

More than four-fifth (84%) of the people suggested T.V. A little less than one-third (31%) of the people suggested radio/FM. One-fourth (25%) of the people chose booklets/publications. Some one-tenth (10%) of the people suggested internet while some 4% suggested cinema.

6.2.11.17. Preferred proximity of mass transit stop from home, place of work, etc.

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.25.

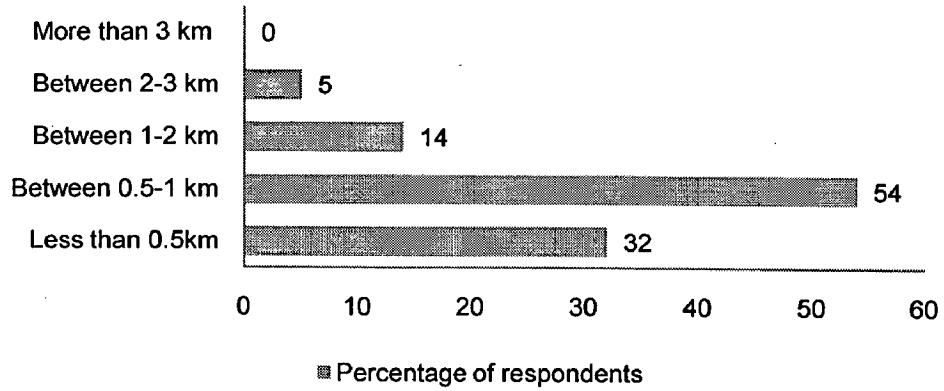


Fig. 6.25: Preferred proximity of mass transit stop from home, place of work, shopping etc.

Source: Primary Survey

More than half (54%) of the people opted for 0.5-1km. Slightly less than one-third (32%) of the people opted for less than 0.5km. More than one-tenth (14%) of the people opted for 1-2km. Hardly some 5% people opted for 2-3km and none of them opted for more than 3km.

6.2.11.18. Measures which can bring in maximum effectiveness to increase pedestrian safety

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.26.

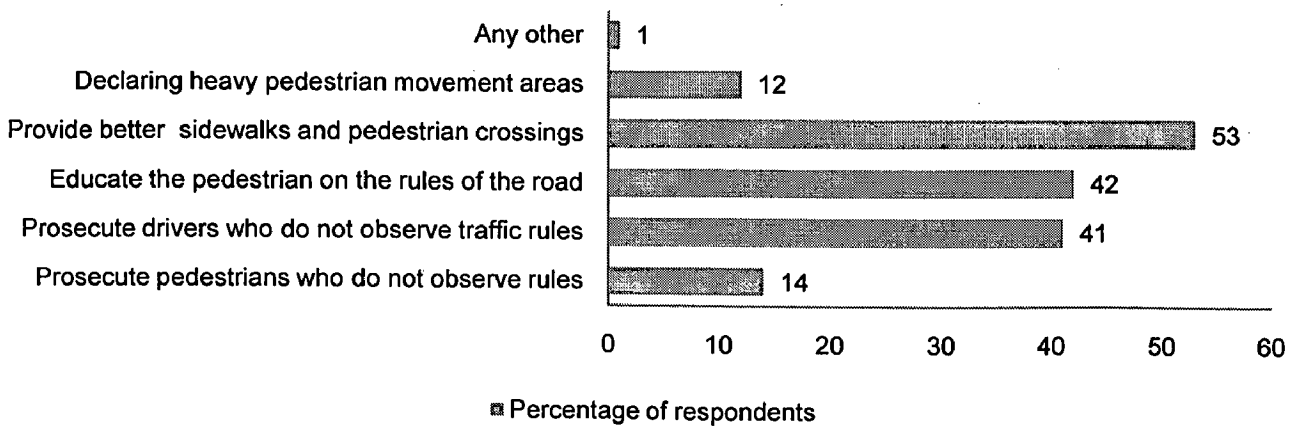


Fig. 6.26: Measures which can bring maximum effectiveness to increase pedestrian safety

Source: Primary Survey

More than half (53%) of the people recommended to provide better facilities. Slightly more than two-fifth (42%) of the people recommended to educate the pedestrians about rules of the road. Slightly more than two-fifth (41%) of the people recommended to prosecute the motor vehicle drivers who break rules. Less than one-fifth (14%) of the people recommended to prosecute the pedestrians who break traffic rules. More than one-tenth (12%) of the people recommended to declare heavy pedestrian movement areas. Only 1% recommended to educate both the drivers and the motorists.

6.2.11.19. Elements lacking in the pedestrian pathways

The options were chosen by the respondents by giving priority (1, 2, 3...) in case of more than one option and the results are illustrated in Fig. 6.27.

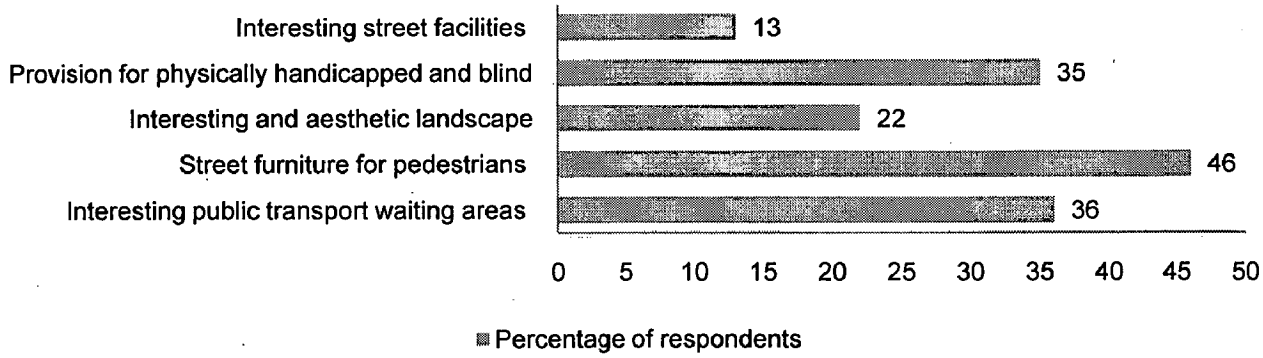


Fig. 6.27: Elements lacking in the pedestrian pathways

Source: Primary Survey

A little less than half (46%) of the people opted for street furniture. Less than two-fifth (36%) of the people opted for interesting public transport stops and waiting areas. A little more than one-third (35%) of the people opted for provision for physically handicapped and blind. A little more than one-fifth (22%) of the people recommended interesting and aesthetic landscape. A little more than one-tenth (13%) of the people recommended interesting street facilities like outdoor café, etc.

6.2.11.20. Suggestions

Some 48 out of 100 respondents recommended suggestions for the improvement of pedestrian facilities and pedestrian safety in the city. The suggestions have been illustrated in Fig. 6.28. indicates the percentage of the respondents to have suggested various recommendations (out of the 48 respondents), put forth in the order of priority, starting from the least to the most prioritized one. The resu

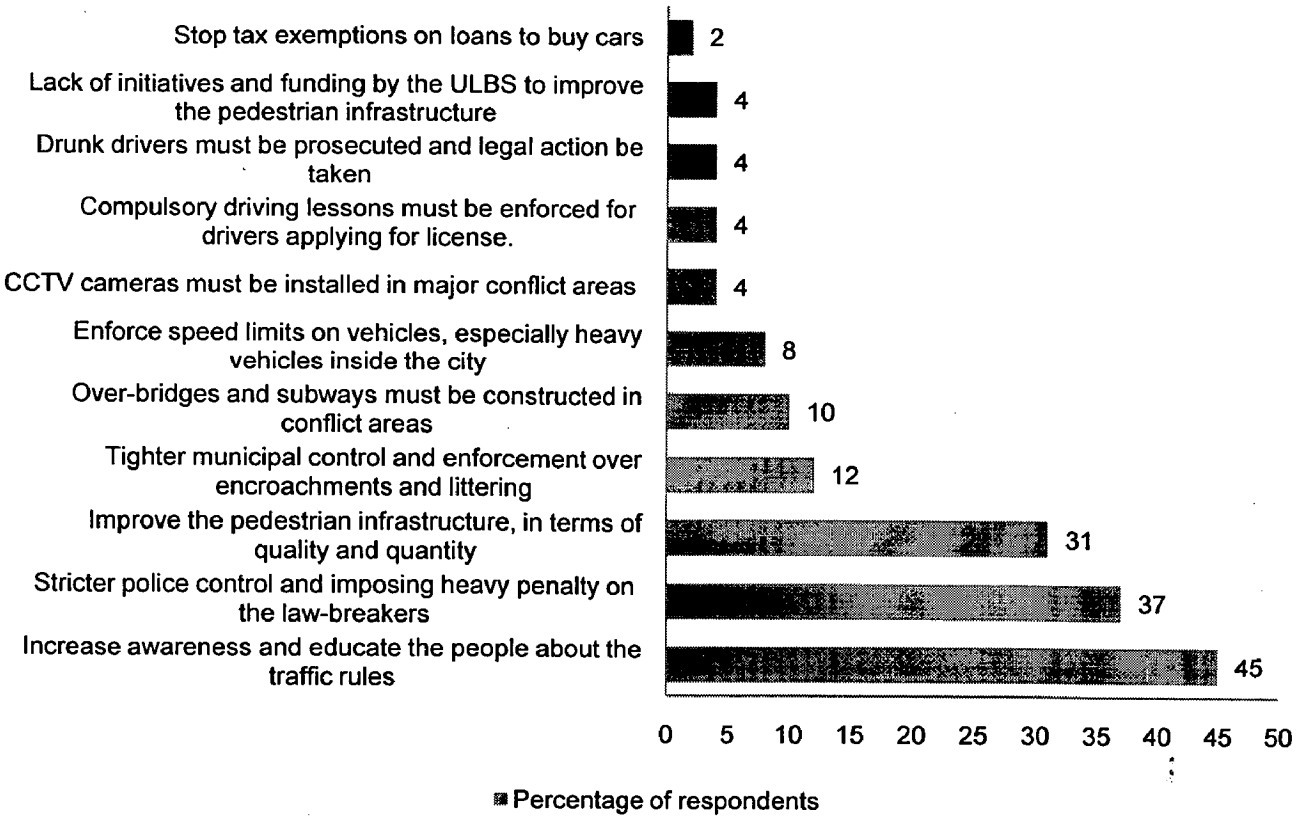


Fig. 6.28: Suggestions recommended to improve pedestrian safety

Source: Primary Survey

6.2.12 Comparison with earlier Survey (1990)

A similar survey was conducted in December, 1990 by The Institute of Road Transport & Madras Traffic Police, wherein they surveyed some 13,000 persons. A comparison of both the survey results has been summarized and shown in Table 6.6.

Table 6.6: Comparison between results obtained from 1990 and 2010

S.No.	Subject	Opinion from 1990 survey	Opinion from current survey	Inference
1.	Major problems faced by pedestrians	Lack of pedestrian sidewalks (30%)	Lack of pedestrian sidewalks (61%)	Large increase (worse)
2.	Reasons for people walking on the road instead of the sidewalk	Encroachments (51%) Poor surface and maintenance (21%)	Encroachments (49%) Poor surface and maintenance (38%)	Marginal decrease (almost same)
3.	Facilities that would be most acceptable as a pedestrian for crossing	Subway (40%) Zebra crossing (20%)	Zebra crossing (47%) Subway (46%)	Notable increase (worse)
4.	Frequency of motorists to stop on their own to give way to pedestrians	Occasionally (53%)	Occasionally (60%)	Slight increase (bad)

5.	Reasons for Pedestrians not using Pedestrian Crossing	Hardly any motorist stops to give way to pedestrians (24%) Crossings are not provided at appropriate places (33%)	Hardly any motorist stops to give way to pedestrians (40%) Crossings are not provided at appropriate places (33%)	Notable increase (bad)
6.	Before crossing, what a pedestrian does	Look at the right, then to the left and again to the right (49%)	Look at the right, then to the left and again to the right (57%)	Notable increase (better)
7.	In case of no sidewalks, where usually a pedestrian walks	Extreme left of the road (68%)	Extreme left of the road (87%)	Notable increase (bad)
8.	The advisable position to cross, in case of parked vehicles	Infront of the parked vehicles (32%) Away from parked vehicles (33%)	Infront of the parked vehicles (35%) Away from parked vehicles (25%)	Marginal increase (bad)
9.	Correct place to cross the road	Away from the road junction (52%) Near the road junction (25%)	Away from the road junction (46%) Near the road junction (29%)	Marginal decrease (good)
10.	Problems faced most frequently while crossing junctions with traffic lights	Motorists generally come on to the zebra crossing meant for pedestrians (41%)	Motorists generally come on to the zebra crossing meant for pedestrians (49%)	Slight increase (bad)
11.	Vehicles that care least for the pedestrians	Lorries/Trucks (50%) Autos (24%)	Scooters/Motorcycles (51%) Lorries/Trucks (45%)	Notable increase (bad)
12.	Vehicle-users who are least considerate towards pedestrians	Young drivers (67%)	Young drivers (66%)	Almost same
13.	Consideration of Dangerous drivers on roads	Professional drivers (71%)	Owner drivers/independent drivers (74%)	Difference in opinion (worse)
14.	Reasons for many pedestrians getting killed in road accidents	Fault of pedestrians as well as drivers (42%)	Fault of pedestrians as well as drivers (51%)	Notable increase (bad)
15.	Sources from which road safety rules were learned	From parents/relatives/friends (18%) Self-learning (37%) From school teachers (19%)	From parents/relatives/friends (49%) Self-learning (41%)	Large increase (worse)
16.	Suitable media for educating about pedestrian safety	T.V. (58%)	T.V. (84%)	Large increase (worse)
17.	Preferred proximity of mass transit stop from home, place of work, shopping	---	Between 0.5-1km (54%)	---

18.	Measures which can bring in maximum effectiveness to increase safety	---	Educate the pedestrian on the rules (51%) Provide better sidewalks and crossings (42%)	---
19.	Elements lacking in the pedestrian pathways	---	Street Furniture (46%)	---

Source: Primary Survey

The results of the current survey are similar to the results obtained from the 1990 survey. The difference in opinion lies in professional drivers being considered more dangerous and pedestrian subways being preferred more than zebra crossings.

6.2.13 Major Findings

1) A majority of the respondents felt that the major problem faced by the pedestrians, is the lack of proper sidewalks and their lesser adequacy followed by adequate and safe pedestrian crossings. Thus, it highlights that the basic need for well-designed sidewalks and safe pedestrian crossings is also not adequately met within the city in most of the areas.
2) A majority of the respondents felt that the major reason for people walking on the road instead of sidewalk were encroachments followed by poor surface and maintenance of sidewalks. This highlights the problem of lack of enforcement by the local bodies. The pavement surface is often broken, dirty, littered and has drainage issues during the monsoons, indicating the lack of maintenance by the local authorities.
3) A majority of the respondents felt both zebra crossings and pedestrian subways to be most acceptable to pedestrians for crossing. Zebra-crossings are convenient as they are on-grade crossings but in heavy traffic junctions, grade separation becomes essential. Pedestrian subways serve as a very good solution of grade-separated crossings, but need to be made universally accessible and safe and maintained clean.
4) A majority of the respondents felt that the motorists occasionally stop on their own to give way to pedestrians. It is disturbing that in a metro city with a high percent of educated persons, hardly any motorist stops to give way. Lack of enforcement and inadequate road markings at many places further aggravate the problem of pedestrian safety.
5) Maximum percent of people felt that the crossings are not provided appropriately and their distances are too large, since very few of them are provided on the roads. This indicates the lack of a proper design in relation to suitable locations and their provisional adequacy, which is encouraging jaywalking and crossing anywhere except on the zebra-crossing. This has led to a rising toll of pedestrian accidents in the city.
6) A majority of the respondents stated that they look to the right, then to the left and again to the right, before crossing a road. Though a decent majority of people are aware of the right rule to cross a road, but it also highlights that nearly 40% do not know the right rule, indicating the need for road safety education through media, campaigns etc.

7) A majority of the respondents stated that they walk to the extreme left of the road. Only 13% of the respondents knew the correct way to walk on the right side in the absence of sidewalks. Since the rule 'Keep to the Left' is widely known, people mistakenly feel it applies for the pedestrians too, which is applicable only for vehicles. This again indicates the lack of awareness amongst people regarding traffic safety rules.
8) Only one-fourth of the respondents knew the correct way to cross away from the parked vehicles, in case there are parked vehicles adjoining a footpath. This indicates a strong need for awareness to be created by the ULBs, voluntary organizations, media etc. towards road safety as an incorrect way of crossing would result in accidents.
9) A majority of the respondents prefer to cross away from the road junction. Normally the zebra crossings are provided in each arm of the intersecting roads at a junction, which means near the junction. This clearly implies that people are in a habit of jaywalking and crossing anywhere on a road. It also implies that the pedestrians are afraid to cross near the road junctions because the motorists don't stop to give them way.
10) A majority of people had stated that the motorists come on to the zebra crossing, making it difficult to cross. This clearly indicates that there is an urgent need for strict enforcement by the traffic police and other related departments. A considerable percentage of people also complained that the green time for pedestrians is too small and one has to run across the road to cross. Though pedestrian signals are installed at some locations in the city, they hardly operate, indicating the poor state of pedestrian infrastructure.
11) A majority of respondents have opted for both scooters/motorcycles and lorries to be the least caring vehicles towards pedestrians. On account of the two-wheeler population to have increased so rapidly in the city, it indicates that there is a need for strict enforcement of traffic rules. It also indicates a need to employ traffic calming and impose speed limts and time restrictions on vehicles in major stretches of the city.
12) A majority of the people stated that it is the young drivers who are least considerate towards pedestrians, though a few also pointed towards drunk drivers. This indicates that in the spirit of youth, they forget their traffic learning and drive with a 'Don't Care' attitude, leading to greater fatalities of pedestrians on roads. This stresses on the need for awareness and education to be imparted on the younger driver especially, about the increasing causalities in the city and the importance of safe driving.
13) Nearly three-fourth of the respondents gave maximum priority to owner/independent drivers. Professional drivers are paid for their work and are comparatively more conversant with the rules and regulations to follow. With leniency in license tests, people tend to obtain licenses without a basic knowledge of traffic safety rules.
14) A majority of respondents complained that it is the fault of both pedestrians as well as drivers, because of which many pedestrians get killed in road accidents. A considerable percentage of people also complained about lack of pedestrian facilities because of which people tend to walk on the road instead of sidewalk and get more prone to road fatalities. This again indicates the need for a better pedestrian infrastructure and traffic management.

15) A majority of respondents stated that they have learnt the road safety rules from parents/relatives/friends or through self-learning. This supports the fact that many of the people surveyed are not well-versed with the correct rules, on account of no reliable source of learning.

16) A majority of respondents opted for T.V. as a very strong medium to educate the people about pedestrian safety. This must be on account of its higher viewership among all age-groups, genders etc. and thus the pedestrian safety message can be conveyed more quickly and effectively.

17) A majority of respondents preferred the proximity of an MRTS stop to be within 0.5-1km range from home, place of work, shopping etc. This indicates a convenient distance to walk and that people do not mind walking if provided with a better infrastructure and an available mass rapid transit for travel. This also lays conveys the need for creating walkable neighborhoods.

18) A majority of the people have given maximum priority to providing better sidewalks and crossings. A significant majority also laid emphasis on educating pedestrians about the rules and prosecuting the drivers who do not observe rules. This clearly implies that most of the respondents feel that the pedestrian infrastructure needs to be improved and that it is far from satisfactory in the city.

19) A majority of respondents have given maximum priority to street furniture for pedestrians. A considerable priority was also laid on interesting public transport waiting areas and provision for physically handicapped and blind. This indicates that the people feel a strong absence of amenities like street furniture, trash receptacles, etc. among the existing pedestrian facilities. Interesting public transit areas become all the more important in a metro city like Chennai where a considerable share of people commute by bus or light rail transit. Universal accessibility is completely absent in the sidewalks and survey result clearly points out the strong need for such provisions.

20) Among the suggestions recommended by people, maximum percent of people indicated to increase awareness of people and motorists towards road safety. A considerable percent also laid emphasis on stricter enforcement by traffic police and improving the existing pedestrian facilities and amenities. The awareness is a secondary issue since firstly the availability of basic facilities for the pedestrians must be ensured and the existing pedestrian infrastructure be improved and re-designed.

21) A comparison of the existing survey results with the results of an earlier survey conducted in 1990 by Madras Traffic Police indicates that the scenario of pedestrian safety has further worsened in the city. Lack of sidewalks, encroached sidewalks, poor sidewalk surface and inadequacy of crossings has put pedestrian safety on stake. People are not much aware of the road safety rules and they fail to follow the traffic safety rules. Unmindful and rash driving has hindered pedestrian safety.

22) Survey results indicate that a majority of people laid stress on better amenities, wider sidewalks, safe crossings, attractive landscaping and interesting public transit stops to bring a desirable change in the pedestrian environment and thus secure pedestrian safety.

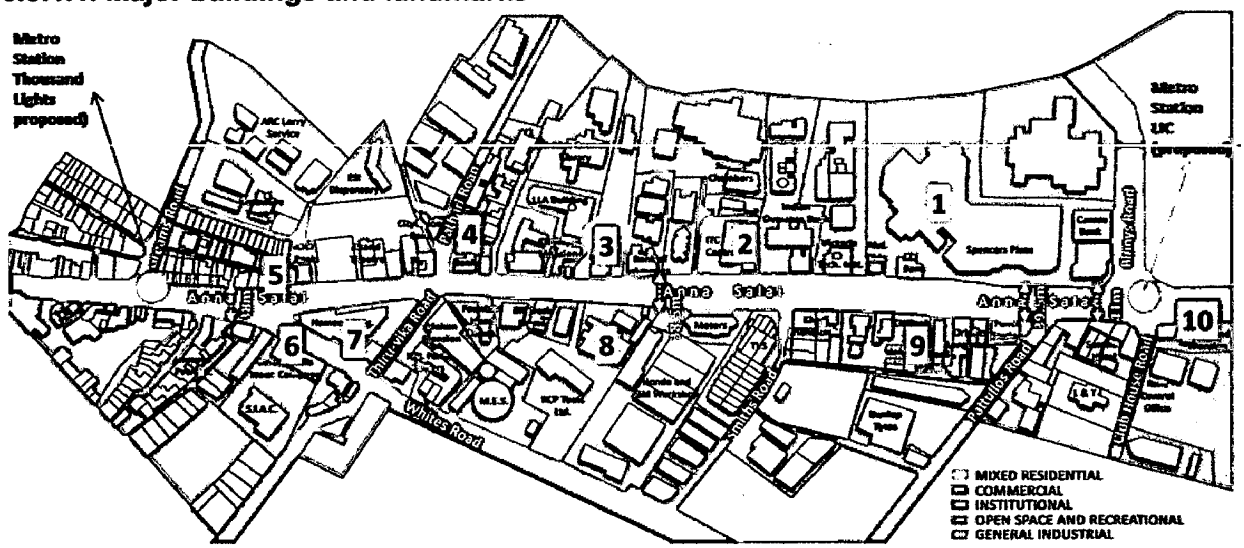
6.3. Visual Survey of Study areas

Two major stretches have been taken up in Chennai for the study. Study area 1 is a 1.1 km stretch of Anna Salai and study area 2 is an area of 1.1 sq.km. in T.Nagar. In order to suggest recommendations and work out detailed proposals to improve the existing pedestrian scenario and bring a desirable change, a visual tour of the stretches is needed to identify the existing facilities and their conditions on site. The following paragraphs illustrate the quality of the existing pedestrian facilities and the problems related to the pedestrian infrastructure.

6.3.1. Anna Salai

Anna Salai or the Mount road is a major arterial road of Chennai city. A stretch of 1.1 km has been demarcated along Thousand Lights between Binnys road and Greams road junction. The visuals below (Map 6.6, Fig. 6.29.1-6.29.10, Map 6.7, Fig. 6.30 & 6.31) depict the existing buildings and the conditions of pedestrian facilities along the stretch.

6.3.1.1. Major buildings and landmarks



Map 6.6: Study stretch along Anna Salai indicating the location of major buildings and landmarks

Source: By Author

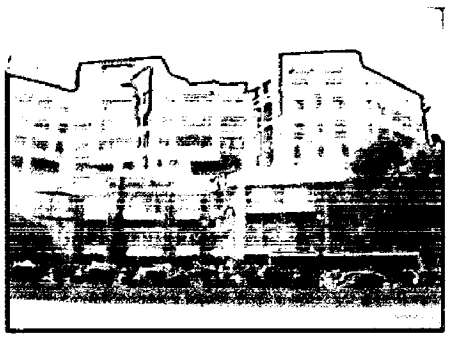


Fig. 6.29.1: Spencer Plaza

Source: By Author

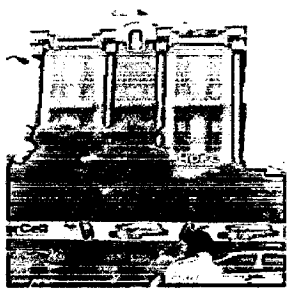


Fig. 6.29.2: ITC Centre

Source: By Author

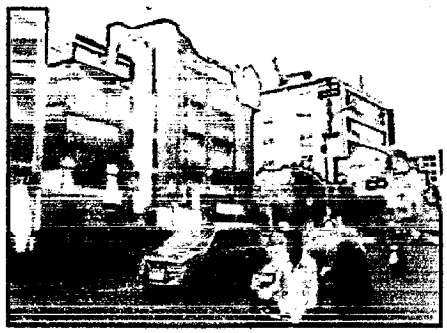


Fig. 6.29.3: City Union Bank

Source: By Author

Fig. 6.29.4: UCO Bank

Source: By Author

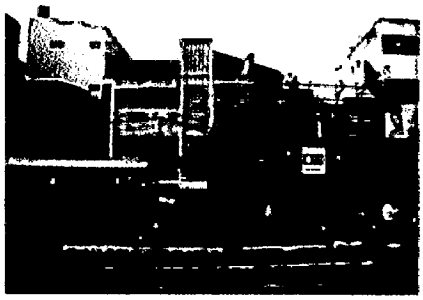


Fig. 6.29.5: Shops

Source: By Author

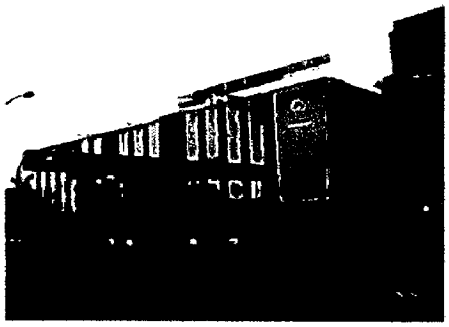


Fig. 6.29.6: United India Insurance

Source: By Author

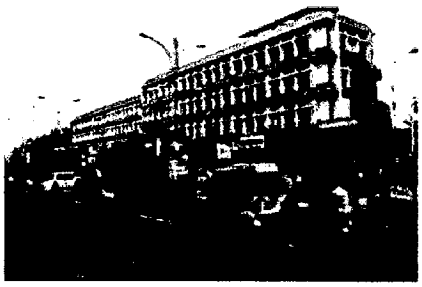


Fig. 6.29.7: Hameed Building

Source: By Author

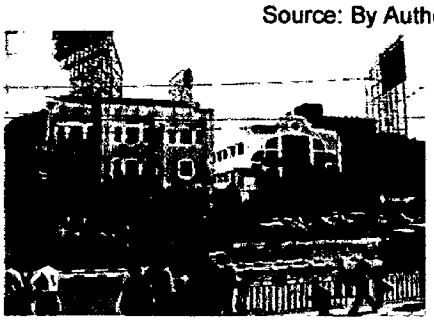


Fig. 6.29.8: Poppat Jamal and Sons

Source: By Author

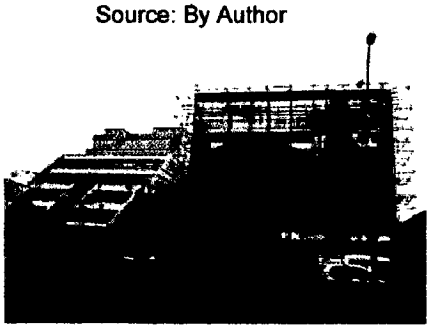


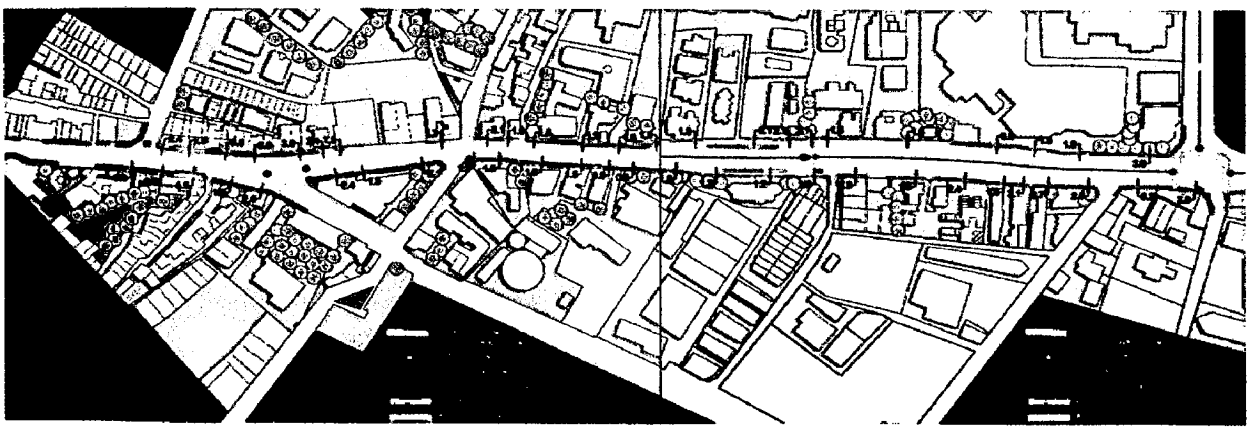
Fig. 6.29.9: CitiBank Building

Source: By Author

Fig. 6.29.10: Guruchand Mansion

Source: By Author

6.3.1.2. Existing pedestrian facilities and problems



Map 6.7: Study stretch along Anna Salai indicating the existing pedestrian facilities

Source: By Author

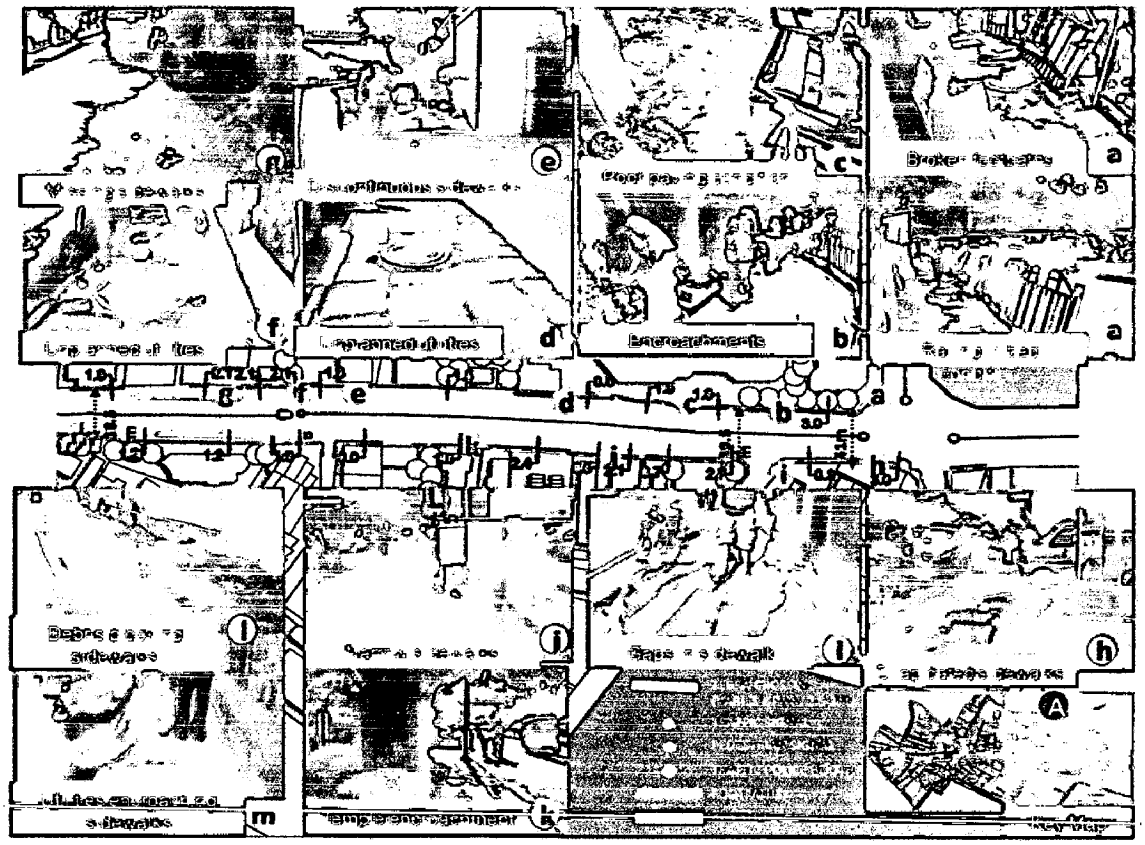


Fig. 6.30: The existing problems related to pedestrian facilities across Part 'A' of the stretch

Source: By Author

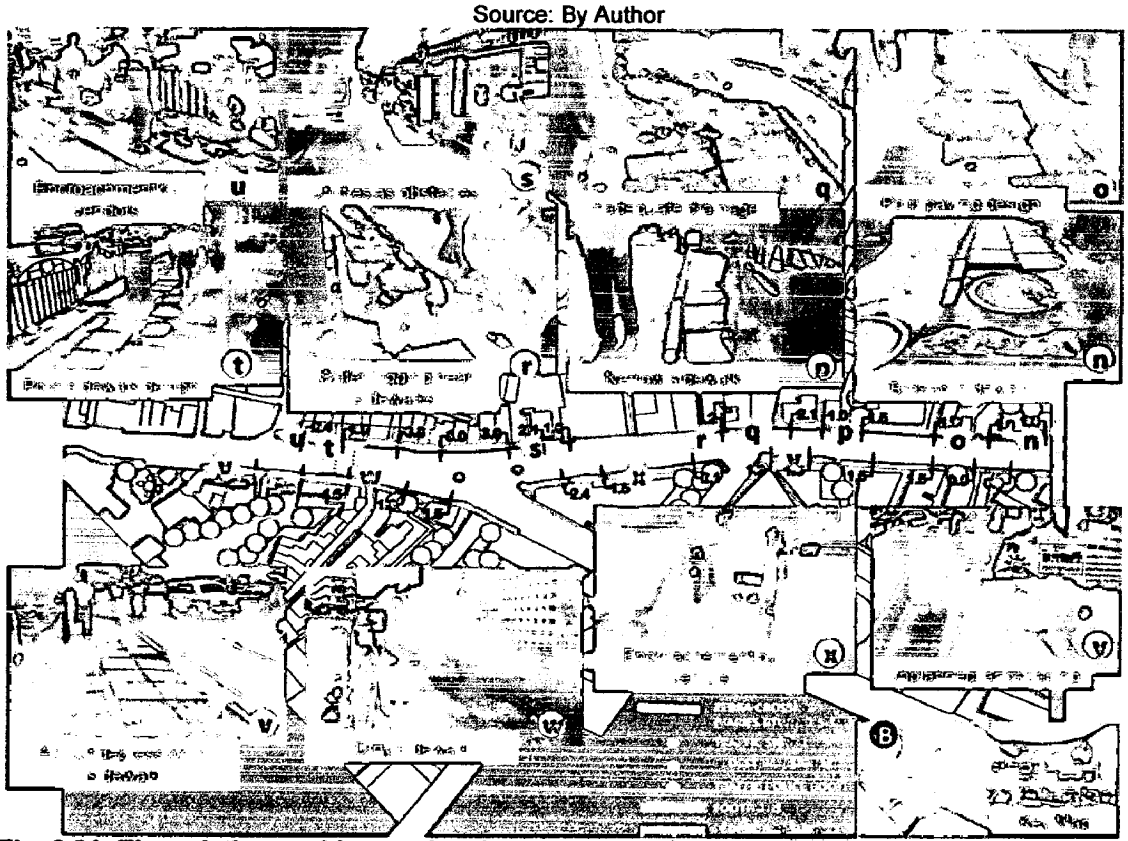


Fig. 6.31: The existing problems related to pedestrian facilities across Part 'B' of the stretch

Source: By Author

6.3.1.3. Major problems identified

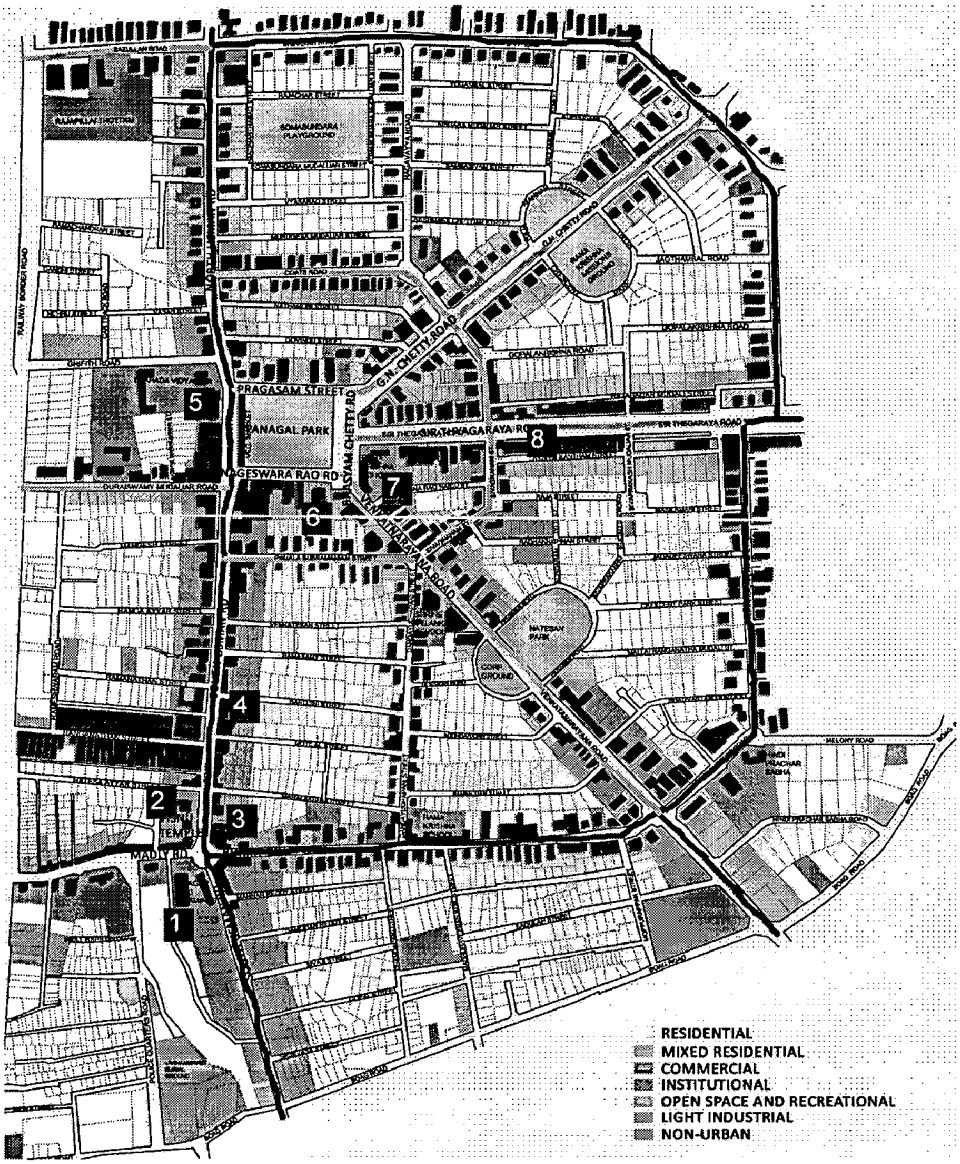
The major problems, related to pedestrian facilities and amenities, identified along the stretch are put forth as under.

1. The sidewalks along the stretch are usually narrow, broken at places, discontinuous and of poor quality and design.
2. The sidewalk surface finish is poor and lacks maintenance. It needs repair and replacement at most of the places.
3. The sidewalks are blocked by obstacles like unplanned landscaping, electricity poles, utility boxes, parked vehicles etc., making pedestrian movement cumbersome.
4. Sidewalks are discontinuous at the entry to private property, resulting in frequent up and down movement, thus making walking tiresome.
5. There are no separate hawker zones demarcated, which leads to the encroachment of the footpaths.
6. There are no provisions for the wheel-chair users and the visually handicapped.
7. The utilities are unplanned and the sidewalks complain of water logging and scattered telephone and other utility cables.
8. The sidewalks are unclean and dirty and poorly maintained. There is an absence of litter bins along the stretch.
9. The on-grade crossings are very difficult and risky to cross, leading to a large number of causalities.
10. The crossings are not suitably provided and the distance between the crossings is very large, making walking very tiresome because of which pedestrians tend to jaywalk.
11. The existing crossings are poorly marked and the other road markings are also not visible properly.
12. There are no provisions for grade-separated pedestrian crossings, except an existing pedestrian subway.
13. There are just two pedestrian signals installed in the whole stretch and they are not in a working condition.
14. The sidewalks lack basic pedestrian amenities like street furniture, signage, trash receptacles, water fountains, bicycle racks and adequate landscaping.
15. The bus stops are poorly designed and lack provisions to sit.
16. The sidewalks are poorly lit during the evening and night hours at many places along the stretch.
17. The street lacks the segregation of motorized and non-motorized traffic.
18. There is an absence of an overall aesthetic appeal and public realm.

6.3.2. T.Nagar

T.Nagar is a major central business district of Chennai city. as already discussed in earlier chapters, an area of 1.4 sq. km. has been demarcated for the study. The visuals below (Map 6.6, Fig. 6.29.1-6.29.10, Map 6.7, Fig. 6.30 & 6.31) depict the existing buildings and the conditions of pedestrian facilities in the area.

6.3.2.1. Major buildings and landmarks



Map 6.8: Study area at T.Nagar indicating the location of major buildings and landmarks

Source: By Author

Fig. 6.32.1: T.Nagar Bus Terminus

Source: By Author

Fig. 6.32.2: Siva Vishnu Temple

Source: By Author

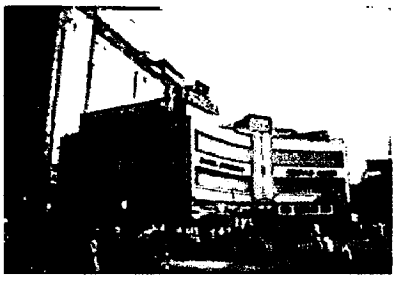


Fig. 6.32.3: Hotel Sudhara

Source: By Author

Fig. 6.32.4: Fathima Jewellers

Source: By Author

Fig. 6.32.5: Hotel Sudhara

Source: By Author

Fig. 6.32.6: Nalli Silk Store

Source: By Author

Fig. 6.32.7: Sri Ramakrishna School

Source: By Author

Fig. 6.32.8: Pondy Bazaar

Source: By Author

6.3.2.2. Major streets

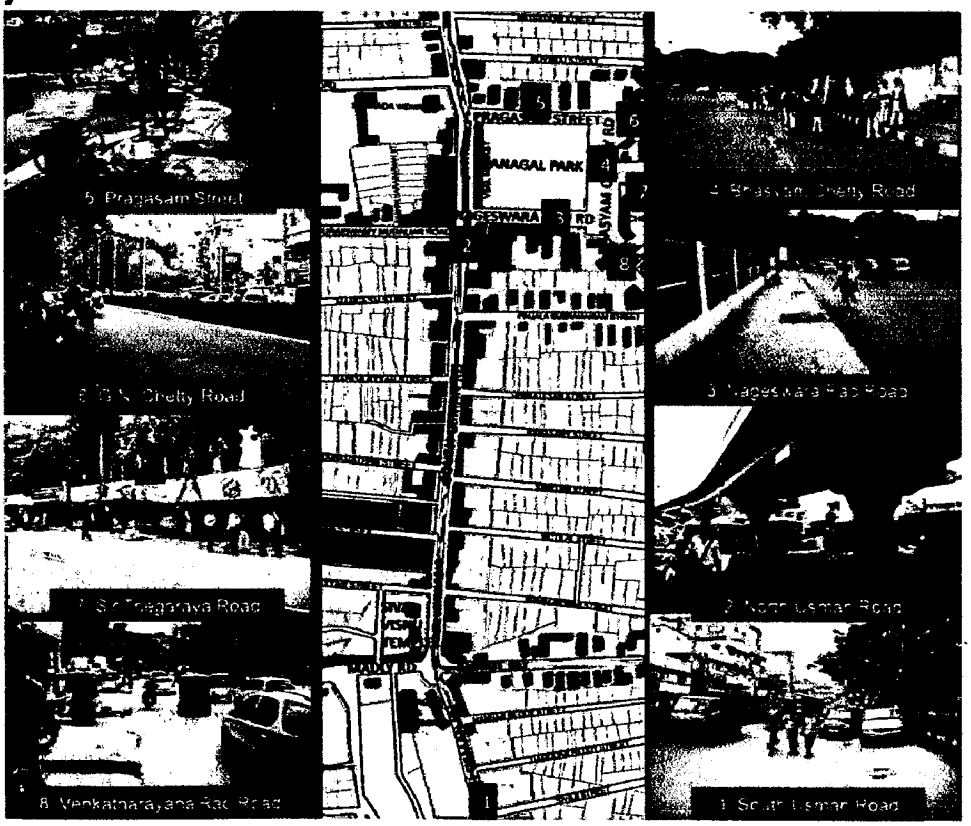


Fig. 6.33: Major streets in T.Nagar

Source: By Author

6.3.2.3. Existing pedestrian facilities and problems

Fig. 6.34: Broken sidewalks

Source: By Author

Fig. 6.35: Narrow sidewalks

Source: By Author

Fig. 6.36 Broken sidewalks

Source: By Author

Fig. 6.37: Insufficient width of Zebra Crossing

Source: By Author

Fig. 6.38: Unplanned and poorly designed landscaping

Source: By Author

Fig. 6.39: Encroachments infront of shops

Source: By Author

Fig. 6.40: Encroachments by hawkers

Source: By Author

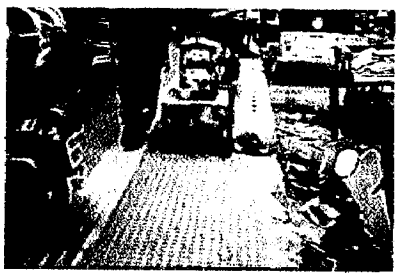


Fig. 6.41: Obstacles like utility boxes

Source: By Author

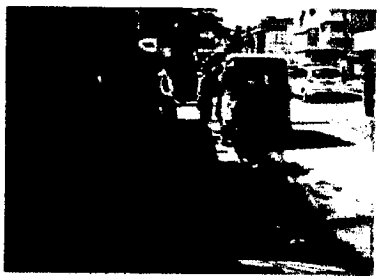


Fig. 6.42: Sidewalks blocked by debris

Source: By Author

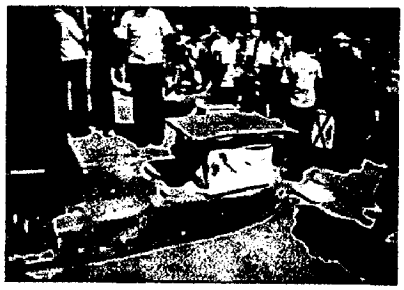


Fig. 6.43: Sidewalks inaccessible for wheel-chair users

Source: By Author

Fig. 6.44: Water logging besides sidewalks

Source: By Author

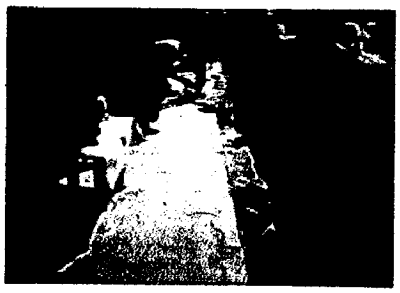


Fig. 6.45: Open and unplanned drainage

Source: By Author

Fig. 6.46: Unplanned utilities

Source: By Author

Fig. 6.47: Unclean sidewalks

Source: By Author

Fig. 6.48: Absence of sidewalks

Source: By Author

6.3.2.4. Major problems identified

The major problems, related to pedestrian facilities and amenities, identified in the study area are put forth as under.

1. The footpaths are broken at most places and have a poor design quality and maintenance.
2. Most of the sidewalks have been encroached by shop goods display, temples, parking, hawkers and vendors and street temples.
3. The sidewalks are not maintained clean and attractive. Garbage Litter is a common sight to watch along the shopping streets.
4. Sidewalks fail to cater to the large volume of pedestrians.
5. Sidewalks are blocked by obstacles like utility boxes, parked vehicles etc. making the pedestrian movement tiring and cumbersome.
6. Sidewalks are discontinuous and encroached with entry to private property.
7. Inspite of being a major shopping precinct, the pedestrian environment lacks major amenities like benches, litter bins, area map boards, signage and information boards etc.
8. The aspect of universal accessibility is lacking in the pedestrian environment.
9. There is a lack of crossings. The existing crossings are poorly marked and are unsafe to cross. Grade-separated crossings are not provided. Pedestrian signals are absent.
10. The curb is high, making access difficult for the elderly and the physically handicapped.
11. Landscaping is entirely missing in the pedestrian environment.
12. There are no separate hawker zones demarcated, which leads to the encroachment of the footpaths.
13. The utilities are unplanned and the sidewalks complain of water logging and scattered telephone cables and other utility cables.
14. There is an absence of an overall aesthetic appeal and public realm.

6.3.3. Major Findings

A. Anna Salai –

1. The model stretch has been experiencing an exceptional increase in vehicular traffic, with traffic congestion being a problem of daily order.
2. Pollution levels have increased and the road widths fail to cater to the large volume of traffic during peak hours.
3. The pedestrian causalities have been increasing, with very little space left-over to the people on foot.
4. The study carried out suggests the poor condition of pedestrian infrastructure along the model stretch selected in Anna Salai.
5. The study indicates the need for grade-separated crossings as the on-grade crossings are unsafe to cross, due to the large volume of traffic.
6. The street sections need to be updated to make more space for pedestrians and other non-motorized means of transport.
7. The study also reveals a recreational space or an open space for the pedestrians.
8. With an upcoming proposal for mass rapid transit system (metro), the stretch holds immense potential to integrate the improved pedestrian environment with the MRTS and achieve a sustainable transit-oriented development.
9. The commercial nature of the precinct further provides a lot of scope to integrate the pedestrian environment with shopping activities and institutional uses.

B. T.Nagar –

1. T.Nagar has been experiencing a rapid change of land-use, which has led to enormous traffic congestion.
2. Pedestrian space has been encroached by informal trade along the major shopping streets, rendering continuous pedestrian movement as a complex affair.
3. The study suggests an exceptional volume of pedestrians flocking in the major shopping streets and the existing sidewalks are unable to cater to such an enormous volume. The pedestrian volume increases further during festive seasons and shopping sales.
4. Hawking and vending activities have encroached most of the walkable area.
5. The space underneath the existing flyover along Usman road has been encroached by parking. The hawkers and vendors use the space for storing their supplies and goods, indicating an urgent need for proper planning.
6. Mixed traffic along the roads have put pedestrian safety at stake and this calls for a need to reinvestigate the liable solutions for traffic management and diversion of traffic.
7. Parking issues have been identified as a major problem in the shopping precinct.

8. The pedestrian space is deprived of essential amenities and this indicates a need for proposing alternative design solutions for the same.
9. The study area holds an immense potential to ban the traffic movement, especially during peak hours and pedestrianize the core to facilitate a comfortable and convenient shopping experience to the people.

6.4. Pedestrian Environment Evaluation Matrix

A pedestrian environment evaluation matrix was designed to rank the condition of the existing facilities and the overall pedestrian environment on any stretch of road in the city. The matrix was designed keeping into consideration the various attributes and components that make a successful pedestrian environment. A total of 5 major attributes were listed and each attribute consisted of various components, which may facilitate the pedestrians. The pedestrian environment of a particular stretch was evaluated by assigning scores to each of the components under the major attributes, based on the visual surveys and the general tour of the stretch. This scoring was done on a scale of 0 to 5. A low score was assigned for poor facilities and a high score was assigned for excellent facilities. Each of the attribute was assigned a weightage out of 10, based on the degree of presence of the attribute to create a successful pedestrian environment. Combining the score of the components forming an attribute and the highest weightage assigned, the final weightage of the attribute was calculated.The final score of the entire stretch is calculated by summing up the attribute weightages.

The matrix can help evaluate a stretch as well as draw a comparison between different stretches on a grade of 10, with 1 indicating nil facilities and 10 indicating the best facilities (Fig. 6.49). Annexure 1 depicts the pedestrian environment evaluation matrix.

Less than 1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10
Nil (almost Absent)	Very poor	Poor	Marginally poor	Fair	Slightly good	Good	Better	Marginally best	Best

Fig. 6.49: Pedestrian Environment Evaluation Score Card

Source: By Author

Five major stretches of Chennai were evaluated using the matrix. Annexures 2,3,4,5 and 6 depict the scores assigned to the stretches. The five major stretches selected for evaluation were Anna Salai, South Usman road, Royapettah High Road, Sardar Patel road and Santhome High road (Fig. 6.50).

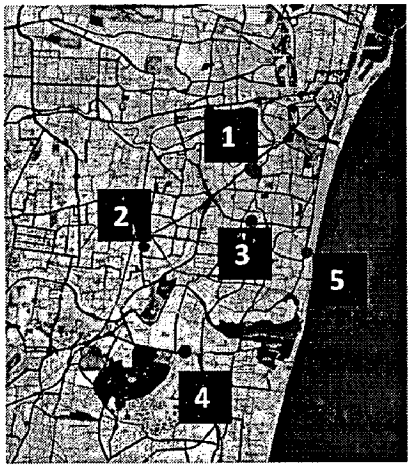


Fig. 6.50: Five major stretches selected for evaluation
Source: By Author

The final scores have been shown in Fig. 6.51.

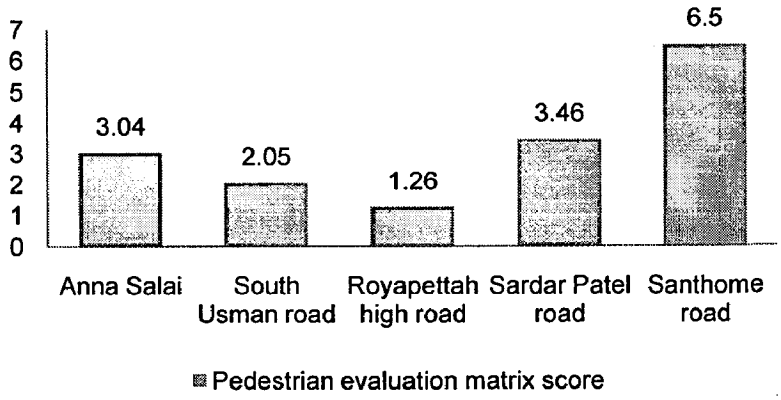


Fig. 6.51: Comparison of pedestrian evaluation score of the five stretches
Source: By Author

The comparison of the five stretches indicates that in general, the pedestrian environment through the entire city is poor. The stretches ranked in the categories of 'very poor', 'poor' or 'marginally poor' (Refer Fig. 6.49). Santhome road is an exception, since it was retrofitted in 2009 as a part of the Chennai Beach Beautification Project. Inspite of retrofitting, the stretch ranked only in the category of 'slightly good' (Refer Fig. 6.49).

6.5. Inferences

The primary survey executed along the select stretches, the study areas and the city of Chennai illustrate the poor condition of the existing pedestrian facilities. The pedestrian environment lacks integration with public transit, to achieve a transit-oriented development, especially along major arterials where metro rail has been proposed. The commercial stretches of the city offer ample opportunities to integrate the pedestrian movement with the land uses and create lively and animated shopping streets. The core areas hold a lot of scope for pedestrianization as an innovative strategy to be employed to decongest the areas. In harmony with the relevant findings already discussed above, proposals and recommendations have been suggested to improve and refine the pedestrian scenario in the city which has been discussed in the next chapter.

7 PROPOSALS & RECOMMENDATIONS

7.1 Proposal for Anna Salai

7.2 Proposal for T.Nagar

7.3 Planning and Design Guidelines for Chennai city

7.4 Policy Recommendations for Indian Cities

7 PROPOSALS & RECOMMENDATIONS

This chapter deals with the proposals for an integrated plan strategy for the two study areas of Anna Salai and T.Nagar in Chennai city. The proposals are based on the detailed field surveys executed and the analysis carried out to understand the problems faced by the pedestrians and what could be the planning and design alternatives to bring a remarkable change in the pedestrian environment in both the areas. These proposals can further be used for various other stretches of Chennai city with suitable alterations as per the site conditions. The chapter also outlines some planning and design guidelines to improve the pedestrian environment at large in Chennai city. The chapter ends with suggesting policy recommendations for making the Indian cities pedestrian-oriented.

7.1. Proposal for Anna Salai

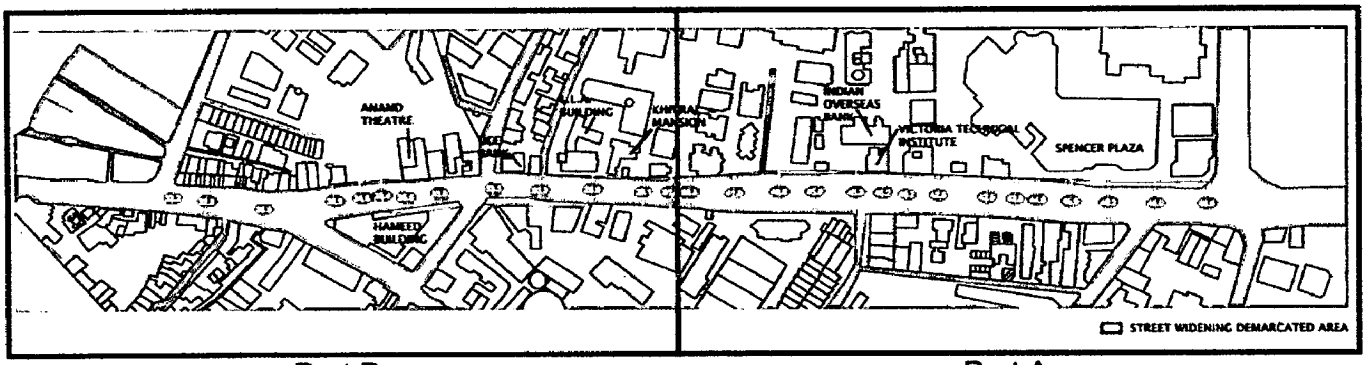
Since the stretch is a major arterial and pedestrianization wouldn't be a feasible approach, the concept behind suggesting guidelines and strategies for Anna Salai was to create a 'Complete Streets' with equitable road space allocated to all the road users. The major emphasis would be laid on facilitating a convenient and comfortable pedestrian movement. With a goal to suggest design guidelines and planning strategies, in improving the existing pedestrian environment at Anna Salai and integrating it with the land-use and the future transport proposal, the following recommendations have been made for the model stretch of 1.1 km between Binnys Road Junction near Spencer Plaza and Greams road junction (refer Chapter 5, Map 5.15).

A. Street Widening -

1. The street should be investigated for suitable scope for widening, taking into consideration the urgent need for increasing the road width to meet the demand of pedestrian space. The street width should be increased to 45m, from the existing maximum width of 39.5m and 29m, from the existing minimum width of 26m, wherever scope is available. As per the on-site practical difficulties and the location of the buildings, possibilities for widening have been suggested at the following places.
    a) The street width infront of Spencer Plaza could be increased from 38.1m to 45.0m (Map 7.1 & Map 7.2).
    b) The street width infront of Victoria Technical Institute and Indian Overseas Bank could be increased from 42m till 45 m (Map 7.1 & Map 7.2).
    c) The street width at the bottle neck infront of L.L.A. Building could be increased from 26.1m to 29m (Map 7.1 & Map 7.3).
    d) The street width at another bottleneck infront of Anand Theatre could be increased from 31.3m to 33.4m till 36.9m (Map 7.1 & Map 7.3).

e) The street width infront of Hameed building could be increased from 27m to 33m (Map 7.1 & Map 7.3).

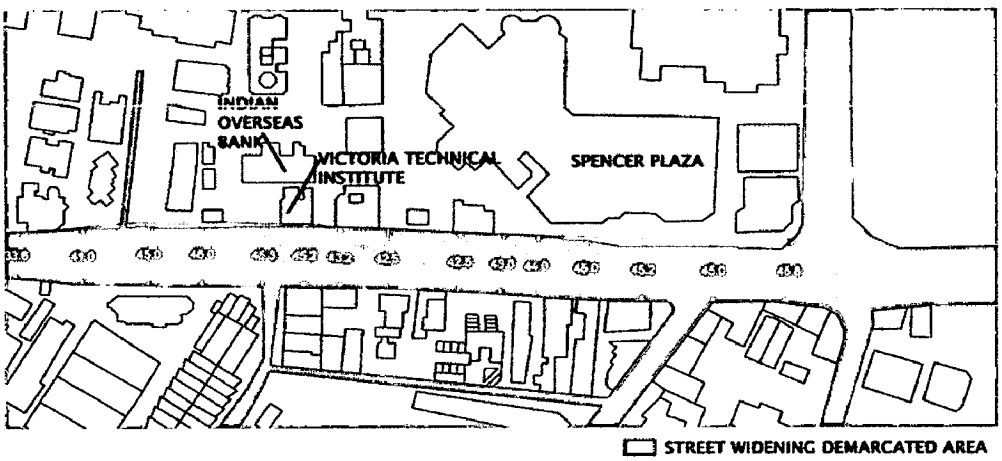
f) The street width infront of UCO Bank could be increased from 27m to 33.5m (Map 7.1 & Map 7.3).



Part B Part A

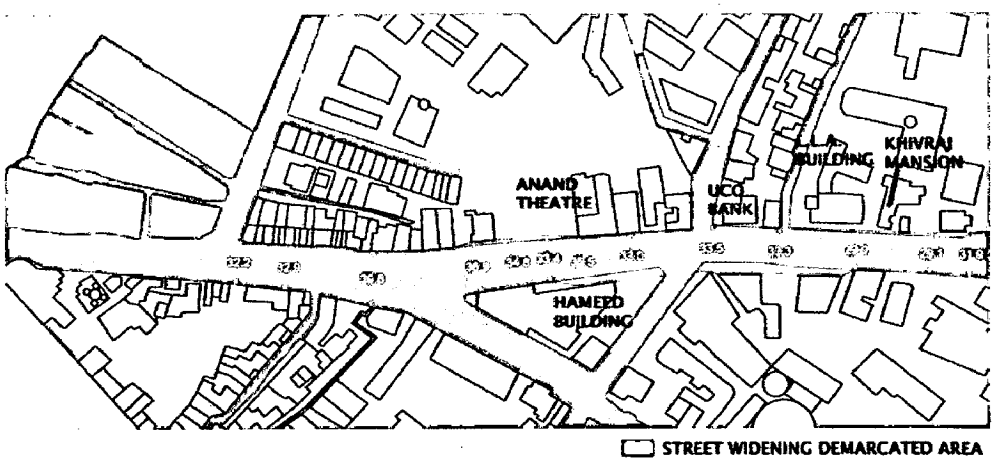
Map 7.1: Street Widening proposed along Model Stretch

Source: By Author



Map 7.2: Enlarged map showing widening proposed along Part A

Source: By Author



Map 7.3: Enlarged map showing widening proposed along Part B

Source: By Author

2. The land acquired in street widening can be compensated through bonus zoning, by allowing extra FAR and permission to construct more built-up area (number of floors), in addition to the present Development Control Regulations.

B. Street Design and Improvement -

1. In order to change the street environment with regard to pedestrians, the street section should be revised.
2. The existing pedestrian sidewalks which varied between 0.9m to 1.8m in width should be widened to range between 2.7m to 6m.
3. Considering the smallest and the largest road width along the stretch, different alternative street sections should be designed, with a convenient width for the sidewalk.
4. For the largest width of 45m (achieved through road widening) along the stretch, three alternative street sections are proposed, keeping into view the arterial nature of the road.

a) The first alternative has been proposed with an idea to suggest a low cost solution for improvement of the existing scenario with provisions for on-street car parking. The traffic lanes have been retained and the sidewalks widened to a width of 4.8m. (Fig. 7.1).

b) The second alternative has been proposed again on the terms of providing a low cost solution to retain the service lane concept and incorporate a multi-utility zone to facilitate the pedestrians. (Fig. 7.2 & 7.5).

c) The third alternative has been proposed for giving maximum priority to the pedestrians and thus is a more pro-pedestrian solution compared to the other alternatives. A 6m wide sidewalk with a 2m wide cycle track and a 3.4m wide multi-utility zone has been provided to facilitate the pedestrians (Fig. 7.3).

5. For the smallest width of 29m along the stretch, one convenient alternative has been proposed with an idea to use the space judiciously for equitable allocation of street space to all users. It proposes a 2.5m wide sidewalk and a 0.8m wide multi-utility zone(Fig. 7.4).
6. Shared lane concept should be successfully used for accommodating both vehicles, entering the private property and the non-motorized traffic. Traffic calming can be employed in a shared lane to give maximum priority to non-motorized traffic.
7. Multi-utility zone should be allocated for accommodating trees, street lighting, street furniture and bus-stops and hawkers and vendors be demarcated a special space in it.
8. The pedestrian sidewalk further should be designed into three sub-zones –

a) The Frontage zone – which consists of entry to buildings, arcades, building canopy etc.

b) The Pedestrian zone – which consists of a convenient width for people to walk and move.

c) The Furniture zone – which consists of space to be allocated for pedestrian amenities like street furniture like benches, trash receptacles, signage, landscaping etc. and hawkers and vendors.

9. The sidewalk width can vary from a minimum of 2.7m to as large as 6m, depending on the situation. Sidewalk zones have been shown in Fig. 7.6, 7.7 & 7.8 & 7:9 for various sidewalk widths.
10. The front setbacks of the private property should be used for creating open air dining, which may enhance the public realm of the street and make it livelier (Fig. 7.8).

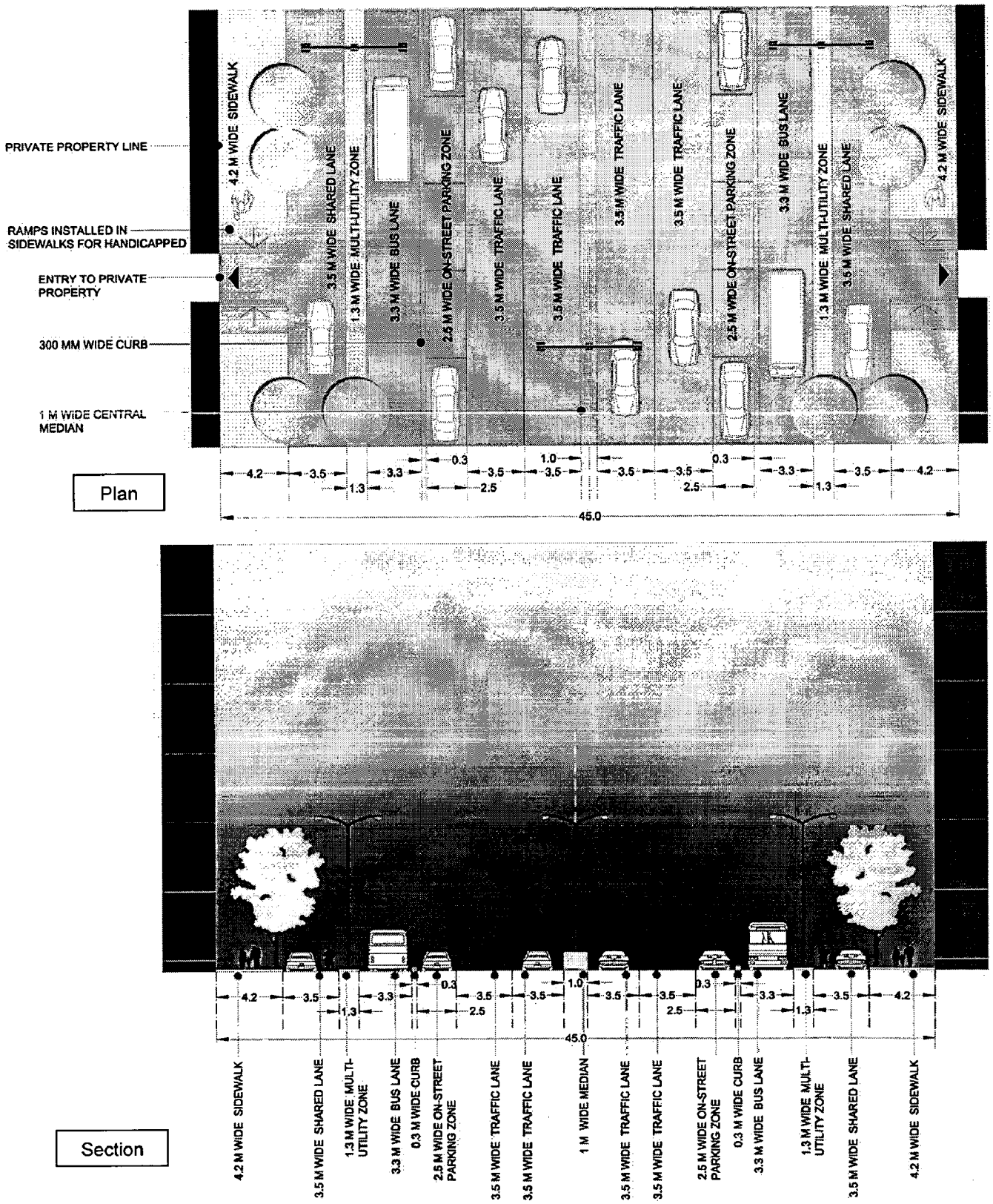


Fig. 7.1: Alternative 1 for 45m width - Low cost solution with on-street parking

Source: By Author

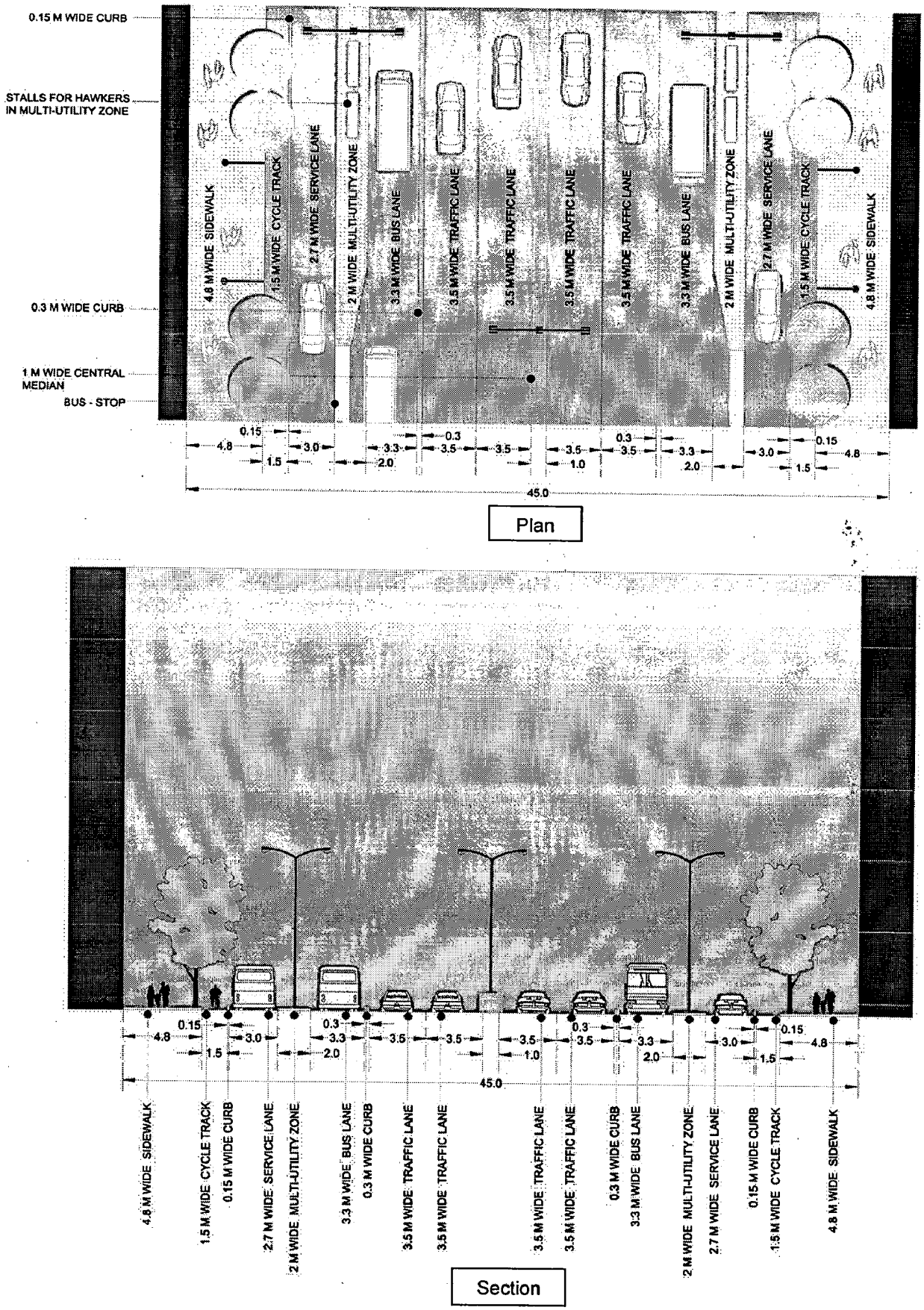


Fig. 7.2: Alternative 2 for 45m width - Low cost solution with service lane

Source: By Author

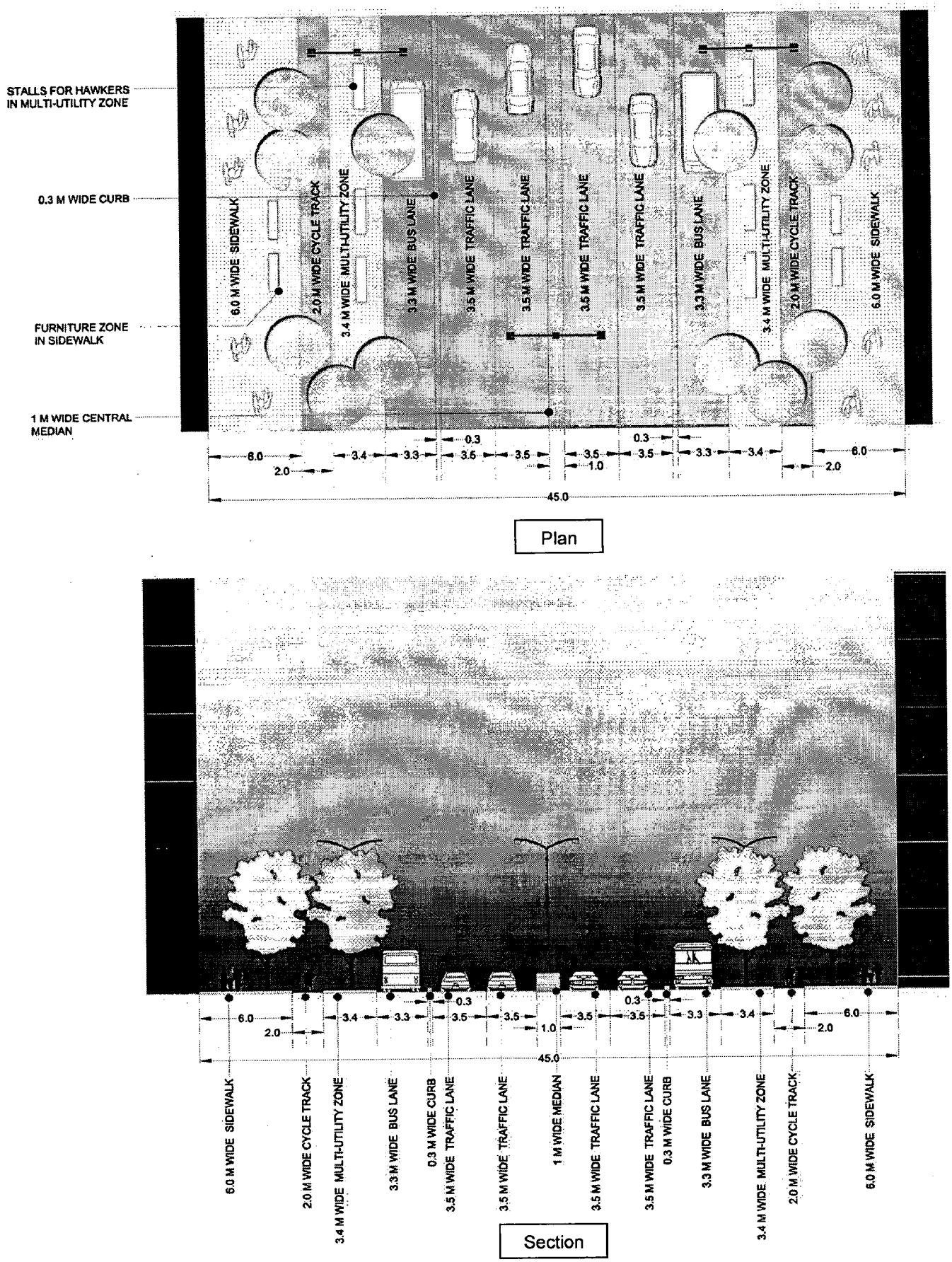


Fig. 7.3: Alternative 3 for 45m width – Pro-pedestrian solution

Source: By Author

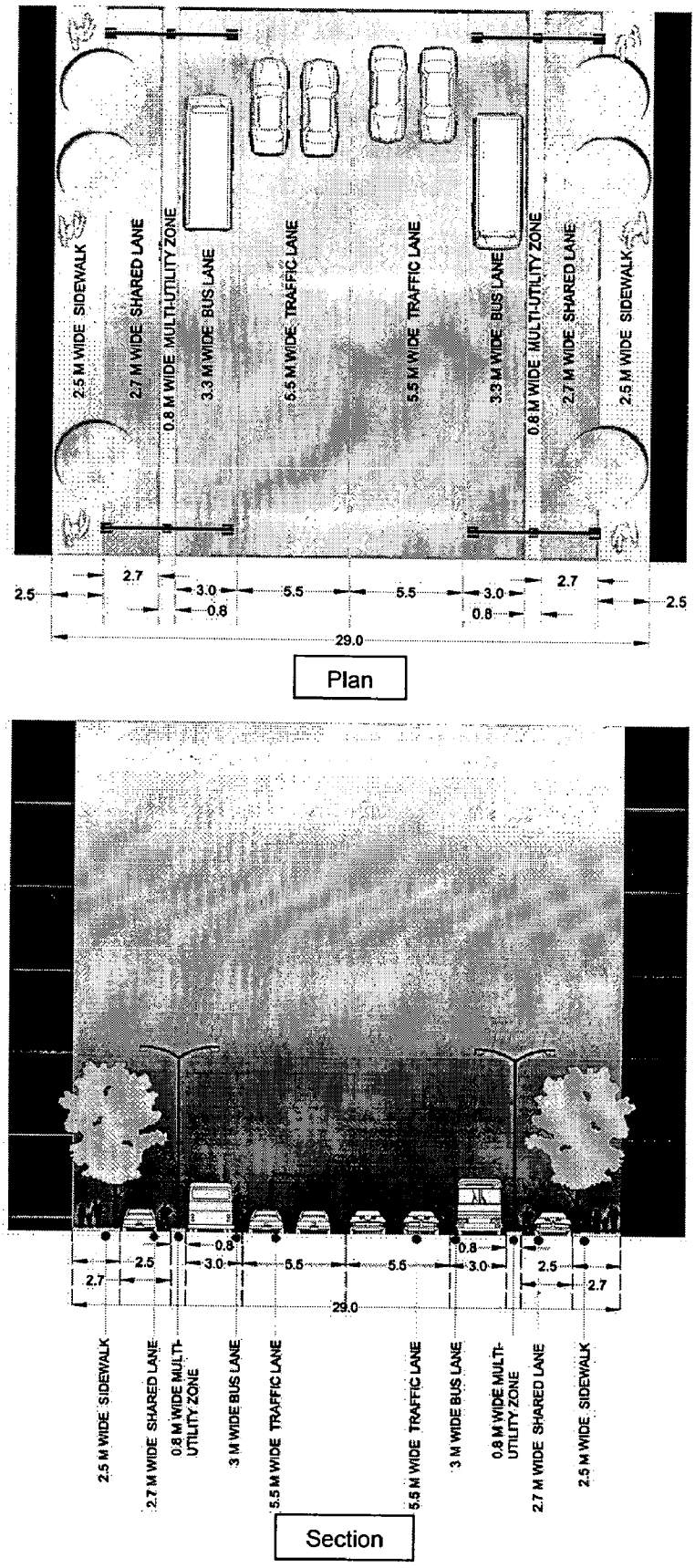


Fig. 7.4: Street section for 29m width – Equitable space for all road users

Source: By Author

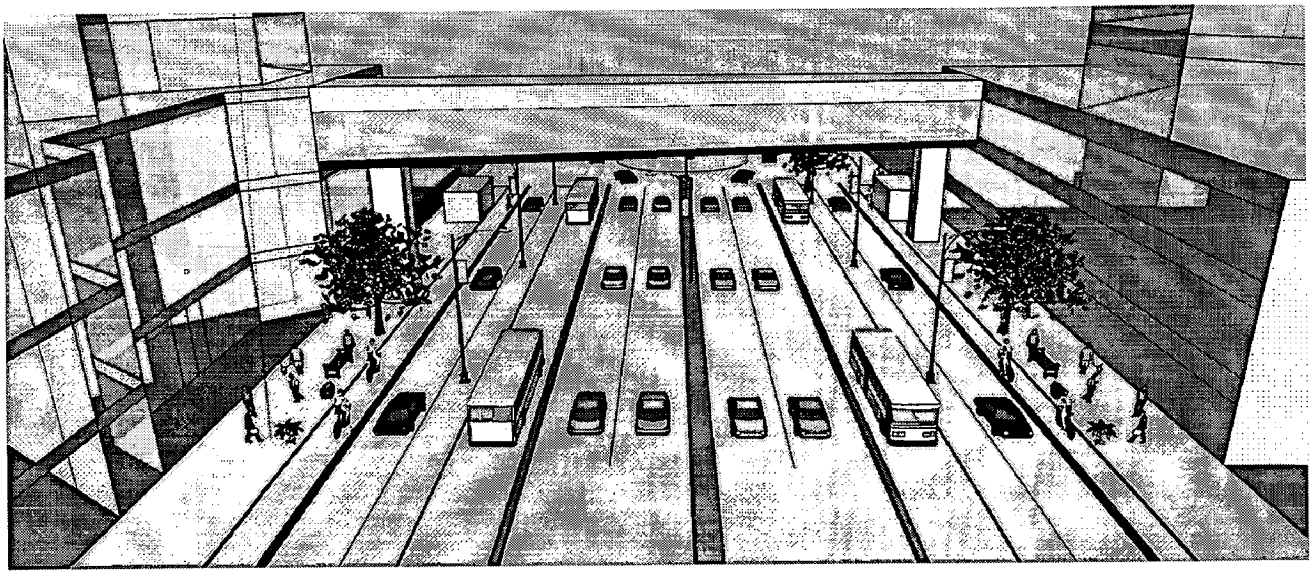


Fig. 7.5: View of street as suggested in Alternative 2 with 45 m width

Source: By Author

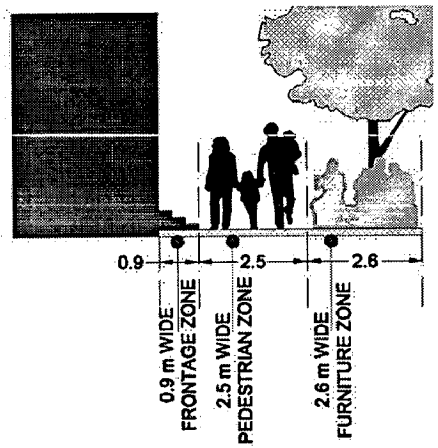


Fig. 7.6: Sidewalk zone for 6m wide sidewalk

Source: By Author

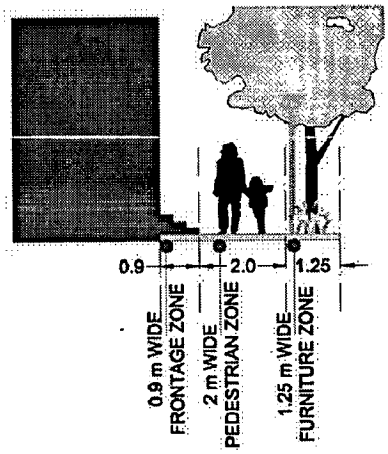


Fig. 7.7: Sidewalk zone for 4.1m wide sidewalk

Source: By Author

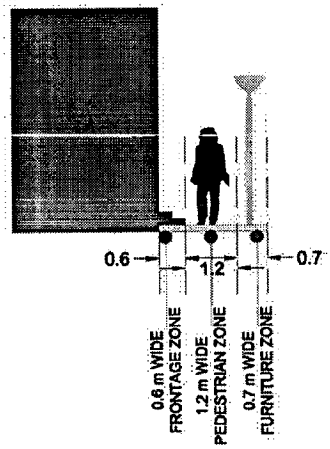


Fig. 7.8: Sidewalk zone for 2.5m wide sidewalk

Source: By Author

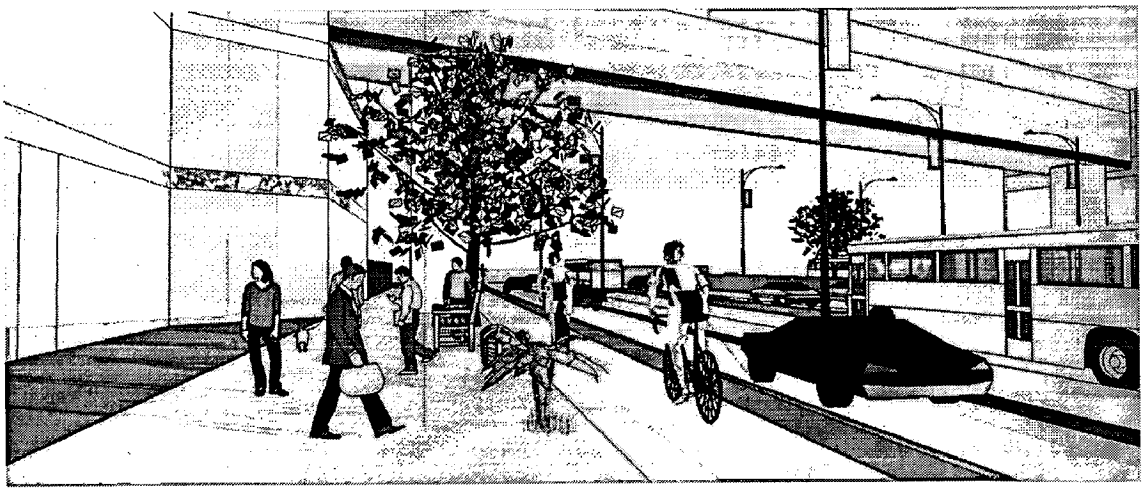
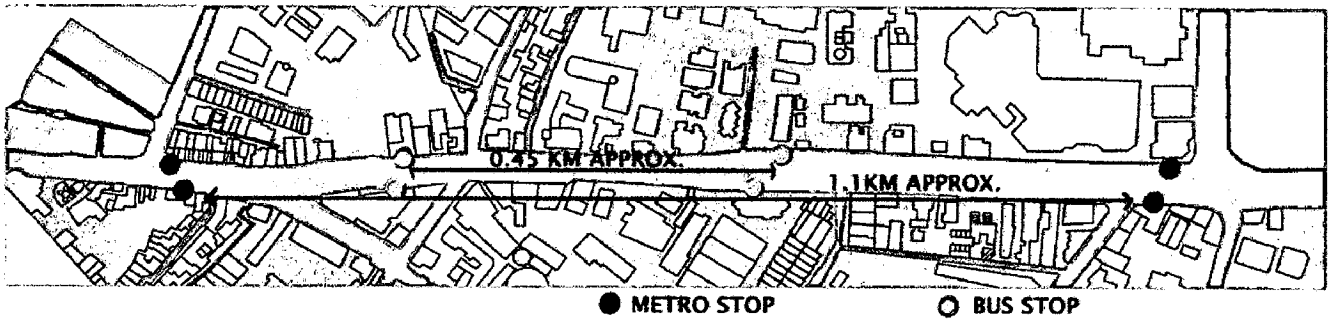


Fig. 7.9: View of sidewalk depicting various zones

Source: By Author

C. Proposal for Transit nodes -

1. In lieu with the proposal for metro rail, entry to underground metro stations is proposed infront of Spencer Plaza near the Binnys road junction and before the Greams road junction (Map 7.4).
2. The location of the existing bus-stops along the stretch could be retained (Map 7.4), considering the comfortable walkable distance between them and their nearby proximity to the metro stations. The bus-stops must be updated as per the proposed street sections and should be made more aesthetic and convenient to the users.



Map 7.4: Proposed Locations for bus stops and metro stops

Source: By Author

D. Proposal for Improvement of Existing Crossings -

1. The existing crossings on the street were a zebra crossing near (1) Binny's road junction, (2) a zebra crossing infront of Victoria Technical Institute, (3) a zebra crossing infront of UCO Bank near Pathari road junction and (4) a pedestrian subway before Greams road junction (Map 7.5).
2. In order to reduce the pedestrian-vehicle conflicts and provide more safety and security to the pedestrians, grade-separated crossings should be constructed.
3. New crossings should be proposed on the basis of convenient locations and at a maximum interval of 200m between two crossings
4. Some suggestions for the removal of some of the existing crossings and the proposal for new crossings are given below.

i. The existing zebra-crossing near the Binnys road junction can be replaced by a 4.5m wide raised table-top crossing (Map 7.6).

ii. Elevated skywalks should be constructed infront of Spencer Plaza connecting both sides of the road as well as connecting the buildings, above (Map 7.6, Fig. 7.10, 7.11 & 7.12).

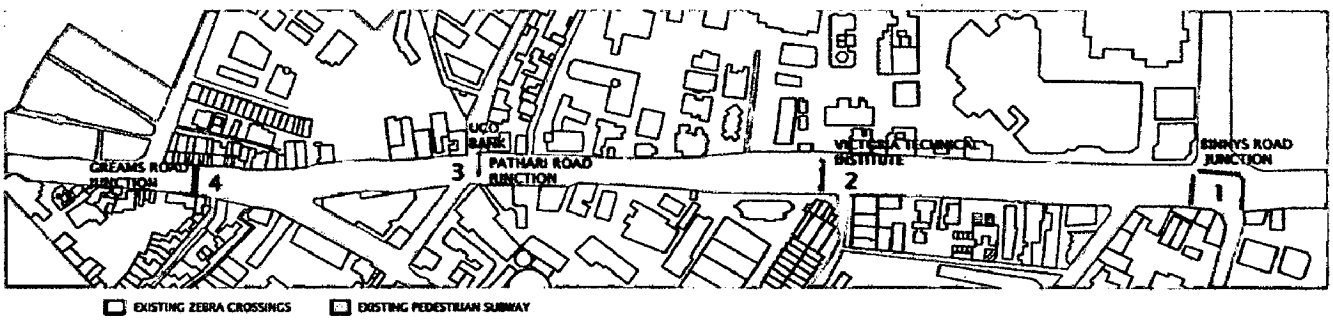
iii. The zebra-crossing infront of Victoria Technical Institute can be avoided and an elevated skywalk can be proposed (Map 7.6).

iv. Pedestrian subway can be proposed infront of Bank of America and T.V.S. Motors (Map 7.6).

v. Elevated skywalk can be proposed infront of Mohan Mansion and UCO Bank near Pathari road junction and the existing zebra-crossing can be avoided (Map 7.6).

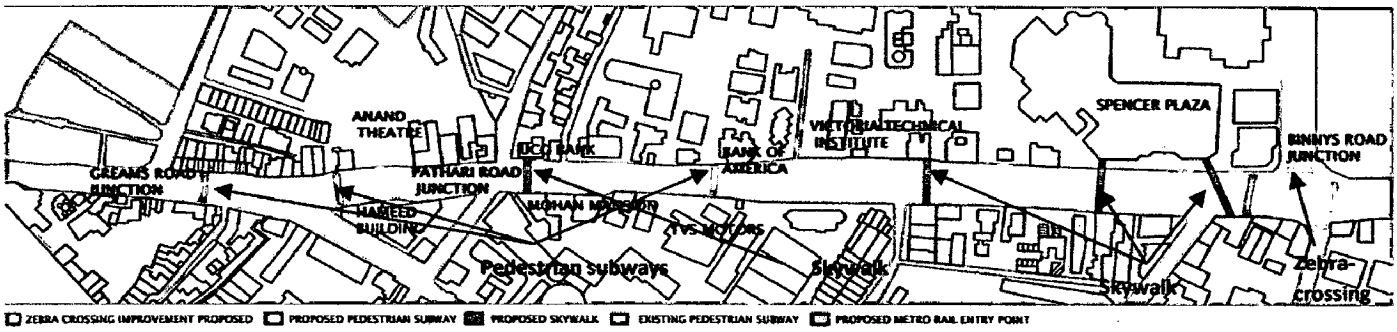
vi. There is no provision for crossing infront of Hameed Building near Whites Road and Anna Salai junction. Pedestrian subway can be proposed infront of Hameed Building (Map 7.6).

vii. The existing subway near Greams road junction can be retained and its conditions improved by making it well-lit, installing ramps or lifts for better access to the wheel-chair users and also introducing informal trade to make it more lively and optimally used.



Map 7.5: Existing location of crossings between Binnys Road & Greams road junction

Source: By Author



Map 7.6: Proposed location of crossings between Binnys Road & Greams road junction

Source: By Author

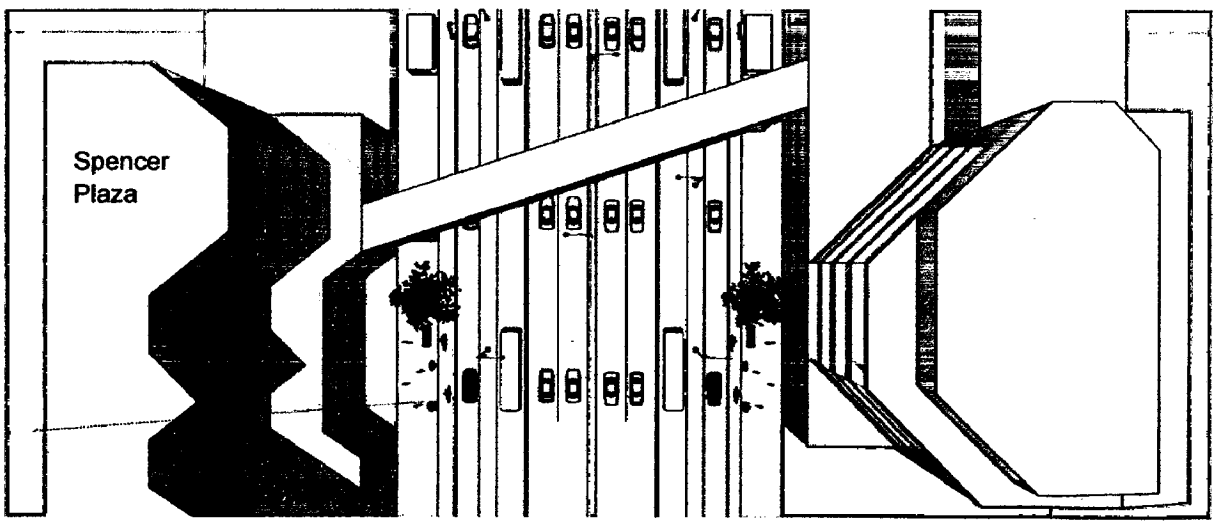


Fig. 7.10: Proposed Elevated Skywalk at Spencer Plaza

Source: By Author

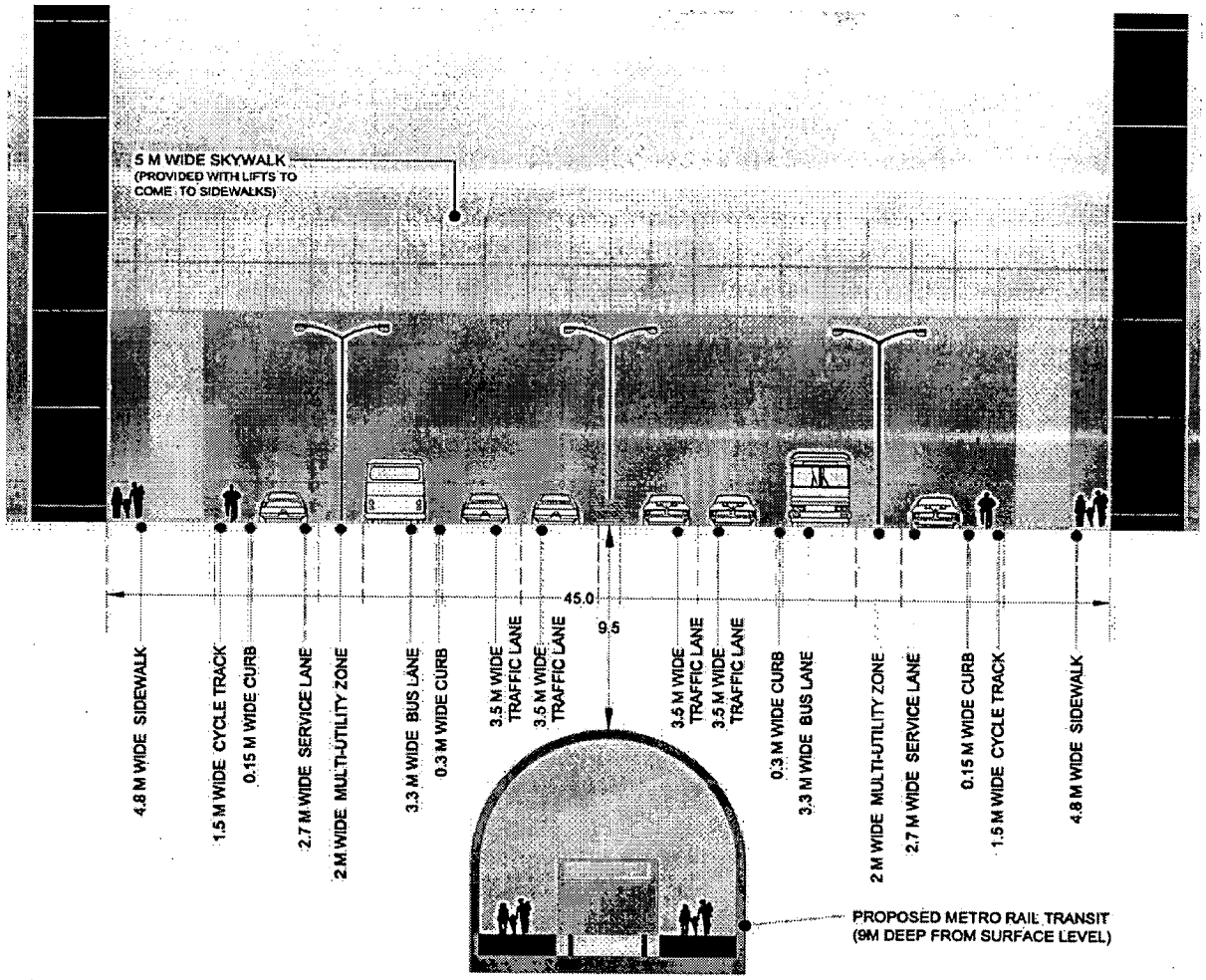


Fig. 7.11: Proposed Section of Skywalk at Spencer Plaza

Source: By Author

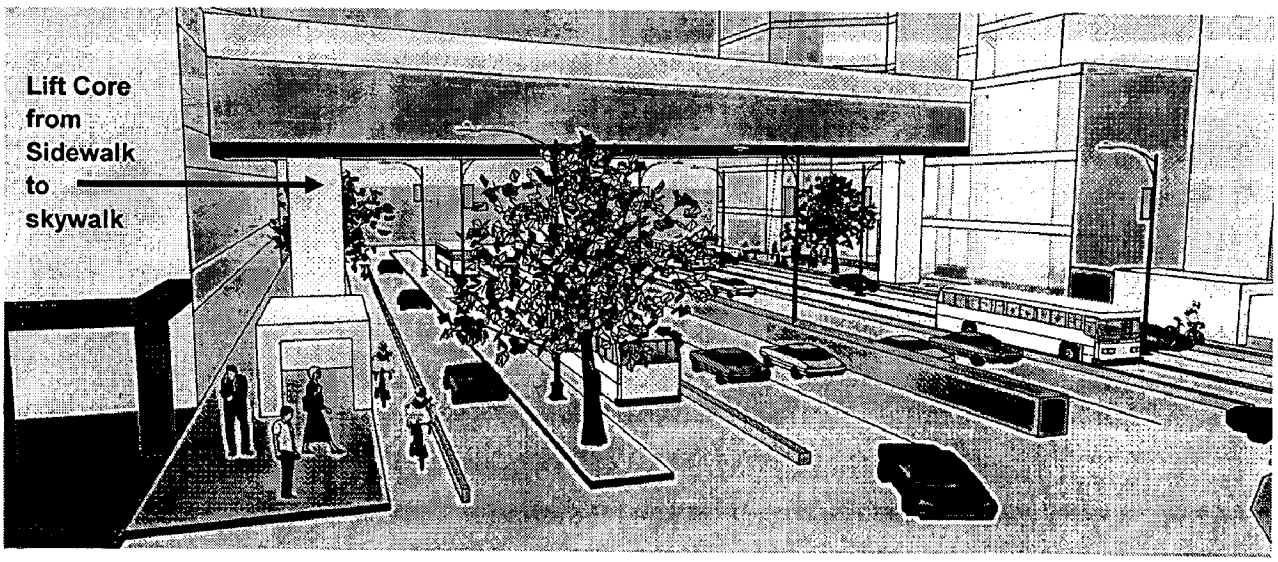


Fig. 7.12: View showing Skywalk at Spencer Plaza

Source: By Author

E. Pedestrian-friendly Design -

1. Curb ramps must be installed at intersections for making the sidewalks accessible by the wheel-chair users.
2. The existing paving condition of the sidewalks is very poor. The existing stone pavers are broken at many places and worn out and needs replacement. It is recommended to re-pave the sidewalks with innovative pavers like interlocking concrete tiles, sandblasted stone pavers, checkered tiles, flyash and asphalt based pavers etc.
3. 300x 300 mm Tactile paving tiles must be installed suitably in the sidewalks for making it convenient for the visually impaired.
4. The utilities can be arranged in a precast concrete box and placed under the furniture zone of the sidewalk. There can be inspection covers installed at the sidewalk level, to facilitate replacement or repair.

F. Proposal for Under-ground Pedestrian Plaza -

1. To integrate the pedestrian facilities with the proposed metro rail, an underground pedestrian subway can be proposed near the Spencer Plaza and Binnys Road junction, providing access to the metro from grade level and also connecting an underground pedestrian plaza.
2. The underground plaza proposed is approximately 900 sq.m.
3. The pedestrian plaza would offer a great relief in the commercial district for the office-goers, shoppers and other users.
4. It can consist of seating spaces, informal trade, small coffee and food outlets, landscape features and an overall aesthetic appeal to serve as a useful public space for people.
5. Cut-outs can be provided at surface level to keep it fairly lit and well-ventilated.

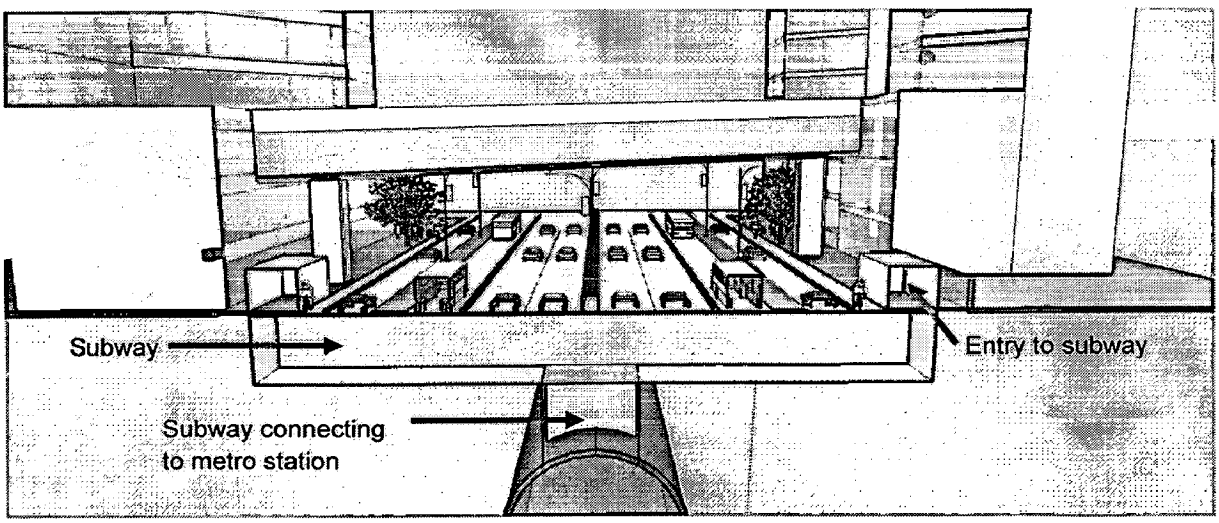


Fig. 7.13: Pedestrian Subway at Binnys Road junction

Source: By Author

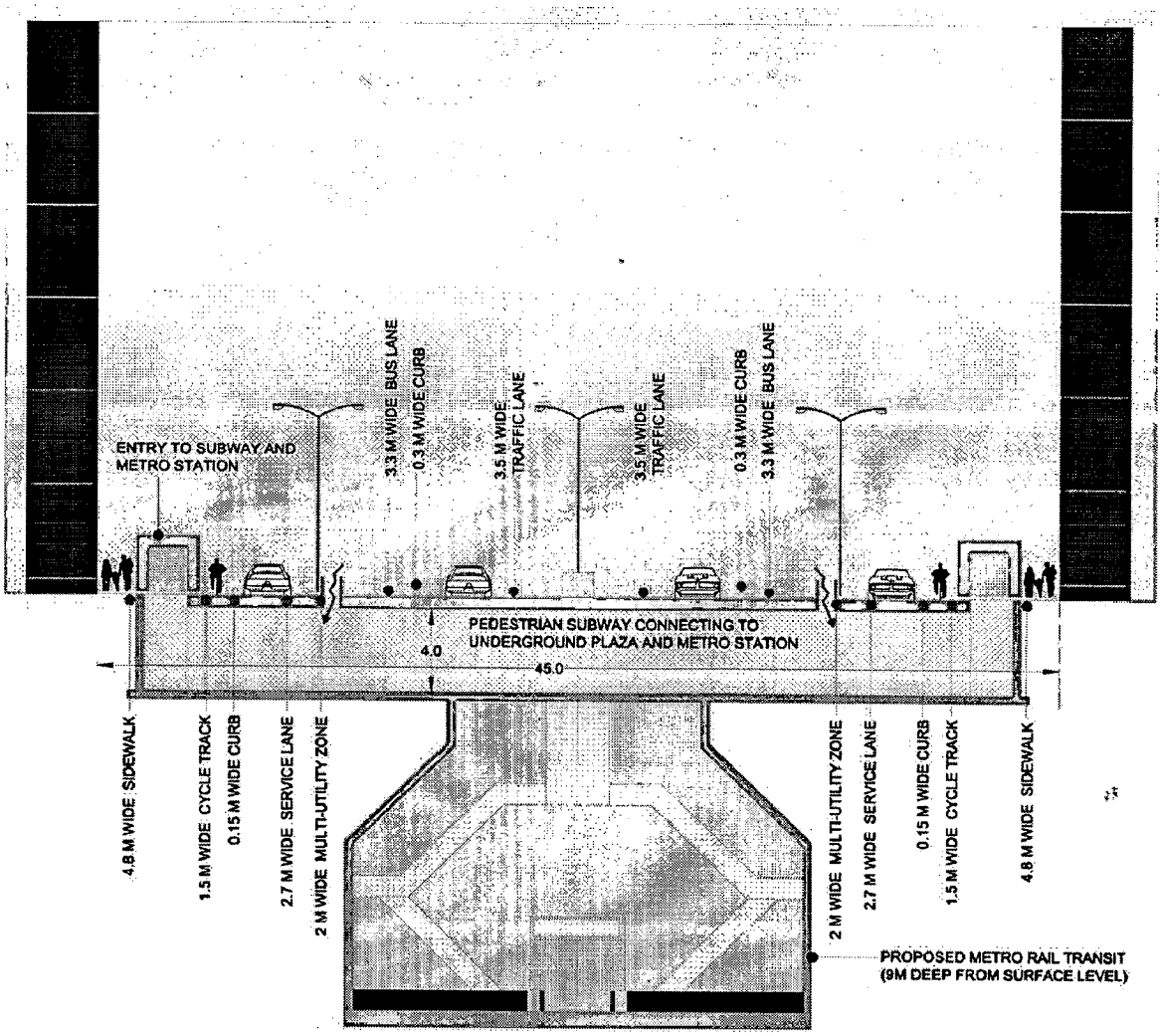


Fig. 7.14: Section of proposed pedestrian subway at Binnys road junction

Source: By Author

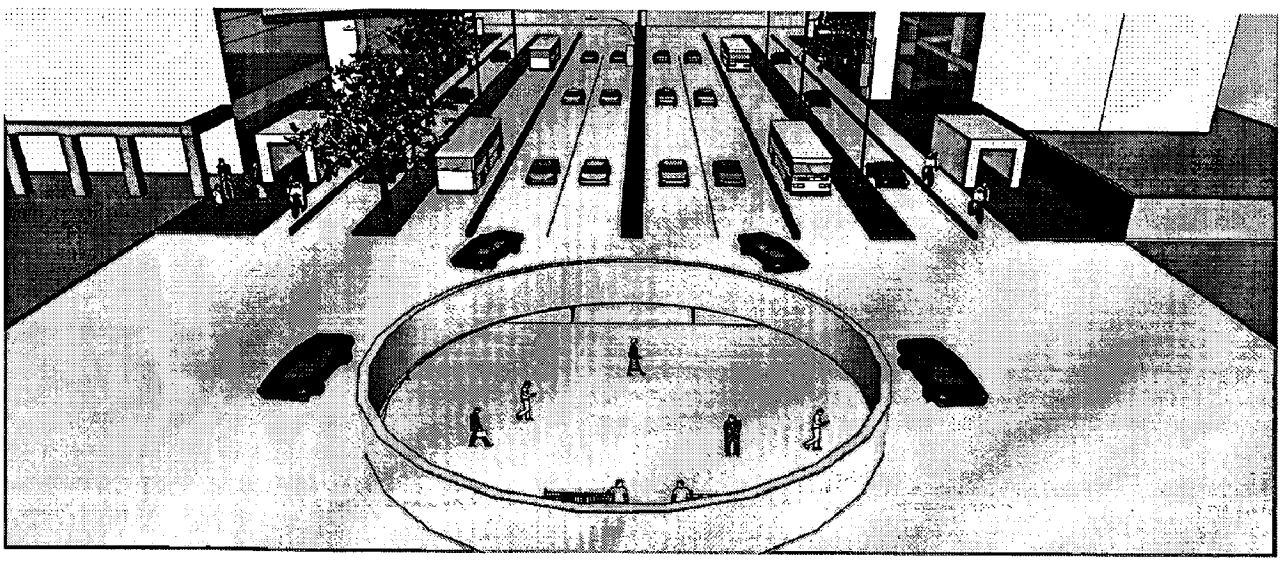


Fig. 7.15: Top View of underground plaza

Source: By Author

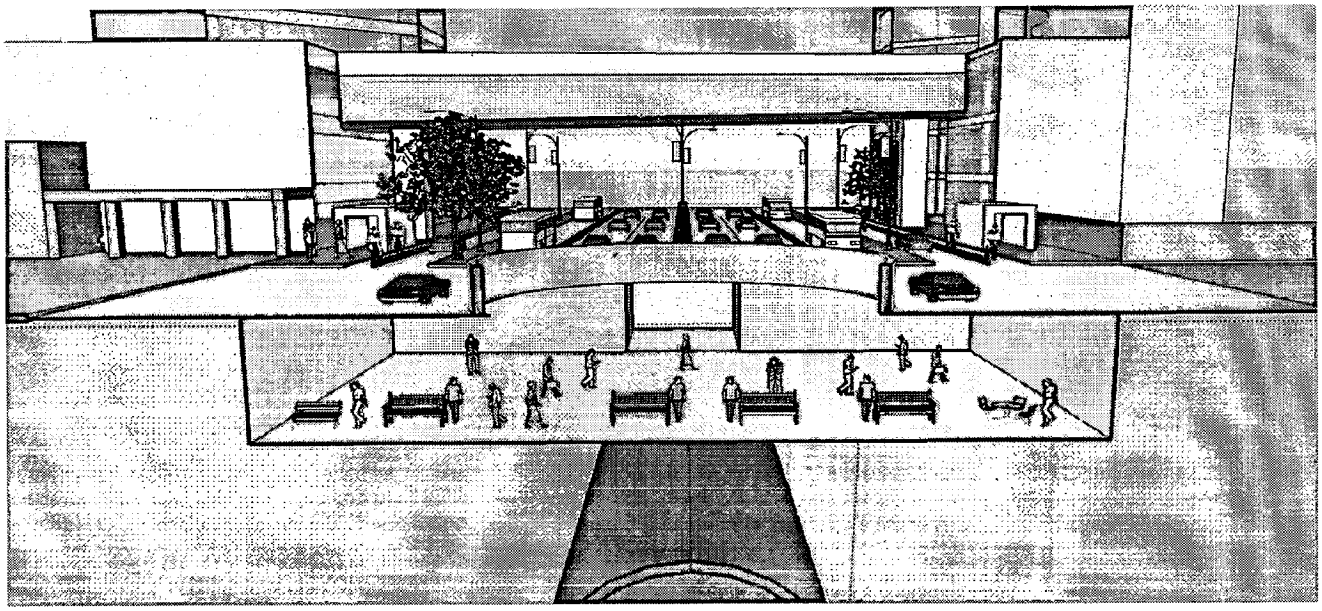


Fig. 7.16: Section showing underground plaza

Source: By Author

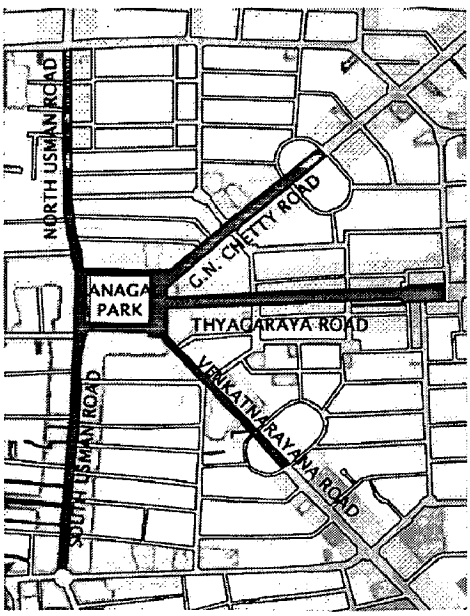
The proposal aims to make the selected stretch of Anna Salai as a model stretch to be followed by other major roads in improving the existing pedestrian facilities. This proposal also explores the realms of how well an improved pedestrian environment can be integrated with the land uses and transport to foresee a sustainable development for the future. The existing FAR (1.5 for commercial land use) can be reinvestigated and increased to look forward to a high-density, vertical and compact development. With both bus-transit and metro rail proposed along the corridor, a good pedestrian network incorporated along the stretch can aim to bring about a successful transit-oriented development along the stretch.

7.2. Proposal for T.Nagar

With a goal to decongest the core and employ pedestrianization and traffic management strategies to improve the pedestrian environment, the following recommendations and planning strategies have been suggested to convert the core into an ideal *walkable* shopping destination.

A. Pedestrianization -

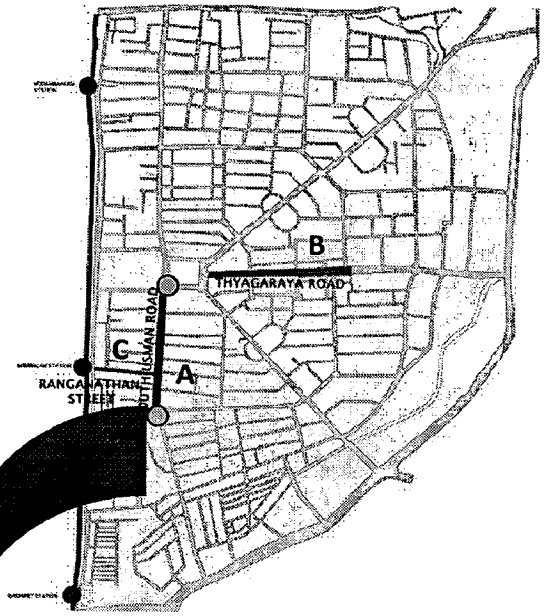
1. In order to relieve the major shopping streets of vehicle intrusion and clear space for pedestrians, South Usman road, North Usman road, Thyagaraya road, Venkatnarayana road and G.N. Chetty road should be made as part-time pedestrian streets (Map 7.7).



Map 7.7: Map indicating Part-time Pedestrian streets

Source: By Author

2. Vehicles should be banned from 12 p.m. to 3 p.m. and from 5 p.m. to 8 p.m., which are the peak shopping hours.
3. On weekends the traffic ban can be extended from 12 p.m. to 8 p.m. continuously.
4. Weekends can also be made 'No Vehicle' day' by enforcing a complete ban on vehicles. Buses and feeder services should be allowed in limited intervals to serve the people.



Map 7.8: Location of Streets to be upgraded
Source: By Author

5. Street sections for Usman road and Thyagraya Road (Along Pondy Bazaar) (Map 7.8) should be upgraded to clear more space for pedestrians and make provisions for pedestrian amenities. Improved street sections have been proposed as shown from Fig 7.17-7.24.

6. To solve the problem of a large volume of pedestrian traffic in Ranganathan street (Map 7.8), it is proposed to make the entire street into a shopping mall with another level of walkway above. Some illustrations to support this concept are shown from Fig.7.25-7.28.

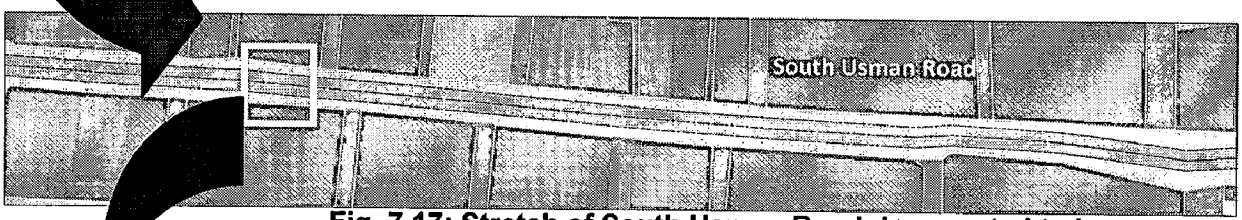
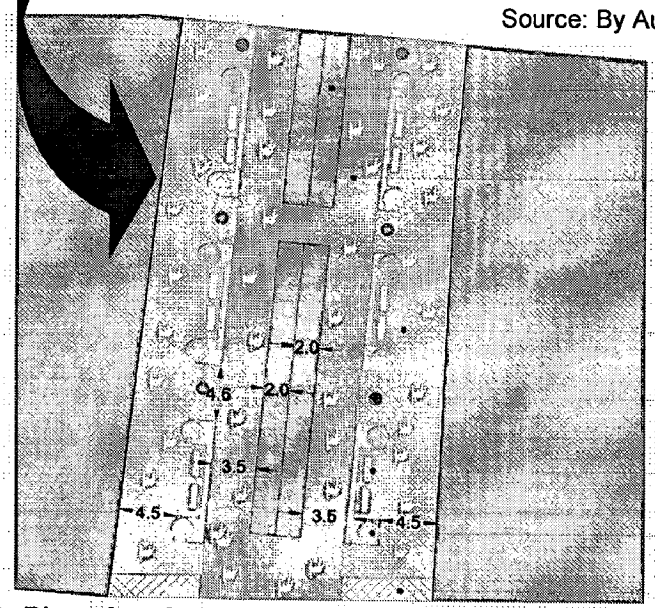
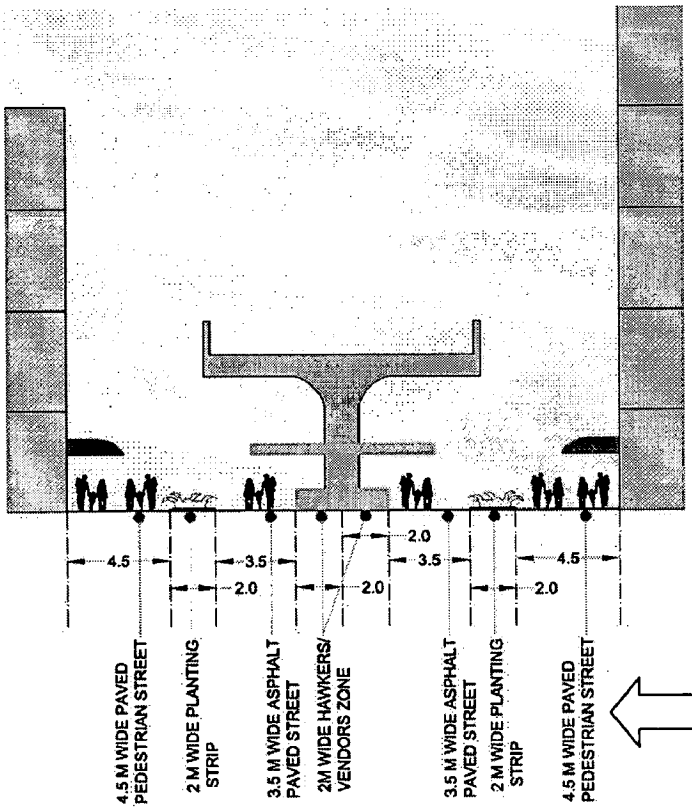


Fig. 7.17: Stretch of South Usman Road demarcated to be part-time pedestrianized (marked 'A' in Map 7.8)
Source: By Author



2 M WIDE HAWKERS/ VENDORS ZONE
ASPHALT PAVED STREET (USED BY VEHICLES DURING OFF-HOURS)
PAVED PEDESTRIAN STREET
LITTER BINS
STREET FURNITURE
PLANTING STRIP
RAMP FOR WHEEL-CHAIR USERS (SLOPE 1:12)

Fig. 7.18: Plan showing an improved South Usman Road
Source: By Author



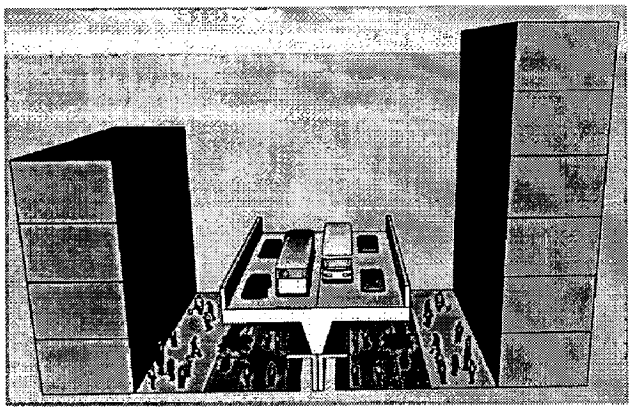


Fig. 7.19: View of South Usman Road
Source: By Author

Fig. 7.20: Section of South Usman Road
Source: By Author

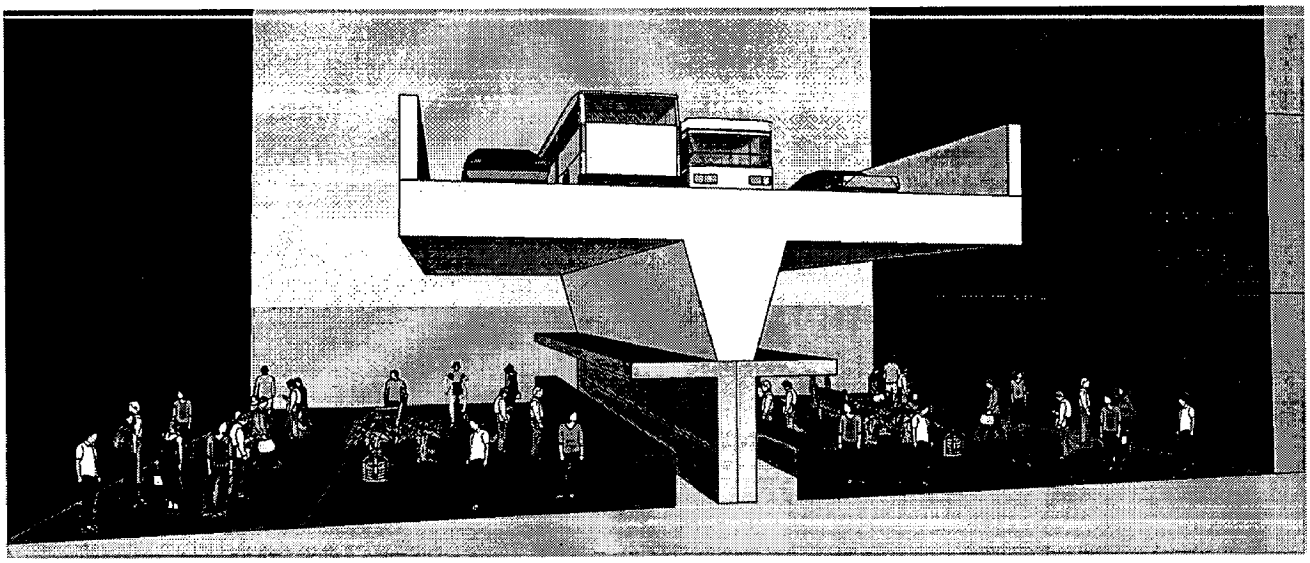


Fig. 7.21: View illustrating pedestrian space in South Usman Road
Source: By Author

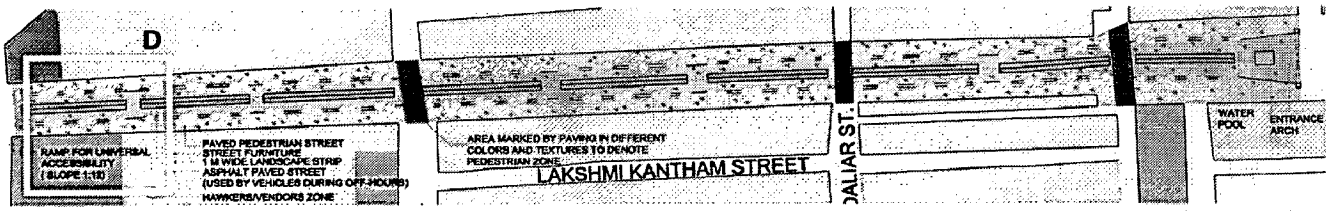


Fig. 7.22: Improvement along Thyagaraya Road stretch infront of Pondy Bazaar (marked 'B' in Map 7.8)
Source: By Author

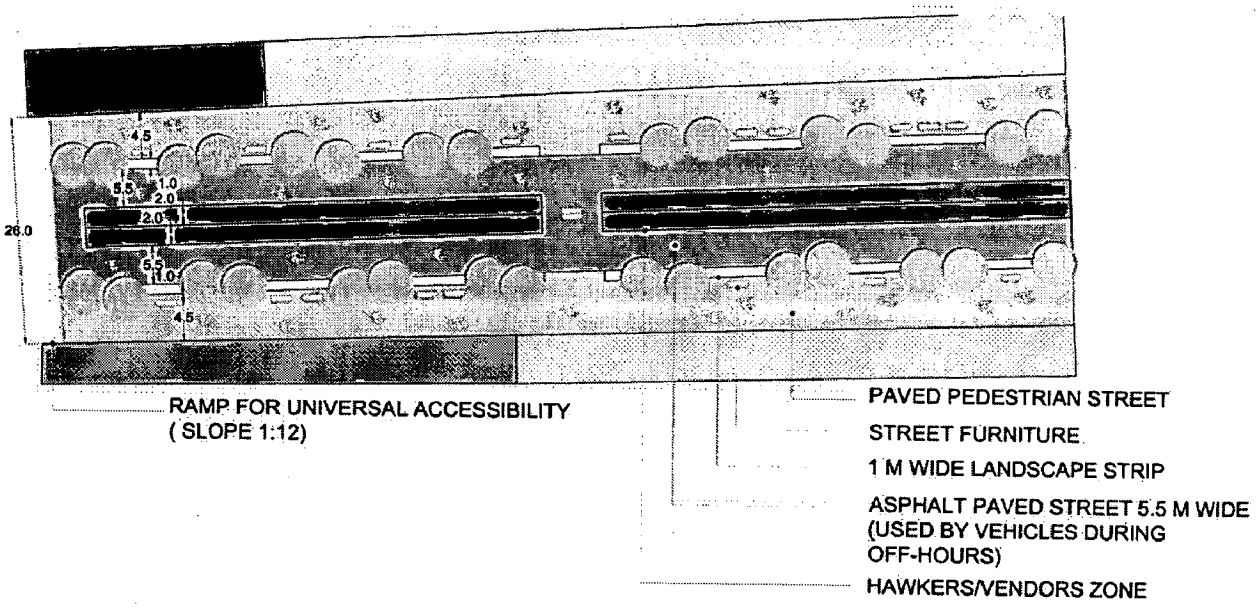


Fig. 7.23: Part Plan showing an improved Thyagaraya Road (marked 'D' in Fig. 7.22)

Source: By Author

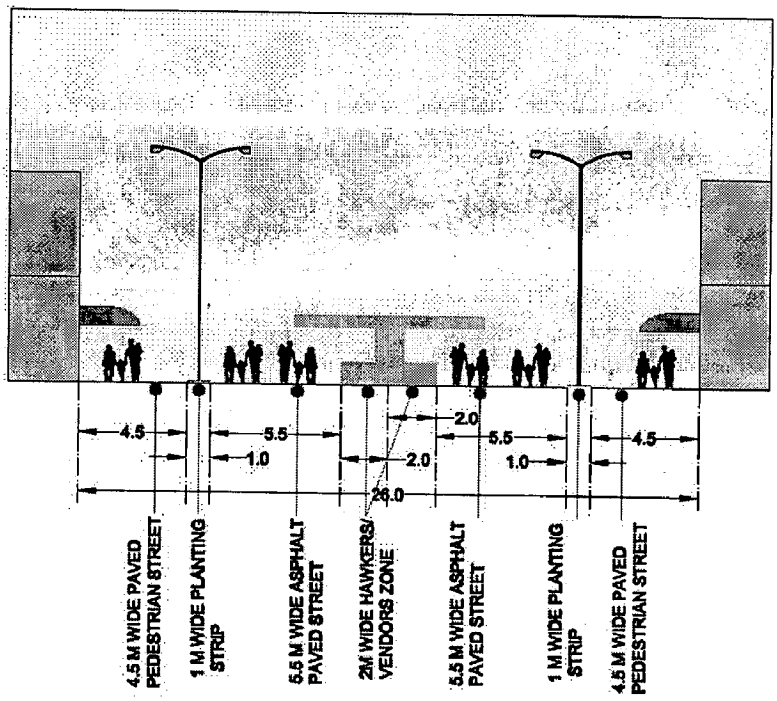


Fig. 7.24: Street Section of Thyagaraya Road

Source: By Author

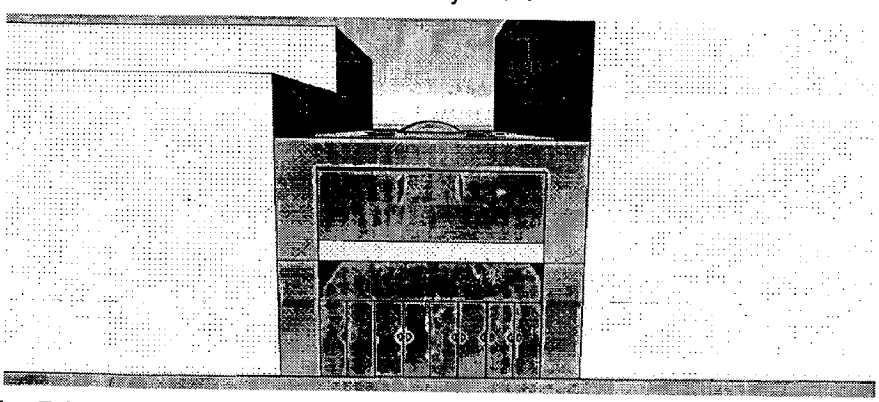


Fig. 7.25: Front Elevation of Proposed mall over Ranganathan Street

: By Author

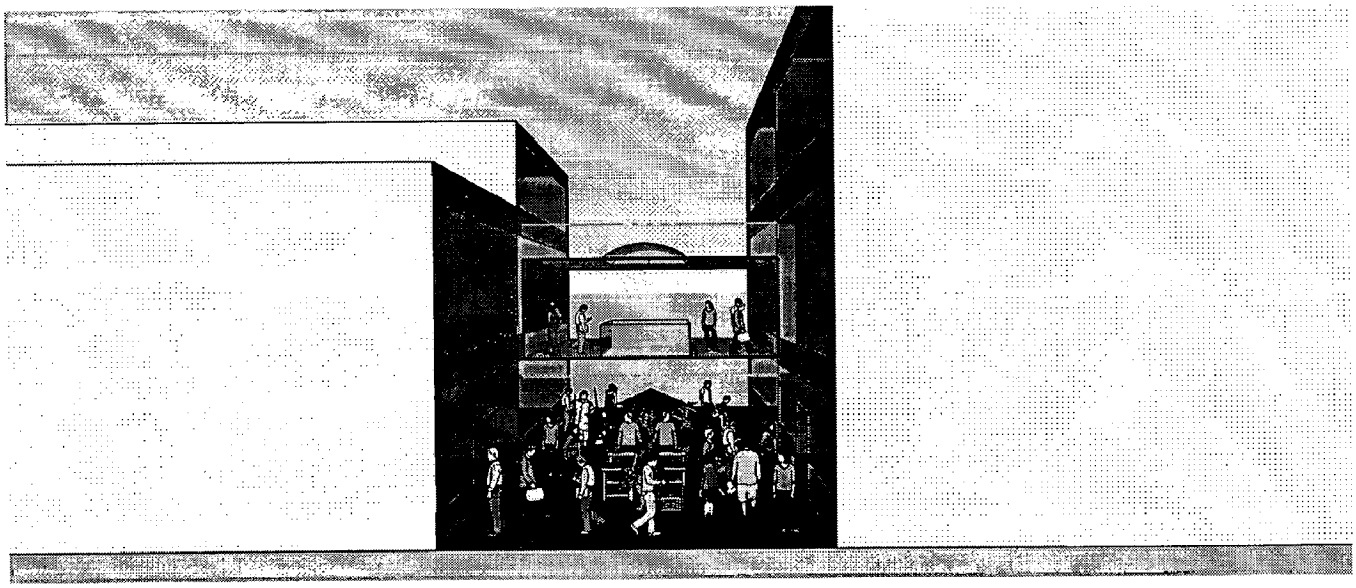


Fig. 7.26: Section of Proposed mall at Ranganathan Street

Source: By Author

Fig. 7.27: View of the Pedestrian mall

Source: By Author

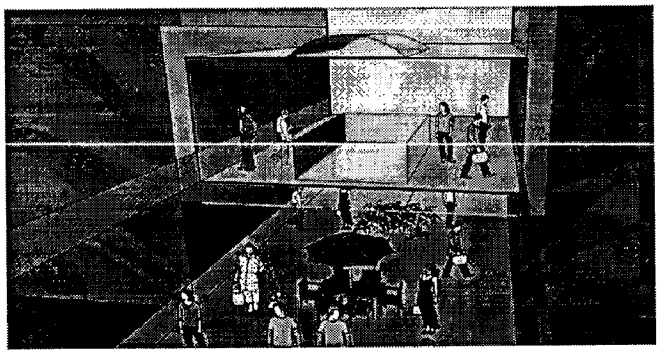
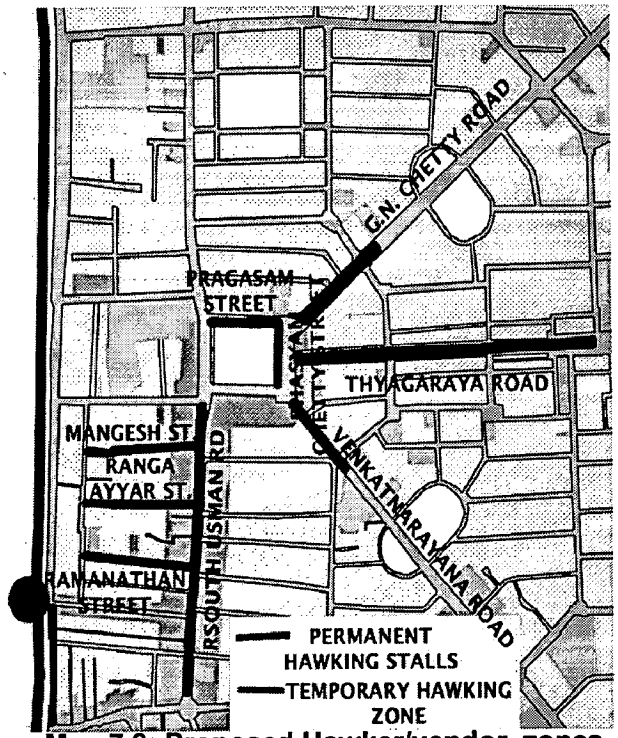


Fig. 7.28: View showing the upper level of the mall

Source: By Author



Map 7.9: Proposed Hawker/vendor zones

Source: By Author

B. Street Vending/Hawking Zones -

1. In order to prevent encroachments of the pedestrian zone, a street vending law should be devised, which provides a legal status to the hawkers and vendors.

2. Separate spaces/zones can be demarcated for street vending. Strict enforcement may ensure that the vendors and hawkers do not encroach the pedestrian space.

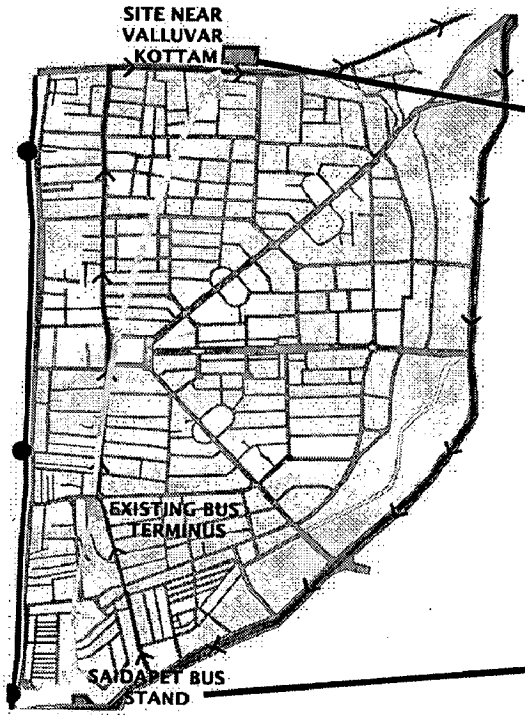
3. Permanent street vending and hawking zones can be created along South Usman road, Thyagaraya road, Pragasam street and Bhasyam Chetty Street (Map 7.9).

4. Temporary hawking/vending could be

proposed along the local streets like Ramanathan street, Ranga Ayyar street and Mangesh street and Venkatnarayana road during weekends and festive seasons to divert some pedestrian traffic from the Usman road and relieve it of the pressure (Map 7.9).

C. Relocation of Bus Terminus -

1. In order to relieve the traffic congestion at the Burkit road junction, it is advisable to relocate the T.Nagar Bus Terminus.
2. The existing T.Nagar Bus Terminus can be relocated to two locations – Saidapet Bus Terminus and along Arcot road near Valluvar Kottam (Map 7.10).
3. The bus traffic coming from Kodambakkam i.e. from the north of the study area can be routed at a new bus station, which can be constructed in an open ground along Arcot Road as shown in Fig 7.29.
4. The bus traffic coming via Anna Salai can be routed to the existing Saidapet Bus Stand, which can further be enlarged to accommodate the additional rolling stock (Fig. 7.30).
5. The Bus stations can further be designed as a multi-facility complex with supporting facilities like cafes, shopping arcades, food joints, fuel outlets, etc.



Map 7.10: Proposed locations for Shifting bus stand

Source: By Author

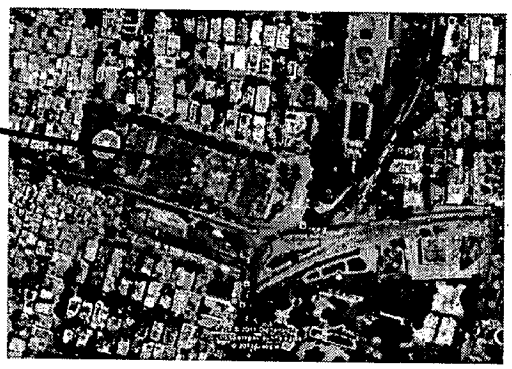


Fig. 7.29: Location near Valluvar Kottam

Source: By Author

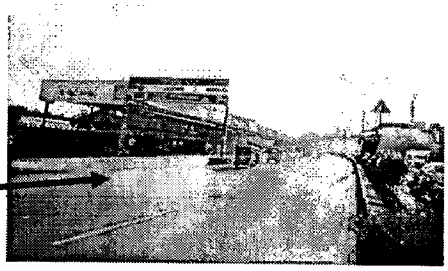


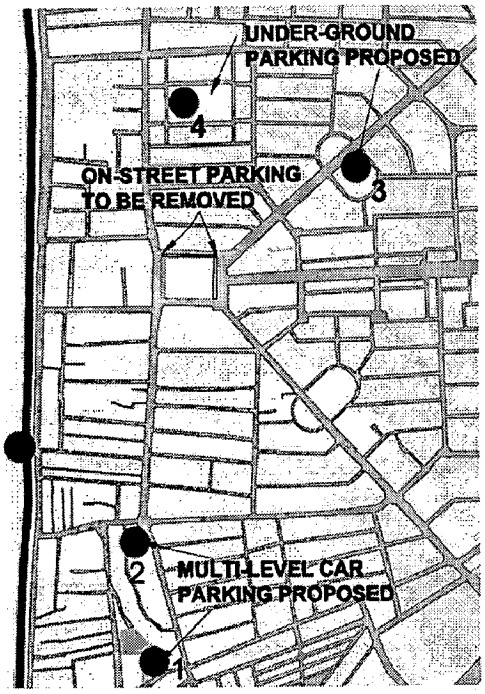
Fig. 7.30: Saidapet Bus stand

Source: By Author

D. Parking –

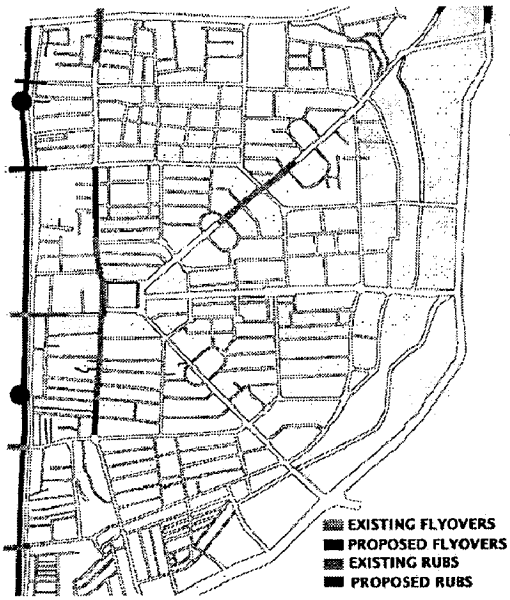
1. The existing on-street parking along Pragasam street and Bhasyam Chetty street should be removed as it is proposed to be a pedestrian zone (Map 7.11).

2. Multi-level car parking can be proposed at Kannammapet burial ground (marked 1 in map) and in the area cleared by the re-location of the T.Nagar bus stand (marked 2 in map) (Map 7.11).
3. Underground car parking can also be proposed under the Rama Krishna Missions Ground (marked 3 in map) and Somasundara Playground (marked 4 in map) (Map 7.11).
4. The parking locations proposed are along the periphery of the study area and hence would not create any traffic movement inside the pedestrian zone.
5. Collection of parking fees must be strictly enforced. Increased parking fees may reduce the number of people commuting by motor vehicles.



Map 7.11: Proposals for car parking

Source: By Author



Map 7.12: Proposed flyovers and RUBs

Source: By Author

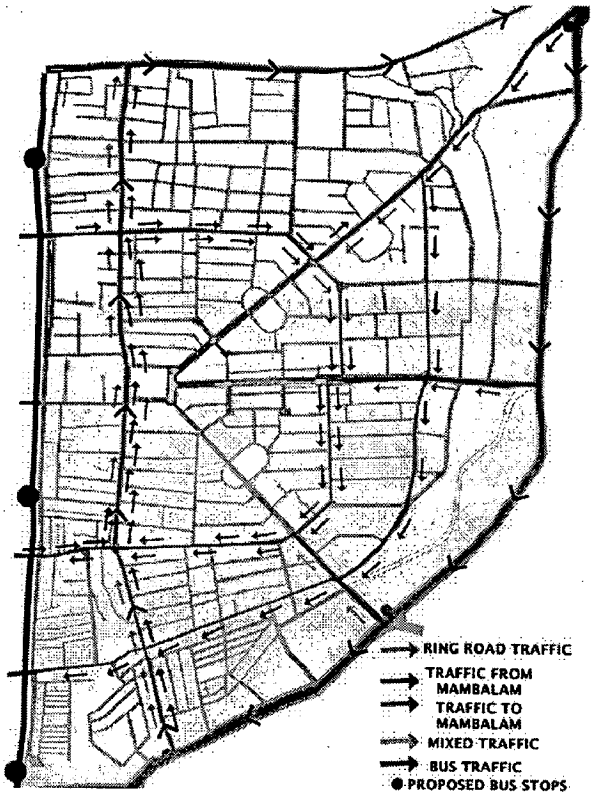
E. Proposed Crossings and Flyovers –

1. The existing flyover along South Usman road begins after Ranganathan street and ends at North Usman road before Bazullah road junction. The flyover can be extended till Bazullah road junction towards north and till the Burkit road junction towards south, to relieve the Usman road stretch of heavy pedestrian-vehicular conflicts (Map 7.12).

2. Two road under bridges can be proposed along the Bazullah road and Habibullah road intersections near the railway line to facilitate better movement of traffic to and from T.Nagar (Map 7.12).

F. Traffic Management –

1. The share autos to Anna Nagar currently stop at the Burkit road junction and congest the area. They take the route of Burkit road and via Thirumalla Pillai road connect to Arcot road. The share auto stop can be shifted near to Boag road junction, to relieve the Burkit road-Medley road junction of congestion and ensure a safe pedestrian movement.



Map 7.13: Traffic Management

Source: By Author

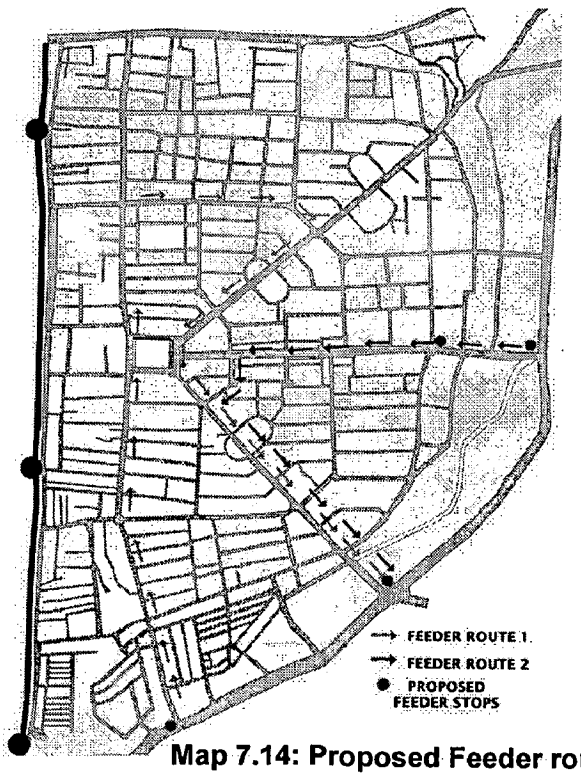
2. Traffic calming streets can be created by employing traffic calming devices like raised crossings, road humps, etc. at intersections to ensure that the motorists lower their speed at the crossings and pedestrian safety is secured.

3. The vehicular traffic can be restricted outside the inner ring (along Burkit road till Bazullah road), to prevent it from entering into the core (indicated in green in Map 7.13).

4. The bus movement can be diverted along the outer ring through Narasimhan road, North Boag road and South Boag road towards West Mambalam. The buses can also take the route along the Usman road flyover towards Kodambakkam (indicated in pink in Map 7.13).

G. Feeder Services –

1. In order to provide an alternate mode of transport for commuters who travel through public transport like buses and metro, a mini bus or a mini-van feeder system can be introduced to operate along defined routes inside the study area and connect to the proposed feeder stops along Anna Salai.



Map 7.14: Proposed Feeder routes

Source: By Author

2. The feeder nodes can serve commuters from various transport modes like buses, metro, rail and from multi-level car parking.

3. Two feeder routes have been proposed. Feeder route 1 starts from Anna Salai along CIT Main road and Usman road and passes across Panagal Park to connect back to Anna Salai (marked in yellow). Feeder route 2 from starts from Anna Salai near Thyagaraya Road and passes through Sivagnanam street to connect back to Anna Salai (marked in red) (Map 7.14).

4. The feeder system would function at lower speeds within the pedestrian streets of G.N. Chetty road Thyagaraya road and Venkatanarayana road.

5. The feeder route 1 passing through the Usman road flyover can stop midway above the Panagal crossing. An elevator core can bring down the pedestrians to the street level.

The proposals recommended above for T.Nagar are an attempt to decongest the core and convert the core into a pedestrian precinct, in integration with the overall traffic movement and the existing and upcoming transit nodes to transform T.Nagar as one of the most desirable shopping destination on foot.

7.3. Planning and Design Guidelines for Chennai city

The pedestrian scenario as already seen in the earlier chapters is very poor in Chennai city. Many stretches do not even have basic facilities like sidewalks. The existing sidewalks are in a state of disgust, leaving the pedestrians with no option but to walk on the carriageway. The stretches where sidewalks exist, lack attractiveness and convenience to the users. The city core areas are facing traffic congestion and losing their character. Pedestrianization as a strategy has by far not been implemented in the city. Thus in regard to the above situation, the following general guidelines and standards may prove useful to improve the pedestrian scenario of the city and achieve a sustainable and a 'green' development in the future.

7.3.1. Planning and design guidelines for the city

To make Chennai city roads pedestrian-friendly, it is advisable to re-look at the present street sections of various road categories and improvise them to make them suitable for the pedestrians and the cyclists. The current segment deals with street sections for various road typologies, with a basic goal to make more space for pedestrians and incorporate the concept of pedestrian streets in street design. This has been illustrated as follows.

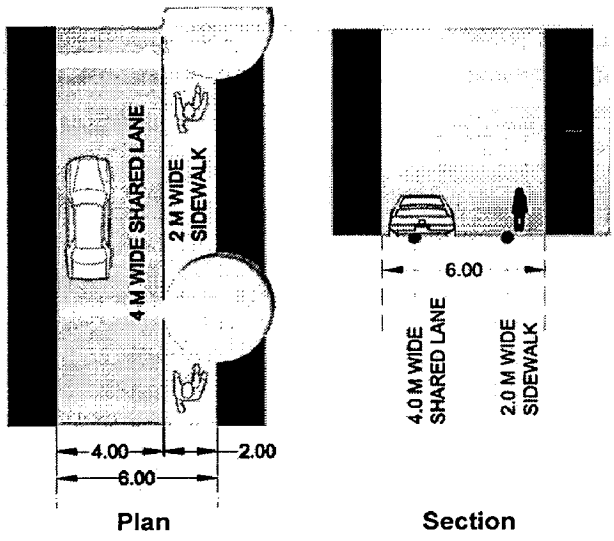


Fig. 7.31: Detail for 6m wide Street

Source: By Author

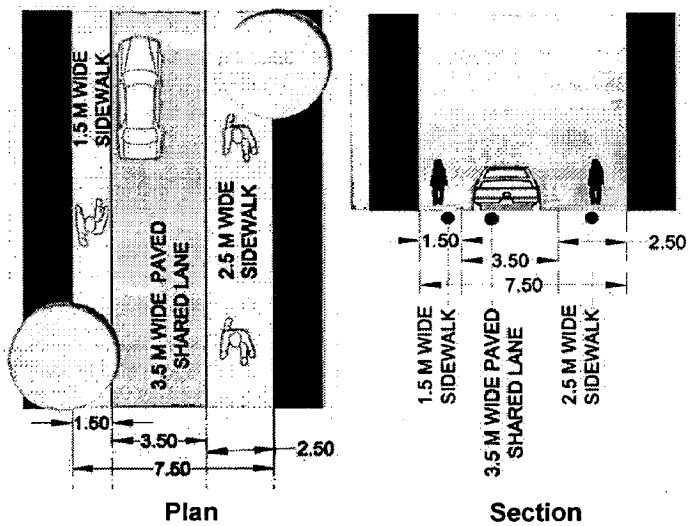


Fig. 7.32: Detail for 7.5m wide Street

Source: By Author

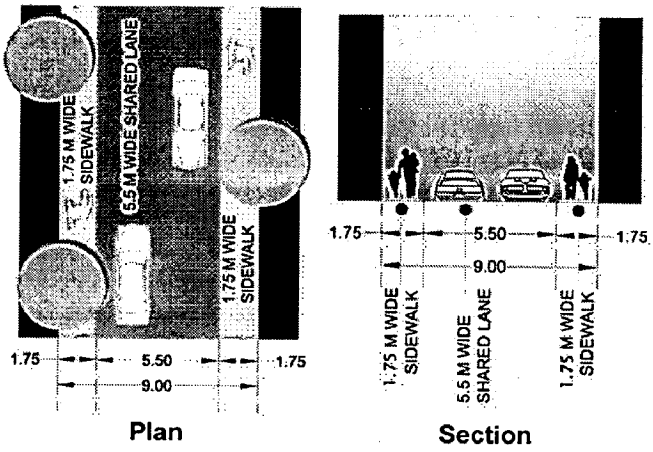


Fig. 7.33: Detail for 9m wide Street (alternate 1)

Source: By Author

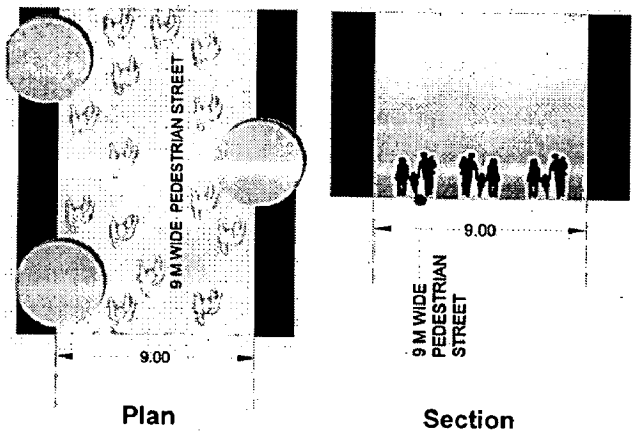
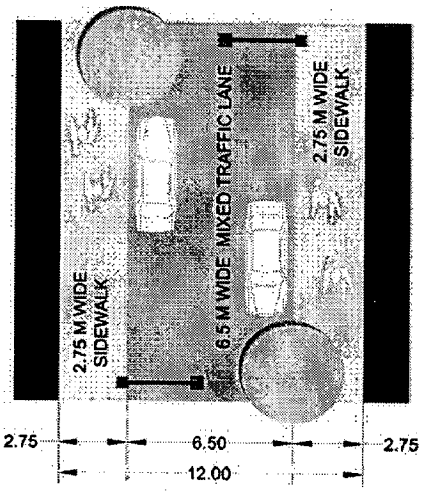


Fig. 7.34: Detail for 9m wide Street (alternate 2)

Source: By Author



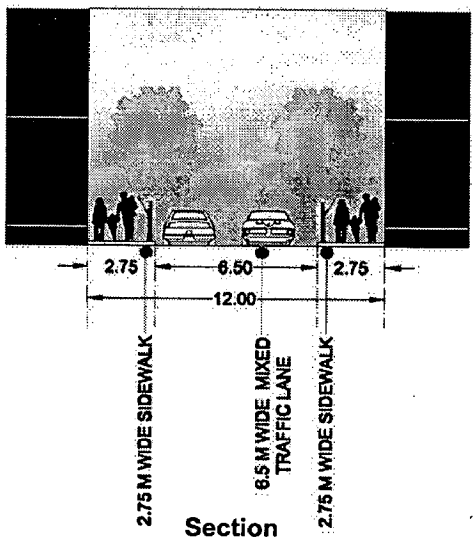
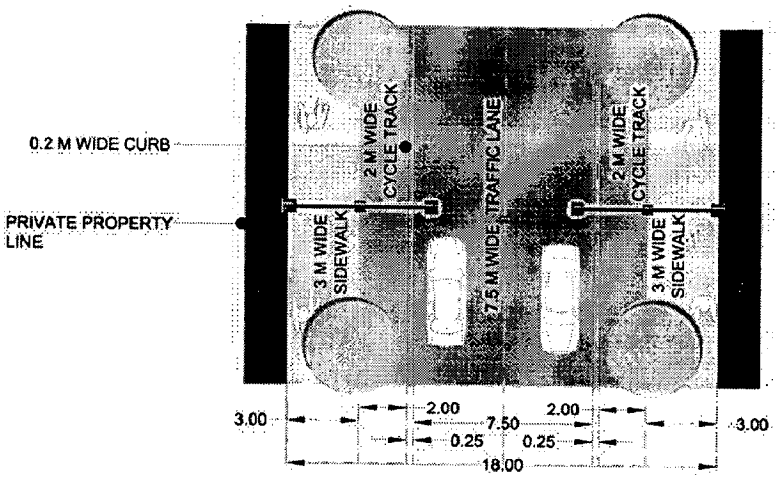


Fig. 7.35: Detail for 12m wide Street

Source: By Author



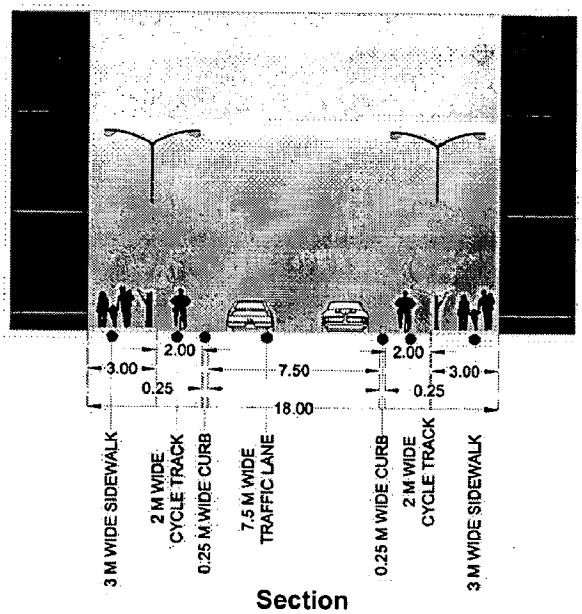


Fig. 7.36: Detail for 18m wide Street

Source: By Author

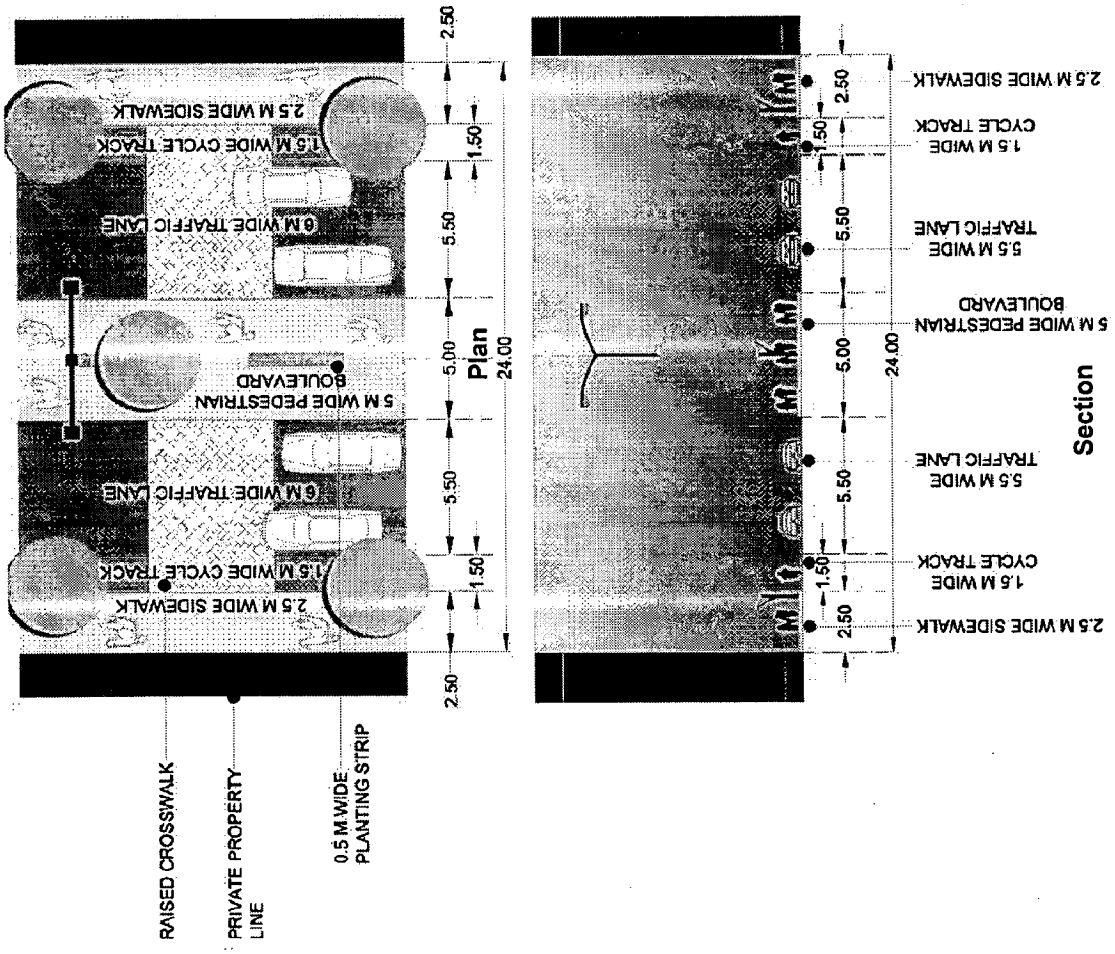


Fig. 7.37: Detail for 24m wide Street (alternate 1)

Source: By Author

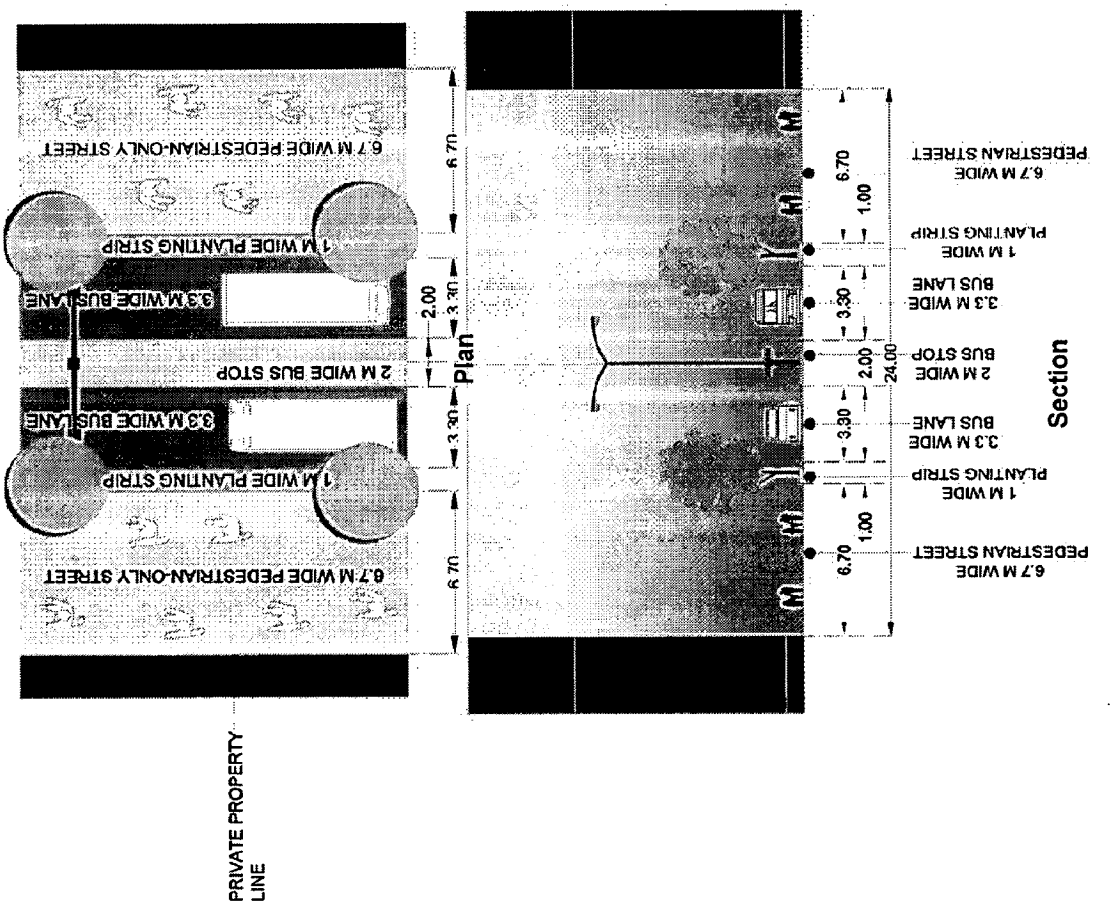


Fig. 7.38: Detail for 24m wide Street (alternate 2)

Source: By Author

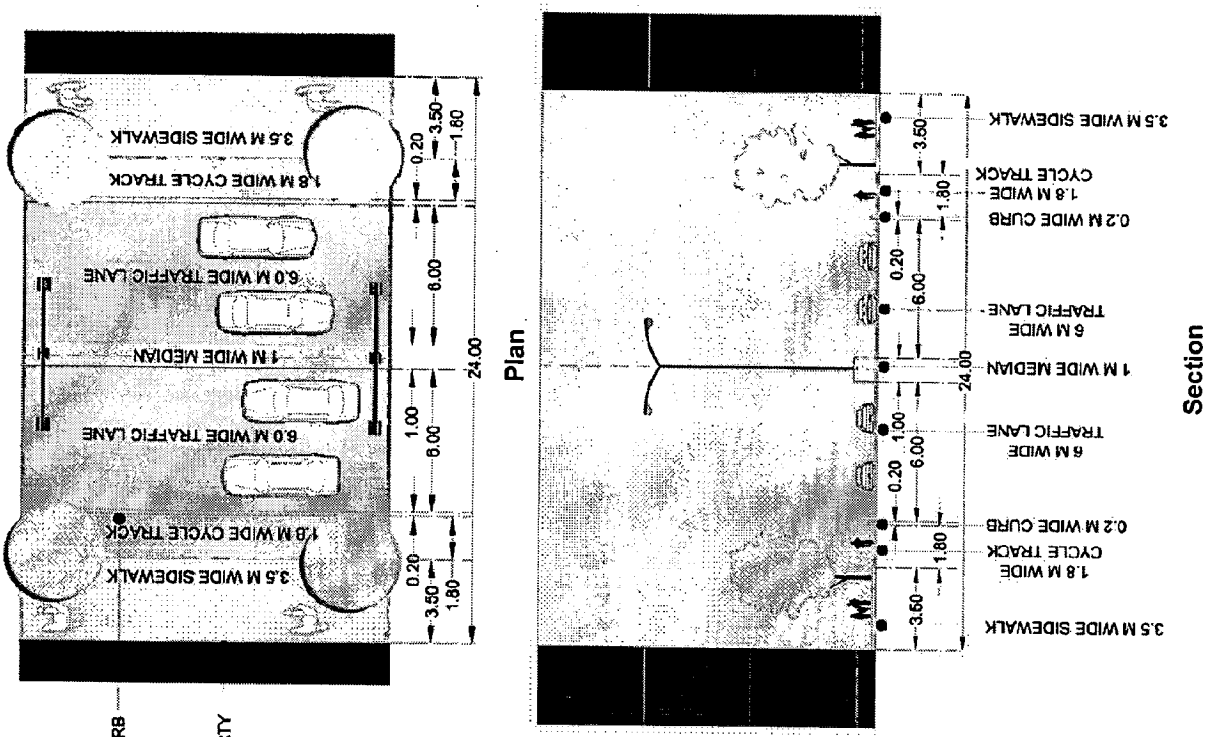


Fig. 7.39: Detail for 24m wide Street (alternate 3)

Source: By Author

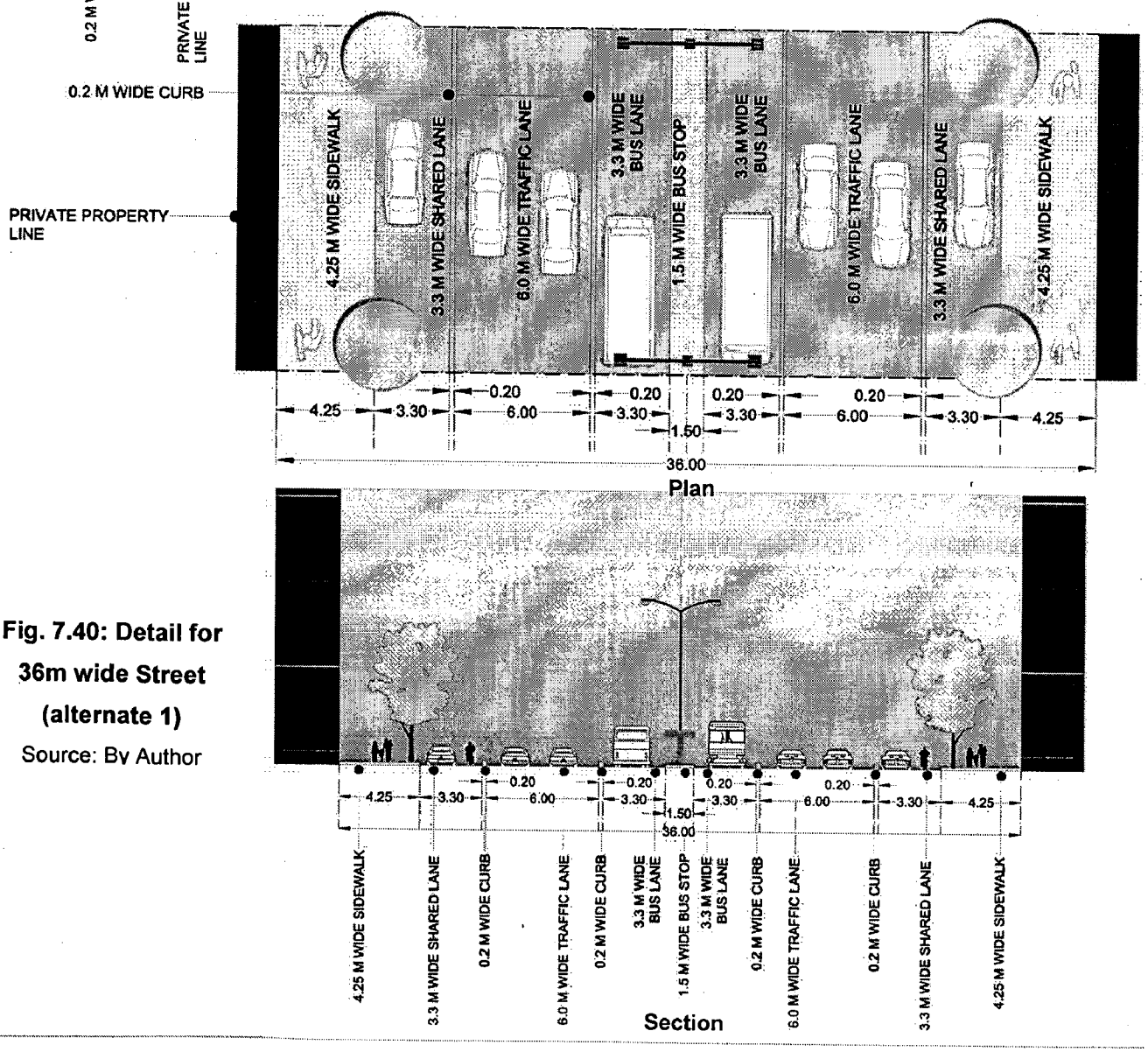
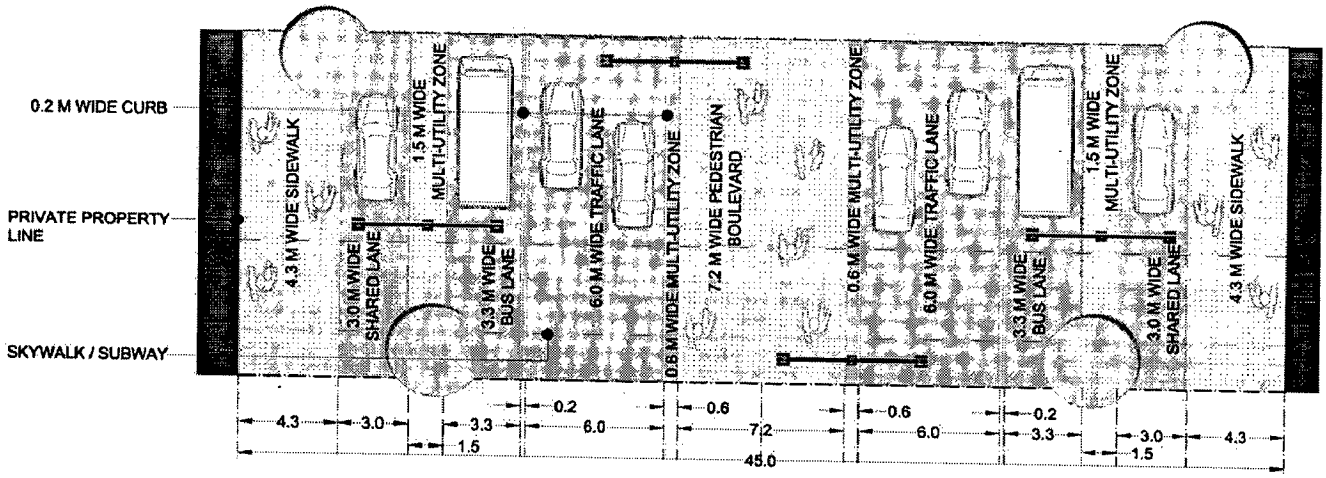


Fig. 7.40: Detail for 36m wide Street (alternate 1)

Source: By Author



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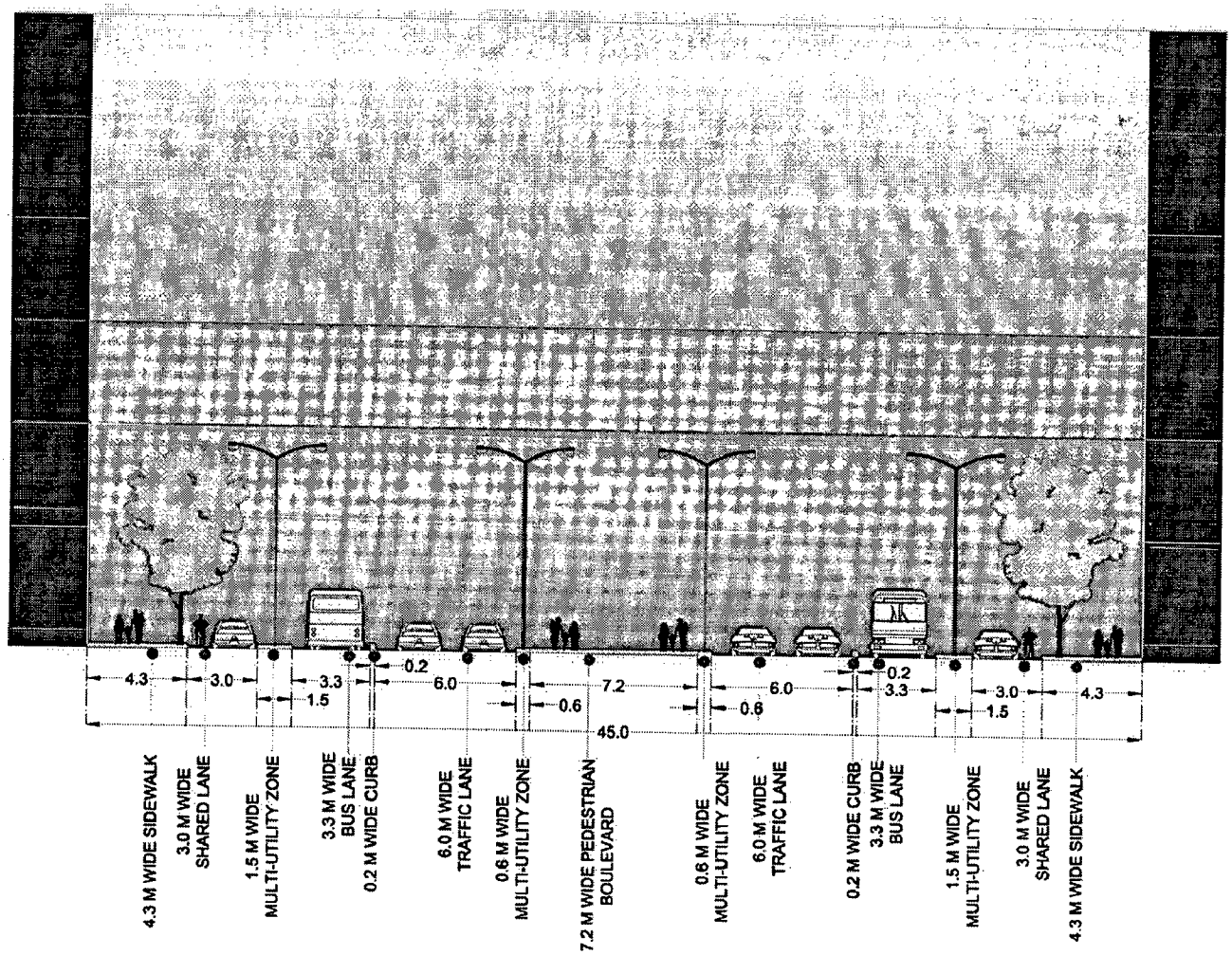

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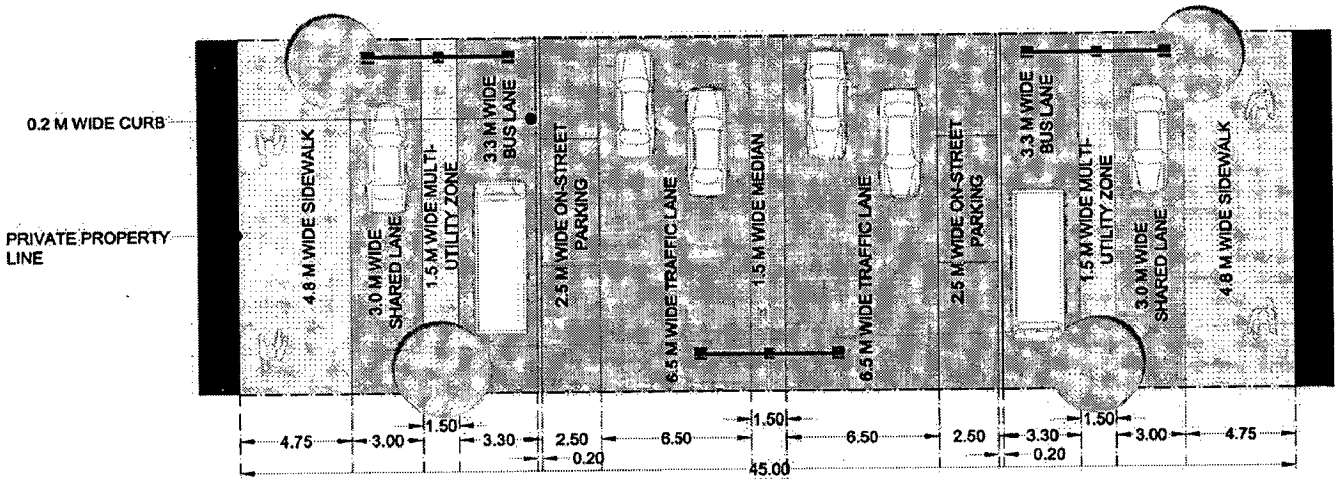
Fig. 7.43: Detail for 45m wide Street (alternate 1)

Source: By Author



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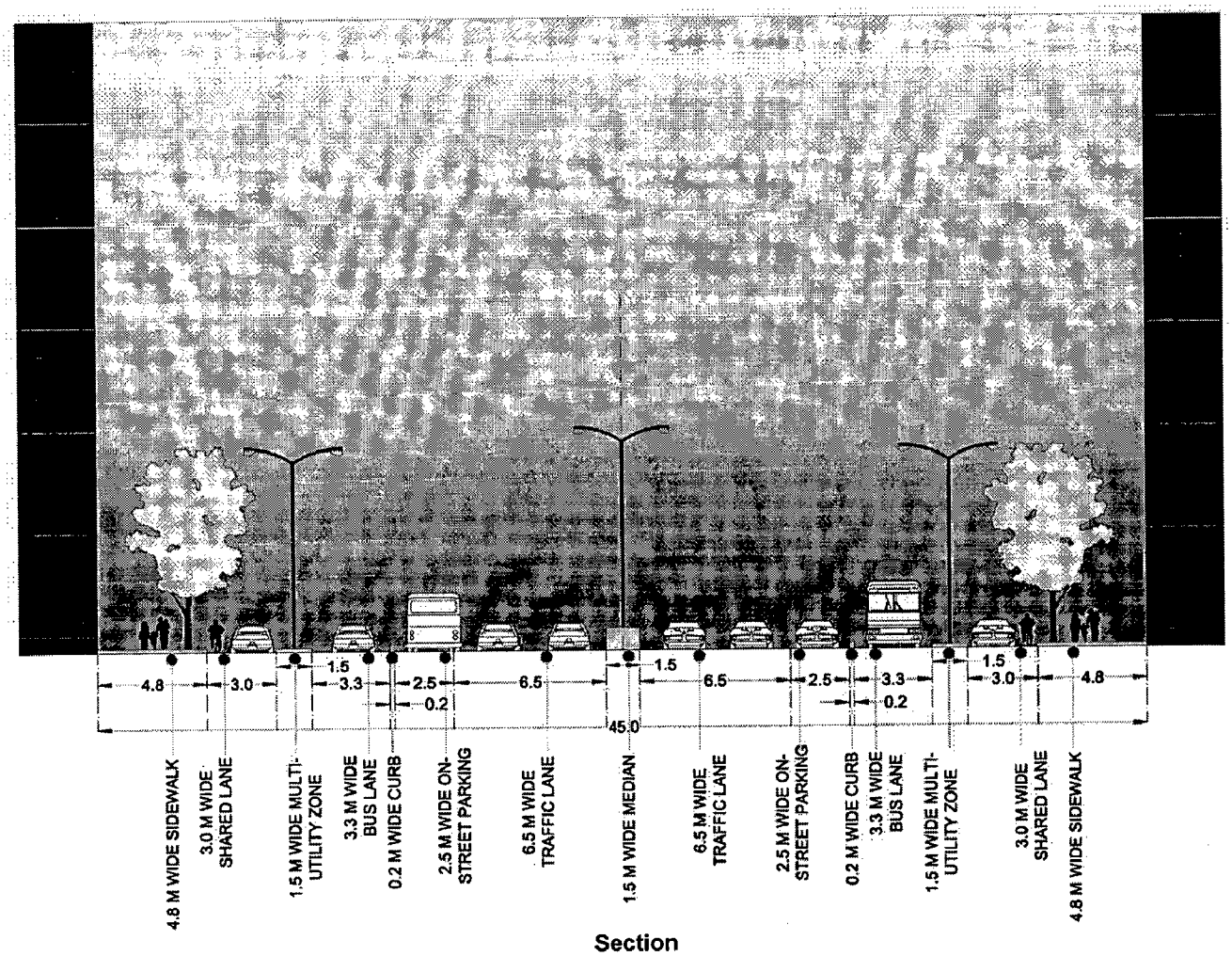

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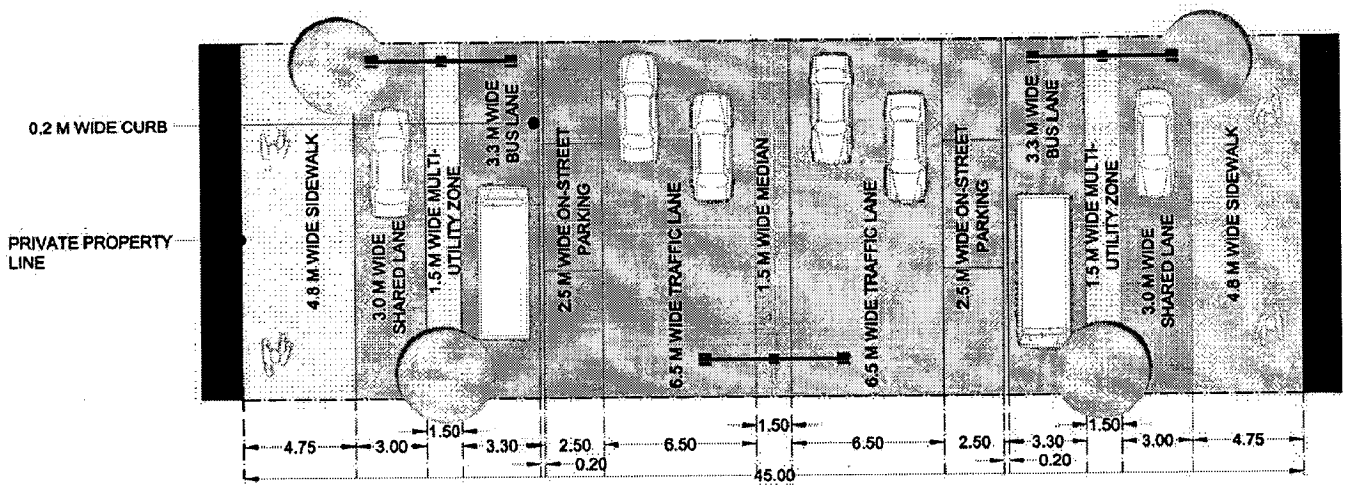
Fig. 7.44: Detail for 45m wide Street (alternate 2)

Source: By Author



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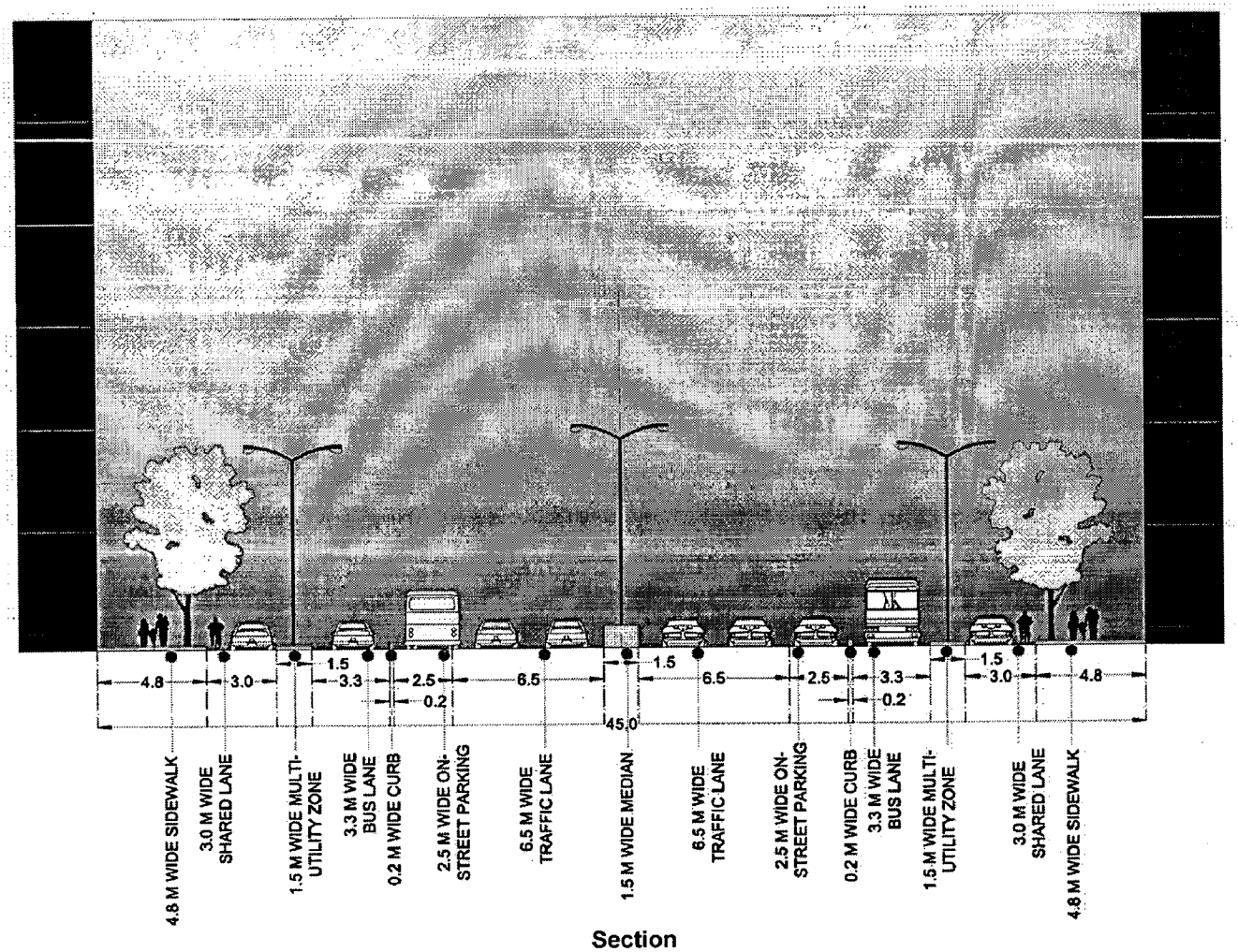

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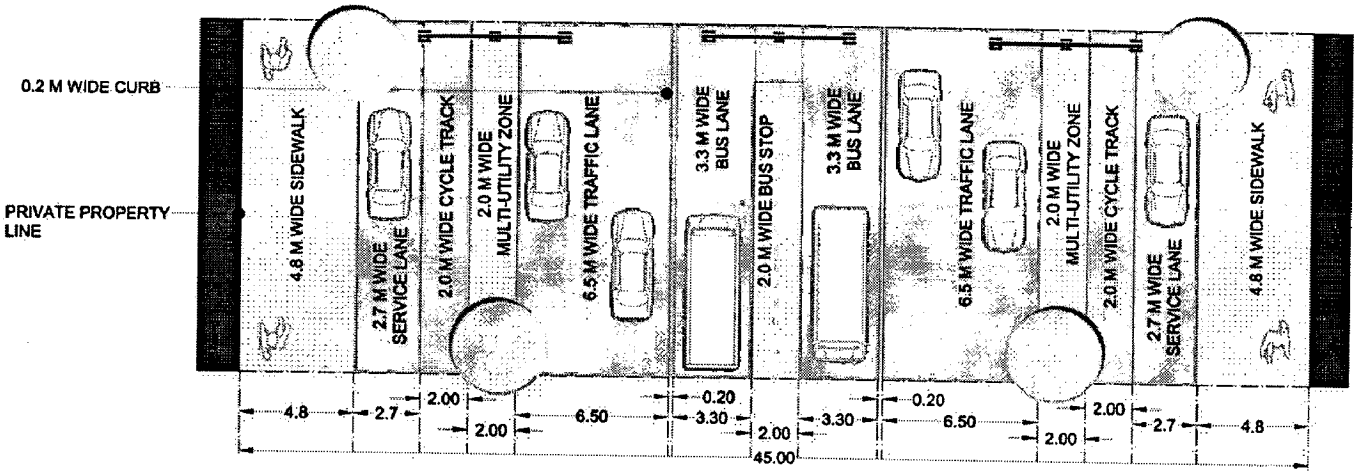
Fig. 7.44: Detail for 45m wide Street (alternate 2)

Source: By Author



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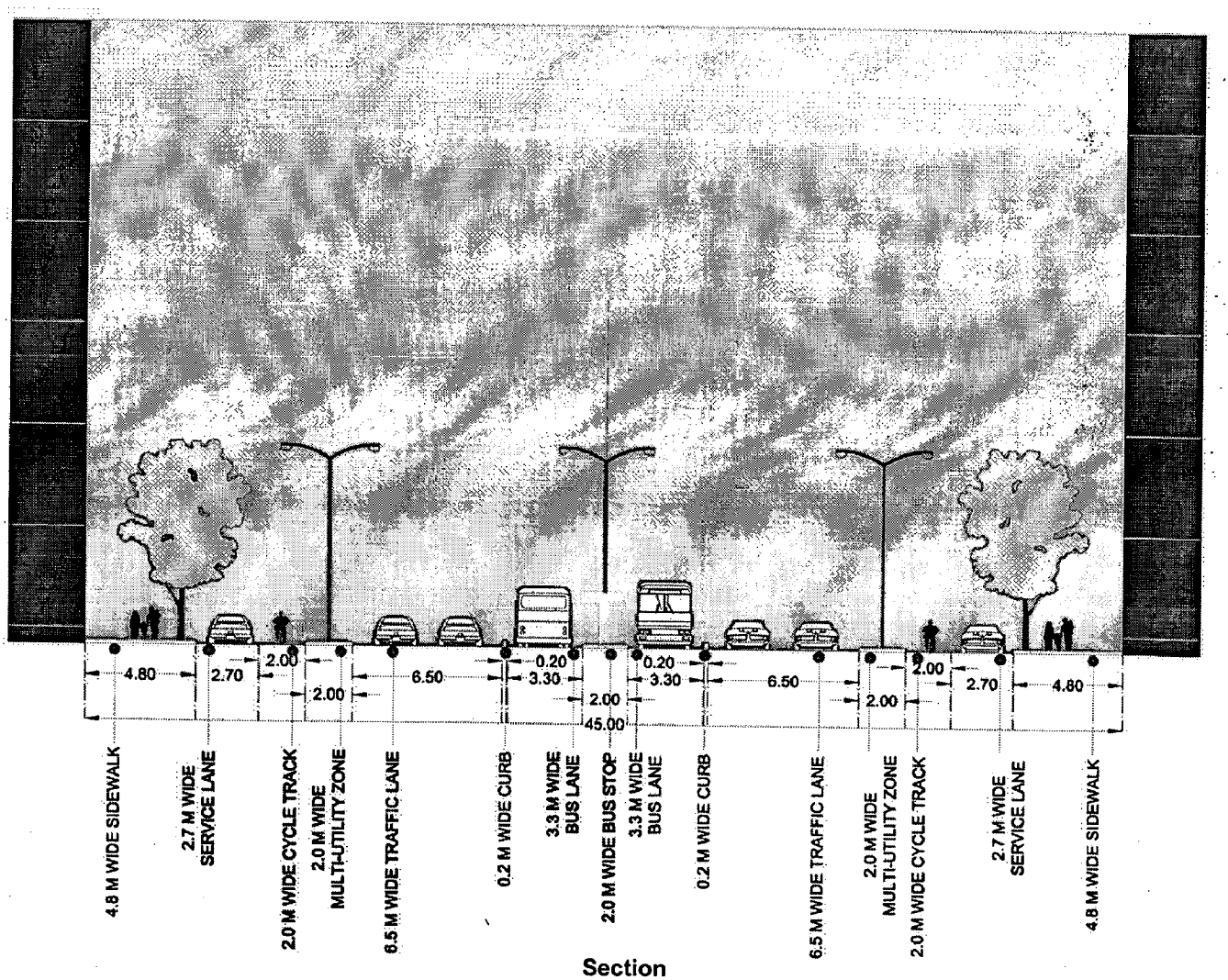

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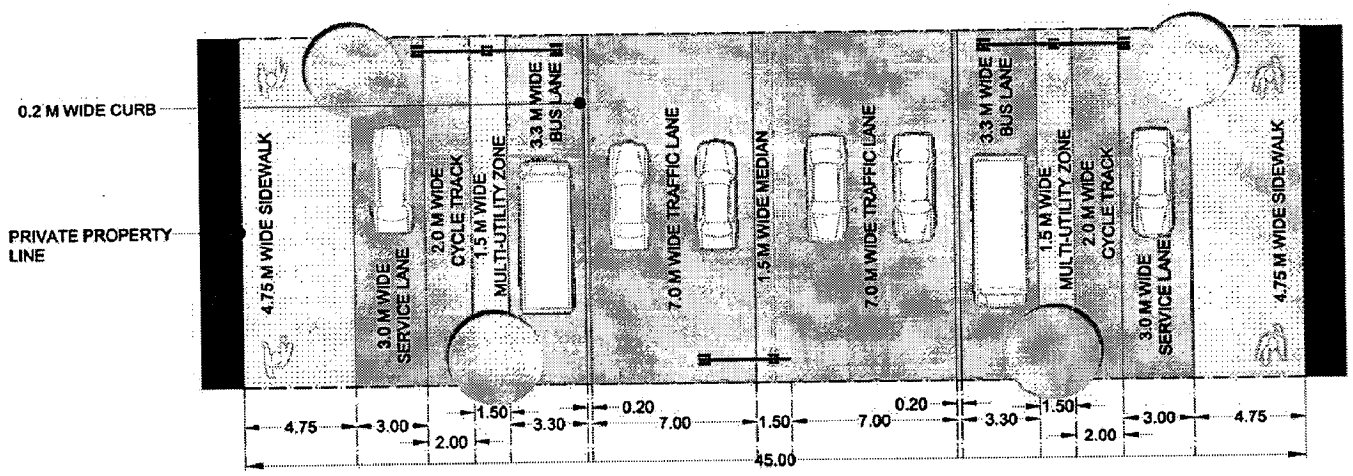
Fig. 7.45: Detail for 45m wide Street (alternate 3)

Source: By Author



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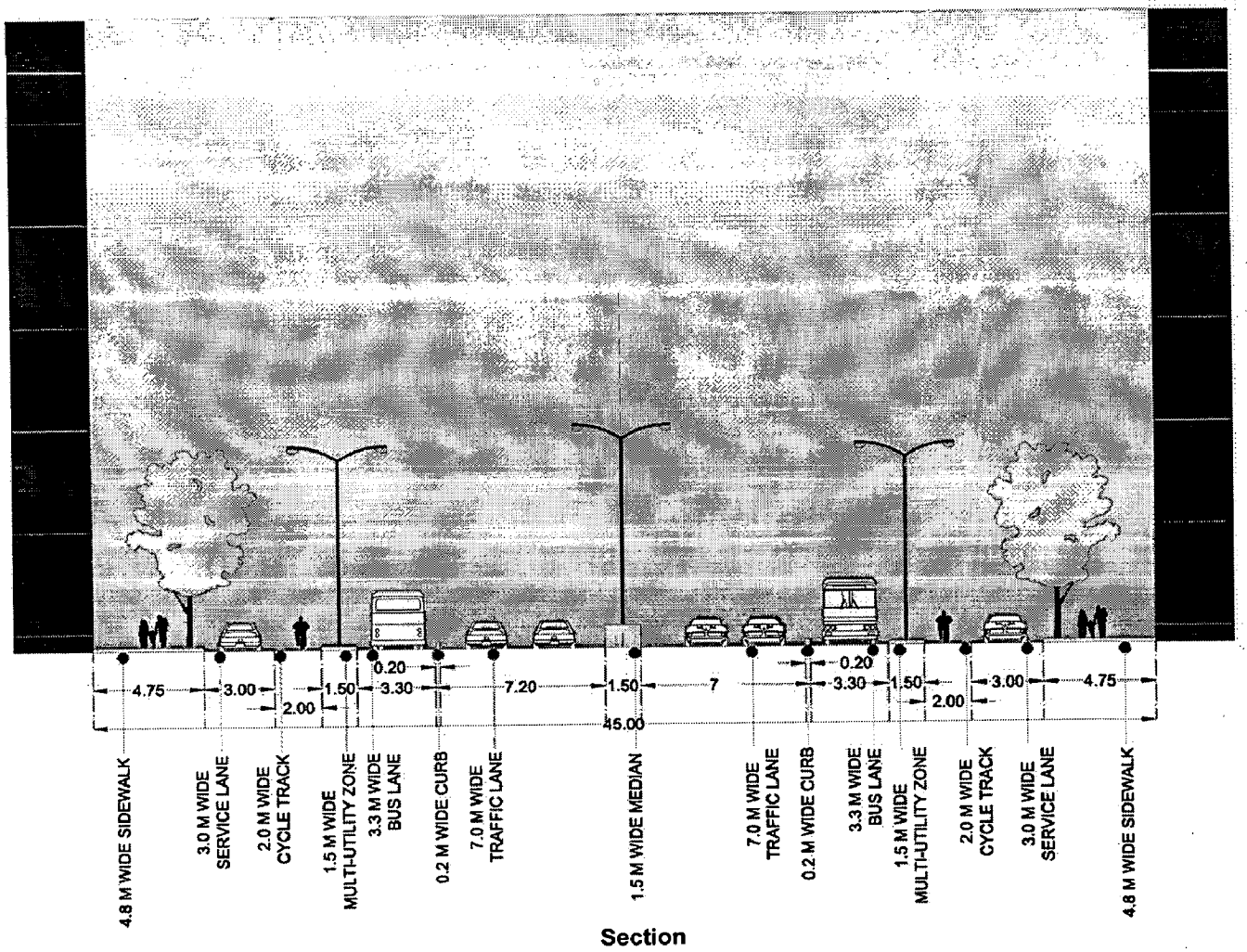

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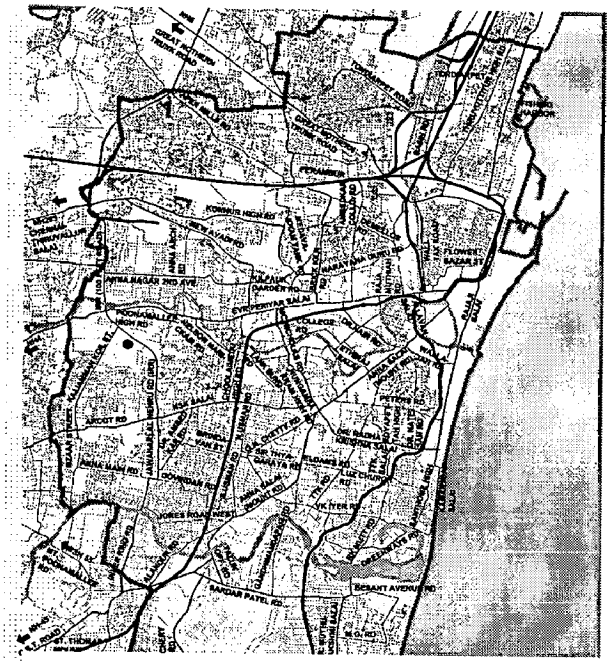
Fig. 7.46: Detail for 45m wide Street (alternate 4)

Source: By Author



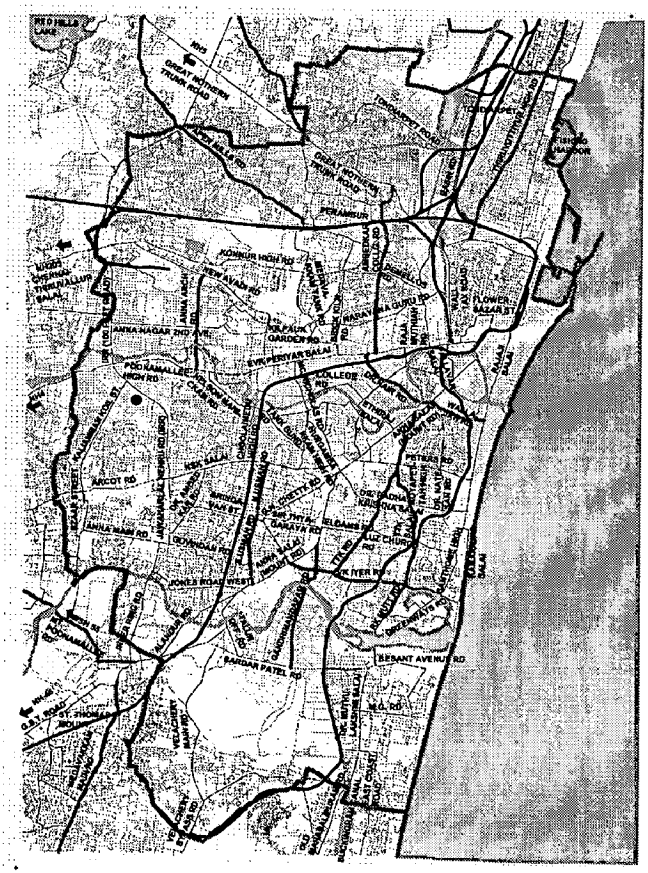
Map 7.15: Arterial roads in Chennai

Source: By Author

1. Arterial roads – Arterial roads with a width between 45m – 60m (few are 80m wide) like Sardar Patel Road, Anna Salai, Jawaharlal Nehru Road, NSK Salai, EVR Periyar Salai, Anna Nagar Second Avenue etc. (Map 7.15) are recommended to implement the street sections as shown in Fig. 7.43-7.46 with suitable changes.

2. Sub-Arterial roads – Sub-arterial roads with a width between 30m – 45m like Gandhimandapam road, TTK road, South Usman road, Dr. Nair road etc. (Map 7.16) are recommended to implement the street sections as shown in Fig. 7.40-7.42 with suitable changes.

3. Collector streets – Collector streets with a width between 18m – 24m like Anna Main road, G.N. Chetty road, Luz Church road, Eldams Road, Sir Thyagaraya road, Dr. Ambedkar road, Brindavan street, Anna Main road, Ethiraj Salai etc. (Map 7.17) are recommended to implement the street sections as shown in Fig. 7.36-7.39 with suitable changes.



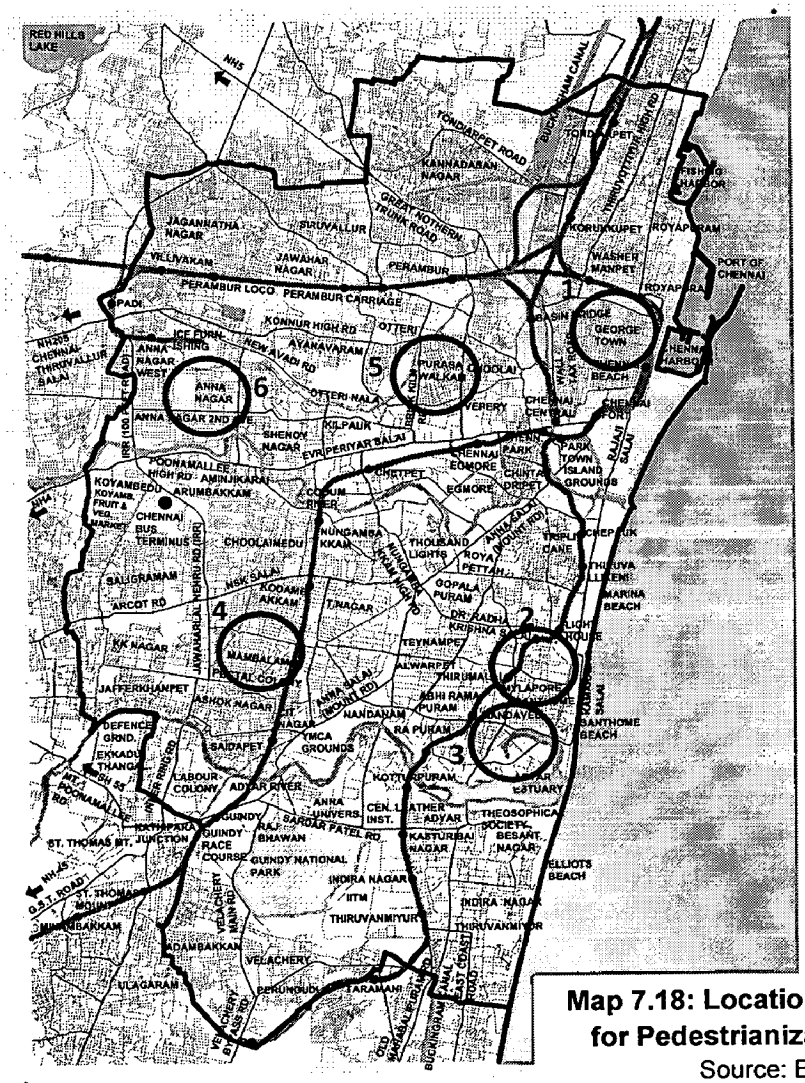
Map 7.16: Sub-arterial roads in Chennai

Source: By Author

Map 7.17: Collector roads in Chennai

Source: By Author

4. Local roads – Local roads with a width between 6m-15m are recommended to implement the street sections as shown in Fig. 7.31-7.35 with suitable changes.
5. The streets with widths between 4.5m-9m are recommended to be made pedestrian streets in core areas of the city. The neighborhood streets are recommended to follow the shared use lane concept with suitable traffic calming devices implemented.
6. Core areas like (1) George Town, (2) Mylapore, (3) Mandaveli and other areas of the city like (4) West Mambalam, (5) Pursawalkam and (6) Anna Nagar are recommended to follow the example of T.Nagar and successfully pedestrianize their streets, to retain the character of the core (Map 7.18). Some of the strategies which can be successfully employed are summarized as follows.
    a) Complete pedestrianization of certain streets by banning the traffic.
    b) Part-time pedestrianization by restricting traffic during morning and evening peak hours.
    c) Traffic calming techniques to be employed in certain streets to
    d) Sidewalks widening and narrowing the carriageway width.
    e) Grade-separated pedestrian facilities like skywalks and pedestrian subways.
    f) By exploring the concept of shared street spaces.
    g) By employing strategies like 'No Vehicle Day' and choosing certain days in a week to allow traffic.
    h) By limiting the access to heavy vehicles during the night hours.
    i) By allowing public transit and feeder services into the pedestrian precinct to provide a secondary mode of transport.
    j) Diversion of vehicles and effective traffic management.
    k) By imposing regulation on the number of car parking spaces and increasing the parking tariff.



Map 7.18: Locations recommended for Pedestrianization proposals
Source: By Author

7.3.2. Design Guidelines and standards for Pedestrian Facilities

For a successful pedestrian environment, it becomes essential to follow some standards or guidelines for designing the pedestrian facilities. Some standards and guidelines recommended for pedestrian facilities and amenities in Chennai city has been put forth as under.

7.3.2.1. Sidewalks

1. Sidewalks must be designed to facilitate safe, convenient and comfortable mobility. Sidewalks should be made mandatory on all streets except pedestrian streets (these would be paved exclusively for pedestrian use only).
2. The sidewalk width can be designed from a minimum of 2.5m to a luxurious width of 6m. In commercial areas, a minimum width of 3m should be provided and can vary till 6m (Fig. 7.47), depending on the road width. In residential neighborhoods, the sidewalk width can vary between 2m-2.5m (Fig. 7.48).

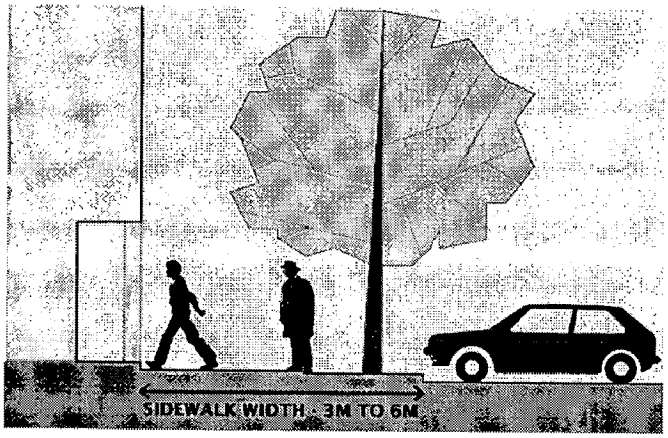


Fig. 7.47: Sidewalk width for commercial land-use

Source: By Author

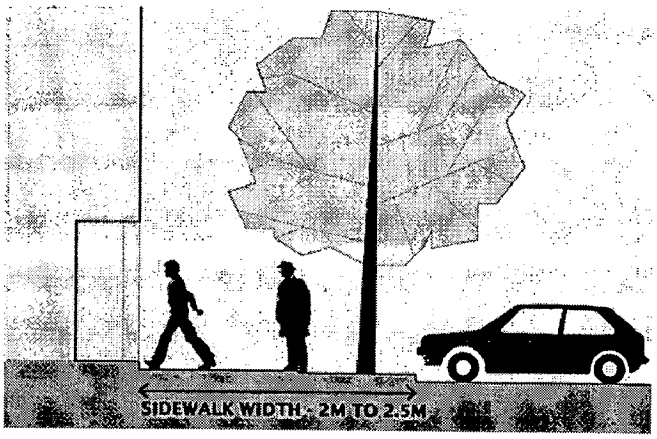


Fig. 7.48: Sidewalk width for residential land-use

Source: By Author

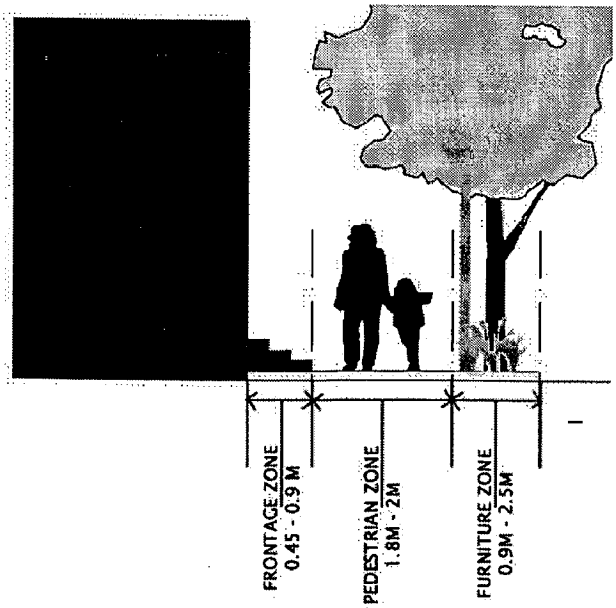


Fig. 7.49: Zones of a sidewalk

Source: By Author

3. The sidewalks must be designed to consist of three major sub-zones – Frontage zone, Pedestrian zone and Furniture zone. The widths are as illustrated in Fig. 7.49 & 7.50.

Fig. 7.50: Sidewalk zones in Minneapolis

Source: Pedestrian Design Guidelines, Minneapolis

4. A minimum unobstructed width of 1.8m should be maintained in the Pedestrian zone. Furniture zone is useful for the provision of amenities like landscaping, lighting, trash receptacles, signage, water fountains, benches, bike racks etc.
5. The curb height of the sidewalks should be preferably 150mm.
6. The sidewalks should have a running slope of 5% (1:20) and a cross slope of 2% (1:50) to facilitate proper drainage.
7. The sidewalks must be continuous. Wherever there are interruptions for access to a private property or a road crossing, there must be provisions for a smooth slope in the sidewalk to make walking convenient and not tiring (Fig. 7.51).
8. Tactile warning strips of 300mm X 300mm must be installed on sidewalks for the visually impaired.

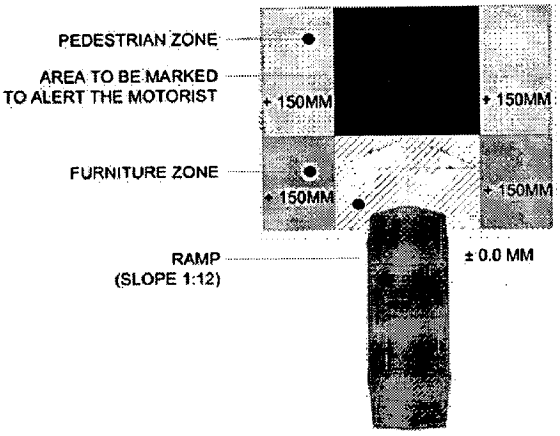


Fig. 7.51: Sidewalk Driveway Detail

Source: By Author

7.3.2.2. Curb Radius

1. Curb radius must be kept less since a shorter radii ensures that a motorist is forced to reduce his speed while turning leading to greater pedestrian safety at the intersections.
2. Curb radius can vary from 2m-2.5m for local streets and collector roads. It can range to 4.5m for major arterial roads.

7.3.2.3. Curb Ramps and Universal Accessibility

1. Curb ramps provide access to sidewalks and crossings, for wheel-chair users, elderly people and other pedestrians who find it difficult to climb the sidewalks and should be provided at all legal crossings and intersections.
2. Perpendicular ramps are generally most desirable as they maintain the continuity in the direction of travel and also help to guide visually impaired pedestrians.
3. The ramp width should be 1.2m with a slope of 1:10 or 1:12 and a cross slope of 1:50 (Fig. 7.52).

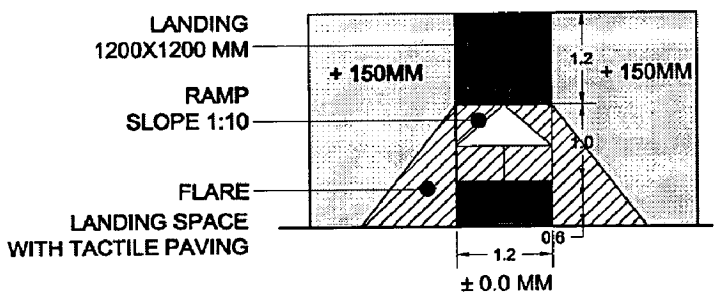


Fig. 7.52: Curb Ramp Detail

Source: By Author (based on Pedestrian Design Guidelines, Minneapolis)

4. Ramps and elevators must be installed in grade-separated crossings like skywalks and subways to facilitate the wheel-chair users.

7.3.2.4. Crossings

1. Crosswalks should be atleast 3m wide. A desirable width would be 5m and in areas with a high pedestrian volume, it could be increased to 6m.
2. Mid-block crossings should be provided at intervals of 90-120m, especially in commercial and institutional areas.
3. Pedestrian subways should be provided on arterial and sub-arterial roads. Subway widths can desirably vary between 2.7m – 3.5m. Subways should be properly lit and ventilated. CCTV cameras inside the subways can improve the safety and security. Ramps with a slope of 1:12 should be provided to facilitate the wheel-chair users.
4. Foot-over bridges/skywalks should be provided at transit nodes and along high-traffic corridors. The width of foot-over bridges can range between 3 – 5m. They must be equipped with elevators to make it universally accessible.

7.3.2.5. Pedestrian Refuge Islands

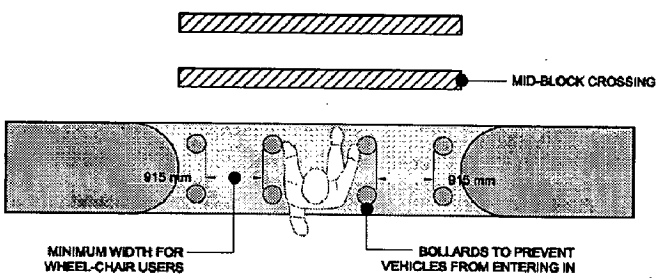


Fig. 7.53: Detail of Pedestrian Refuge Island

Source: By Author

1. Pedestrian refuge islands can be ideally 1.5m wide and 4.5m long (Fig. 7.53).
2. The refuge islands must be paved with tactile blocks to assist the visually impaired. Bollards can be installed to prevent motorists from barging into the refuge island.

7.3.2.6. Multi-utility zones

1. Multi-utility zones are zones along the sidewalk and cycle tracks that can be created to accommodate landscaping (trees), cycle-rickshaw stands, hawker zones, paid car parking machines, street furniture, bus stops and auto stops, traffic police booths, utilities etc.
2. Multi-utility zone widths can vary between 1.5m to 2.5m.

7.3.2.7. Pedestrian Amenities

1. Pedestrian amenities provide convenience to the pedestrians. They should be ideally located in the furniture zone of the sidewalk. Street furniture like benches is a basic amenity for pedestrian comfort and should be provided at frequent intervals.
2. Public toilets should be located within a comfortable walking distance of 0.5 km radius in the area.
3. Bus-stops should be spaced at every 1 km and should be aesthetically and functionally appealing.

4. Signage and information boards should be located at frequent intervals along the sidewalk.
5. Area·map boards and street direction boards should be ideally located near the sidewalk crossings.
6. There should be provisions in the sidewalk for including other amenities like dustbins, post boxes, telephone booths, fire hydrants, sand bins, bicycle racks and utility boxes,.

7.3.2.8. Sidewalk Lighting

1. Lighting should be appropriate to the pedestrian scale and not the automobile scale.
2. Sidewalk lighting should be mid-mast lighting, which are 9-10m tall or pedestrian scale lighting, which are 3-5m tall.
3. Tree planting should be in conjunction with the lighting design, so that the trees do not obstruct the lighting.
4. Lighting should be glare-free. Automatic cut-off lights should be installed to save energy.

7.3.2.9. Shared Use Lanes

1. Shared-use paths are intended to serve pedestrians, wheelchair users, cyclists, or other non-motorized modes of transport.
2. Shared use lane width can vary between 2.7m – 3.5m and should incorporate suitable traffic calming devices and speed restrictions, in case of vehicular entry.

7.3.2.10. Sidewalk Cafes

1. Sidewalk cafes should be accommodated in the furniture zone of the sidewalk.
2. For a sidewalk width of 3.3m, a minimum width of 1.8m can be allocated for the pedestrian zone and the rest 1.5m can be allocated for sidewalk cafes.

7.3.2.11. Street Vendors

1. Vending should take place in the Furniture zone of the sidewalk or in the multi-utility zones.
2. A clear width of 1.2m should be provided infront of the street vendor stands.

7.3.2.12. Paving

1. The sidewalks must be level, firm, stable and slip resistant.
2. Concrete pavements are the simplest sidewalk material for the pedestrian zone. The panel sizes can be 1.8mx1.8m.
3. Colored concrete pavers, tinted and un-tinted concrete, sand-blasted stone pavers, asphalt pavers, granite pavers, brick pavers, tiles and rubber pavers are the other types of paving.

7.3.2.13. Landscaping

1. Native vegetation should be used to minimize maintenance and long term costs.
2. Low height shrubs must be used near crossings to provide better visibility.
3. Trees with damaging root systems should not be planted, which seems to be a common problem on many of the city's sidewalks.
4. Planting strips should be 1.5m-2.4m wide to accommodate the vegetation planted.
5. Large canopy trees should be spaced 7.5-15m apart and small canopy trees can be spaced 6m-7.5m part.

7.3.2.14. Traffic Calming

1. Speed humps and speed tables, full closures, raised table top crossings of 4m to 5m width, roundabouts, curb extensions, chicanes, lateral shifts and chokers can be effectively used to calm the traffic.

7.3.2.15. Pedestrian Signals

1. Pedestrian automated signals should mandatorily be installed at crosswalks and mid-block crossings. Pelican crossings and puffin crossings are recommended.
2. A displayed automatic *Walk* signal with a countdown can also be recommended.

7.3.2.16. Utilities

Utilities like telephone cables, electrical cables, road lighting cables, gas pipelines, water supply pipes, drainage pipes and sewerage lines can be planned under the furniture zone of the sidewalk or under the multi-utility zone (Fig. 7.54).

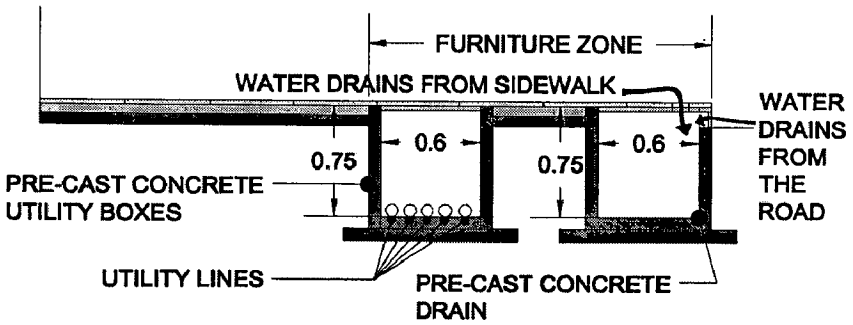


Fig. 7.54: Detail of utilities planned under the furniture zone

Source: By Author

7.4. Policy Recommendations for Indian Cities

The picture of the pedestrian environment in Indian cities is grim as already seen in the previous chapters. The Chennai experience has proved useful to draw recommendations for other Indian cities, to create pedestrian-oriented and sustainable communities.

1. In concurrence with the National Urban Transport Policy, the city streets must be designed to ensure equitable road space to all users and to create 'Complete Streets'.
2. Street sections must be revised to meet the requirements of the pedestrians.
3. All the city streets must be made pedestrian and bicycle-friendly and universally accessible.
4. The pedestrian routes must be safe and well-protected from harsh weather.
5. Grade-separated infrastructure must be made mandatory in major arterial roads and should be designed to appeal to the users, both aesthetically and functionally.
6. The local authorities must ensure a rigorous cleaning and maintenance regime.
7. Pedestrianization strategies must be implemented suitably to convert specific areas exclusively for pedestrian movement.
8. Traffic calming techniques, traffic management and regulation, parking facilities, encouraging informal trade etc. would provide special aid to pedestrianization strategy.
9. Special zones must be demarcated for hawking and vending activities/weekly markets.
10. Areas with high pedestrian activity must be recognized and they must be demarcated as pedestrian zones.
11. All development plans must involve the design and planning for pedestrian facilities.
12. Pedestrian movement must be integrated with the public transportation system to achieve transit-oriented development.
13. Compact and mixed land-use developments support walking as a major mode of transport.
14. Urban planning on the principles of 'Smart Growth' ensures a walkable and bicycle-friendly land-use.
15. Upcoming developments must be pedestrian-friendly to incorporate major uses within convenient walking distances. Preparation of pedestrian plans must be made mandatory in the design of new townships and developments.
16. Campaigning and advertising could create an impact in sensitizing and creating awareness amongst people towards walking.
17. The concept of Bonus Zoning must be used as an effective tool to acquire land and make it for public use in existing dense developments.
18. Pedestrian improvement projects can be implemented on PPP model to ensure speedier implementation.
19. Congestion tax, parking charges and a part of the motor vehicle tax can be contributed for financing the maintenance of the pedestrian infrastructure.
20. Implementation and monitoring of these projects can not only be governed by the local authorities but citizen groups, other associations and organizations should also get involved in overseeing the effectiveness of the engineering works.

7.5. Conclusion

The study has been worth undertaking to shed some light on the grim situation of pedestrian environment in Indian cities. The dissertation study has helped in evolving certain significant strategies and proposing some valuable design standards and guidelines for the renewal of the city's pedestrian facilities. The study has highlighted the scope of pedestrianizing some of the core areas of the city to relieve it of traffic congestion and encourage walking as a popular mode of transport. A need to reinvestigate the existing street sections and provide an equitable space to all the road users has been highlighted and alternative solutions have been suggested for various road categories. The dissertation also suggests general policy recommendations for other Indian cities to improve the pedestrian scenario. The scope of these recommendations could be further increased to suggest elaborate planning strategies for making Indian urban environment pedestrian-responsive. The study highlights the need to upgrade the poor pedestrian infrastructure by means of proposing Pedestrian Facilities Improvement projects, undertaking pilot studies along the difficult stretches, pooling in financial assistance as well as ensure a speedy implementation of such projects by the urban local bodies and other organizations. A pedestrian-oriented approach in urban planning may hold a key to transforming urban development in India, sustainable and eco-friendly in future.

ANNEXURES

Annexure I

Pedestrian Safety Questionnaire

THE INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

DEPARTMENT OF ARCHITECTURE AND PLANNING

ROORKEE – 247 667, UTTARAKHAND, INDIA

PEDESTRIAN SAFETY SURVEY

AIM:

1. To find out the problems you face as a Pedestrian and the adequacy of the facilities available to you.

2. To know the opinions and suggestions among various age groups about what more can be done to enhance the pedestrian facilities of Chennai.

INSTRUCTIONS:

1. Please put a tick in the box opposite the answer you choose.

2. If you feel that there are more than one answer, please number them in the box as 1,2,3 based on your preference.

PERSONAL DETAILS

Name

.....

.....

Age ..... Sex

.....

Name of the city you are familiar with

.....

Occupation (Job) : Student / Service (Central/State) / Public Sector / Private Sector / Own Business / Professionals (Specify .....) / Housewife / Retired person / Self Employed / Unemployed

Driving Skill :

(a) Do you know Driving : Yes (.....) No (.....)

(b) If yes, what category of vehicle : Scooter(Gearless / Geared) / Motorcycle / Car / Heavy Vehicle / Auto

(c) Do you own a vehicle : Yes (.....) No (.....)

(d) If yes, What category of vehicle : Scooter (Gearless/Geared) / Motorcycle / Car / Heavy Vehicle / Auto

(e) Do you have license to drive a vehicle ? Yes (.....) No (.....)

(f) If yes, then for which vehicle : Scooter (Gearless/Geared) / Motorcycle / Car / Heavy Vehicle / Auto

QUESTIONS

(Note : Read the instructions carefully specified above and tick appropriately)

1. The major problem faced by pedestrians is:

a) Lack of proper sidewalk [ ]
b) Lack of adequate safe crossings [ ]
c) Lack of police control on motorists [ ]
d) Lack of knowledge about traffic safety rules among pedestrians [ ]
e) Any other .....

2. People walk on the road instead of the sidewalk mainly because:

a) Pedestrian walks have poor surface and maintenance. [ ]
b) They are not continuous, leading to interrupted walking. [ ]
c) Often encroached by shopkeepers and hawkers. [ ]
d) Too many ups and downs make walking cumbersome and tiring. [ ]
e) Obstacles like electric poles, trees etc. on the footpath. [ ]
f) Congested footpaths. [ ]
g) Any other .....

3. Which of the following facilities would be most acceptable to you as a pedestrian for crossing:

a) Zebra crossing [ ]
b) Overbridges [ ]
c) Pedestrian subway [ ]
d) Traffic signals for pedestrians [ ]
e) Any other .....

4. At pedestrian crossings how frequently do motorists stop on their own to give way to pedestrians:

a) Occasionally [ ]
b) Frequently [ ]
c) Mostly [ ]
d) Always [ ]
e) Never [ ]

5. Why do many pedestrians not use Pedestrian Crossing:

a) There are very few of them on roads. [ ]
b) Hardly any motorist stops to give way to pedestrians [ ]
c) People generally do not understand what zebra crossing means [ ]
d) Crossings are not provided at appropriate places, wherever need is felt. [ ]
e) Distance between crossings are too large to walk, without getting tired. [ ]
f) Any other .....

6. Before crossing the road what would you do:

a) Look to the right, then to the left and again to the right [ ]
b) Look to the left, then to the right and again to the left [ ]
c) Show hand to convey your attention to cross the road [ ]
d) Any other .....

7. If there are no sidewalks on a road then you would walk on the:

a) Extreme left of the road [ ]
b) Extreme right of the road [ ]
c) Middle of the road if the road is divided. [ ]

d) Any other .....

8. While crossing a road, it is advisable to cross:

a) Between parked motor vehicles. [ ]
b) Away from parked vehicles. [ ]
c) Infront of the parked vehicles. [ ]
d) Behind parked vehicles. [ ]
e) Any other .....

9. While crossing a road, it is advisable to cross:

a) Near the road junction. [ ]
b) Away from the road junction. [ ]
c) At the road junction. [ ]
d) Any other .....

10. While crossing road junctions provided with traffic lights, the problem faced most frequently is:

a) The green time for pedestrians is too small and one has to run to cross the road. [ ]
b) The motorists generally come on to the zebra crossing meant for pedestrians. [ ]
c) Pedestrians are trying to cross all over the place instead of zebra crossing marked for them. [ ]
d) Ferry walas block the smooth crossing of pedestrians, by bringing their own 'thelas'. [ ]
e) Any other .....

11. Which of the following vehicles care least for the pedestrians:

a) Cars [ ]
b) Lorries / Trucks [ ]
c) Buses [ ]
d) Scooters / Motorcycles [ ]
e) Autos [ ]
f) Any other .....

12. Who are the least considerate towards pedestrians:

a) Older drivers [ ]
b) Young drivers [ ]
c) Middle aged drivers [ ]
d) Students [ ]
e) Any other .....

13. Whom do you consider as more dangerous drivers:

a) Owner drivers / independent drivers [ ]
b) Professional drivers [ ]

14. The main reasons why many pedestrians are killed in road accidents is due to:

a) Carelessness of the drivers of motor vehicles [ ]
b) Carelessness of the pedestrians themselves [ ]
c) Lack of pedestrian facilities available [ ]
d) Fault of pedestrians as well as drivers [ ]
e) Any other .....

15. From whom did you learn road safety rules:

a) From parents / Relatives / Friends [ ]
b) From school teachers [ ]
c) Publicity campaigns in Radio/ T.V. / Newspapers [ ]

d) Voluntary organizations [ ]
e) Self learning [ ]
f) Not learnt much about road safety. [ ]

16. Which of the following media do you consider most suitable for educating about pedestrian safety:

a) T.V. [ ]
b) Internet [ ]
c) Radio / FM [ ]
d) Booklets / Publications [ ]
e) Cinema [ ]
f) Any other .....

17. As a pedestrian, at what proximity do you feel the need for a mass transit/ bus transit stop to be from your home, place of work, shopping etc.:

a) Less than 0.5 km [ ]
b) Between 0.5 – 1 km [ ]
c) Between 1 – 2 km [ ]
d) Between 2 – 3 km [ ]
e) More than 3 km [ ]

18. Which of the following measures can bring in the maximum effectiveness to increase pedestrian safety:

a) Prosecute the pedestrians who do not observe the traffic rules [ ]
b) Prosecute the motor vehicle drivers who do not observe traffic rules [ ]
c) Educate the pedestrian on the rules of the road [ ]
d) Provide better facilities like sidewalks and pedestrian crossings [ ]
e) Declaring heavy pedestrian movement areas exclusively for pedestrians [ ]
f) Any other .....

19.What according to you is lacking in our pedestrian pathways:

a) Interesting public transport waiting areas (bus stops, tram stops, MRTS stops) [ ]
b) Street furniture for pedestrians (benches, seating arrangements etc.) [ ]
c) Interesting and aesthetic landscape [ ]
d) Provision for physically handicapped and blind [ ]
e) Interesting street facilities like Phone booths, Outdoor café, Games and street dance etc. to make it more lively. [ ]

20. Suggestions you want to recommend:

a) .....
b) .....
c) .....
d) .....

Annexure II

Pedestrian Evaluation Matrix

S. No.	Attributes	S.No.	Components	Excellent	Good	Average	Poor	Very Poor	Nil	Weightage to Attribute
				5	4	3	2	1	0	
I.	Sidewalk Dimensional Adequacy, Continuity and Universal Accessibility	1	Sidewalk dimensional adequacy (including universal accessibility)							2.5
		2	Sidewalk adequacy interms of continuity and presence							
		3	Sidewalk slope							
		4	Existence and adequacy of Curb ramp for the wheel-chair users Yes/No (in terms of Width, Slope and Surface treatment)							
II.	Safety and Security	5	Provision of zebra-crossing/subway/footover bridge Yes/No							2.5
		6	Adequacy of zebra-crossing/subway/foot-over bridge in terms of width and their interval and presence of refuge island, manually automated signals and street markings in case of zebra-crossings							
		7	Provision of guard rails Yes/No							
		8	Existence of police control booths/ police men/ police vans Yes/No							
		9	Traffic calming (Speed humps, raised intersections, speed tables, roundabouts, curb extensions at intersections, roadway narrowing, markings for speed limit on road) Yes/No							
		10	Provision of curb Yes/No (as per the standards for Curb height and Curb radius)							
		11	Street lighting adequacy (in terms of illumination and spacing between fixtures)							
		12	Illuminated traffic signage Yes/No							
		13	Provision of fire hydrants / sand bins for safety against fire Yes/No							
		14	Surveillance cameras on major traffic conflict nodes between pedestrians and vehicles Yes/No							

III.	Convenience and Comfort	15	Provision of benches to sit Yes/No						
		16	Provision of litter bins Yes/No						
		17	Provision of restrooms Yes/No						
		18	Provision of bicycle racks Yes/No						
		19	Provision of drinking water fountains Yes/No						
		20	Provision of clocks, information boards and kiosks Yes/No						
		21	Provision of street signage and information Yes/No						
		22	Provision of post boxes / telephone booths Yes/No						
		23	Provision of utility boxes Yes/No						
		24	Sheltered walkways (arcaded, awnings, canopies, trees and shelters) Yes/No						
		25	Paving quality (texture, colour and surface finish)						
IV.	Attractiveness and Aesthetic Quality	26	Neatness and Cleanliness						
		27	Provision of attractive public transit shelters						
		28	Provision of landscape features (trees, planter boxes, shrubs, potted plants, water fountains)						
		29	Building façade aesthetics						
		30	Street art and décor (murals, paintings, frescos etc.)						
		31	Intermediate spaces for relief/ for hawkers/for vendors						
		32	Other activity areas (Open air cafes/ outdoor dining)						
		33	Overall aesthetic appeal (in terms of design quality)						
V.	Maintenance	34	Broken footpaths and presence of holes on the footpath						
		35	Presence of garbage dumps on the footpath						
		36	Obstructions on footpath (poles, trees, utility boxes, street furniture, litter boxes, debris etc.)						
		37	Discontinuity of the footpaths due to debris of construction etc.						
		38	Encroachments on the footpath by hawkers, parking, movement of animals etc.						
		39	Water logging problem						
		40	Overall Maintenance quality						

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