PLANNING AND DESIGN OF URBAN ROADS FOR USER NEEDS

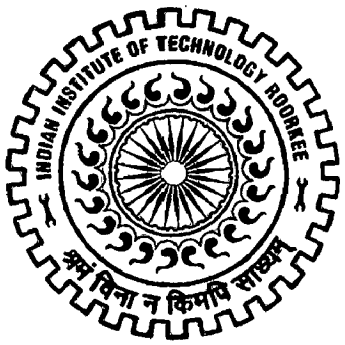
A DISSERTATION

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

MASTER OF URBAN AND RURAL PLANNING

By

KIRTI GUPTA



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CANDIDATE'S DECLARATION

I here by declare that the work which is being presented in the dissertation entitled **"PLANNING AND DESIGN OF URBAN ROADS FOR USER NEEDS"** in partial fulfillment for the award of the degree of **Master of Urban and Rural planning** submitted in the **Department of Architecture and Planning** of **Indian Institute of Technology Roorkee,** is an authentic record of my own work carried out during period of eight months from July 2002 to February 2003 under the supervision of Prof. R. Shankar, Professor, Department of Architecture and Planning, Indian Institute of Technology Roorkee.

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

Date

28.02.2003

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

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CHAPTER 1: THE RESEARCH CONTEXT

CHAPTER 1: THE RESEARCH CONTEXT

1.1 Introduction:

Roads are called as arteries of the city. They are not just the routes along which people in vehicles move from one part of the environment to another; nor are they just ribbons of asphalt or concrete built to accommodate vehicle, from which the outside environment can be observed through the windows like flickering images of a television screen. To a large extent the road with its setting of buildings or landscape is the outside environment. All these aspects of the surroundings come together in a person's perception and the road is just seen as a composition of all the elements in view. The road can be thought as analogous to room series: the surface is the floor; the walls are the building, the vegetation, the surrounding views, the roof top is the canopy of the trees or the building top and the residents are the different users.

Like building, the road has users and like building this has to serve the needs of users, but unlike building, the road has a heterogeneous mix of users whose needs are not only different but also often conflicting. This makes the task of the road design very complex and demanding great sensitivity and imagination, this is more so in case of urban roads.

1.2 Need Of The Study:

The urban roads in India are not only used by the different types of users but also for purposes other than the movement of the traffic and accessibility. The failure of the Indian urban roads arises out of failure to recognize the above two facts namely-

1. The existence of different categories of users
2. Use of roads for purposes other than traffic and accessibility.

In the design and planning process of urban roads there is an urgent need to shift the focus from motorized vehicles to all types of vehicles and all type of other road users. The present thesis work is an attempt towards this direction.

In the context of the Indian cities the need of the study arises from the following problems:

Failure of the present street section

The population of Indian urban cities is growing rapidly resulting in increase of number of vehicles. This increase in number along with the pressure of diverse modes of transport exerts

unending pressure on the existing urban roads resulting in the failure of the carriage width of roads. The present street sections have not kept pace with the complex needs of city traffic.

Diverse needs of urban road users in India:

In India, the **slow moving and fast moving vehicles** are equal in terms of the traffic volume in using the road but as far as the present standard section is considered the space given to slow moving vehicle is next to nothing. Due to this they share the space with the fast moving vehicles causing problems such as speed reduction, delays, congestion, accidents etc.

The **pedestrian's** facilities are the most neglected on the Indian Urban roads and if at all they do exist they are not properly maintained and often encroached. Besides this they are not adequately designed for pedestrian's convenience and safety. There is no provision for the disabled, the elder and the children in terms of the pedestrian facilities. All types of the pedestrians have to shares the common inadequacies. However the behaviour and need of different types of pedestrians are different.

Lack of policies for **roadside vendors,** who conduct trade and business, are also responsible for the deteriorating the environment of the road. In India the informal sectors are also part of the road users. Due to lack of design and planning for informal activities such as street hawkers and vendors there is considerable chaos and congestion on roads.

The presence of the animal drawn vehicles and non-standard slow moving vehicles in urban roads are not at all considered in the design of urban roads.

Non-consideration of user's behaviour on urban roads

The Indian urban roads are different from the western roads in terms of its use and the activities that are taking place on these roads. For instance the roads are encroached during festivals, elections, religious and marriages occasions by the local users. The modern roads are developed based on the western norms but the traditional behaviour or the character of users has not changed.

All of these prevailing conditions call for an attempt at urban road design and planning based on the user needs.

1.3 Aim And Objectives

1.31 Aim:

The aim of the study is to evolve useful design standards and planning guidelines for the intra- urban roads based on the study of the existing road system and its users in selected areas of Lucknow.

1.32 Objectives:

- To study the existing urban roads in terms of their design characteristics and elements in residential, commercial and mixed land use sectors of Lucknow.
- To study the needs, demands and behaviour of different urban road users
- To study the traffic flow pattern on these roads and existing management system.
- To analyze the problems in these roads and the inadequacy of the urban road system.
- To evolve appropriate design and planning guidelines for Indian urban roads that would meet adequately the needs of the various road users.
- To demonstrate the application of the evolved standards and guidelines.

1.4 Scope:

In the Indian context of our planned urban roads not being able to meet the diverse and conflicting needs of the different roads users, the present study's attempts to evolve road design standards and guidelines based on the actual user's needs prevailing in India is highly relevant. The outcome of the project is expected to trigger off many more intensive and comprehensive research work resulting in appropriate urban roads standards and road planning guidelines that could be used in the development of urban extensions and urban renewals in new towns in India.

1.5 Limitations:

- Only selected stretches of urban roads in a sample residential, commercial and mixed land use areas of Lucknow are studied in this work and as such the findings from the analysis from the surveyed data may not represent all situations in all Indian cities.
- Similarly, as the new urban road standards and guidelines would be based on the study of typical road stretches of Lucknow, these may not be perfect solutions to other Indian cities.
- The bulk of traffic surveyed data is barrowed from the traffic studies done by T.C.P.O. in 2001-2002 and the data is presumed to be correct.

1.6 Criteria For The Selection Of The Study Area:

The following criteria were concerned for the selection of the city.

- A metropolis, which represents a typical Indian city having old core and rapidly developing periphery, depicting different situations of roads design and use.
- A city which shows a variety of typical users of Indian Urban roads and presents the problems and needs of these users.

- A city which shows the use a typical Indian slow vehicles such as rickshaws, cycle, handcarts, bullock carts etc., their needs and problems.

- A city, which shows a other users of the roads such as street hawkers and vendors.
- Familiarity of the city, convenience of survey and availability of data.

On the basis of the criteria stated above the city of Lucknow has been selected. Specified stretches of the residential, commercial and mixed land use sectors of this city have been taken for study purpose.

1.7 Methodology:

The main focus of the study is on the four components of the urban roads system:

1. The physical characteristics of the roads
2. The user needs and problems.
3. The traffic characteristics
4. The traffic management system

The inputs to the database are derived from literature study, data from secondary source and field surveys. The inferences from the data analysed are used to evolve the new urban roads design standards and planning guidelines. Their validity is demonstrated/ tested through application in real planning situations. The complete methodology is shown in fig. 1.1

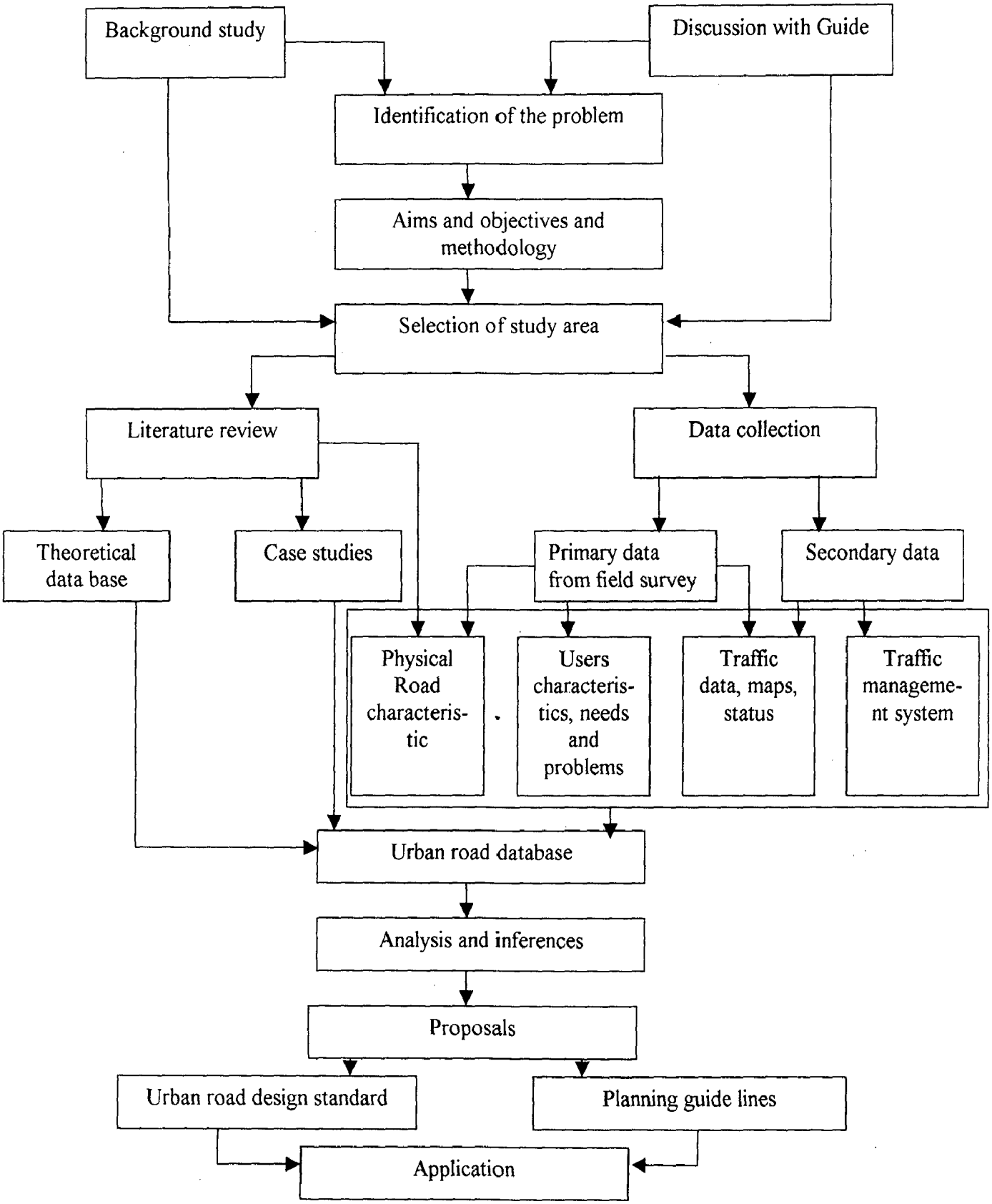
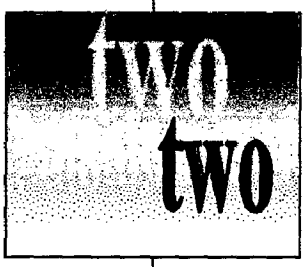


Fig. 1.1- Methodology Chart

CHAPTER 2: REVIEW OF LITERATURE & CASE STUDIES



CHAPTER 2: REVIEW OF LITERATURE & CASE STUDIES

2.1 General Overview:

The general purpose of the literature survey is to provide the thesis report with a base. By this one could come across most of the works, which have been undertaken in this field, and also it gives the justification of the research or the thesis topic, which has been carried out.

Road design and planning is one of the latest issues of the world. Lots of agencies have done work dealing with the design and planning of urban roads and the criteria adopted for finding the road design and planning differs from one to another. Through the previous studies done one can have the idea of the various parameter affecting the road design and planning.

The following pages present the research that has been undertaken by the institutions and individuals, in the field of the urban roads. This helps in shaping the design and planning guidelines of urban roads for users need. This section includes a few studies that have been done in India and abroad.

2.2 Literature Studies:

2.21 Road user cost study: Central Road Research Institute, 1988

The study was done by the Central research road institute New Delhi in 1988 for making highway design model very comprehensive. The road user cost study deals with road user cost component of the total transportation cost. This was the first attempt in India towards establishing the relationship between vehicle operation cost and maintenance cost. In The methodology that they have taken statistical method and data they have taken from the real life. The required data that was taken from the primary survey were fuel consumption and speed flow experiment, observing the behavior of traffic and interaction of constituents of traffic streams. (1)

The Objectives of the study:

- Building up database for the evacuation of the road user cost.
- To determine effect of road geometry surface vehicle and traffic characteristics.

Salient findings of the study:

- The road user cost study components are route character, user character, speed flow, fuel consumption special components accident rate and cost and time cost and last one is simulation model .
- The road user cost study consists of maintaining cost, time cost and accidental cost
- The factors responsible for the vehicle cost are highway cost, traffic cost, vehicle cost, and environmental cost. Highway cost includes the Geometry and surface of the road, traffic cost includes the volume composition and speed, and vehicle cost includes the age, maintenance cost.
- The Indian traffic is heterogeneous in nature consist of slow as well as fast moving vehicles and in case of slow moving vehicles there is lot of variety of users such as horse carts etc.
- The majority of the roads are deficient in the geometry.
- The P.C.U for converting the heterogeneous unit are adopted from the research abroad
- Speed of the vehicle and consumption are largely governed by the road geometry.

2.22 Capacity of roads in urban areas: Central Road Research Institute,1988

This study was done by the Central research road institute New Delhi in 1988 for developing the standards for roads in urban and rural areas. The factors affecting the road way capacity are road width factor, traffic factor and traffic control factor. The need of the study for urban capacity standards were because of the western standards are not applicable in India because of appreciable difference in the Indian condition the most important is high degree of heterogonous traffic composition. For the different types of the roads in urban and rural areas and practical approach will be useful for the economic and functional design of the road. (2)

Objectives of the study:

- To establish the capacity standard for the selected categories of urban roads.

Salient findings of the study:

- Factors affecting the road capacity are road way factor, traffic factor, abutting land use and traffic controls and regulation
- Heterogeneity of the traffic on the urban roads of India

- ❖ Consideration of car as a P.C.U. in spite of its small share.

Recommendation of the study:

- ❖ Particular type of vehicle, which is having major share, should be taken as the standard vehicle.
- ❖ The design of the roads includes both the future as well as the existing facilities
- ❖ Restricting the animal vehicle at the peak hour
- ❖ Regulation of the pedestrian's movement along the road at predetermined locations only through railing barriers and zebra crossing.
- ❖ Prohibiting on street parking and developing the off street parking
- ❖ Segregate the up and down traffic by constructing central verge or median
- ❖ Segregate the vehicular and non-vehicular component of the street.

2.23 Utility of slow moving vehicles, Mr. R. N. Dutta, 1985

The study was done in the medium sized cities of West Bengal dealing with the typical Indian non-motorized vehicles. The author describes the importance of the slow moving vehicles in the Indian cities. He also state that the availability of the cheap labour and energy crisis will necessitate the importance of the slow moving vehicles in Indian urban roads and for the efficient transportation system the utility of these modes has to be considered. He descries the techno- economic characteristics (technical and economic factors such as spped, capacity, turning radius, capital cost and maintenance cost.) of each mode. (3)

Silent findings of the study:

- ❖ Except animal drawn carriages all other slow moving vehicles are extensively used in the Indian urban areas right from the small town to metropolitan areas.
- ❖ Non- motorized vehicles are extensively used in the Indian cities because of the economic condition of the people in India.
- ❖ Route planning of the slow moving vehicle can be decided by the shape of the city, physical size of the city, location of the activities, spatial distribution, density of activities and transportation network characteristics.

Recommendation of the study:

- The design parameter for the slow moving vehicles were suggested by the author which are as follows –

Track on which hand cart and bullock cart can move should have min. 3m lane width of Gradient-1in 60

Track without bullock cart and handcarts should have 2m-lane width of Gradient-1 in 35

Raised curb of the track from the C.W.=6cm.

Turning radius for bicycle and cycle carts and rickshaw= varies 2-5m

Turning radius for bullock carts/ hand carts= Min. 25 m

Material used for the track can be brick or tile (easy to repair material)

Vertical clearance= min. 2.8m

- Planning proposals for the slow moving are as follows-

Separate path beside the carriage way

Street exclusively meant for the pedestrians and slow vehicle

Grade separation at intersection

Special sign and road markings

Parking facilities for them at mode interchange points

Safe parking facilities for the specially for rickshaw and bicycle near the recreational area , educational institutions, commercial facilities

Parking for them where bulk and break activities take place

While planning the route the preference for shortcuts should be given.

2.23 Utility of slow moving vehicles, Mr. R. N. Dutta, 1985

This paper highlights the problems and mobility of the bicycle and its importance in Indian cities. The author also stressed on the importance of accessibility consideration for planning of bicycle traffic in Indian cities. It describes the benefits arising in promoting the bicycle traffic. The concept of the bicycle traffic is very sensitive issue and accessibility may be used as indicators of effectiveness of alternative plans in meeting the mobility objectives of transportation system users. (4)

Findings:

- Bicycle is one out of eight available modes such as walking, taking bus, car, train, scoter etc.
- For most of the cities, trips by cycle decrease with income.

- ❖ High proportion of the distance is performed by the bicycle and bicycle trip of 20 km. is observed in Lucknow.
- ❖ The share of the bicycle in the city varies from the 10% to 89% of the total volume in medium class city.
- ❖ Factors that will affect the accessibility for bicycle traffic are network (link, node), travel resistance (physical effort, road surface, distance, gradient, weather), level of services (parking- congestion)

2.25 Road Safety: Wright and Robertson: Department of transport, Britain,1992

This paper presents the cause and their remedial of accidents on the urban roads. The author says that the road users in general are exposed to greater risk in urban areas than anywhere else and greatly with the mode of travel and pedestrians, cyclists and motorcyclists are more involved than vehicle per occupants per unit distance. Among them the young and elderly pedestrians and young cyclist and motorcyclists are more vulnerable. (5)

Findings and recommendations:

- ❖ The factors, which affect the road safety, are road layout, road surface, road margins and vehicle access to and from carriageway.
- ❖ The factors, which were analyzed as contributing to accidents, are curvature, gradients, no. of lanes , sight distance, width of Carriage way degree of access control presence of road side obstacle camber edge marking kerbs footpath designed road side development
- ❖ The curvature <500m does not produce marked safety problems short sight distance below 200m have been found with high accidents risk accidents decrease with the decreases in the width.

2.3 Case Studies:

2.31 Secondary Towns Infrastructure Development Project": Local Government Engineering Department [LGED] with the financial assistance of the Asian Development Bank [ADB] and executed by AQUA Consultant & Associates [Bangladesh] Ltd. in association with Louise Berger International Inc. [USA]. Oct. 1996

The study reveals the traffic and transportation problems in urban areas of Bangladesh. For this three metropolitan cities, Bogra, Mymensingh, Sylhet has been taken as the study area. This study has been taken because these cities are similar in character to Indian metropolitan cities having similar typed of roads condition and road users. (6)

The main objective of the study is –

To identify traffic management controls and procedures, which will, in short term will relieve the traffic congestion in the core area and optimize the smooth flow of traffic with in the existing road system

To recommend, for the long term, a road master plan for future improvement and new constructions.

The study presents that road traffic consists of three components: the road, the human and vehicle. To operate without failure, these components must be fully compatible. Generally this does not occur and often results in the breakdown of the traffic system. Road accidents, traffic congestion and intrusion are such e.g. of the system break down.

The data that has been collected for the assessment of traffic problems characteristics are –

- Locating the area with traffic problem location
- Travel and traffic characteristics in area of study
- Contact meeting with the concerned agencies, including identification of the travel groups and their interests in area of study
- The analysis of traffic movement and identification of the areas of the traffic conflicts and their underlying causes in area of study
- The development of the short-term management schemes, which could be logically implemented in phases in area of study
- The development of recommended long term institutional and infrastructural development plan, which will serve as guidance for future road improvement.

The survey results showed that the 90% 0f the vehicles were non- motorized vehicles, particularly Rickshaws and cycle were predominant and 91.4% non-motorized vehicles are involved in accidents of the total accidents occurring on urban roads.

The problems, which have been found out in area of study are -

- No footpaths are available for pedestrian movements; pedestrians walk through both sides of the roads causing traffic congestion
- Sufficient number of speed breakers, traffic signs, light posts with streetlights are not available in major roads of the cities. Also Zebra crossings, markings, and

commodities mainly cause traffic congestion in busy places of main and traffic signals are not found

- Floating shops, mobile hawkers and artisans and traders of different goods roads;
- Almost all major roads are blocked by construction works like road cutting, laying of gas lines, pipe lines, telephone cables including welding work, motor repairing by private enterprises and construction materials stacked on roads;
- Railway crossing at narrow roads creates traffic congestion when trains pass through the crossing;
- Non-availability of wider roads with divider and median in the city;
- Excessive number of rickshaws most of which are either unauthorized or unregistered;
- Most of the rickshaws and truck drivers are not aware of traffic rules or intentionally do not abide by traffic regulations resulting in undisciplined traffic operation;
- Overtaking tendency of drivers specially by rickshaw drivers is one of the main reason of traffic congestion and hazard;
- Haphazard parking is another reason for traffic congestion
- Due to carelessness or lack of civic sense, horns are blown loudly in front of schools, colleges, hospitals and abutting residences creating disturbances and noise pollution;
- The utility of the central bus terminals is not fully materialized in terms of usage and revenue collection;
- Unauthorized taxi stands located within busy business area of the cities are haphazardly used due mainly to the absence of strong administration of the city authority;
- Traffic police personnel are not able to utilize their skill and ability on roads due to limited scope and lack of proper training on traffic rules, regulations and order
- Lack of awareness and/or negligence [on the part of both users and police] is also responsible for not properly applying traffic rules and systematic control of traffic;
- A limited number of duty police personnel and non-availability of traffic posts and islands potentially aggravate towards increase in traffic congestion on roads;
- Loading and unloading of truck goods at narrow roads causes traffic hazards;
- An unplanned growth of shops, workshops and residential buildings on roadside causes traffic congestion.

The following short-term measures are recommended based on the traffic management studies conducted in the cities.

Measures relating to road design

- Improvement of major and critical intersections by
- Widening of roads in the neighborhood of the intersections
- Redesigning of intersections in order to facilitate easy turning preferably by channelizing left turnings
- Providing adequate visibility and sight distmce1 and clear road markings and signing
- Installing traffic signals at busy locations
- Improvement of bridge approaches by widening on both sides to provide additional road space and thereby to improve traffic and pedestrian movements.
- Immediate construction of pedestrian facilities in the form of segregated footpaths/footways along the main arterial roads land Zebra crossings at intersections and mid-block sections.
- Of additional one-way road systems resulting in reduction of conflicts of streams of traffic which causes traffic congestion and safety problems.
- Establishment of a hierarchical concept within the three main classes of roads viz. arterials, sub-arterials and local roads.
- Increasing the pavement width and road width at railway crossings to reduce traffic congestion and facilitate better pedestrian movement; constructing properly designed islands and speed breakers at railway crossings of the cities to prevent high speeds and maneuverings of vehicles at railway crossings.
- Shifting bus and truck terminals located inside the cities to the peripheral area of the cities.
- General improvement of road geometric, quality of surfaces, road lighting intensities, road side sanitation facilities, solid waste management, drainage etc.

Measures relating to operations and control

- Intensifying traffic policing on major roads. Dangerous offences especially those related to improper lane-change maneuvers, wrong-way driving and undisciplined road users behavior should not be tolerated.
- Contemplating measures to limit long and heavy vehicular loads within the city centre.
- Restricting heavy truck movements on relatively narrow streets.
- Taking proper step to bring truck and bus terminals into full operation and to collect revenues.
- Taking adequate actions to prevent and/or eliminate road side hawkers, markets,

storage of construction materials, business merchandise etc.

- Preventing haphazard parking of rickshaws near major shopping and activity centres which deter free movement of through vehicles providing well-planned parking and efficient loading facilities.
- Introducing speed limit of 20 to 25 kilometer per hour for all motorized vehicles within the city area.
- Framing legal requirements of reporting and recording of traffic accidents and maintaining systematic accident records.
- Construing enforcement through gearing to raise the level of voluntary compliance among road users and to be a deterrent to violators and potential violators of traffic law.

Administrative and institutional measures

It was recommended to form a united agency "Town Traffic Advisory Committee" with representatives from concerned authorities and an expert specialist in traffic engineering from a technical university.

2.32 Chandigarh city:

The Chandigarh city is the capital of the two city and also the union\ion territory. This is one of the designed cities of India. Lecorbusier has designed this in 1952 and the initial project was for 150,000 people : a development to 500,000 is envisaged. Lecorbusier in the design of Chandigarh adopted two very different planning ideas of his time and to achieve a over a good result in the over lay -city plan first he has taken grid iron form as it was believed at that time that it provides access without limit to he motor vehicle to every part of the city and the second was the view that if the neighboured has to be kept free from the traffic lanes than the tree type plan would be appropriate as it ensures that the motor vehicles stay on roads designated for them without choice the roads has been planned in the eight categories from v-1 to v-8. The hierarchy of the roads and their function is given in the table no. 1.(7)

Table no.2.1 Urban roads of the Chandigarh city

S.N.	Types of roads		Width(m)	Functions
1	V-1	Inter city roads	60	Main roads connected to other cities, has dual carriageway and central verge lighting
2	V-2	City distributors roads	30-60	Major avenues of Chandigarh, with important institutional and commercial centres running along it.track for fast, slow, cycle, and walk
3	V-3		30	They are corridor streets for fast moving vehicular traffic. T sector is surrounded either by V-2 or V-3. segregated fast moving traffic roads no side walks
4	V-4		24-30	Roads bisecting sectors with the shopping complexes located along the southern edges
5	V-5		18	Roads meandering through the sectors giving access to the inner lands.
6	V-6	Access road	7.2,9,12,13.5	Roads coming of the V-5 and leading to residential houses
7	V-7		-	Intended for pedestrian movement and run thought the middle of the sectors in the green areas
8	V-8		-	Run parallel with V-7 for bicycles not properly developed

Source Chandigarh Master Plan

The arrangement of road leads to the remarkable hierarchy of movement, which also ensures that here residential areas are segregated from the noise and pollution of the traffic. It was first attempt to plan the separate roads for cyclist and pedestrians.

Fig. 2.1 V-2 (Jan Marg)

2.33Traffic and parking study, Clifton U.K.: Seven Side Consultancy Unit & Bristol Polytecnic, May 1992

This study was commissioned by the Bristol Civic Society, Clifton and Hotwe11s Improvement Society, Clifton Village Association and representatives of the four political parties active in the Clifton ward, to examine the rapidly worsening parking and traffic conditions' in Clifton.(8)

Clifton is a conservation area containing outstanding groups of buildings, architectural features and spaces of high environmental quality and character. The vitality of the area is maintained by a balanced population and a diverse mix of business shopping and social activity. The recent dramatic rise in the number of vehicles parking in Clifton is threatening to change-its economic and social composition and erodes the outstanding quality of the built and natural environment that makes Clifton distinctive.

Aim of the study

The main aim of the study is to reach agreement with all sections of the Clifton community (including the local authorities and the police) on methods that can be introduced to improve parking, traffic conditions and the related quality of the environment within the Clifton Conservation Area.

To achieve this aim a number of objectives were set:

- To work closely with Bristol City Council, Avon County Council and the police to achieve proposals that can be successfully implemented
- To undertake surveys of vehicle and pedestrian movement, parking plus other relevant issues identified by the community
- To examine alternative schemes for resident's parking which improve access to key locations for visitors and businesses
- To explore ways of reducing conflict between various users of the roads
- To recommend measures that minimizes the detrimental effects of motorized traffic on pedestrians, residents, traders and other users of the Clifton Conservation Area.

The two roads, St John Road(residential street, Princes Victoria Street has been taken.

The approach to the study:

An underlying feature of this study has been the involvement all sections of the local community at every stage of the project. The composition of the different groups, the method of working and their influence on the outcome of the study is being considered. Than they have examined the range and severity of traffic and parking problems affecting Clifton and explore some of the underlying strategic issues that have created Clifton's problems and are likely to influence the area in the years ahead. A considerable amount of data has been collected on the nature of traffic and parking in Clifton and the attitude of residents and the business community to these issues.

Proposals:

Various proposals for different roads has been shown in the Fig no.2.1,2.2,2.3

Recommendations -

Since the measures were introduced there have been no reported accidents.

As part of a comprehensive plan to discourage through traffic, reduce the speed of vehicles and encourage environmental improvements it is recommended that:

- Priority be given to the introduction of traffic calming measures on the roads
- Traffic proposals should be designed using a careful choice of signs, materials and details positively to enhance the visual environment of Clifton.
- To improve the pedestrian's facilities footways are widened and facilities side roads off and partial closure section of roads in residential street.

Findings:

These have been identified as:

- Increased supply of parking space

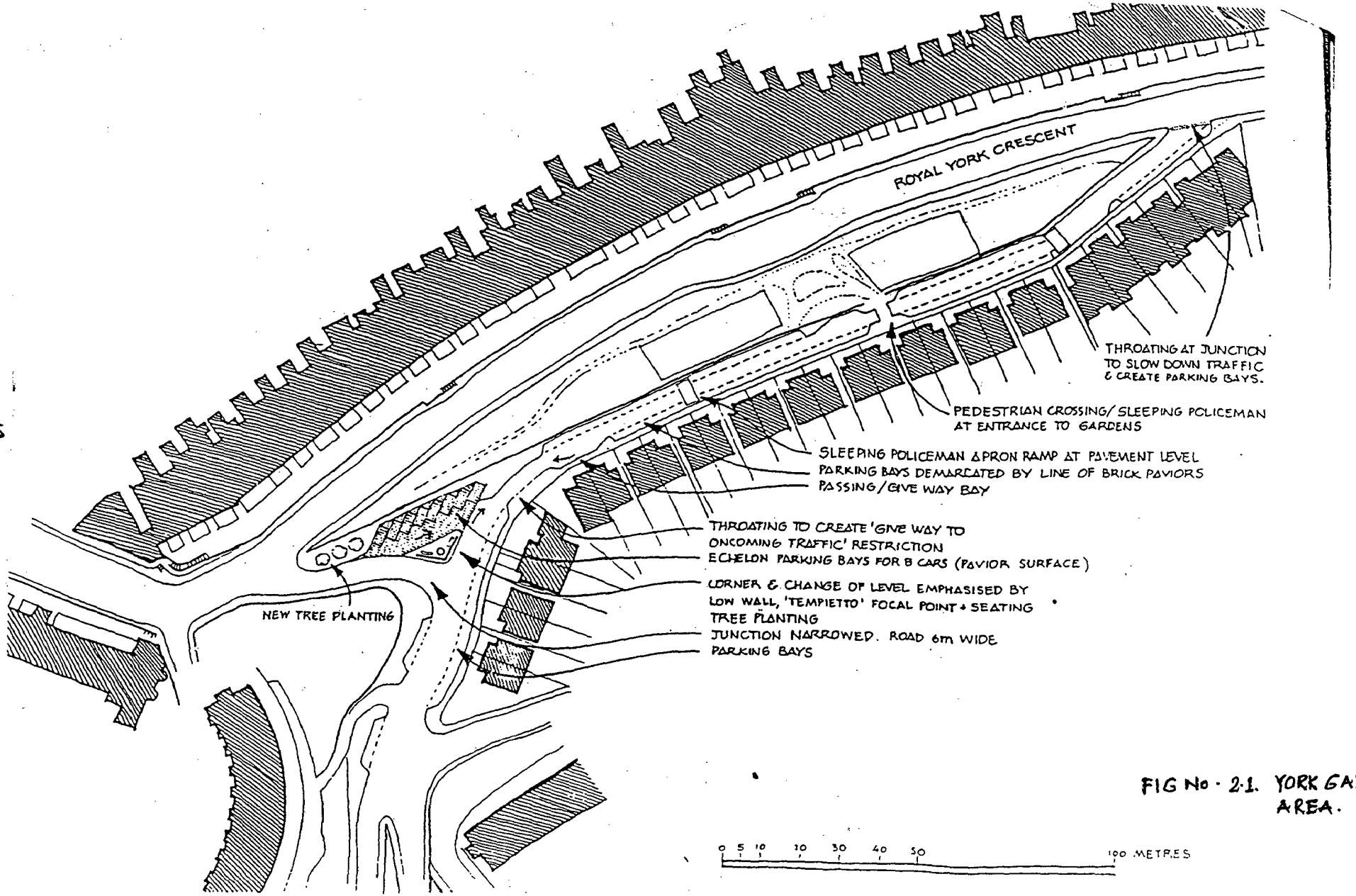


FIG No · 2.1. YORK GARDEN AREA.

INDICATIVE SCHEME FOR PARKING & TRAFFIC CALMING : ST JOHN'S ROAD, CLIFTON

SCHEME PROVIDES FOR 41 CAR PARKING SPACES BETWEEN OSBORNE RD & BEAUFORT RD. PARKING BAYS 5M x 2·5M. NEW CARRIAGEWAY WIDTH 6 METRES

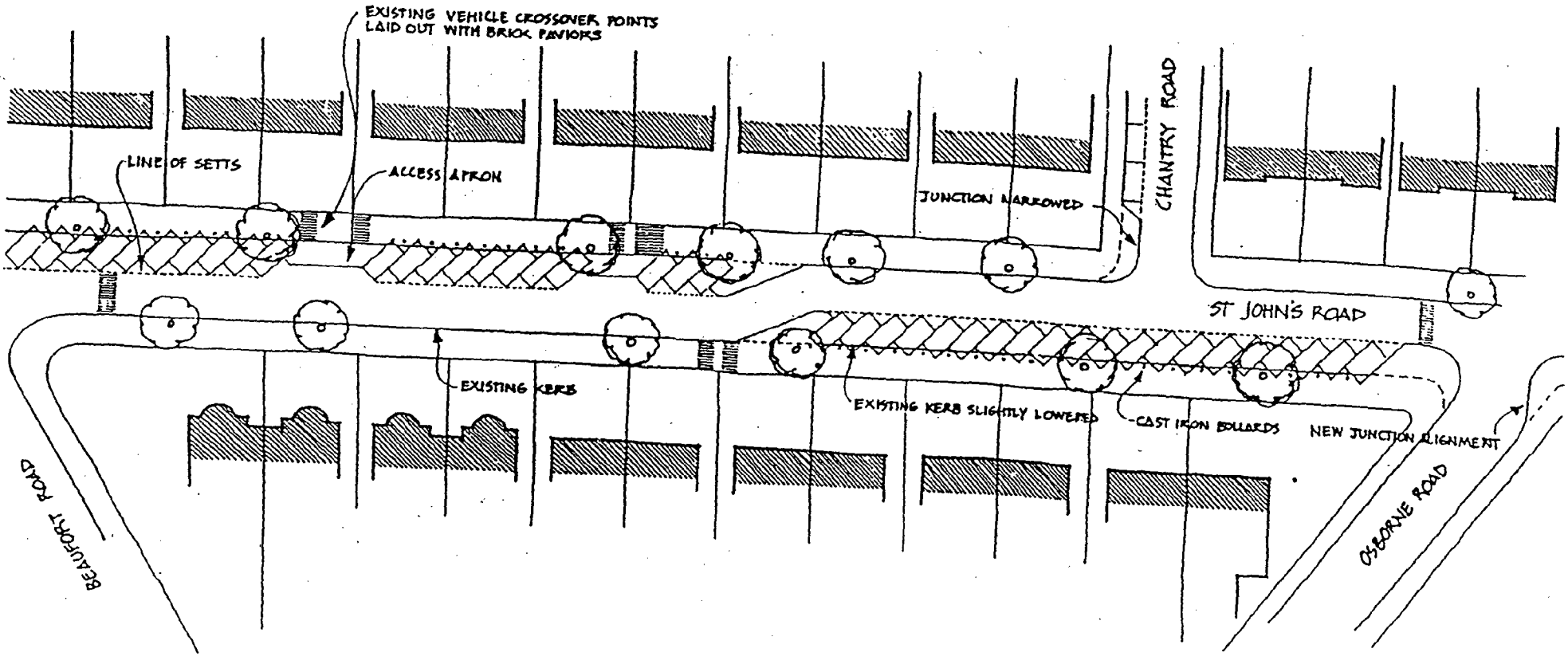


FIG. No. 2·2. ST JOHN.

- Control of on-street parking
- Management of traffic flows
- Encourage walking, cycling, public transport
- Restriction on conversions and new development
- Protection of the environment.

2.4 Critical Review Of The Case Studies:

The case studies of three cities of Bangladesh reveals the three component i.e. road, human and vehicles. The problems regarding them have been pointed out and the solution is given in terms of the road design, operation and control and administrative measures.

The second case study reveals the importance of the hierarchy of the road design with in the city and their users.

Reliance on the private car is creating an insatiable demand for road space. Residents, businesses, shoppers, commuters and Visitors all compete for a fixed number of parking spaces.

The third case study point out the parking and problems and gives its solution.

2.5 Findings And Lessons From The Literature Study:

All the referred works clearly reveals that the design and planning of the road is very important in the management of the smooth flow of traffic. The design and planning of the roads depend on the users characteristics, route character, and geometry of the road design and proper geometry of the road is very important factor. Due to lack of proper design and planning accidents, speed delay, time delay, congestion etc. takes place.

In the Indian papers and report clearly points out the heterogeneity of the vehicles on Indian roads and point out that the roads in India are designed for fast vehicles only not for the slow \vehicle where as they shares the major part of the traffic on Indian road. These papers also points out the feasibility of the roads design consideration for slow moving vehicles on Indian roads.

After the literature survey the author clearly finds the importance of the design and planning of roads for users needs and the users group and their needs has to clearly find out.

CHAPTER 3: URBAN ROAD SYSTEM

3.1 Introduction

In this chapter the road and its components are discussed along with prevailing standards.

The roads are the public spaces for many activities and functions besides enabling the movement of traffic and accessibility. They provide opportunities for landscaping, paths for walking, places for talking, right of way for utilities, and among all the other activities i.e. facility for movement, shopping and storage of motor vehicles. Hence before a road can be designed or planned it is necessary to study all the components of road separately, so that the result would be a safe road, and an integral part of the total environment, enhancing it rather making it enjoyable to use. Hence we can say road as a system rather than calling it as entity.

The road system consists of the type, the design, as transport modes, the users and the traffic management.

3.2 Types Of Urban Roads:

a road can be classified in different ways. According to the authors of " High way engineering " (8) the roads can be classified as follows-

i. According to weather

According to weather roads are of two types: All weather road and fair weather road. All weather roads are those, which are negotiable during all weather and fair weather road, are those, which are interrupted by the rain and other factor.

ii. According to road pavement

According to road pavement they are of two types: paved road and unpaved road. Paved roads are those that have at least water bound macadam and unpaved roads are earth or gravel roads.

iii. According to traffic volume

Depending on the traffic volume the road is of three types (a) Heavy traffic carrying (b) medium traffic carrying (c) light traffic carrying.

iv. According to location and function

This is the most acceptable classification as far as the roads classification and the functioning of the roads are considered. They vary according to the country norms. In the developed world they are classified in two major ways: Urban roads and Rural Roads.

v. According to land use

Besides its location the roads are also sometimes divided in a different land uses i.e. Commercial lane, mixed land use, industrial roads etc.

vi. According to built up environment

Other than this **Mclusky** in his book Road form and Townscape has classified road according to the built up environment. (9)

According to the built up environment they are of four types: The townscape alignment, the flowing alignments, the hill road alignment, and the countryside alignment. The pedestrians and vehicles at low speeds mainly dominate the townscape alignments. The flowing alignments are those, which accommodate fast moving vehicle. The hill road alignments are those, which are indispensable narrow and serpentine roads clinging to the counters of the glens and hillsides. The countryside alignment, it is low land equivalent to the hill road; its scale is much smaller than the flowing alignment.

3.3 Roads Classification In India

Road are also in the interest of the efficient road transportation system which effectively serves the various land uses in an urban area and at the same time census logical community development. So it is desirable to establish a network of road divided into different classification, each system serving a particular function or purpose according to their function they are classified depending upon the travelled demand pattern of the movement by various modes of the transportation safety of the traffic land uses and environmental consideration.

The classifications of road in India are redefined in every 20 years plan according to its location and the classification as per Bombay Road Plan (1961-1981) is given below. (8)

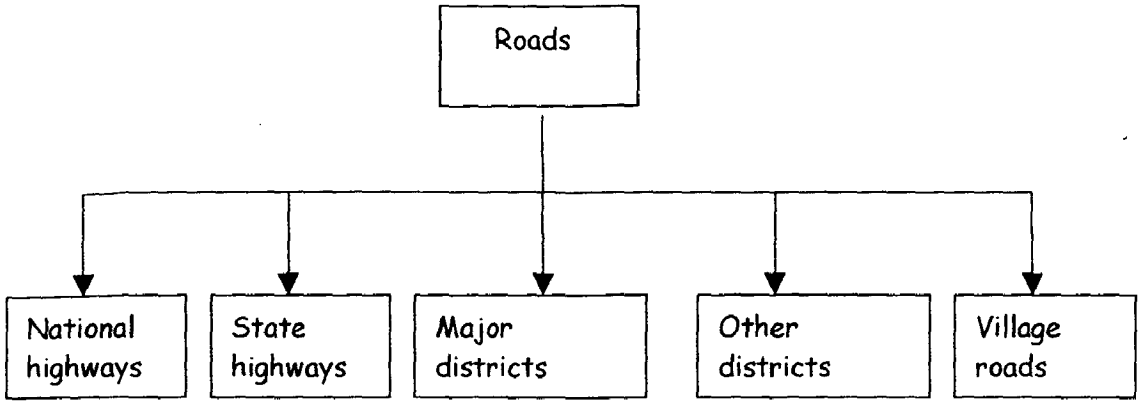


Fig. No. 3.1- Road classification in India (*source - highway engineering by Justo and Khanna*)

3.4 Urban Roads

Roads in the urban areas are called the urban roads. (10). They are the part of the urban infrastructure. These roads are required for both intra city movement and inter city movement and render much higher level of services compared to the regional roads, state highways, and national highways. Importance's of the urban roads are increasing on account of the fact that the urban areas are increasing in their size and number.

Depending on the location and function in the urban areas they are of different types as stated below.

3.41 Urban roads: India

The division of the urban roads in India is shown in fig no 3(11)

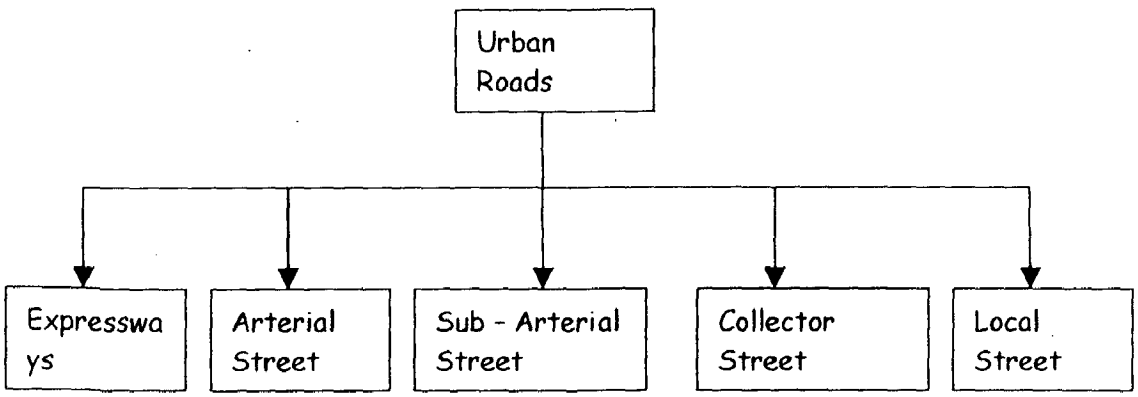


Fig 3.2: Urban road categories in India (*source - highway engineering by Justo and Khanna*)

i. Expressways

A divided arterial highway for motor traffic with full or partial control of access and provided generally with grade separations at intersections. Fig. 3.3

ii. Arterial Street

It's a highway/street primarily for through traffic usually on a continuous route. Arterial Street is coordinated with exiting and proposed expressway systems to provide for distribution and collection of through traffic to and from sub arterial and collector street system. Fig 3.4

iii. Sub-arterial Street

It's a highway/ street primarily for through traffic usually on a continuous route but offering somewhat lower level of traffic mobility than the arterial street. These are functionally similar to the arterial street. Fig 3.5

iv. Collector Street

A Street or road for collecting and distributing traffic from and to local streets/ roads and also for providing access to arterial streets. Fig 3.6

v. Local Street

These are intended primarily to provide access to abutting property and normally do not carry large volume of the traffic majority of the traffic in urban areas either originate from or terminate on these streets local streets may be residential commercial or industrial depending upon the prominent use of the adjoining land they allow unrestricted parking and pedestrians movements. Fig 3.7,3.8

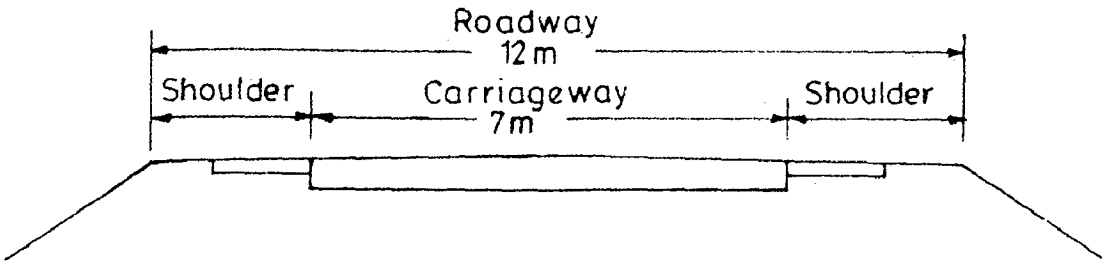


Fig. 3.3 Express way

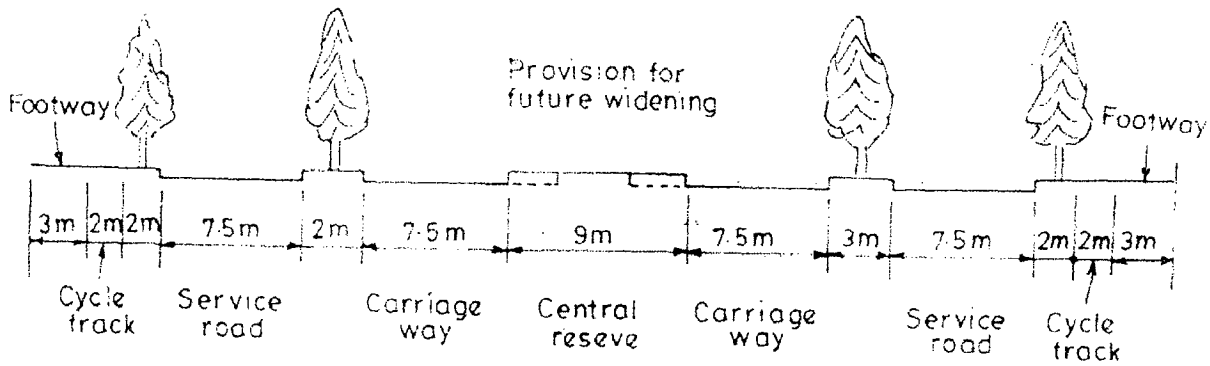


Fig. 3.4 Arterial Street

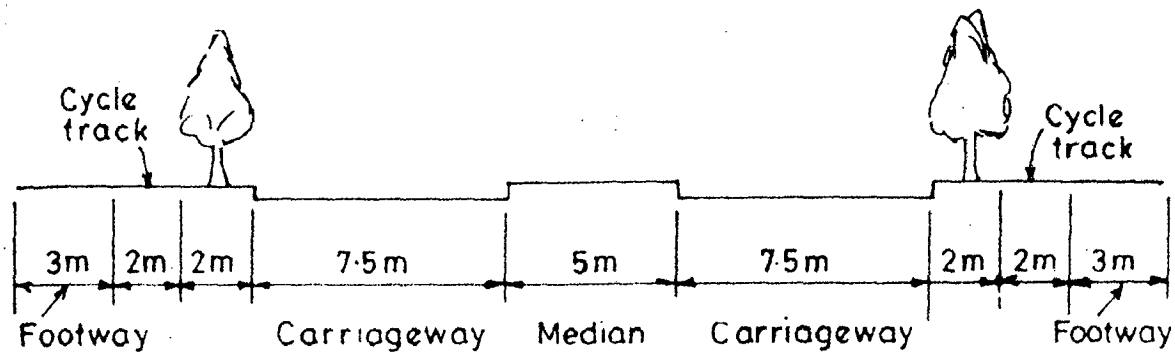


Fig 3.5 Urban sub Arterial Street

(Source –Traffic and Transportation engineering by L.R.Kadiyali)

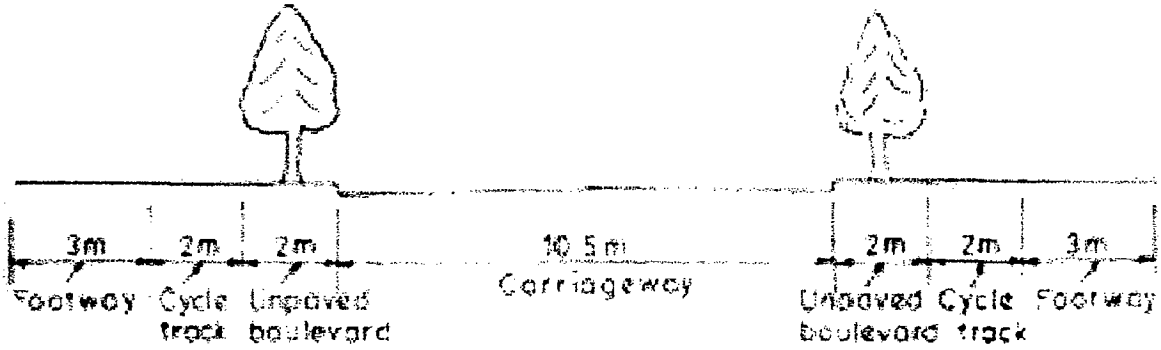


Fig. 3.6. Urban Collector Street

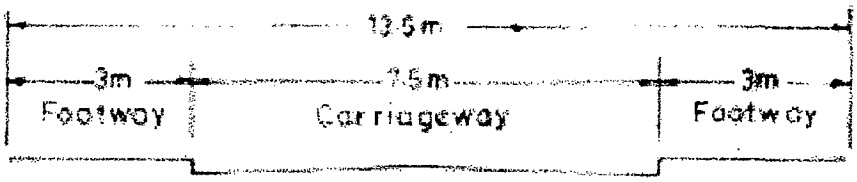


Fig. 3.7 Urban Access Street

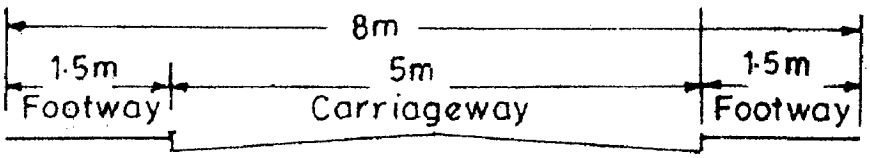


Fig. 3.8 Urban Access Street

(Source –Traffic and Transportation engineering by L.R.Kadiyali)

3.42 Urban roads Abroad:

The general followed in Great Britain is given below(10)

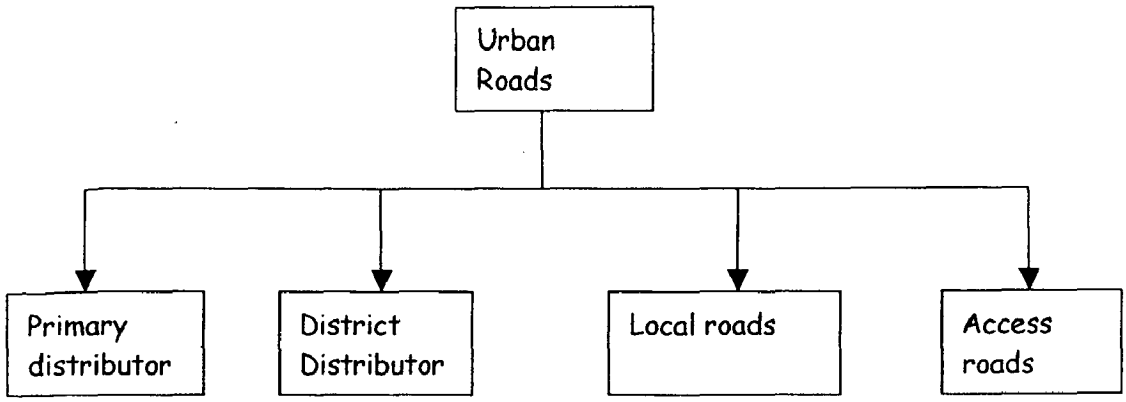


Fig. 3.9 Urban road classification (*source - Roads in Urban areas by Scottish department*

i. **Primary distributors**

These roads are primary network for the town as a whole, all longer distance traffic movements to, from and with in the town are canalised on to the primary distributors. Fig. 3.10

ii. **District distributors**

These roads distribute the traffic with in the residential industrial and principal business district of the town they form the link between primary network and the road with in the environmental areas. Fig 3.11

iii. **Local distributor**

These roads distribute traffic with in the environmental areas they form the link between the district distributor and the access roads. Fig 3.12

iv. **Access road**

These roads give direct access to the building and load with in the environmental areas. Fig. 3.13

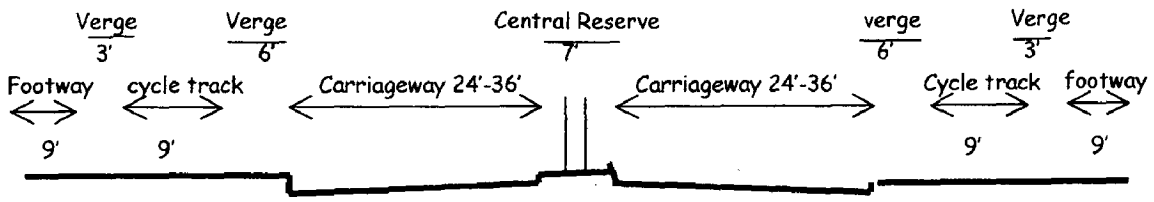


Fig 3.10 primary distributors-all purpose road

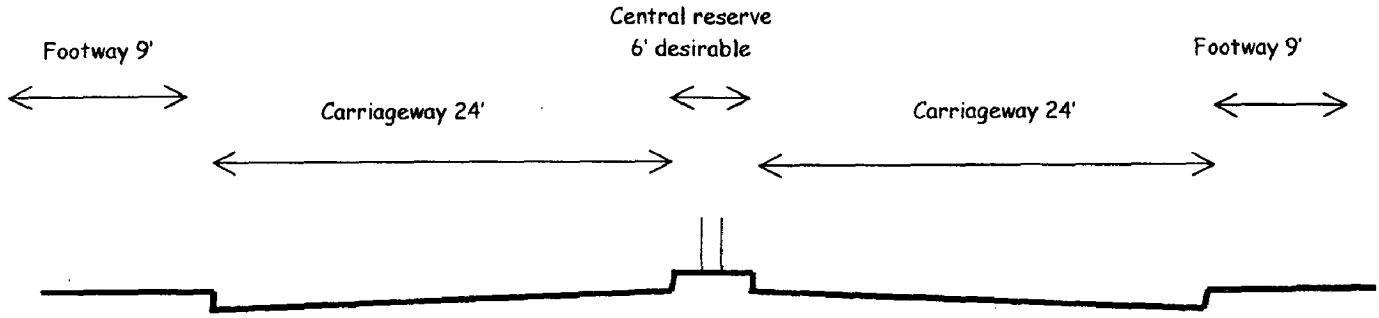


Fig 3.11 district distributors in principal and business district

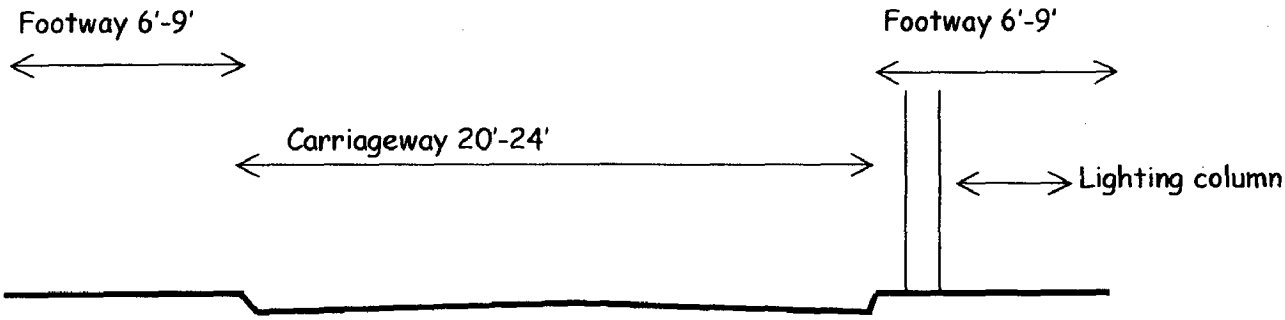


Fig 3.12 local distributors

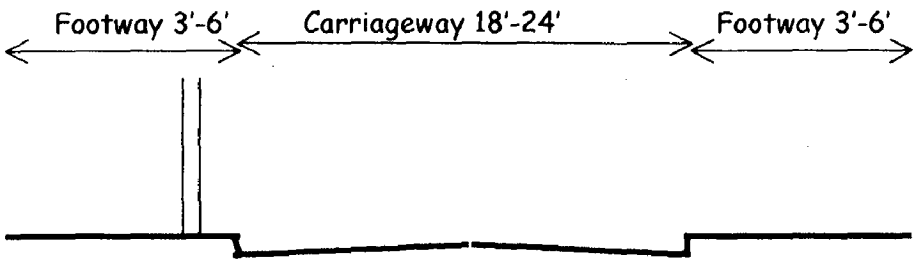


Fig 3.13 principal mean of access

3.5 Design Of Roads

Design of roads of consists of two elements- Geometric design of the road and aesthetic of the road i.e. street furniture, signage, graphics etc.

3.51 Geometric design

The geometric design consists of number of factors and variables. This deals with the dimension of these roads features, such as cross sectional elements, alignment, grades, sight, clearance etc. in relation to the anticipated character and volume of traffic to be served for adequate safety and comfort. (12)

3.5.2Cross sectional elements of the Road

The cross sectional elements in the road design pertain to those features which deal with its width. They embrace aspects such as right of way width, roadway width, pavement width, central reservation (median), shoulder, camber, side slope, horizontal and vertical clearance etc. (12)fig 3.14

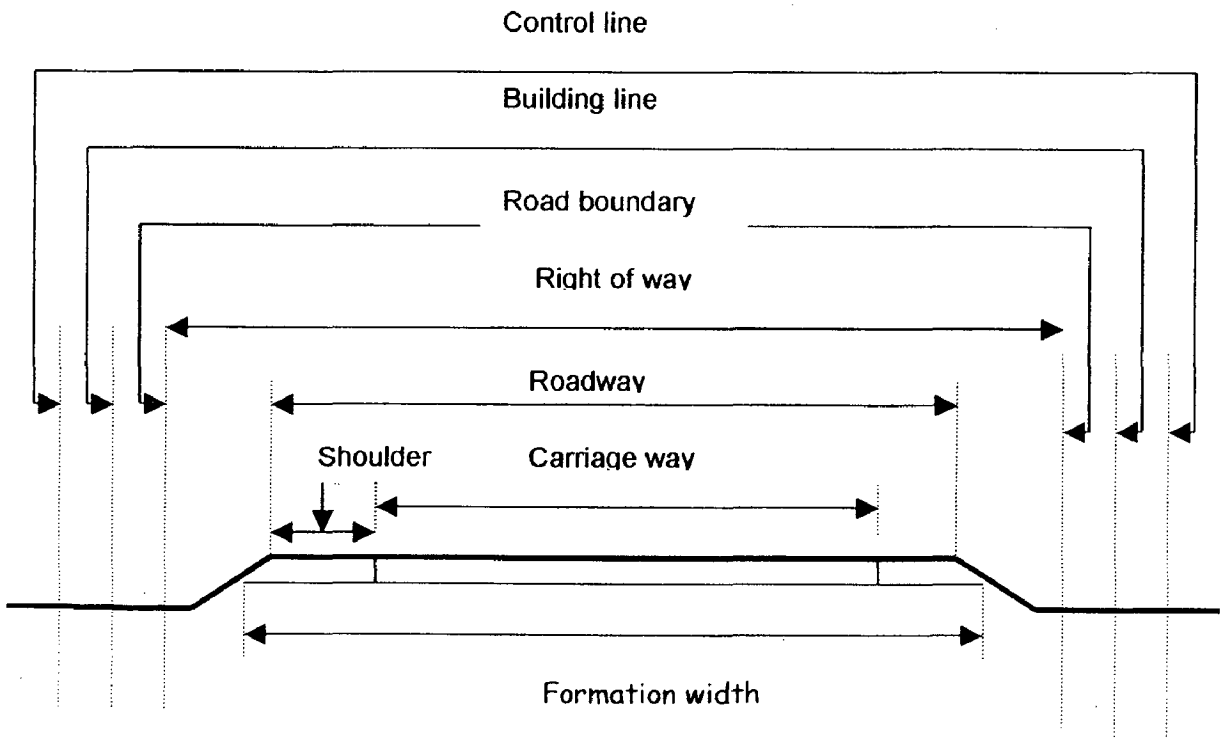


Fig. 3.14 Cross sectional elements of roads

3.5.3 Carriageway width

The width of the traffic lane governs the safety and convenience of traffic and has profound influence on the capacity of the road. The carriage width is decided by the traffic moving and expressed in terms of lanes and each lane is 3-4 m wide. (12)

Table no. 3.1 Design standard for the carriage way

S.N.	Description	Width in meters	
		India	Abroad
1	Single lane without kerbs	3.5	-
2	2 lane without kerbs	7.0	6.0
3	2 lane with kerbs	7.5	7.2
4	3 lane with or without kerbs	10.5/11	9-10
5	4 lane with or without kerbs	14.0	12-15
6	6 lane with or without kerbs	21.0	18-22

Modified fromIRC-86-1983 and Roads in urban areas

3.5.4 Footpaths

It is the path for the movements of pedestrians along the carriageway. These are of different types. (See fig. 3.14)(10)

3.5.4.1 Types of footpaths

i. Side walks or pedestrians ways-

They are the secondary networks of streets for pedestrians only and it should be ensured that they should be segregated from vehicular traffic. (10) Fig. 3.15

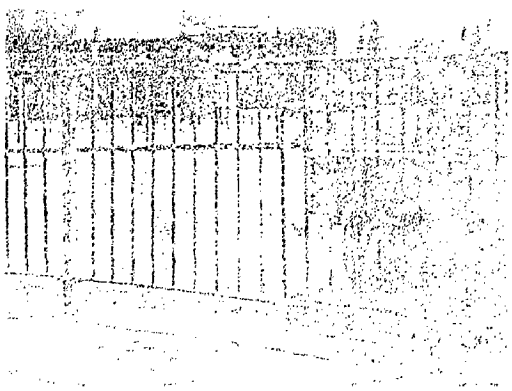


Fig. 3.15Side walks

ii. **Elevated footways-** They ensure the complete segregation of pedestrians from the vehicle and enable wider carriageways to be constructs at ground level. The width is calculated as on the ground level. Bridges should interconnect them across the roads at suitable interval. Fig 3.16

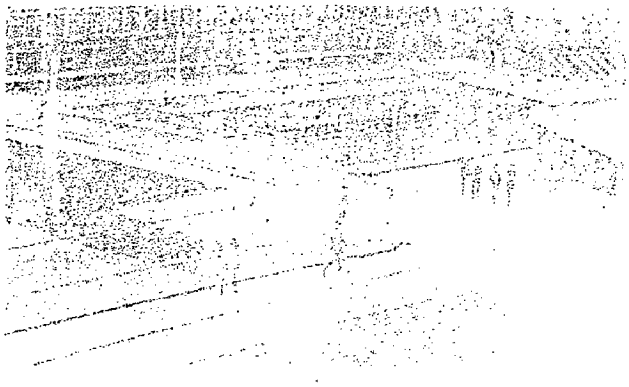


Fig 3.16 Elevated footways

iii. Pedestrians Arcade

The upper storey of the building may be allowed to project over the public foot way provided day lighting and sun lighting can be maintained.
Pedestrian's arcades-arcades have the advantage of doing shopping under cover. Fig 3.17

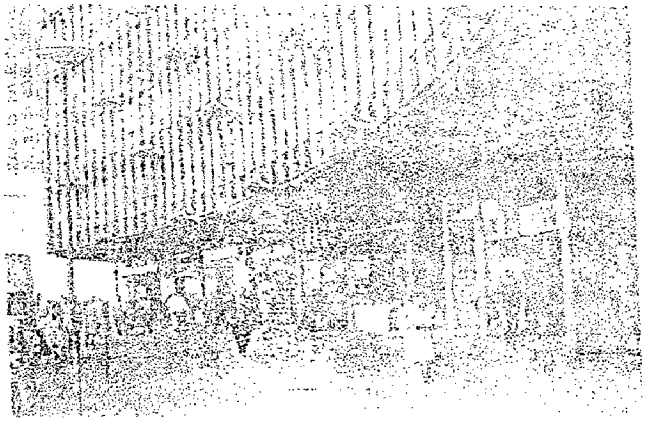


Fig 3.17 Arcading over footways

3.5.4.2 Types of Pedestrians crossing

Being the most vulnerable user the pedestrians should be given preference to cross the road.(10)

Types of pedestrians crossing:

i. At grade crossing pedestrians crossing-

They are those where the pedestrians cross the road at the same level as that of the vehicular movement. They are again divided in two categories

a) Pedestrians crossing at intersection
b) At grade pedestrians crossing away from intersection. Fig 3.18

Fig 3.18 at grade pedestrians crossing away from intersection

ii) Grade separated crossing

a) Pedestrian's subways- this is the underground facilities provided beneath the carriageway at intersection to connect all the arms of it.

b) Foot over bridges-a foot over bridge is usually a straight over bridges across the carriageways

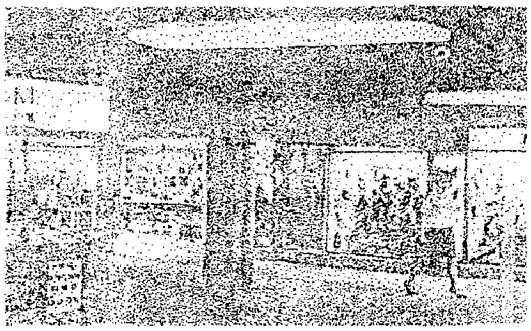


Fig. 3.19 At grade pedestrians crossing away from intersection

Table No. 3.2 Design standards for footways-

Types	India	Abroad
Pedestrians foot ways or side walks	Min. 1.2 m and changing with the increase in no of pedestrians	Business district-6 m Residential area-2m
Arcading over foot ways	-	Clear Head Height- 5m. Parapet height-.90m The canopies clearance-shown in fig no.
Pedestrians arcades	-	Min width – 6m.
Elevated footways	-	Min. width 5m Parapet height-1m min. and max.1.2 m
Foot over bridges	Vertical clearance-2.5m Width-2.5m	Width is 50 person/minute/per metre Gradient-1in20 Drainage 1 in 20 Height 3.0m
Pedestrians sub ways	2.5m wide Clear head height -2.5m Drainage slope-1 in 30	Min. width 2.25m Clear head height -2.1m Ramp gradient- 1in 10

	Ramp gradient-1in10 In 10	

Modified from - IRC103 and roads in urban areas

3.5.4.3Materials used for pedestrian's path

Material texture is a very important aspect of foot design. The walk way should be relatively smooth and the aggregates pavements used should be smooth. (13) Available materials are-

-Bricks

-Pre-cast concrete slab

-Chequered tiles

-Sand stone

-Tar macadam surfacing

3.5.5 Cycle track

A cycle track is a way or a part of the road way designed and constructed for the use of the pedal cycle and over which the right of way exists.(14)

3.5.5.1Types of cycle track

Cycle tracks are classified in to the following two groups-

i. **Adjoining cycle tracks-**

These completely fit in with the carriageway and are adjacent to and on the same level with it

ii. Raised cycle tracks -

These are also adjoining the carriageway but are at higher level

iii. Free cycle ways -

These are separate from the carriageway by the verge and may be at the same level as the carriage way or at the different level.

Cycle subways are also practiced abroad. For sub ways slope 1in 20 for upward and for down ward 1in 15 ht 2.25 m width 1.6m for one way for two way 5m.

Table no.3.3. Design standards for cycle tracks

S.N.	Features	India (m)	Abroad (m)
	Single Lane width Min. Two lane Three lane Four lane	1 m 2m 3m 4m	3 4 5.3 -
1	Gradient	1in 30	1 in 20
2	Horizontal curve	10m for 1in 40 gradient or slope	
3	Vertical curve	200	
4	Sight distance	25 meters min.	
	Clearance	-	
7	Vertical	2.25	
8	Horizontal	2.5	
9	Railing in case of the bridges	90cm	
10	Verge	1m min. from C.W. 1m from footways, trees, ditches etc.	2m from C.W. And 1m from footways

Modified from IRC-11 and roads in urban areas

3.6. Geometric Design Elements

3.6.1 Design speed

Design speed is the maximum safe speed that can be maintained over a specified section of highway when conditions are favourable which the design features. (12)

Table no. 3.4 Design speed of street

Types of street	India Kph	Types of street	Abroad kph
Sub Arterial street	60	Primary distributor	65-80
Collector Street	50	District distributors and other roads	50
Local Street	30		

Modified from Roads in urban areas and urban roads manual

3.6.2Sight distance

The distance along the road surface at which a driver has a visibility of objects stationary or moving at a specified height above the carriage way is called as sight distance. They are of two types- stopping distance, overtaking distance.(12)

3.6.2.1.Stopping distance

It is the distance required by the driver of the vehicle travelling at a given speed to bring his vehicle to a stop after an object on the road way becomes visible or it is the sum of the distance travelled during perception and break reaction time and the braking time.

3.6.2.2 Over taking distance

Overtaking is necessary because some travel fast while some travel slowly. The road section should be designed in such a way so that vehicles travelling at the design speed are affordable chance to overtake the slower vehicles. This comprises of initial manoeuvre distance and distance while passing vehicles occupies the adjacent lane.

Table no. 3.5 sight distances

S.N.	Design speeds (K.P.H.)	Stopping distance (m)		Overtaking distance (m)	
		India	Abroad	India	Abroad
1	20	20		-	
2	25	25		-	
3	30	30	33	-	144
4	40	45	-	165	-

5	50	60	57	235	210
6	60	80	-	300	-
7	65	90	90	340	285

Modified from –IRC 86 & road in urban areas

3.7Street Furniture

Street furniture consists of two broad categories – traffic safety devices and other street furniture.

3.7.1Traffic safety devices

Traffic safety devices are those which safe the users. These are of two types- traffic control device and other safety device

i. Traffic control devices are those, which govern or control the traffic. Traffic control devices-central refuges, intersection channelisation, traffic signal system, barricades, traffic signs, road markings, traffic lightings
ii. Other safety devices are Guardrails, Traffic light speed breakers, and Roadway delineators.

3.7.2. Traffic signs

To ensure smooth and efficient flow of traffic, to reduce the area of conflict and prevent accidents and adjust and regulate the needs of the traffic to the capacity and the limitation of the facility under use, the road requires to be in constant communications with the road user, the road signs (along with the road markings) constitute the language in which the road speaks to the road user. (15)

3.7.2.1Characteristics features of traffic signs

i. Visibility, legibility and lettering

It is essential that all signs and signals are visible and legible by day and night and also under adverse conditions particularly during rain. It must have the following characteristics

-A distinctive shape and color

-Sufficient size

-Sufficient size

-Located at standard location and easily visible

-Not to obstruct pedestrians, vehicle and not obscured by parked or stationary vehicles

ii. Lettering

The min. letter size is 20 cm and important sign may carry the message in Hindi/ regional/ English language.

3.7.2.2Types of the signs

A broad classification is made in the light of the message the sign intends to convey and these may be of three types:

a) Mandatory/Regulatory,
b) Cautionary/ Warning and
c) Informatory

a) **Mandatory/Regulatory**

These signs remind the road user about the existing laws and regulations to which the road user is subject and is bound by law to follow.

The following mandatory series

- Speed series: speed limit series

-Movement series: vehicle control signs, compulsory direction control sign and the message word only and arrow sign

-Parking series- no parking, no stopping sign

-Pedestrians series-stop, give way,

-Other sign – restriction ends, prohibitory signs

b) Cautionary/Warning Signs

These signs warn the road user about the existence of certain conditions with potential of hazard.

Cautionary signs

- Change in horizontal alignment
- Intersections

Warning signs

Changes in horizontal alignment- turn and curve sign, large arrow sign

Intersection sign-Cross road sign, T symbol, etc.

c) **Informatory Signs**

These signs provide useful information and guidance to the road user and keep him posted with tips regarding places of historical/geographical interest along the road and also about the route, distance to different destinations etc. So far as urban situations are concerned, these signs may be grouped as under-:

- Direction and Place Identification signs,
- Facility/information signs,
- Other useful Information signs, and
- Parking Signs

3.7.2.3 Material for traffic signs

The signs are made of the stove emailed metal plate and for the post the material that should be used are mild steel section or aluminum section. (16)

Table no 3.5 Features of the traffic signs

Type Of signs	Features	India	U.K.	U.S.
1.Mandatory				
1.1Stop	Shape and size and color	Octagon of dia. 90 cm. Min. dia 60cm. Written message in white on red background, with white border	Octagon of dia. 90 cm Written message in white on red background, with white or yellow border	Octagon of dia. 90 cm. White word message on red background, with white border
1.2Give way	Shape and size and color	Inverted equilateral triangle with red border and white background of	Inverted equilateral triangle with red border and white background	Inverted equilateral triangle with red border and white background and

		triangle with red border and white background of base size 90 cm.	triangle with red border and white background	triangle with red border and white background and the word in red
1.3 Other signs	Shape and size and color	Circular shape of 60 cm. dia	Do	Do
2. Warning	Shape and size and color	Equilateral triangle with red border and symbols indicated in black color of size 90 and min. 60	Do	Do
3. Informatory	Shape and size and color	Rectangle with letter size 8-10 cm. Of size 80*60*40	Do	Do
	Sitting	Left		Right
	Lateral clearance from carriage way	0.6m in Kerbed roads and 2-3m in un kerbed road	0.75 m	.75mfrom street lamps
	Vertical clearance	2 m above kerb	2.0 m	1.5m
Overhead	Clear ht.	5.5m		

Modified from IRC 67 & road in urban areas

3.7.3.Traffic signal

The use of traffic signals for control of conflicting streams of vehicular and pedestrian traffic is extensive in most of the towns and cities. (17)

3.7.3.1 Types of signals

i. **Fixed-Time Signals**

Fixed time signals are those in which the green periods and hence the cycle lengths are predetermined and have fixed duration.

ii. Vehicle actuated signals

They are those in which the green periods vary and are related to the actual demands made by traffic. This is made possible by installing detectors on all the approaches.

iii. **An intermediate type**

In these semi-vehicle-actuated signals, is also available, in which, the right of way normally rests with the main road and detectors are located only on the side roads.

3.7.3.2.Visibility of the signal

The signals should be placed in such a way so that it will make angle between the signal and visor from 2 to 8 degree.

3.7.3.3 Installation of Signs –

Typical layout of traffic signals is given below

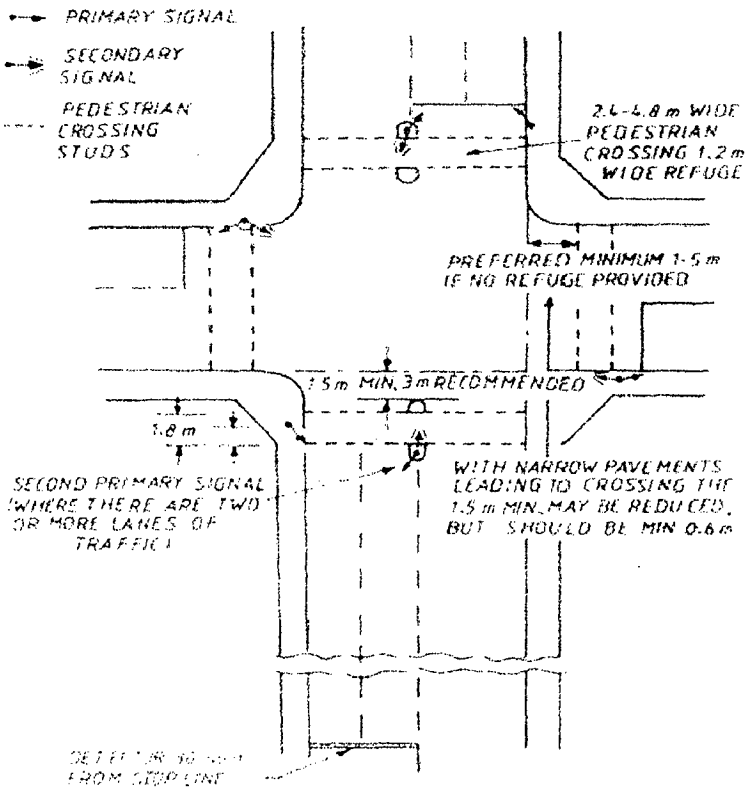


Fig 3.20 typical lay out of traffic signals

Table 3.6 traffic signs in British, America and India

Features	British	America	India
Signal Sequence	Colour-Red, amber, green. Red denote to restrict the entry from the right of way to the intersection, amber alert that the signal is going to green signal and permits to enter to intersection	Colour-Red, green, yellow Red denote to restrict the entry from right of way to intersection, yellow alert that related green movement is going to terminated and red is going to come and green represents to enter to intersection	Colour-Amber, green, red Red amber, green. Red denote to restrict entry from right of way to intersection, amber denotes the transition phase between red and green level and green represents to enter to intersection
Pedestrians signal indication	Don't cross indication is given by red standing men where the green signifies don't start to cross	-	Red sanding man represents the don't cross indication and the green represents cross indication
Signal face	Three face red amber and green	Five face	Red amber green three face
Lenses size	200-300 mm	200-300	200-300
Fixed time signal	Vehicle acetated system	Fixed time signal	Fixed time signal

Modified from traffic and transportation engineering by L.R.Kadiyali

3.7.4. Roads markings

Road markings are defined as the lines, patterns words or similar devices (excluding road sign kerbs or other objects) marked with in or just adjacent to the carriageway to control, to warn, to guide the road users.(18)

3.7.4.1Types of the road markings

i. Carriage way markings –

- Centre line

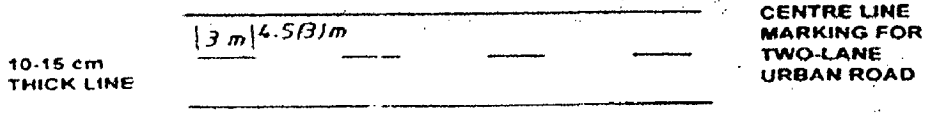


Fig 3.21 centre line markings for two lane Urban roads

- Traffic lanes line

- Traffic lanes line

-No passing zone markings

-Border or edge line

-Carriage width transition marking

-Obstruction approach marking

-Stop lines

-Pedestrians crossing

-Cyclist crossing

-Route direction arrow

-Word message

-Parking space limits

-Bus stops

ii. Object markings

-Objects in the carriage way

-Kerb marking for visibility

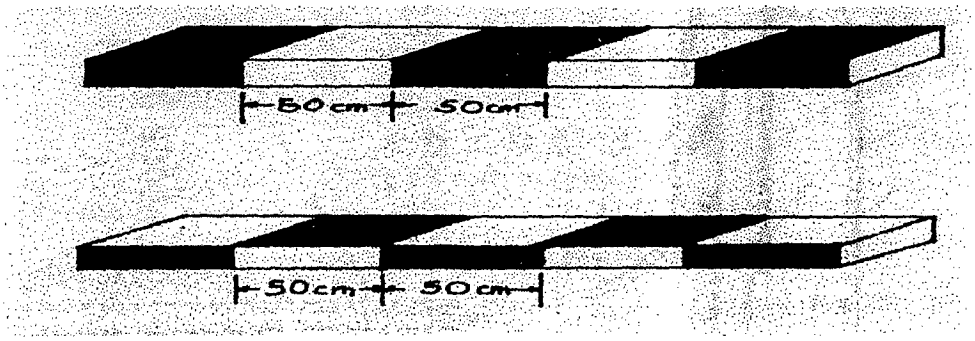


Fig 3.22 Kerb marking

-Kerb marking for parking restriction

-Object adjacent to the carriage way

3.7.4.2. Colour

White colour are used except for the yellow for parking restriction and White with black colour used for kerb

3.7.4.3. Material

Ordinary paints are used in India. Abroad refectories paint is used as they have better visibility and last longer.

3.7.4.4 Representation of markings

-Broken line

-Longitudinal solid lines

-Transverse solid line to the position of a stop line

3.7.4.5.Design aspects of marking

i. Consideration for centre lines

The roads having width less than 5 m are considered undesirable. In such cases short section of centre line are put on busy intersection pedestrians crossing etc.

-Word message

Letters height 1.25 m and2.5 m for the speed above 50 m/hour e.g. Stop,

-Obstructions approach marking

Physical obstruction with in the carriageway such as monuments to see transmission poles should be marked

-Stop line

It shall be located in between 2-3 m from the pedestrians crossing

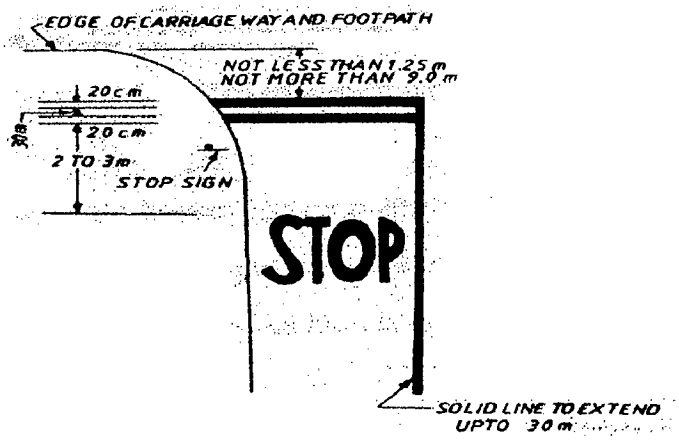


Fig. 3.23 stop line markings

-Pedestrians crossing and cycle crossing

At intersection they are marked.

-Obstruction in the carriage way

They should be marked not less than five alternatives black and white strip. Object marking on kerb are alternate marked in black and white colour

3.7.5. Road light

Lighted roads Increase safety of the road user (with or without vehicle) from the point of view of traffic interaction, enables road-using vehicles to achieve the design potential of the road in respect of speed. Capacity etc. to the maximum possible extent during night and contributes to general public safety from the point of view of law and order and prevention of crime. The following influences the visibility of an object at night from a moving vehicle: - (16)

(I) Size of the object,

(ii) Degree of illumination and

(iii) Its light or color contrast with the carriage way surface.

3.7.5.1 Lighting System

The characteristic light distribution intended in the installation. The common systems are 'cut off, 'semi-cut off and 'non-cut-off.'

i. Cut-off System

In this system the candle power per 1000 lumens does not exceed 10 cd at an angle of 90° above nadir (i.e. at the horizontal) and 30 cd at a vertical angle of 80° above nadir.

The direction of maximum intensity may vary but should be below 65°.

ii. Semi-Gut-Off System

In this system the candle power per 1000 lumens does not exceed 50 cd at an angle of 90° above nadir (i.e. at the horizontal) and 100 cd at a vertical angle of 800 above nadir.

The direction of maximum intensity may vary but should be below 75°.

iii. Non-Gut-Off System

The system in which there is no candle-power limitation in the zone above the maximum candle-power is termed 'non-cut-off system.

3.7.5.2 Sources of Light

i. -Mercury Lamps
ii. -High Pressure Mercury Vapor Lamp (HPMV)
iii. -Mercury-Halide Lamps
iv. -Tubular Fluorescent Lamps
v. -Low Pressure Sodium Vapor Lamp
vi. -High Pressure sodium Vapor Lamp

3.7.5.3Arrangement of Installation

Arrangement of installation and provision of light support is generally decided on consideration of roadway width, the width of median available, presence or absence of median barriers and the total cost of project. There are four general type of arrangement as described below.

i. Single side arrangement

For narrow roads, generally in residential areas single side arrangement is provided.

ii. Staggered two-side arrangement

For roads of medium width, location of luminaries on either side of carriageway in a zigzag formation may provide more uniform illumination and better visibility on both sides.

iii. Two-side arrangement (opposite)

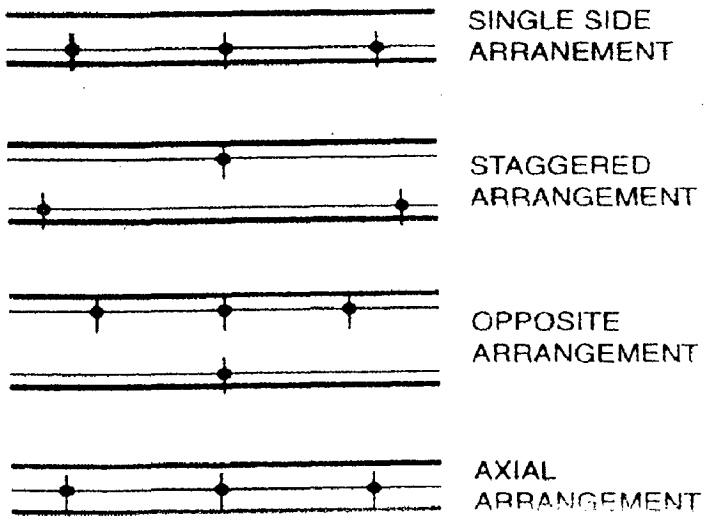


Fig.3.24 arrangements of lights

Two-side arrangement with mountings opposite to each other is recommended for carriageway widths exceeding 1-5 times the mounting height.

iv. Axial arrangement

If the road has divided carriageway with adequate median width axial or central support arrangement may be resorted to.

3.7.5.4. Illumination level

The lamination level for lighting for main road and secondary roads is as follows

Table no. 3.7 Light pattern for roads

S.N.	Types of roads	Average illumination (lux)
1	Main roads carrying mixed traffic	15
2	Secondary road with medium and heavy traffic	8
3	Secondary road with medium and heavy traffic	4

Source Urban roads manual

Table 3.8. Design guide for different roads

Right of width	Height	Spacing	Power	Lighting fixtures	Position
100 ft.	10.5	30	250 watts	HPSV	Central verge
60-100	9.1	30	150	HPSV	Both side in staggered
30-60	6.6	25	70	HPSV	One side
>60	6.6	20	15	Incandescent bulb and tube light	One side

Source urban roads manual

3.7.6Other safety device

The other safety devices are those who help in the traffic safety other than traffic control. Refer appendix (2) for this

3.8 Other Street Furniture for road Beautification

Road Beautification elements

Besides the functions of the roads there are other element, which enhances the beauty of the road and adds life in it.(12) They can be-

- ❖ Landscape elements-

1.Tree Guards

2. Planters and trees
3. Benches, sculpture, dustbins, telephone kiosks, police call boxes.

- ❖ Facilities

1. Bus Stands
2. Roadside Toilets
3. Taxi Stands
4. Roadside Rest Areas

- ❖ Information Providers

1. Roadside Advertisements

- ❖ Services

1.Letter Boxes, dustbins

3.8.1Principles of other Street Furniture Design

The following are the general principles to be borne in mind while selecting and designing street furniture items.

1. Only those items, which are absolutely necessary, should be provided. Superfluous items clutter the streets cape. Sometimes it is possible to combine light poles and signal posts.
2. The initial cost and cost of maintaining the facilities must be given due consideration.
3. The materials selected should be durable.
4. The design should be vandal-proof.
5. The designs should be aesthetically pleasing and match with the surroundings.

3.8.2Landscape elements

- Traffic safety requirement for plantations
- Height, spread, and location of the tree in all shall be shall be such that that it does not obstruct the clear view of the motorist view form signs and signals and light
- No branches till 6.5 meters.
- Planting at a distance of 6 m. from light poles
- It should be not near to the utility services
- The nearest distance between the nearest point of the tree and kerb should be 1

3.8.3Plantations

Plants and shrubs of height 1.5 to 2 m other street element should not restrict the movements of the pedestrians and vehicles nor limit visibility at junctions or on bends.

3.8.4Road side advertisements

"ADVERTISEMENT", means any word, letter, model, sign, placard, board, notice, device or representation, whether illuminated or not, in the nature of, and employed wholly or in part, for the purpose of advertisement, announcement or direction (excluding any such thing employed wholly as a memorial, road sign or railway signal). Advertisement includes any hoarding or similar structures used or adapted for the display of advertisements. (19)

3.8.4.1 Principles of advertisement control

- It should not be at or within 100 m of any road junction, bridge or another crossing in urban areas
- Within 10 m of the edge of a carriageway
- Not within 50 m along the road, of any sign board erected for the regulation of traffic under the orders of a Public Authority such as a Traffic Authority, a Public Transport Authority etc.
- Not on the On boards, placards, cloth banners or sheets hung across a road with in right-of-way of the road;
- Illuminated advertisements of the following description are objectionable from the angle of traffic safety and should not be allowed:
- Advertisements which contain, include or are illuminated by any flashing, intermittent or moving light or lights except those giving public service information such as time, temperature, weather or date;

- ❖ Advertisements which contain, include or are illuminated by any flashing, intermittent or moving light or lights except those giving public service information such as time, temperature, weather or date;
- ❖ Illuminated advertisements of such intensity or brilliance as to cause glare or impair vision of the driver or pedestrians, or which otherwise interfere with any operations of driving;
- ❖ Advertisements illuminated in such a way as to obscure or diminish effectiveness of any official traffic sign, device or signal.

3.8.4.2 Dimensions of advertisements

The general rule for maximum permissible area of advertisements should be 0.3 sq. meters per meter of setback from the edge of the carriageway. For more information on the tyoes of the advertisements see appendix-2

- ❖ **Conditions for permits**

The following conditions might be attached to permits:

(1) The advertisement must be maintained in a clean, tidy, and safe condition;

(2) If the Road Authority requires the removal of the advertisement, it must be removed forthwith;

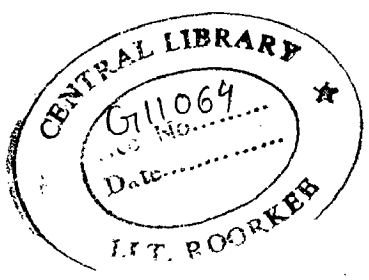
(3) The advertisement must not be put in such a position as to obscure or hinder the ready interpretation of any road traffic sign, railway signal, or any other public notices; The advertisement must not offend public morals and decency.

3.9 By Utility

Utilities along the road should be thee and constructed in such a way so that they do not conflict with the road users of the right of way or from the through traffic roadway.

3.9.1Overhead utilities

They are the overhead structure on the right of way. When the spanning is required they should be placed on the median the min. Clear height should be 5.5 m.



3.9.2 Under ground utility services

Utilities crossing the underground below the roads shall be of durable material and so installed as to virtually preclude any necessity for disturbing the road way to perform maintenance or expansion operation.

- ❖ Category of utility line

Utility lines can be grouped under four categories

-Sewer and drainage line

-Water supply lines

-Electricity and telecommunication lines

-Gas pipelines and those carrying combustible material

3.9.2.1 sewer lines

Sewer lines and drainage lines have the gravitational force flow and they are laid at substantial depth and not on the carriageway because of the presence of manholes and in minor roads it can be laid along the edge of the carriageway.

3.9.2.2 Drainage of the roads

Since water is the prime cause for the failure of the pavement, so attempt should be made to clear the water from the road. Drainage channel has Roadside channel chutes to carry collected water down stream. Curbs and channel are also used to drain the water.

3.9.2.3Curbs and channel

They serve the following purposes-

-Drainage control

-Carriageway edge delineation

-Aesthetics

-Delineations of pedestrians walk ways

-Reduction s of maintenance operation

-Assistance in orderly roadside development

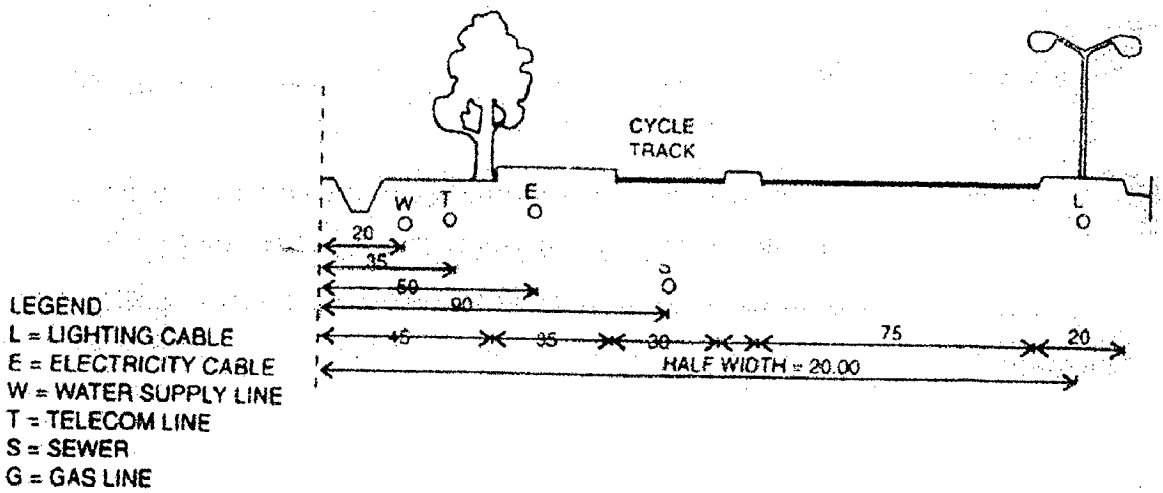
for detail see appendix –2

for detail see appendix –2

3.9.2.4Water supply

They are for carrying water under pressure and leakage can damage the road. So this is not closed to the sewer lines to avoid intermixing in case of leakage. The electric lines should not be enclosed to the water lines to avoid any short circuits

Gas lines and other pipelines



They should be away form the electricity cables and sources of heat

Fig.3.24 Service line for four lane divided with cycle track

Table no. 3.9 depth of the different utility services.

Utility type	Sewer line	Electricity cables	Water supply line	Telecommunication cable	Gas lines
Depth in m	2-6	1.5-2	06-1.5	2-3	2-3

Source IRC 98

Generally a width of 5 m is adequate for both sides for services and this can be given under footpath.

3.10 Land And Building Use

The land and building use along the road also affect the need of the users and thus the designing and planning of the roads. According to the building and land use the roads can be classified as the residential street, commercial street, industrial street etc . this factor has not been taken into consideration in India and no norms and no standards. (20)

3.10.1 Residential street

In the institute of the transport and traffic environment studied, U.S.A. the residential roads are of two types one is the local distributor roads and another is access road. Local distributor roads include the originating and terminating traffic with in districts and Access roads form a major part of the residential road networks and provide direct access to individual dwellings anal parking spaces. They also include the road shared by both pedestrians and vehicles.

According to the Redburn principle the need of the residential street can be as follows(20)-

- Psychological need
    1. Functional cooperation
    2. Mothers informal meeting
    3. Toddlers social play
    4. Visual harmony
    5. Less danger and safety
    6. Adolescent needs for adventure, places for love
    7. Accessibility for local shops, pubs etc.
    8. Special need for older and disabled people
    9. Feeling of belonging and participation of inhabitants
    10. Good impression for visitor
    11. Workable dwelling plans
- Ecological criteria

1. Green amenity

- Economic and administrative criteria

1. General maintenance of area and running costs
2. Development

However the real needs can be seen to apply as follows

A. Access for service

(a) Waste collection

(b) Delivery house hold goods

© Letter posts

B. Access for people

(a) Going out by car

(b) Going out by foot

© Formal visitors

(d) Informal visitors

© Ceremonial family occasion

The balanced solution will results from

- Correct prediction of conflicts points and cross current routes
- Limitations of vehicle speeds
- Pedestrians sight lines.
- Alternative safe route which can be taken if danger of the shortest route is apparent

All these can be solved through the proper design and proper planning as conceived by Redburn-

3.10.2 The design aspect -

- Paths in front of the houses which faces the major roads must lead to pedestrians areas
- The pedestrian areas should be clearly defined end where it meets the roads so that the small children can easily recognize and the visual enclosure of the area is more complete
- At such points adequate lay byes and spaces are required for visitors coming car or bus stops
- Where the point coincide with the under pass as each man footpath serves a large population as does the each road junction, the planning of bus stops, the step leading to the road etc can be thought.

According to the highway traffic and transport division the design and planning of the residential roads should be as follows(21)-

- The speed limit in the street should be restricted to less than 30 miles / h
- Design of the shared access road should have regard to people with mobility impaired, people who are blind and partially sighted difficulty and min. 25 mm kerb up stand to delineate the foot way.
- Residential road other than cul-de-sac should be adequate to serve all but largest buses.

- Links between the cul-de-sac and the path must not be opposite. In case of mixing the pedestrian and vehicles in cul-de-sacs the traffic segregation design should be followed and provide shortest route to shops school and bus stop and the main entrances to dwellings should face the path side.
- First the traffic capacity of the roads should be seen and alternatively the vehicles are allowed to move.
- At Junction special consideration should be given.
- Cul-de-sac also provides security as the house overlooks each.
- Drives need to made aware, on entry and as they traverse a site that they are in surroundings where the needs of the cyclist and pedestrians including those with impaired mobility are expected to take precedence over the convinces of free flow of motor vehicle
- Provision For The Cyclist And Pedestrians. The width of the footways along the main carriageway need to ensure that the widths and alignment of footpath and are adequate to meet public utilities requirement
- The adequacy of the off street parking provision
- The spacing, layout and dimensions of the turning areas should be designed to cater for the size of the vehicles excepted to use turning areas at heads of cul-de-sac serving more than small no of dwellings should be large enough for vehicles to turn.
- Sufficient No Of Parking Space For The Person Living In The Residences.

Table no. 3.11 residential road width

Typical recommended layout guidelines	Access road	Local road
Range of min. carriageways widths(m)	5.5/4.8/4.1/3.0	6.7/6.0
Min. center line radii (m)	29/20/10	90/60
Min. junction spacing Adjacent Opposite	 29/20 15/0	 90 40
Min. kerb radii at junction (m)	6/4	10

Source- highway traffic and transport manual- U.S.A.

3.11 Urban Road Users

As studied earlier, India urban roads are not only used by vehicles but also by pedestrians and other users such as street hawkers and vendors.

Urban roads user are heterogeneous in character in India. It consists not only of vehicular movement but also the pedestrians and other users such as street hawkers and vendors. And in the vehicular movement they are of fast moving motor traffic and slow moving traffic such as cycle, animal drawn vehicles etc. Motor traffic itself consists of car light vans, different kinds of commercial trucks, buses, scooters, auto-rickshaws, motorcycles, etc. Animal drawn vehicles could be bullock-carts, camel carts, or horse drawn vehicles. There is a considerable volume of cycle traffic and in some towns cycle rickshaws also ply.

3.11.1Pedestrians and vehicles user

The man and vehicle users are the most vulnerable users of the road. Before going to the requirement of them we should know their characteristics(20)-

Table no. 3.12 man vehicle characteristics

	Man	Vehicle
Size	Small	Large
Tactility	Soft	Hard
Speed and range	Slow and small	Fast and great
Momentum	Sight, safe	Great, dangerous
Movement	Organic	Organic tendencies through drivers alone
Rhythm	Organic pattern	Mechanical patterns, predetermined sight lines
Routes	No sight lines	Site line and curvature according to speed and formulae
Ecological	Harmonious	Petrol, poisonous gases
Sociological	Need security conducive to friendship	Allows meeting of the distant friends
Damage	Care increases with damage, Long average life	Care decreases with damage, short average life

Source – planning for man and motor by Paul Ritter

3.11.2Pedestrian's users

Pedestrians are the users who move on their own foots and they use the roads for mobility, accessibility and leisure. Walking is the important modes of transport and moreover every journey starts and ends with it. Since they are the most vulnerable users so there must be adequate consideration for the safety of the pedestrians. They use the footpaths along the road.

3.11.2.1Characteristics of pedestrians

- Normal circumstances can travel unto one km/h
- The concentration of population inside the settlement is an important factor that will affect padestrinasation more the population means more pedestrians and more users of pedestrians facility
- High pedestrian in the C.B.D. area, leisure area bus stations railways where the fast moving vehicle are not there
- Residential area also has much of pedestrians this is because of the street has become the meeting point and activity centre lot of children and old aged who are not cope with the fast moving remain pedestrians
- Pedestrians in Anthropometrics dimension- the size of the people varies from the physique, age and capability (disabled and normal)
- Types of pedestrians- there are different types of the pedestrian's traffic. They are the children, young and middle aged, elderly and special pedestrians the disabled people.(13)

    1. Children and their activity on the pedestrians area
       The children play on the ground and makes friends on the footpath and they are more safer on the footpaths
    2. Elders – they are comfortable on the footpath and they spend time on this while walking, wandering.
    3. Family as a whole also enjoys on the footpath
    4. Disabled people – they have very specific requirement depending on the kind of disability.

Table no.3.13 average walking rate of pedestrians

Type	KM/sec	Space req. (m)
Younger male	4.5	1.8
Younger female	4.2	2.0
Older male	4	2.4
Older female	3.8	2.6
Bunching	3.6	Variable

Source PhD thesis by santosh Kumar Mishra in 1998 at I.I.T.roorkee

3.11.2.2Principle of the pedestrians flow

The major principles are comfort, convenience, safety, security, and economy of the walkway system. (23)

Comfort factors include the weather protection, climate, arcades, transit shelter, walkway width and other pedestrians' amenities.

Conveniences factor include the walking distance, pathway directness, grades, sidewalk ramp, directional signing, directory maps.

Safety factors include the separation from vehicular traffic, height, degree and type of street activity.

Security factors include the security from damage or Accidents.

Economy factors include the energy and shortest route path.

3.11.2.3Comfort factors

a. Path way width –

The width of the pathway depends on the flow of the pedestrians. The minimum width is 1.5m in Indian context. In Indian standard only the no. of the person are taken into consideration rest such as age, pantaloons, structure etc are not being considered. (24)

Table no 3.14. Design standard for the width of footpath in India

Width of the side walk	Capacity in no. Of the person per hour	
	All in direction	In both direction
1,50	1200	800

2.00	2400	1600
2.50	3600	2400
3.00	4800	3200
4.00	6000	4000

Source IRC 103

In abroad the width of the footways is taken 10-15 persons per foot width of pavement per minute.

Abroad the pathway width is analysed through the types, age, sex etc. of the pedestrians. The level of services of the pedestrian flow is judge by the speed of the pedestrians and the pedestrian's flow is given in terms of the pedestrians per unit width of walkway per unit time.

Pedestrians width= Vp=V15/(15*We)

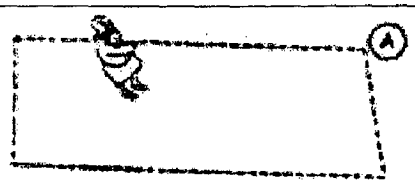
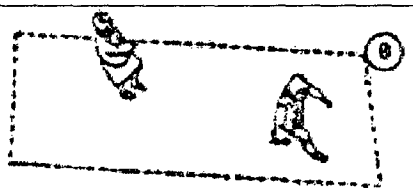
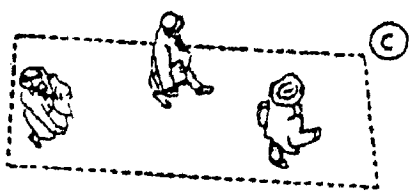
Vp= pad. Unit flow rate (p/min./m)

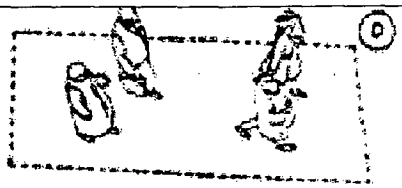
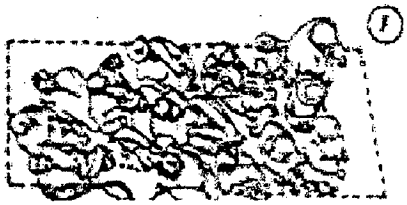
V15= peak flow

We= effective walkway width

Abroad the comfort factor is judged by the Level of services which is shown in table no. 3.15

Table no. 3.15 Level of services on walkway

Level of services A Pedestrians space >=130 sqft/ped Flow Rate: <=2 ped/min/ft At walkway LOS A pedestrian basically move in desired paths without altering their movements in response to other pedestrian. Walking speeds are freely selected and conflicts between pedestrians are unlikely.	
LEVEL OF SERVICE B Pedestrians space >=40 sqft/ped Flow Rate <=7 ped/min/ft. At LOS C, sufficient space is available to select normal walking speeds, and to bypass other pedestrians is restricted. Where crossing or reverse flow movements exist, the and to avoid crossing conflicts with others and to respond to their presence in the selection of walking paths	
LEVEL OF SERVICE C Pedestrians space >=24 sqft/ped Flow Rate <=10 ped/min/ft. At LOS C, sufficient space is available to select normal walking speeds, and to bypass other pedestrians in primarily unidirectional streams. Where reverse direction or crossing movements exist, minor conflicts will occur, and speeds volume	

will be somewhat lower.	
LEVEL OF SERVICE D Pedestrians space >=15 sqft/ped Flow Rate <=15 ped/min/ft. At LOS D, freedom to select individual walking speed and to bypass other pedestrians is restricted. Where crossing or reverse-flow movements exist, the probability of conflict is high, and its avoidance requires frequent changes in Speed and position. The LOS provides reasonably fluid flow; however, considerable friction and interaction between pedestrians is likely to occur.	
LEVEL OF SERVICE E Pedestrians space >= 6sqft/ped Flow Rate <=25 ped/min/ft. At LOS E, virtually all Pedestrians would have their normal walking speed restricted, requiring frequent adjustment of gait. At the lower range of this LOS, forward movement is possible Only by "shuffling." Insufficient space is provided for passing of slower pedestrians. Cross Or reverse-flow movements are possible only with extreme difficulties. Design volumes approach the limit of walkway capacity with resulting stoppages and interruptions to flow.	
LEVEL OF SERVICE F Pedestrians space <= 6 sqft/ped Flow Rate variable At LOS F, all walking speeds are severely restricted, and forward progress is made only by "shuffling". There is frequent, unavoidable contact with other pedestrians. Cross and reverse flow movements are virtually impossible. Flow is sporadic and unstable. Space is more characteristic of queued pedestrians than of moving pedestrians streams.	

Source fundamentals of transport eng. By C.S. Papacostas

Pedestrian's facility according to location: there is as such no particular norm according to the location. But the widths are increased by 1 m in case of shopping areas in India and for residential area the norm are based on the table no. 3.16

Table no.3.16 recommended width abroad according to location

Size of the spatial activity	Width
Public event	1.8m
Shopping	2.8m-3.6m

Normal walk	4.6m-5.5m
Pleasure walk	10.6 m plus

Source the pedestrian and the city traffic by Hass Kalu

b. Stairway

Minimum width for stairway is 1.5 m and single stairway should not be provided and riser is 11.2 cm. Ramp for the handicapped people. With slope of 1in 12.

3.11.2.4Safety factors

i. Pedestrian's safety element

Slope – the most comfortable slopes for walk is 1 to 5%

Drainage – the drainage slope depends on the materials used.

Table no. 3.17 materials for the footpaths/pathways

Materials	Slope	Materials	Slope
Slab paving	1:70	Cobble	1:40
Rolled asphalt	1:40	Hogging and gravel	1:30
Tar macadam	1:40	Uses	
Bricks and concrete block	1:50	Courtyard	1:60
Granite	1:40	Footways	1:20

Source: Highway eng. By Justo Khanna

ii. Lighting

The pedestrian's areas should be well lighted specially near crossing and junction. Monochromatic yellow light can be used in normal case and at junction there can be flood lighting.

iii. Fire protection

Dry riser can be laid for the narrower roads where the froe services cannot reach.

iv. Guardrail

Design- it should be simple and vandal proof height of the guardrail varies from .98 m to 1.2 m and they can be located at junction, school, bus stops, central reserve, and near hazardous location on the long stretches.

Gap -it should be 150 mm from the carriage way and in abroad it is 500 mm from carriageway.

3.11.2.5 Activity

The analysis of the needs of the pedestrian's movement and rest along the path system, by Christopher Millard done in relation to use of botanical garden is applicable to any path system. This is shown in fig 3.25

3.11.2.6 Facility for disabled/ special groups

Raised kerb of 1-1.5 cm along the carriageway at the pedestrians crossing can be put for the elderly and disabled people or the change of the texture and colour are practised in the foreign situations.

3.11.2 Pedestrianisation in India

3.11.2.1Pedestrian's performance on urban roads

In India the 30% of the population live in the cities and with the urbanisation the pedestrian's volume is also increasing in India

Table no. 3.18 Growth of the pedestrian's population in India

Year	1971	1981	1991
Population in millions	565	680	825

Source CRRI report pedestrians of chandni chowk, Delhi

3.11.2.2 the pedestrian's safety

A large no. Of the road accident involves pedestrians. In U.S.A one fifth of the person are pedestrians, In Europe almost one third of the person are pedestrians and in Delhi almost 46% that is nearly half of the people involve the pedestrians.

3.11.2.3Trend in pedestrian's accidents

Age- In most of the research has concluded that the children and the elder people are more involved in the accidents in UK almost nearly half of the pedestrians casualties were children out of total pedestrian's casualties.

Social condition-the low-income groups figure more causality in pedestrian's accident due to lack of education.

There are as such no norms for the special group of pedestrian's users. .

3.11.3 Vehicular users

In general the needs vehicles can be discussed in two categories

Man as a driver includes the perception like distance at which the driver will naturally focus on an object with a given a speed, glare monotony, regular rhythmic stimuli, road furniture etc. These all has been discussed in the design of the roads in section 2.4

And Vehicles requirement includes route planning, types and their requirement, road space, shape, noise and danger, parking etc.

3.11.3.1Route planning

The technical and administrative alternatives are many, depending on the political system, the size of the town and other factors.

3.11.3.2 Types and their requirement

Vehicular users or urban traffic uses the vehicles used the road as a mode of transport.(25)

In general are two types of vehicular user

1. Motorized or fast moving vehicle
2. Non motorized or slow moving vehicle

3.11.4Slow vehicle users or non-motorized users.

The characteristics of the slow moving vehicles is defined by Mr. R. N. Dutta in his Book "utility of slow moving Vehicles" which are as follows-

3.11.4.1Characteristics

- ❖ They are slow motivate by animate energy, requires less power and less maintenance cost

- ❖ Move with the speed less then 20mkm. /h
- ❖ Generally have low capital
- ❖ They are whole environment neutrally.(25)

3.11.4.2Types of the slow moving vehicles

The non-motorized or slow moving vehicle can be of two types-

- ❖ Men driven- The man driven can be of two types –

Hand driven- Handcarts, hand cycle rickshaw, pushed lorry

Pedal driven- Cycle, cycle-cart, cycle-rickshaw

i. Animal driven- Horse cart, bullock cart etc.

3.11.4.3Design features

The design features include the vehicles requirement and the users requirement. Vehicles requirement depends on the size, shape and capacity of the vehicles.(25)

Anthropometrics standard of vehicles

Table no. 3.19 vehicles Anthropometrics of the slow moving vehicle.

Vehicle type	Average speed	Capacities	Size			p.c.u.
	Km/h		Length	Breadth	Height	
Bicycle	15	1	1.75	.45	-	.5
Cycle rickshaw	12	2	2.8	.94	1.63	1.5
Hand pulled rickshaw	4	2	2.91	.91	1.98	1.5
Pedal cart	10	2.25 t/km/h	2.95	.95	-	1.5
Hand cart	4	2.4 t/k/h	4.27	1.47	-	6.0
Bullock cart	2.5	2 t/km/h	4.5	1.72	-	6.0
Horse cart	12	-	4.11	-	-	4.0

Modified from utility of slow moving vehicle by Mr. R.N.Datta

3.11.5 Fast moving vehicle or motorized vehicle

3.11.5.1 Characteristics

1. They are fast motivate by machine
2. Move with the speed more than 20mkm. /h.

3.11.5.2 Types of the motorized vehicles

Motorized can be divided into two ways

1. According to weight
2. According to wheels

According to weight-

1. Heavy- Truck, bus
2. Medium- Car, jeep, van, auto rickshaws
3. Light- Moped, motor cycle, scooter

According to wheels

1. Two wheelers- Moped, motorcycle, scooter
2. Three wheeler- Auto rickshaw, tempo
3. Four wheelers - Passenger car, Taxi, jeep, bus, truck,

3.11.5.3 Design features

The design features include the vehicles requirement and the users requirement. Vehicles requirement depends on the size, shape and capacity of the vehicles.(26)

Anthropometrics standard of vehicles

Table no. 3.20 vehicles Anthropometrics of the fast moving vehicle.

Vehicle type	Average speed	Capacities	Size			p.c.u.
	km/h	person	length	breadth	height	
bus	30	60	12	2.5	3.8	3
motor cycle/ moped / scoter	25	2	1.75	.6	-	.5
passenger car	60	4	3.5	1.5	1.75	1.0
auto rickshaw/ tempo	20	2-6	-	-	-	1.0
other goods vehicle	20-25	2-4 t/km/hour	10	2.5	-	3.0

Modified from Justo Khanna high way eng.

3.11.6 Road space/ capacity

The fast as well as slow vehicular users generally use the carriage width or the track provided to them. In case of the no separate facilities they share the same facilities. The capacity of the carriage width can be found out by the no. of the vehicular users. To make them comparable they are converted into P.C.U. value.(27)

P.C.U. can be defined as the standard vehicle unit to convert the other vehicle unit. The different values given by the different agencies are different and shown in table no. 3.22

Table no. 3.22 Passenger car unit values for urban roads sections

Type of vehicle	CRRI	D.O.T.	Pillai	India sarna	I.R.C	Bhattchayara and Mandal	Justo	T.R.R.I	Belgium
Car/ Jeep/ Van	1.0	1.0	1.0	1.0	1	1	1	1	1
Bus	3.6	3	-	2.5	3.0	1.38-2.24	2.2	3.0	1.6
Single Decker	-	-	-						
Double Decker	-	-	-	-	-	2.20	-	-	-
Mini Bus	-	-	-	-	-	.94	-	-	-
Truck	2.8	3.0	-	-	3.0	-	-	2.25	1.5
Auto Rickshaw	.6	1.0	.85	.87	-	-	.5	-	-
Scoter/motor cycle/ moped	.3	1.0	.8	.5	.5	-	.5	.75	.4
Cycle	.4	1.0	1.25	0.2	.5	-	.7	.33	.2
Tonga	2.6	6.0	-	4.0	-	-	-	-	-
Bullock cart	11.2	6.0	4.0	-	8.0	-	4.6	-	-
hand cart	2.8	-	-	-	6.0	-	4.6	-	-
Cycle rickshaw	1.4	1.0	1.5	-	1.5	-	1.0	-	-
Horse cart	3.1	-	-	-	-	-	-	2.0	-
Tractor	3.5	-	-	-	-	-	-	-	-

Tram car	-	-	-	-	-	-	-	3.0	-

Source- thesis report Entitled "comprehensive transportation plan for Delhi by Mr. D. Sanyal

The capacity of the roads is calculated in the terms of P.C.U./ hour and accordingly the no. of lane is decided.

Table no. 3.33Practical capacity of the road in P.C.U./hour in India

Type of carriageway	P.C.U/ hour	
	Sub arterial	collector
2 lane-one way	1900	1400
2 lane-two way	1200	900
3 lane one way	2900	2200
4 lane two way	2400	1800
4 lane one way	2900	-
6 lane one way	3800	-
6 lane two way	4300	-
8 lane two way	-	-

Source IRC- 106

Table no. 3.34 Practical capacity of the road in P.C.U./hour abroad

Type of road	Effective width of carriageway excluding the median	District distributor	Local distributor
2 lane	6	800	300-500
	6.	1000	450-600
	7.2	1200	600-750
3lane	9	1600	900-1100
	10	1800	1100-1300
4 lane	12	1200	800-900
	14	1350	900-1000
	15	1500	1000-1200
6 lane	18	2000	1300-1700

	20	2250	1500-2000
	22	2500	1600-2200

Source roads in urban areas

3.11.7 Level of services-

The needs of the vehicles is analysed by the level of services. This has been defined for the vehicles in Indian standard and abroad both. The following are the factors, which might be considered in evaluating the level of service. (12)

1. Speed and travel time, including the operating speed and travel time consumed in traveling over a section of roadway

2. Traffic interruptions or restrictions, with due consideration e number of stops per mile, delays involved and the speed changes necessary to maintain pace in the traffic stream.

3. Freedom to maneuver to maintain the desired operating speeds.

4. Driving comfort and convenience reflecting the roadway and traffic conditions in-so-far as they affect driving comfort and conveniences of the driver.

5. Economy, with due consideration operating cost of the vehicle.

The operating conditions for the six levels of service selected by the manual are given below, Level *A* representing the highest and *F* representing the lowest:

Level of service A-. Free flow, with low volumes and high speeds. Traffic density is low, with speeds controlled by drivers. Desired speed limits and physical roadway conditions. Little or no restriction in maneuverability due to presence of other vehicles, and s can maintain their desired speeds with little or no delay.

Level of service B.- Zone of stable flow, with operating speeds beginning to be restricted somewhat by traffic conditions. Drivers, still have reasonable freedom to select their speed and lane of operation. Reductions in speed are not unreasonable. The lower limit (lowest speed, highest volume) of this level of service has been associated with service volumes used in the design of rural highways.

Level of service C-. Still in the zone of stable flow, but speeds and maneuverability are more closely controlled by higher volumes. Most of the drivers restricted in the freedom to select their own speed, lane changing or overtaking maneuvers. A relatively satisfactory operating speed is still obtained with service volumes perhaps suitable for urban design practice.

Level of service D. Approaches unstable flow, with tolerable operating speeds being maintained though considerably affected by changes in operating conditions. Fluctuations in

volume and temporary restrictions to flow may cause substantial drops in operation speeds. Drivers have little freedom to manoeuvre: comfort -and convenience are low, but conditions can be tolerated for short periods of time.

Level of service E. Cannot be described by speed alone, but represents operations at even lower operating speeds than in level's, with volumes at or near the.capacity of the highway. At capacity,speeds are typically but not always in the neighbourhood of 50 KP.H. Flow is unstable, and there may be stoppages of momentary duration.

Level of service F. Forced flow operations at low speeds, where volumes are below capacity. Conditions result from queues of vehicles backing up from a restruction downstream. The section under study will be serving as a storage area during parts or all of the peak hour. Speeds are reduced substantially and stoppages may occur for short or long periods of time, because of downstream congestion. In the extreme, both speed and volume can drop to zero.

3.11.8 Parking requirements-

Besides moving on the road the vehicle also has to be parked when the users do not use it. (12)

3.11.8.1Types of parking

1. On street
2. Off street

On street parking can be of-

-Parallel parking

-30 degree angle parking

-45 degree angle parking

-60 degree angle parking

-Right angle parking

Off street parking can be of-

-Surface car parking

-Multi-storeyed parking

-Roof parking

-Mechanical car parking

-Underground car parking

3.11.8.2 Parking requirements

The parking requirement includes the space and other facilities for vehicles.

Space needed by the vehicles(28)-

Table no.3.35 Parking space for vehicle

Type	Parking space	E. C.S. (equivalent car space)
Car	2.5*5=12.5 sq. m.	1.0
Taxi	16 sq. m.	1.0
Auto rickshaw	5 sq. m.	.50
Two wheeler	4 sq. m.	.25
Cycle	1.2 sq. m.	.10

Source- UDPFI Guidelines

- Parking area requirement

In commercial area one space is provided for every 80 Sq. m. of floor area

In residential area, one community parking is required for the plots are 100-300 esq., for 300-500 one third of the open area is given, for 500 to 1000 one third and above 1000 one sixths of the open area is given to parking.

Abroad the parking area requirements depend on the demands of potential users and also influence the scale and nature of parking provision. This is shown in table no. 35.

Table no. 3.36 parking policy based on four tiered hierarchy of standards

Category	Type of Area	Offices and Commercial	Residential	Retail
A	City centre location with excellent public transport and strong economy where parking restraints need to be applied	Operational space only. Commuted payments would be required to assist the financing of the public transport, in recognition that more staff would not be provided with parking	One space per dwelling	Space to be provided to meet the short day demand with communal parking

B	Town centre location with good public transport where parking restraint needs to be applied	Operational space more broadly, with some commuted payments would be required to assist the financing of the public transport in recognition that more staff would not be provided with parking		
C	Smaller town centre – adjacent to towns centre where some parking restrained needs to applied	Standard based on the about 50% of demand with the contribution to assist public transports in recognition that 50% of the staff would not be provided with parking	Two space allowed per dwellings	The development site is designed to favour the public transport
D	Other areas including out of town centre	Based on demand and standard economic pricing should be encouraged	Full demand of the standard	Based on demand the economic parking charges should be done

Source- traffic and transport manual, U.S.A.

3.11.9 Other requirements

i. Parking requirement for disabled groups

In India no special consideration has been given to the special groups such as disabled or cyclist. In the traffic and transportation department, U.S.A. they have given the orange blade schemes for the parking of disabled people vehicles.

Orange blade scheme-

1.The disabled group can park for as long as they wish, where others may wait for a limited period only.

1. They can park free of charge and without time limit at parking meters on street and pay and display on street parking

2. They can park for three hours on single or double lines, when no waiting force restrictions are in force.
3. Special sign system for them as shown in plate no.
4. The most convenient spaces on street and in public car parks should be allotted for them.
5. Lowered kerbs at adjacent footways to assist the wheelchair users.

ii. Unauthorised parking on footways and cycle track

Unauthorised parking on footways and cycleway causes problem and are hazard to pedestrians, elders, blind, disabled, cyclist group so by law it has been forced that it is illegal to park on the footways and cyclist.

The installation of bollards guardrail or plating of trees can provide an effective means of parking on footways or cycle ways.

Apart from the mere provision of adequate space the information regarding parking lots should be displayed through a map.

iii. Accessibility for conveniences

The location of parking and loading area should be sufficiently close to building or land where the like hoods of drivers parking indiscriminately to avoid parking and also good lighting, gradients etc.

3.11.10 Cyclist

Among the slow vehicles the cyclist are the most vulnerable users of the roads they have been considered in the design and planning of roads separately in the India and abroad both.

iv. Cycle track

The principal objectives of providing cycle track

v. To maintain the increase the level of use cycle

vi. To reduce the danger to the cyclist.(29)

In this, a hierarchical approach is recommended (29) in the U.S.A.

- Traffic reduction
- Traffic calming
- Junction treatment

- ❖ Reallocation of the carriageway space –more space to cyclist
- ❖ Cycle lanes and cycle track
- ❖ Cycle networks include the coherence, directness, attractiveness, safety and comfort.

3.11.10.1Cycle lanes and cycle track

Separate cycle tracks are provide for the cycle traffic is 400 or more on the routes with the motor vehicle 100 or more per hour but not more than the 200 per hour. When the number of motor vehicles using the road is more than 200 per hour, separate cycle track may be justified even if the cycle traffic is only 100 per hour.(14)

Table no.3.37Capacity/ width of the cycle traffic in India

s.n	Width of the cycle track	Capacity in no. Of the cycles per day	
		One way	Two way
1	Two lanes (2m)	2000-5000	500-2000
2	Three lanes (3m)	Over5000	2000-5000
3	Four lanes (4m)	-	Over 5000

Source IRC- 11

Abroad the width of the Bicycles lane is 3 m per lane wide if provide separately. And the level of services is determined by considering the below factor-

Fp=min. no of passing events(bicycles in the same direction)

Fe= no. of opposing events (bicycles in the opposite direction)

F= total no of events on path=Fp+0.5Fe

V= F/ 1-0.812P

V= total no. of bicycle flow (by/h)

P= prop of the flow rate in the same direction

Table no. 3.38 Level of services for cycle track

Level of services	V(E/H)for 2 way 2 lane	V(E/H) 2 way three lane
A	<40	<90
B	40-60	90-140
C	60-100	140-210

D	100-150	210-300
E	150-195	300-375
F	195	>375

Source – traffic and transportation deprtmnet. Manual U.S.A

3.11.11Shared facilities (bicycle and pedestrians both)

The shared facilities is analyzed by the below formula

Fp=3VpS+0.188 Vbs

Fm= 5Vpo+ 2Vbo

F=0.5Fm+Fp

Vps= flow rate of pedestrians in subject direction

Vbs= flow rate of bicycle in subject direction

Vps= flow rate of pedestrians in opposite direction

Vps= flow rate of bicycle in opposite direction

- ❖ Cycle traffic at Road crossing

When the cycle track crosses the road, the carriage way should be marked with appropriate markings

- ❖ Riding surface

The riding surface and lighting on the cycle track should be better than the main carriageway to promote the use of cycle path.

3.11.12 Vehicular behaviour on Indian roads

Urban traffic in India is heterogeneous in character. It consists not only of fast moving motor traffic but also of primitive modes such as animal drawn vehicles. Motor traffic itself consists of car light vans, different kinds of commercial trucks, buses, scooters, auto-rickshaws, motorcycles, etc. As such there are no design and planning guidelines for the different types of the vehicular users so they creates problems i.e. accidents, speed delays etc. and also with the increase in the no. Of the vehicles the development of the road is not done so this also calls for the need of the space on the road.

i. Road construction and increase in vehicles

The road construction in India is not pacing with the increase in the vehicles.

The table show the gap in the road length with the increase in the vehicles no.

Tables no. 3.39

S.N.	Feature	
1	Increase in vehicles population	89.96%
2	Increase in road length	9.28
3	Increase in population	3.06
4	No. Of person killed	54,058
5	Increase in fatality rate	29.16%
6	Death I road accidents	6 person per three hour
7	Economic losses	1500 crores

Source highway manual –oct. 1999

ii. Composition of the types of the vehicles

Table no. 3.40 showing the fast moving vehicles composition on Indian roads

S.N.	Types	No. Of vehicles (in millions) 1997	% Composition	No. Of vehicles (in millions) 1991
1	Car, jeep etc.	4.2	13%	2.5
2	Bus	0.5	1%	0.17
3	Goods vehicles	2.3	6%	1.51
4	Others	25.9	11%	20.19
5	Total	37.6	100	25.28

Source Highway manual-oct-1999

3.11.12.1Problems faced by vehicles in India

i. Problems faced by the slow moving vehicle-

1. The conflicts with the different vulnerable sure
2. The delay and congestion resulting in chaos
3. Damage to the life cost as well as property
4. Accidents

There are more chances of hitting the slow moving vehicle by the fast moving due to the vehicles design and other factor. This was viewed in the Gujarat studying the accidental cause in 1996.

Table no.3.41 Accident in Gujarat: 1996

S.N.	Name of vehicles	No. Of accidents (1996)
1	Cycle	2688
2	Cycle- rickshaw	837
3	Hand cart	183
4	Animal drawn vehicle	334
5	Pedestrians	6515
6	Animals	474
7	Trees	969
8	Level crossing gate	596
9	Other things	12364

Source may -highway manual

ii. **Fast vehicular problems**

Problems faced by the fast moving vehicles in India

1. The conflicts with the different vulnerable sure
2. The delay and congestion resulting in chaos
3. Damage to the life cost as well as property

No. of Fast moving vehicles in Indian cities

The increase in the number of vehicle in some of the Indian cities is shown in the below table no. 3.42

Table no. 3.42 Increase in no. Of Vehicles in metropolitan cities

S.N.	Metropolitan cities	1986	1991
1	Ahemdabad	103	374
2	Banglore	175	577
3	Bhopal	Na	212
4	Bombay	480	629
5	Calcuta	339	475

6	Cohicin	Na	119
7	Delhi	961	1813
8	Indore	Na	214
9	Hyderabad	89	581
10	Jaipur	48	266
11	Lucknow	53	216
12	Patina	Na	Na
13	Surat	Na	136
14	Varanasi	Na	112
15	pune	107	280

Source Ministry of transport department

Due to the increase in the vehicles the road length is not increasing. The table no. 3.43 Shows the demand and the gap of the urban roads.

Table no. 3.43Gap between the demand and supply of the roads

Year	**2001-2**
Demand	3280
Supply	2065
GAP	1213

This has results in the accidents and delays on the roads

Speed and delays- the speed delays are there due to the intermixing of the traffic and insufficient lane width.

Table no. 3.45 average speed of the vehicles on Indian roads

S.N.	City	Average peak hour journey/h
1	Delhi	10-15
2	Bombay	15-20
3	Calcutta	14

- Accidents

Table no.3.46 Road Accidents and Persons Killed (Road Wise) In India during 1987-1994

Year	Urban roads (Sub arterial/collector/access road)		Total	
	No of accidents	Persons killed	No of accidents	Persons killed
1987	112209	17888	233981	44440
1988	118243	17278	246736	46561
1989	124984	16825	270015	50711
1990	137137	18385	282602	54058
1991(P)	180457	29648	294022	56525
1992(E)	199065	32491	308087	57217
1993(E)	218829	35041	323491	57789
1994(E)	239192	37439	339666	583667

Source-ministry of transport department

3.11.13 Street hawkers and vendors

They generally perform the business on the right of way. The distinctive characteristics can be as follows-

3,11.13.1Characteristic

1. They acquire the streets for the commercial purposes
2. The generally perform the informal sector of the city
3. They encroaches the other users path
4. Supplement the activities of the organised sector
5. Provides the employment opportunities at low capital cost
6. Less space and less capital inputs
7. Equity is consumption of goods and services

3.11.13.2 Types of street hawkers and vendors-

The street hawkers and vendors can be divided in many ways depending upon the mobility, according to time, according to temporary and permanent, and according to the profession.

i. -According to the mobility

Mobile and stationary, mobile are those who sell their things from one place to another on some modes or other. Stationary are those who stand or sit at one place and sell their goods.

ii. -According to the structure or establishment

Temporary or permanent, the temporary are those daily bring and take their things for the selling purpose. He permanent are those who are not authorised but make some structure for the sell of their goods i.e. P.C.O. booth etc.

iii. -According to profession

According to different profession the requirement of the spaces are different. For e.g. the fruit seller requires less space than the cloth seller.

iv. -According to the time

According to the season they are also changing they can be seasonal hawkers and routine hawkers. The routine hawkers can be further divided according to the time daytime street hawkers etc.

3.11.13.3 Problems caused by the street hawkers and vendors-

The street hawkers and vendors causes the following problems to others as they uses the others spaces

1. It deprives pedestrians of the space of the footpath
2. It deprive the space of the scooters on the carriage way
3. Lowering of the speeds of the vehicle and there by causing congestion
4. Leads to increase in the vehicle operating costs
5. Causes delays
6. Causes traffic safety problems
7. Causes environment degradation in terms have the noise and air pollution Spoils aesthetic.

3.11.14 Others users

The other uses can be street hawkers and vendors either for living or wandering and street furniture. They don't perform the business on the road and acquire the other spaces. They are more common in the big cities. They have been not discussed in the Indian standard. Abroad

traffic and transportation department, U.S.A, has considered them. And this is shown in table no. 3.47

Table no. 3.47 Presumption of walkway width for other users

Other users	Min. distance (m)
street furniture	
Light poke	0.8-1.1
Traffic signal	.9-1.2
Fore alarm	.8-1.1
Fire hydrant	.8-.9
Traffic signs	.6-.9
Mail box	1.0-1.1
Telephone booth	1.2
Waste bucket	.9
Benches	1.5
Parking meter	.6
Public Access	
Sub ways stairs	1.7-2.1
Subways raised	1.8
Transformer vault	1.5
Landscaping element	
Trees	.6
Planter box	1.5
Commercial use	
Vending stands	Variable
Advertising displays	Variable
Store display	Variable
Side walk cafes(two rows of table)	2.1
Building protrusions	
Columns	0.8-.9
Stoops	0.6-1.8

Cellar doors	1.5-2.1
Standpipes connection	.3
Awning poles	.8
Truck docks	Variable
Garage	Variable
Driveways	Variable

Source –highway capacity manual U.S.A.

3.12 Traffic Management And Maintenance Schemes

The motor vehicle is a machine in charge of a human being and this makes it necessary for the formulation of suitable regulations for safe operation of traffic and enforcement of these regulations. The regulations should be framed so as to achieve safe and efficient movement of traffic and pedestrians, without at the same time infringing unduly upon the individual rights of the road users. The design of streets and facilities and the safe operation of traffic are vitally connected with the Traffic Regulations.

i. Scope of traffic regulations

Traffic regulations cover matters dealing with the control of Vehicles, drivers and other road users.

3.12.1 Existing Guidelines for traffic or vehicles

The control of vehicles deals with the registration, weight, size, design, construction and maintenance.

Driver regulations deal with the licensing and other aspects of operation of vehicles by drivers.

In India, the Motor Vehicles Act. 1988, provides the basis for regulating vehicles, drivers, and traffic. It deals with *Licensing* of drivers of motor vehicles, Registration of Motor Vehicles, Control of Transport Vehicles, maintenance of Motor Vehicles and Control of Traffic.(12)

3.12.1.1Guidelines for vehicle

i. Regulation of speed

Speed limits in urban areas are governed by the type and volume of traffic. Mixed traffic conditions increase the changes of accident occurrence. Parking is frequent along the streets

and this is another source of accidents. The need for speed limit under these conditions is well known and most of the countries in the world prescribe a speed limit on urban roads.

Table no. 3.48guideline for the speed limit on urban road

Types	Speed limit in India	Types	Speed limit in U.K.	Types	Speed limit in U.S.
Moderate traffic	40 for light and medium &30 for heavy	Urban area	50km/h	Urban area	50km/h
Congested area	30 for light and medium & 20 for heavy			Residential	35 km/h

Source traffic & transportation eng. - L.R. kadiayali

ii. **Enforcement methods and instruments for detection of speed violators**

For success of speed regulation measures, strict enforcement of law is needed. Motorists who violate the speed limit must be apprehended, given official summons or arrested, and penalties must be imposed.

One of the common methods of detecting speed violation is to follow the violator in an automobile or motorcycle. These vehicles are made conspicuous by marking them with a distinctive color.

iii. **Regulation of the vehicle** –

The regulation of the vehicle covers the following

-Vehicle. Registration

-Construction and equipment of vehicles.

- Size, weight and loads of vehicles

- Lighting of vehicles.

- Inspection of vehicles.

- Control of transport vehicles.

- Insurance.

iv. Vehicle Registration

Vehicle registration is a basic requirement and the data accumulated provides guidance to administrators, planners, traffic police, economists and traffic engineers on total number of vehicles in use, their different types and use, taxation, name of the owner and license plate number.

v. Construction and equipment of vehicles

It is essential that the motor vehicles be constructed and equipped in such a manner as to promote safe and efficient traffic. For this purpose, the regulations usually cover the following aspects:

1. The width, height, length and overhang of vehicles and trailers;
2. The diameter, width and condition of tyres of vehicles and trailers;
3. The maximum unlade and laden weight of vehicles and trailers, and the maximum axle weight;
4. seating arrangements in, public service vehicles and the protection of passengers against weather;
5. Brakes and steering gear *(e.g.,* in India it is necessary to have right hand steering control unless the vehicle is equipped with a mechanical or electrical, signaling device);
6. The use of safety glass;
7. Signaling appliances, lamps and reflectors;
8. Speed governors;
9. The emission of smoke, visible vapor, sparks, ashes, grit, oil or pollutants;
10. Noise caused by the vehicles;
11. The use of trailers with motor vehicles;
12. Prohibiting the use of horns at specified locations;
13. The periodical testing and inspection of the vehicles.

In India, the State Governments are empowered under the Motor Vehicles Act to make rules for the above purpose.(12)

vi. Control of Transport Vehicles

In India, under the Motor Vehicles Act the State Governments have been empowered to frame rules to govern the use of commercial transport vehicles, These rules are intended to grant permit for the plying of goods vehicles on specified routes and regions, having due regard to:

1. The advantages offered by the development of road transport;

2. Desirability of preventing the deterioration of the road system

3. The desirability of preventing uneconomic competition among motor vehicles.

Similarly, the State Governments can grant permits for vehicles carrying passengers. The permits issued under this rule indicate the route or area *of* operation, the manner in which the vehicle is to be used (Stage carriage, contract carriage, private or public carrier etc.), the carrying capacity, schedule for trips etc. A system of National Permits for goods vehicles is prevalent in India.

vii. Regulations concerning driver

Regulations concerning driver cover the following aspects:

1. Licensing *of* the driver
2. Requirements *of* physical fitness
3. Age *of* drivers
4. Disqualification and endorsement *of* licenses.

1. Licensing of the Driver

Driving *of* a motor vehicle without the driver having a valid driving license is an offence. The Third Schedule of the Motor Vehicle Act, in India prescribes the criteria that should be satisfied by determining the competence of the driver in a test. Among other things, the driver will have to demonstrate his ability in driving the vehicle and should be conversant with the general traffic rules and regulations.

2. Physical Fitness of driver

In India, the following diseases and disabilities are deemed to absolutely disqualify a person from obtaining a license: Epilepsy, Lunacy, Heart disease likely *to* produce sudden attacks of giddiness or fainting, Inadequate perception, Deafness preventing the hearing of ordinary sound signals, Inability readily *to* distinguish red and green colors and Night blinded ness.

3. Age *of* Drivers

In India, the minimum age *to* drive a motor vehicle is 18 years and the minimum age *to* drive a transport vehicle is 20 years.(12)

3.12.3 Laws given for the removal of unauthorized users

i. Ribbon development act

It presents a review of the various problems associated with the ribbon development act. It measures possible to control the menace recommendation for immediate action against it

ii. The Bombay high way act

The act provides for restriction of ribbon development and provision and removal of the encroachments. This is done by fixing building and control lines, restricting access on the highways and other roads serving notice on encroachments and removing them.

iii. The My sore highway act 1964

The act provides for restriction of the ribbon development and removal of the encroachment applicable to highways and other roads of the state and not to the national highways.

Enforcing restriction on the building activities along the highways does this

iv. Haryana public premises land control act.

It describes the rule for the control of the ribbon and removal of the encroachments and also control of the access.

v. Section 269 0f the penal code

It describe encroachment on the public road is nuisance and no arguments by the user can justify an encroachments on the public way.

It's a duty of the magistrate to find whether the claim of the person is bonfide or not .

vi. Section 97 IPC

Right of private defence or body and property

For the removal of the new temporary encroachments removes the encroachments in the sane manner as the private individual do to protect the misuse of the property

vii. Section 34 of the police act

For the removal of the new temporary encroachments a constable can Challan offenders and mobile magistrate can punish on the spot

viii. U.P. premises act

For the renewal of the new old /tem / permanent encroachments provides the remedy for the eviction of the unauthorised occupants from the public premises which includes land appurtenant of the roads

Force can be used for eviction if an encroachment fails to vacate with in the 30 days of the notice

ix. Section 441 /447 of the IPC

For removal of the new permanent encroachments applicable when all measures stated above fails

Encroachers are said to commit the criminal things.

x. U.P.R.L.C. act 1945 (U.P. road side land control act)

It states for the removal o f the old / permanent encroachment prosecution for the building being erected with in the control area of the R.S.L.C.

It describes the Prohibition of the structures / fixtures movable whether temporary / permanent which causes obstruction in streets.

Prohibition of the deposits on the street

Prohibition of the animals on the public street and milking of cattle in any public street. Consumers can remove any thing deposited or exposed for sale in contravention of this act.

3.12.4 Guidelines for the road maintenance

The maintenance of the road is important for the smooth traffic flow and for the safety of the users. It is divided in to four categories(16)

i. Restoration of all wear or tear due to use of road
ii. All steps to clear the facility
iii. All measure for the promotion of the safety of the road users
iv. Preparing the record regarding the aspects of the traffic accidents etc.

- ❖ Classification of the maintenance work

Four types-

i. Ordinary maintenance
ii. Periodic renewal
iii. Special repairs
iv. Emergent repairs

i. Ordinary maintenance

This is day-to-day maintenance work for the road and will cover all restoration measures for minor deficiencies and normal wear and tear.

ii. Periodic renewal

Periodic renewal is to do periodic renewal of the elements of the roads if required.

Table no.3.49 Norms for the periodic renewal

Operation	Periodicity
kerb cleaning	Once a weak
White washing of kerb stone	Once in month
Lane marking and other signs	Once in every three months
Cleaning of signs boards, railing delineators	Two times in a year
Painting of sign boards	Once in a year
Pruning of trees	Twice in year
Manu ring of beds	Twice in year

Source- urban roads manual

iii. Special repairs

The repair under this category includes minor works original nature to improve the facility like improvements to curves to increase the visibility, minor repairs to culverts etc.

iv. Emergent repairs

This in done case of the rainfall, snow falls etc.

In this chapter, the urban road design standard and the users of the road have been discussed in details. The characteristics features and the standards given for the users needs have been studied. This will be used for the analysis of the selected stretches of the Ctiy of Lucknow.

CHAPTER 4: STUDY AREA PROFILE -LUCKNOW

CHAPTER 4: STUDY AREA PROFILE -LUCKNOW

4.1 Introduction

Lucknow, the capital of the Uttar Pradesh, situated on the banks of the River Gomti has been the centre of the education, culture, trade and commerce since many centuries. It is the type of city fabled for its culture, tradition, warmth, and hospitality. It is human art and peculiar character of its own. Patronize by the Nawabs of the Lucknow, the city has seen a rich growth of the trade and commerce, cultural and social ethos and hence has been central place of the attraction for the people of the state.

4.2 History And Growth

Historically no account can be given of the Lucknow's origin but tradition assert that it was originally called Laksmanpuri after Laksman, the brother of Ram who built it as a fort for the defence of its capital.

The earliest historically marked settlements in Lucknow are those of the Muslims around 13th century. They were the Shaikhs who ruled the city till the 17th century to be followed by the sultans of Delhi and then the Moguls. Not much was added during this period. Two monuments of this period like the Akabari gate and Aurangzeb still stand in the city.

Considerable changes took place when the Awadh dynasty took over Lucknow in 1728 after the death of the Aurangzeb and Lucknow became the city of the Nawabs. Most of the Lucknow was built during this period.

The Nawabs of Avadh made Lucknow his capital and made tremendous progress in trade and commerce thus becoming wealthy and affluent. Thus the nobles of the Lucknow basted their newly acquired status by patronising art, culture and architecture. The third Nawabs, Asaf-ud-daula, gave the city its much admired monuments, culture and wealth. This culture developed during the Nawabi days and ended in the twentieth century. Chowk was developed on the Nawabi period.

Significant growth is seen in the British period. In this the development of the Cant area and leisure centre as Hazratgang was developed. After the independence it has become the capital of the state. Since than, it has grew as a metropolitan city.

4.3 Physical Setting

Lucknow Lies in the centre of the Indo-Gangetic plane on the bank of the river Gomti between 26.53 ' N latitude and 80.56' E longitude with an average height of 403' above the mean sea level.

Lucknow is well connected to all the major places as well state by rail and road due to which there is continuous low of passengers and travellers through out the Year it is an important railway station of northern and north-eastern railway. Several State and National highway converge into city providing ready connection of cities from the other cities.

4.4 Demographic Profile

The growth trend of the Lucknow city has been phenomenal especially in the last two decades or so. During the last decade it registered 33.9% and before that it has registered maximum increase of 62.9%. Since 1931, the city has registered a steady growth; it had a population of 4.96 lakhs in 1951, which has come up to 22 lakhs in 2001. This has resulted into the special separation of the activities and residential areas. Further, there has been unchecked and ever increasing migration of people from neighbouring state and cities. This has results an increase in residential and other activities in Lucknow.

The population of the India= 1, 027, 01547

Male= 531,277,078

Females=495,738,169

Population of Uttar Pradesh= 166,052,859

Male= 87, 46,301

Females=78586558

Population of the Lucknow urban agglomeration =2,207,340

Male= 1,119,273

Females=1,067,670

Lucknow Municipal cooperation= 2,207,340

Male= 1,165,932

Female= 1,041,400 *(Source-census India 2001)*

Table no.4.1 Demographic table of the Lucknow city

POPULATION GROWTH			
S.N.	Year	Population	Decadal Growth of the city
1	1931	274659	41%
2	1941	387177	28.3
3	1951	496861	31.9
4	1961	655673	24.1
5	1971	813982	23.7
6	1981	1007604	62.9
7	1991	1642134	33.9
8	2001	2200000	

Source-T.C.P.O 2001

i. Population structure

Table no. 4.2 Population structure of the city

S.N.	Characteristics	1991	2001
1	Population density	548/sq Km.	689/sq Km.
2	Sex ratio	876	898
3	Literacy rate	57.36	65.38
3.1	Male literacy	75.85	54.16
3.2	Female literacy	76.63	61.22
3.3	0-6 of age	-	523059

Source –census India –2001

4.5 Land Use Pattern Of The City

Lucknow town group area comprises the area of Lucknow Municipal cooperation, cantonment board and Charbah- Alambagh notified area committee. The Urban agglomeration covers the area of 145.95 Sq km. and it comprises the Aliganj extension scheme, Hind Nagar colony and PAC area, Ramsagar Hal Charbagh-Alambagh Notified Area and Lucknow cant.

Lucknow city is said to be constituted of administrative and institutional town.

The land use pattern in the Lucknow city is shown in table no. 4.3

Table no. 4.3 Land use pattern in Lucknow

	Land use	Percentage		
S.n		1965	1987	2001
1	Residential	20.40	48.92	66.29
2	Commercial	1.30	2.44	4.35
3	Industrial	2.30	6.50	3.49
4	Offices	3.5	5.18	1.91
5	Transportation	9.4	10.38	10.30
6	Community and other services	-	9.38	5.40

Source –T.C.P.O.-2001

The Lucknow is divided into five zones A-west, A-south, A-east, A-north and central area. The central area consists of the main C.B.D area and the core area is Chowk and other area. The city has got 110 wards and the population density is high in Chowk area. The land use map is shown in the Map no. 1

4.6 Socio- Economic Characteristics

The socio- economic characteristics is shown in the table no 4.4

Table no. 4.4 Occupational Structure of the Lucknow

	Occupation Structure	1961	1981	2001
1	Cultivated, Agriculture, Labour, Livestock Plantation	17515(7.85)	8706(3.11)	8505(2.06)
2	House Industries	50467(22.6)	14699(5.26)	24300(5.89)
3	Other Manufacturing	-	30000(10.74)	35850(8.69)
4	Construction	7838(1.72)	9775(3.49)	22275(5.4)
5	Trade and Commerce	35919(16.1)	50273(17.9)	74520(18.06)

6	Transportation, Storage and Communication	24630(11.0)	36300(12.9)	54270(13.1)
7	Other Services	86616(38.8)	129542(46.3)	192780(46.7)
8	Total	222985	279295	412500

Source –T.C.P.O.-2001

The work force in the industrial sector is negligible as there is neglect of the industrial sector hence as a state capital it continuous to be an administrative centre, commanding and influencing a vast regions. It is an important educational and commercial centre of the state and fast an important trade and commercial centre. Assuming the function of its rapid growth is making it increasingly difficult to maintain minimum acceptable levels in urban services.

4.7 Community Facilities Prevailing In The City

Due to the rapid urbanization in the city a large number of people settled in Lucknow so there are community facilities serving the present population.

4.7.1Education facilities

Table no. 4.5 Education facilities existing in Lucknow

S.N	Education centre	Number
1	Junior High school	546
2	High school	112
3	Degree college	21
4	Medical college	5
5	Polytechnics	4
6	Vocational training centers	26
7	University	1

Source TCPO. 1991

4.7.2.Medical facilities

Table no. 4.6 Medical facilities existing in Lucknow

S.N	Hospitals	Number
1	General hospitals	34
2	Dispensaries	21
3	Mother and child welfare centers	16
4	Mobile dispensaries	2
5	Dental hospital	1
6	Mental hospital	1

Source TCPO. 1991

4.8 City Roads –

The roads of Lucknow city can be classified (as according to Justo and Khnna discussed in Chapter 2) as follows -

i. According to location
ii. According to land use
iii. According to development

4.8.1According to location-

The hierarchy of city roads according to location can be –

Primary roads- national highway/ state highway/ inner and outer ring roads

Secondary roads –arterial/ sub arterial roads

Tertiary roads – local roads/ access roads

4.8.1.1.Primary roads-

National highways:

NH25- Connected to Kanpur

NH26- Connected to Sitapur

NH 56- Connected to Sultanpur

NH 28- Connected to Faizabad

4.8.1.2State highways:

The state highways Raibarely road and Hardoi road, Sitapur road, Faizabad Road etc. are there which are connected to the city road with other road.

4.8.1.3Inner ring/ outer ring roads:

The city has radial pattern of the road and all the main roads originate from the city centre. Since the ring road has yet not constructed fully so the traffic coming from the state highways has to pass through the city.

4.8.1.4Arterial/ Sub- Arterial roads:

The Arterials and Sub - Arterial Street are the major roads of the city i.e. Tulsidas marg, M.G. marg. etc.

4.8.1.5.Other city roads:

The other city roads are local distributor roads and other access roads. They are the residential roads serving to the residents.

The map no. 2 shows the hierarchy of the roads.

4.8.2According to development

According to development the roads can be divided in two, the road, which serves the old area of the city and the road, which serves the new area of the city.

4.8.2.1Old area roads or core roads:

This can be further divided into two categories the old unplanned area roads and the old planned roads. The old roads acquired often near the river Gomti as most of the old areas were developed along the river. They are mostly on one side of the Gomti. The other side of the Gomti River has the new developed town roads. The British authorities developed the old planned roads showing the colonial character.

4.8.2.2Old unplanned roads

Roads in the Chowk area, roads in the Aminabad area. The Chowk area includes the Tulsidas Marg etc.

4.8.2.3Old planned roads

Roads in the Hajratgang area, Cant. Area are the planned developed area in the British period.

4.8.2.4.New planned roads

Roads in the new developed areas such as Aligang, Indira Nagar, Gomti Nagar are new town roads. The Aliganj has the Kapoorthal market lane.

4.8.3According to land use

According to land use the roads can be divided into residential street, commercial street etc. Commercial Street serves the major commercial area e.g. M.G. Marg, Tulsidas Marg etc.

Residential Street serves the residential zone e.g. Chowk Residential street, Kapoorthala residential street.

4.9 Design Of The City Roads.

i. The roads have varying no. of lanes depending on their location and load on the roads. The foot paths are there on the main roads but in new areas the provision has been given but they have been made. The provision of the cycle track is not there in any part of the city. Roads in the new areas are having building line much away from the roads so the widening of roads is possible on these roads are developed as according to the byelaws prevailing in the city. (Lucknow master plan report-2001)

ii. Traffic signals and manual management not synchronized(traffic plan report-2001 by T.C.P.O)

iii. Absence of roads signs (traffic plan report-2001 by T.C.P.O)

iv. Obstruction to traffic from electric poles and traffic lines on carriageway(traffic plan report-2001 by T.C.P.O)

v. The intersection geometric are poor and control system inadequate absence of foot paths and absence of slow moving path on major and sub arterial roads

vi. Inadequate right of way of almost all roads and in central area poses a constraint for capacity expansion.

vii. Conforming and mixed land use causing large scale road encroachment on Tulsidas mark etc.

viii. Absence of footpath and slow vehicle lane and other facilities on arterial and sub-arterial lane.

ix. Local and through traffic mix of traffic due to lack of inner ring roads.

4.10 The Existing Byelaws For Roads

The byelaws regarding the roads in the city are different according to the use of the area

4.10.1Commercial area

In the commercial area min. road width is 12 m. and the width varies according to the length of the road

Table no. 4.7 road width for the commercial zone

Maximum Length of the road	width of the road
200	12
600	18
>600	24

Source Lucknow master plan-2001

For the set back distance they are according to the types of the commercial center. For market area the 1.2 F.A.R. is permissible.

4.10.2.Residential bye laws

In the residential area the min. road width will be 9 m and if the park is facing another side of the road than the min. road width can be 7.5m. and for cul-de-sac road there should be provision of turning and that should be 15m.

Table no. 4.8 recommended width for residential roads

Maximum Length of the road	Width of the road
>500	9
400 m.	7.5

Source Lucknow master plan-2001

The residential byelaws follow the building set backs according to the size of the plot.

4.11 Users Of The Roads

The city is characterized by the variety of the users: The vehicular users and non-vehicular users.

The vehicular users are again categorized into the slow vehicles users and the fast vehicle user.

The slow vehicle consists of the cycle, cycle rickshaws and Tongas (horse driven vehicle), hand cart, bullock cart etc.

4.12Traffic characteristics

i. The city traffic is heterogeneous in nature and two types of modes are there, they are fast vehicle movement and slow vehicle movement. The table number shows that the fast vehicles that are there on the urban roads of Lucknow are two-wheeler, three-wheeler and four-wheeler (heavy and medium vehicle). In the two wheeler moped, motor cycle and scooter are seen on the city road. The three- wheeler users of the city are tempo taxi and auto are the users and in the four wheeler users, the medium vehicles users are Jeep, car, van and heavy vehicle users are truck, Van, bus, mini bus, tractor, trailer are the users. Due to increase in no of both fast as well as slow vehicles the traffic on the urban roads leads to the congestion, delays and accidents. The fast vehicles has just becomes double in the last decades where as the roads are the same.

ii. The table no. 4.9 shows the increase in the number of slow moving vehicle. According to this there is 40% increase in the no. of slow moving vehicles and still no provision is made for the slow moving vehicles.

Table no. 4.9 no. of slow moving vehicles

Types	1981-82	1983-1984	1990-1991
Cycle	50106	74654	80934
Cycle Rickshaw	21501	23508	22508
Tonga	122	121	110
Others	7647	8422	8992
Total	78920	79705	112544

Source Lucknow area transport studies by school of planning and architecture, New Delhi 1992

iii. the slow vehicles percentage vary from 50-70% on the urban roads of the city (study of traffic and transport plan in Lucknow by NATPAC in 1992)

iv. The non-vehicular users are pedestrians of different age group and other users such as street hawkers and vendors.

v. The use of mode for different purpose is different depending upon the user's choice and availability. The choice of mode for different purpose in the city is given in table no. (NATPAC Report of traffic and transport plan in Lucknow in 1992)

Table n. 4.10 distribution of trips according to different modes and purpose

mode/ purpose	work/business	education	social and recreation	total
walk	295754	757040	126040	1178894(35%)
scooter/motor cycle	494818	12518	75036	5823729(17%)
bus	8234	2248	4628	15008(0.4%)
tempos	121420	68352	13776	203548(6%)
cycles	262332	375574	41628	679534(20%)
train	5048	1840	432	73000(0.2%)
car	140286	5120	50944	196350(6%)
slow vehicles(ricksh-aw/Tonga)	293788	82888	48324	425000((15.4%)
total	1639514	1362970	362494	3364978(100)

Source NATPAC Report -1992

According to above table pedestrian are the largest users of the Urban roads for different purposes in the Lucknow. They constitute almost one third of the total travel pattern.

4.12.1 Problems due to traffic or vehicular users in the city

4.12.1.1Accidents

Due to lack of proper design and planning consideration for the mixed traffic and road condition the accidents occur on the urban roads of the city.

Table no. 4.11 Accidents in Lucknow city

Year	Total no, of accidents	Fatal	Dead	Minor	Injury
1997	720	242	258	478	558
1998	598	193	208	405	494
1999	812	267	295	545	599
2000	878	290	311	588	583
2001(January -march)	237	75	81	162	201

2001 (April -June)	306	98	112	208	246
2001 (July- September)	238	79	81	159	172
2001(October-December)	323	111	125	212	268
Total (2001)	1104	363	399	741	887

Source- traffic police Lucknow 2001.

Table no.4.12 Accident involving different vehicles in Lucknow

S.N.	Years	Cycle	Scooter	Motar cycle	car	truck	Bus	total
1	1970	31	159	89	52	101	54	486
2	1980	37	107	87	48	84	70	433
3	1982	25	95	74	53	83	78	408

Source: report on the transportation of Lucknoow by s.p.a. 1992

From the above table we can see that two-wheeler are most affected due to improper road system.

4.12.1.2 Speed and delays

i. Due to heterogeneity of the vehicles in the city and no facilities for the slow moving vehicles the average speed varies from 5km/h to 15 km/h in the peak hour. The reasons for low speed are high volume of the slow moving traffic, inadequate carriage width and encroachment along the poor road surface. (Report of traffic and transport plan in Lucknow by T.C.P.O.in 2001)

4.12.1.3 Parking of the vehicle

i. Unorganized street parking and shortage of space for the off street parking (NATPAC Report of traffic and transport plan in Lucknow in 1992)

4.12.2. Other users

i. The other users of the city are street hawker and vendors, beggars and animals. They occupy mainly the footpath and carriageway.

ii. Encroachment of road space by Road side vegetable seller/ fruit seller/ /grain seller and Tahbazari trading (Report of traffic and transport plan in Lucknow by T.C.P.O.in 2001)

4.12.3.Traffic management

The traffic management in the city are governed by different agencies. These agencies are however interrelated to each other but due to lack of coordination of work and communication gap they are not well coordinated.

4.12.4.Agencies involved in the management of the traffic

The agencies that are related to the road system in the city are

- Lucknow nagar nigam responsible for the cleaning and maintainece of the road.
- The traffic police deal with the vehicle movement and vehicle condition. This also defines the route marking for public transport and other vehicle.
- The traffic police also define the one way street and they also penalized the persons for not following the rules under Motor Vehicle act.
- The management of the traffic on the road is governed by the local traffic police. They also keep the record for accident data.
- The T.C.P.O. deals with the circulation proposal in present and future situation in the city.

4.12.5Regulation of the traffic in the city

The traffic regulation with in the city

i. The heavy vehicles are not allowed to enter in the city during day time. They are allowed after 12 A. M. in the night and they are allowed till 5 o clock in the morning.
ii. The other rules are as the same as in the motor vehicle act.
iii. The one way street are defined in some of the roads with in the city.
iv. According to the traffic and transport plan for Lucknow by T.C.P.O. the problems related to the management of the traffic are-
v. Lack of awareness in the public of the traffic rules.
vi. Presence of rail road crossing in the busy corridors of city

vii. Lack of proper control of traffic management measure.

4.13 Earlier Studies On Lucknow Urban Roads

The following are the study that has been done by different agencies, institutions on urban roads of Lucknow city.

4.13.1 Lucknow area transport study and transport system plan by S.P.A., New Delhi

This study was done by the school of planning and architecture, New Delhi in 1992. They have recognized some corridors in the city which needs a lot of improvement as far as the road is concerned. They have recognized Mahtama Gandhi marg, Tulsidas Marg and other road as one of the major problematic roads in the city.

4.13.2 Comprehensive traffic area transport study for Lucknow by NATPAC1992

This study was done by the National transportation planning research centre Trivendrum in 1992 for the improvement of the traffic and transport plan in the Lucknow.

i. Findings of the study

Predominance of slow moving vehicles nearly 70% of cycles shares 59.20%

Heterogeneity of the traffic, a Predominance of slow moving vehicles nearly 70% of cycle's shares 59.20%

- They have identified the problems area in the city by conducting detailed survey. And comparing with the given standard. They have identified as Tulsidas marg and its junctions at the road joining with the other roads and Hajratgang area
- Incomplete rings roads and missing links
- Lack of the parking centers near the activity areas such as city center etc.
- Absence of the pedestrian's facilities on majority of the roads
- Mushroom growth of the commercial establishments along the roads side
- Mixing of the local traffic and through traffic
- Narrow roads and lack of the parallel corridors with in the cit
- Lack of the proper terminals facilities for minibus
- Improperly designed intersection
- Level of Encroachments is one of the major parameter for the traffic delays and accidents.

ii. Measures suggested

- Restrict on the vehicles on the C.B.D. area
- Policy on the slow vehicles
- Ban on the slow vehicle and offering the loans schemes for the users of the slow vehicles
- Initiate measures for the to organize the cooperative society for the users of the slow vehicles
- Land use control measures
- Shifting of the nonconforming activities from the C.B.D. area of the old city strict ban on the conversion of the existing residential areas for commercials activities
- Findings
- Traffic circulation plan by implementing one way traffic and improvement signal and public awareness is also given attentions

4.13.3.Physical and financial plan for Lucknow metropolis study by RITES -1993-94

i. Findings

- Heterogeneity of the vehicles in almost all the roads such as Mahatma Gandhi Marg, Tulsidas marg, Aminabad etc.
- The central area which have the main market of the city are congested and encroachments on these roads.
- The vehicle runs for the 5% of time and remaining 95%it needs the space for standing, considering this factor they have identified that lack of the proper parking space leads to unsafe roads.

ii. Measures-

- Door to the public transport

The public transport use should be encouraged

- The education regarding the rules and regulations of traffic should be given in the schools, offices etc.
- The programs related to the traffic safety plan should be promoted among the users
- They have segregated the parking space for different vehicles according to E.C.S.
- Suggested the lane segregation facilities for slow moving Vehicle on tulsidas road

- The continuity of pedestrians facilities even in the small stretches
- Strict control on the encroachment specially in the market areas.

In this chapter the characteristics features of the Lucknow city and city roads has been dealt. The Urban road user of the city represents the typical city road users of any Indian city and the earlier study shows the extent of the problems on these roads. Through the earlier study the main problematic has been identified and some of them has been taken for the detailed investigation in the next chapter.

CHAPTER 5: STUDY OF SELECTED URBAN ROADS

5.1 Introduction

The aim of the conducting detailed study is for the identification of the design and planning parameters, which contribute to the fulfillment of the performance criteria, which in turn are prerequisites for the fulfillment of the users of the urban roads. The field survey has been analyzed with respects to the parameters found in the preceding chapter i.e. the design of the roads, the users of the roads. For this specific stretches of the urban roads has been taken in Lucknow city in commercial, mixed and residential land use areas. For considering the changing users needs and their impact on the roads design, the specific stretches of roads has been taken according to development: newly developed roads and the core area roads.

Considering the above criteria the following stretches have been selected-

- **Commercial street**

1. Tulsidas Marg (Chowk) old /core areas
2. Mahatma Gandhi road (Hajratgang road) old planed area
3. Kapoorthala road (Aliganj) newly developed area

- **Residential street**

1. Sarai Kale Kha zone (chowk) old/ core are
2. Kapoorthala zone (aliganj) new area

- **Mixed land use**

1. Akbari gate area old area

The map no. 3 shows the area of the study.

5.2 Commercial Roads

5.2.1.Tulsidas Marg (Chowk)

The area is among the most developed commercial area. It is likely that the Chowk, which means the space at the crossing of roads, existed as a linear market place. The area is predominately commercial and lots of wholesale activity takes place. The street corridor serves the government offices, saw mills, furniture goods shops and other commercial center.

The selected stretch starts from the Kauneshwar chowk to the road where the road from the Akbari gate road is meeting. The selected stretch is 530 meter in length.

This was originally old unplanned market area and this was improved by the Govt. in the recent time. It has widened the road and now the street is also serving as the Sub-arterial Street.

The layout is shown in map no. 4

5.2.2 Mahatma Gandhi road (Hajratgang area)

Asf-ud daulla was particularly fond of the new style houses of the British and at the start of his reign in 1775 A.D. asked the British residents at the court of the Lucknow to procure for him a plan of the house in European style. This was prepared and subsequently constructed in the area presently known as Hazratgang, by Captain Marsack who was in charge of the one of the Nawabs battalions at Lucknow. His successor Sadat Ali khan was responsible for making the Hajratgng, one of the most splendid streets.

Hajratgang, which is the main commercial center of the city, presents to the visitor the colonnade European architecture, its spacious feel and its automobile traffic, and its somewhat western ambience. The street corridors serve the government offices, cinemas hall, public town halls, religious building and other commercial centers. The shops are large with a colonnade and sides walk between them and the street.

The selected stretch starts from the Halwasiya Intersection and ends at the Allhabad Intersection. The selected stretch is 550 meter in length. It is intersected by Nadan Mahal road at Halawasiya Intersection and at the Allhabad intersection it is intersected by the four roads Park road, Ashok marg and G.P.O. Road. The Shahjanaf road intersects in between the stretch.

The layout is shown in map no. 5.

5.2.3.Kapoorthala market

Kapoorthala, is one of the commercial center of the city serving the resident of Aliganj locality. The street serves the commercial complexes and these complexes consist of the different types of the shops, cinemas, offices and other activities. The commercial area is still not fully developed even though the commercial activity began in 1990. The selected stretch starts from Vivek Cinema Chauraha to the Kapoorthala Chauraha and from Kapoorthala Chauraha to the Indian oil building. The selected stretch is 450 meter in length.

The layout is shown in map no. 5.

5.2.4 Land / Building use features of selected commercial roads

The layout, building use/ land use features along these roads mainly commercial. The features along these roads are shown in the table given below-

Table no. 5.1 land use features of selected commercial roads

Land/ building Features	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**
Building types	Retail shops, offices, wood cutter industries, amenities like police Chowki, public toilets etc.	Mainly retail shops, offices, schools, health center, cinema halls etc.	Mainly offices, and shopping complexes
Floors			
Max.	G+3	G+4	G+7
Min.	G	G+2	G+4
Land use			
Offices	56(31)	26(12)	45(34)
Commercial	106(60)	99(50)	80(61)
Education	-	16(8)	-
Health	-	14(7)	-
Recreation	-	9(4)	2(1)
Industrial	6(3)	31(15)	-
Others	10(6)	9(4)	6(4)

Other features	The ground floor is used for shops, industries and the above floors are used for offices	The ground floor is used for shops, industries and the above floors are used for offices	The semi basement and ground floor and is used for shops, industries and the above floors are used for offices and other activities

Source – Primary survey & T.C.P.O.

The older roads, Tulsidas and M.G. Marg are serving different types of activities such as industries, schools, cinema halls, religious building, health center, offices etc where as new road, Kapooortahla Marg is serves mainly offices and shopping cum office complexes. The Tulsidas and M.G. Marg have linear shops arrangement parallel to the road. In Kapoorthala, shops are with in commercial complexes perpendicular to road. In the older area the building height is restricted to two floors only where as the new areas the 7 floors building with semi basement facilities. The semi basement and ground floor is for shop.

5.2.5 Design features of selected commercial roads

The design features identified in the chapter 3 are studied along these selected stretches. They are shown in the table no. 5.2

Table no. 5.2 design features of selected commercial roads

S.N.	Design features	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**	**Standard**
1	Detailed layout	Map no. 6	Map no. 7	Map no. 8	-
2	Cross section of the road	Fig no. 5.1	Fig no. 5.2	Fig no. 5.3	Refer fig no. 3.6,3.7 in chapter 3
3	No. of intersection	-	2 **a.** From Halwasiya to Shajanaf **b.** From Shajanf to Allhabad crossing	2 a. From Vivek cinema to Kapoorthala Chauraha b. From Kapoorthala	-

				Chauraha to Indian oil building	
4	No. of lanes	6 lanes(divided)	a. 6 lanes b. 5 lanes	a. 4 lanes b. 4 lanes	Depend on the traffic volume
	Cross sectional elements				
5	Width of each lane	3.5 m.	3.5 m	3.5 m.	Varies from 3-3.75m
6	Total C.W.	21 m.	21 m.	14 m.	Varies
7	Median	Divided by guard rail	Divided by guard rail in between Halwasiya to Shajanaf and after that its divided by road marking	Divided by Kerb.	In case of heavy traffic divivde by guard rail, in case of light traffic divided by marking
8	R.O.W.	Varies 25.5-28m	Varies 24.5-26m	Varies 15.5-20 m	34 m for four lane 40 m for six lane
9	Control of access				
10	Min. distance	40m	100m	100m	150-300m
11	Max. distance	231m	200m	200 m	-
12	Foot path				-
13	Foot path length (right) (left)	 490m 290m	 500m 490 m	 nil nil	
14	No. Of continuity break (right)	 7(6 out of which	 2, both are	 No foot path	No continuity breaks should be there

		are accesses to the properties and in one it is encroached by the Sulabh Sauchalaya)	accesses to the properties		
	(left)	9(6 out of which are accesses to the properties and in one case it is encroached by the buildings)	4(3out of which are accesses to the properties and in one case it is encroached by the parking	do	
15	Max width	3.0m	3.0	do	-
16	Min. width	1.5m	2.0	do	3m
17	Covered	Nil	60%	do	-
18	Uncovered	100%	40%	do	-
19	Surfacing type	Brick	Generally tiled, mosaic floors in front of the big show rooms	do	Refer section 2.44
20	Cycle track	Nil	Nil	Nil	Min. 2m
21	Kerb	Mountable barrier	Mountable barrier	Mountable barrier	Refer appendix -1
	Street furniture				
22	Traffic safety devices			Nil	
23	Traffic signs			Nil	
25	Type Mandatory sign Warning	Speed limits, parking, pedestrians sign are absent No sign regarding	Speed limits sign parking, Stop sign absent Warning sign near school	Speed limits sign parking, Stop sign absent Warning sign	Sign of pedestrians movement etc (refer 2.6.1.1) Warning signs

		the turn or intersection No sign. Nil	building ,near cinema halls absent at the Allhabad intersection defining location just left side	near Cinema halls absent nil	near sensitive area such as schools, cinema halls Informatory signs regarding the palce identification, route map etc.
26	Position	Nil	Left	Nil	Both side depending on the movement
27	Traffic signal				
28	Type	Nil	Fixed time of 100 sec and 180 sec at two junction	Nil	Fixed type intersection and heavy crossing as decided by warrant (refer appendix –2)
29	Position	-	Left side just near to the footpath and on the median	-	Refer fig no. 19
30	Road markings	Carriage way marking	Lane divided marking white in colour median marking in white colour Parking line continuous making white in colour	Lane divided dashed line marking white in colour	Object, other carriageway markings such as stop lines , pedestrians crossing etc. with reflectors type of paint

31	Road light	High pressure sodium vapour lamp	High pressure sodium vapour lamp	High pressure sodium vapour lamp	Refer 2.6.4
32	Type of arrangement	Staggered two side arrangement	Axial arrangement	Axial arrangement	
33	Spacing	30 m. approx	Approx 50 m.	45 m	
34	Position	Median	At a distance of .5 m from the of the carriageway	On the central divider	
35	Other safety devices	Only guard rail dividing the footpath from carriageway other such as speed breakers etc. are absent	No speed breakers near the school area	No speed breakers near intersection, cinema halls	Speed breakers, etc. should be presents near sensitive area. Segregation by guard rail (refer appendix-2)
35	Plantations	Nil	Presents but not in proper manner they do not have any space allocation	On the central divider	Planting at a distance of 6 m from light poles 1 m from kerb.(ref. No. 2.7.2)
36	Advertisements	footpath and the verge area	Displayed in improper manner	Acquiring the middle of the verge of the road	Not with in 100 m of any junction . No glare on the drivers eves (ref. Section 2.73)
37	Services Dustbins	Nil	Near Vasant	Nil	Dustbins, letter boxes, fire

			cinema		hydrant(ref.
	Toilets	Present, acquiring foot path (plate no. 1)	Nil	Nil	Section 2.7)
	Letter boxes	Nil	Present, acquiring foot path (plate no. 1)	Nil	
38	Facilities Taxi stands, Benches, Telephone, Police call boxes	Nil		Nil	Benches, Kiosks, police call boxes etc. (ref. 2.7)

Source – Primary survey & T.C.P.O.

From the survey of the selected roads are not designed according to standards given by the IRC. They are as follows-

i. No central divider is there on the M.G. road.

ii. Control of access in older street is not restricted.

iii. No footpaths are there in the new area however the shops have their own corridor as they ar in the complexes. and even if the footpaths are there in old areas they don't form coherence. At certain points its breaking. See map no 6,7 The footpaths are not continuous.

iv. No cycle tracks for the movement of the cycles.

v. None of the traffic signs prescribed in the IRC standards for the urban roads are there. Even the traffic signs near the sensitive area such as school, health center are not there. The traffic signs regarding the speed limits, information etc. are not there

vi. The pedestrian's crossing signals at the heavy pedestrians crossing are missing on the M.G. road. Pedestrians crossing marks are there only on the M.G. road.

vii. Other safety devices such as speed breakers are provided even in front of the sensitive area.

viii. Absence of facilities such as dustbins, fire hydrants, telephone, police call boxes etc. on almost all the three roads.

ix. Advertisements along the roads are Haphazardly displayed of on the building façade. The rules regarding advertisements such as lettering, position materials are not followed.

Even though the standard has been given by IRC but they are not followed while constructing the roads.

5.2.6. Road Users

Different categories of road users like pedestrian's users, vehicle users, street hawkers and vendors and other users are discussed in this section.

5.2.6.1 Pedestrians

Pedestrian's users are of different character. They can be divided according to age, groups, purpose etc. The survey charts for each stretches are shown in appendix-3. The outcome in the respective stretches are shown in table no. 5.3

Table no. 5.3 pedestrians features of the selected commercial roads

Pedestrians features	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**	**Standard**
Age –group				
Children	20%	14%	16%	
Adults	58%	60%	60%	
Elderly	22%	26%	24%	
Group				
Single	65%	60%	64%	
Group	35%	40%	26%	
Walking in right direction	80%	70%	70%	
Wrong direction	20%	30%	30%	
Average pedestrians traffic volume	708 pedestrians/ hour in both direction	800 pedestrians/ hour in both direction	564 pedestrians in both direction	-
Foot path width	Varies 1.5- 3.0 m	Varies 1.5m. – 2.0 m	Nil – no footpath	Depend on the volume of the pedestrians. Refer 3.11.1
Hazardous elements	Open drains, pits etc .in footway(see map no. 6)	Pits, open drains in between the footway (see	Nil	No hazardous elements should be there

		map no. 7		
Intrusion of other users	Parked vehicles, digged , building structure materials, transformer, advertisement display, street hawkers and vendors, displaying furniture etc. reduces foot pays to 0 m	Parked vehicles, digged materials, transformer, advertisement display, displaying furniture, street hawkers and vendors reduces foot way width to 0 meter .	No foot path	-
Maintenance	Not maintained so very few people use it rest use the C.W. (see map no. 6)	Maintained as it is V.I.P. road	Nil	Maintained at interval once in year
Facilities	No facilities such as drinking water, benches, phone booths etc. only public toilets acquiring the footpath	No facilities such as drinking water, benches, phone booths, toilets etc.	Nil	Facilities regarding safety, convenience etc.
For special groups- disabled, elderly	No facilities	- No facilities	- No facilities	Refer sec. 3.11.1
Safety devices				Refer section

Guard rail, Speed breakers Pedestrians crossing signal Pedestrians sign Pedestrians markings	Footpath is segregated by guard rail Nil Nil Nil At intersection only	Footpath is segregated by guard rail Nil Nil Nil Nil	Nil -Nil Nil Nil Nil	3.11.1
Services Fire hydrant, Public booths	Nil	Nil	Nil	
Level of service	D (probability of conflict is high, Walking Speed between .80-1.14 m sec	E-F (forced flow) Walking Speed between < . 75 m sec m sec		For sufficient walking space C. (Refer section)waking speed 1.5 m sec

Source – Primary survey

The following are the problems faced by the pedestrians

i. The new area does not have pedestrian foot ways.
ii. The footpath width given in IRC standard deals with the no of pedestrians only. They don't consider age, sex, and permutations of the pedestrians. Hence they are insufficient.
iii. Presence of hazardous elements on the footpath causing danger to pedestrian's movement.
iv. Intrusion of the other users such as parked vehicles, street hawkers and vendors and other users such as bells, letter boxes etc reduces the given width of the footways. F.W. (See map 6, 7)
v. Improper Maintenance of the footpath distracting pedestrians to use it (see map 6)
vi. No facilities for special groups i.e. Disabled and elderly even they are also the users and require special provision.
vii. Absence of pedestrian's safety devices on the footways near crossing.
viii. Absence of facilities such as drinking water, rest areas, benches etc. For pedestrians

5.2.6.2.Vehicle users

The vehicles users on these stretches are surveyed in two groups: slow moving and fast moving. The survey is taken in three different times, morning 9-11 am., afternoon 1-3 pm. , evening 4- 6 pm. the field survey chart is shown in appendix –3. the modified out come on the selected stretches is shown below in table. 5.4

Table 5.4 vehicular features of the selected commercial road

Vehicles features	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**	**Standard**
No of lanes	6	6, From Halwasiya to Shajanaf, further it is 5 lane; one lane is used for on street parking.	4	Refer chapter 3 section 3.11
Peak Hour P.C.U.	3456	5447	2235	
No. of lanes required	6, 21m	8	4 lane, 14m	
Peak hour Time	9-11. Morning	4-6, evening	Morning 9- 11	-

Normal P.C.U.(peak hour. *0.8)	2900	4337	1800	-
Fast only	2036	2250	1450	-
No of lanes existing	6, 21 m	6, 5	4 lane	-
No. of lanes required	4 , 14 m	4		-
Slow only	1510	905	770	-
No of lanes existing	Nil	Nil	Nil	-
No. of lanes required	3, 10.5 m	2 lanes, 7.5 m	2 lane	-
Cyclist	1380 in both direction	2560 in both direction	550 in both direction	-
No of lanes existing	Nil	Nil	Nil	-
No. of lanes required	2 lanes , 2 m	2 lanes , 2 m	2 lanes , 2 m	-
Level of service	D	From Halwasiya to Shajanaf E, further its F	D	C
Average Speed	15-20 km. Per hour	10-15 km. Per hour	18-22 km. Per hour	30 km. Per hour
Safety devices				
Traffic signs	Nil	Nil	Nil	
Traffic signals	Nil	Presents (fixed vehicle articulated	Nil	
Road markings	Carriageway markings	Carriageway markings, parking markings etc.	Carriageway markings	
Median	Guard rail divider	Guard rail divider From Halwasiya to Shajanaf further by markings	Keb divider	
Lights	Well	Well illuminated at	Well illuminated at	

	illuminated at intersections, C.W.	intersections, C.W.	intersections, C.W.	
Hazardous elements Soil pits	Presents at the edge C.W.	Presents at the edge C.W.	Nil	
Intrusions of Street hawkers &vendors Pedestrians Other users	On the carriage way, Presents where the footways are not there Transformer, animals etc. (see plate no.)	On the carriage way, Presents where the footways are not there Temple bells etc. (see plate no.)	On the carriage way Walk on the C.W as there is no foot path Animals, wire etc. (plate no.)	
Services				
Route map	Nil	Nil	Nil	
Road surface	Tar coal	Tar coal	Tar coal	
Parking	No parking provision along the street	On street as well as off street parking shown in map. No.	Parking with in the building complex.	-
Required	181 E.C.S.	253 E.C.S.	75 E.C.S. besides the complexes requirement	-
Existing	Nil	251 E.C.S., 120 on street, 131 off street	Nil	
Special facilities for disabled	Nil	Nil	Nil	

Source – Primary survey & T.C.P.O.

The following are the problem faced by the vehicular users-

i. Inadequate C.W. for the existing P.C.U.
ii. Absence of separate track for slow moving vehicles even if they equally sharesthe traffic.
iii. No cycle track for cyclist even if the separate cycle track is required for the given no. of cycle according to I.R.C. standard.
iv. The average speed of the vehicles reduces to 10-22 km per hour where as the speed limit for this road is 30 km per hour.
v. No safety devices related to the vehicular users are there even if IRC standards recommend that.
vi. Intrusions of other users such as street hawkers and vendors, pedestrians reducing the C.W.
vii. Absence of facilities for vehicular users
viii. Parking facilities are not provided even if they are provided they are not meeting the required demand forcing vehicles to park on the C.W. and footways.
ix. No parking provision for special group such as disabled and elderly

5.2.6.3. Street hawkers and vendors

The street hawkers and vendors represent the informal sectors of the city. The informal sectors refer to those economic activities and enterprises, which are typically small scale, labour intensive, unorganized relatively easy to enter and taking place in improvised spaces. The types of street hawkers and their features are surveyed and field survey is shown in appendix-3. These are precisely put in the table no. 5.5 in all these stretches.

Table no. 5.5 features of the Street hawkers and vendors

Street hawkers and vendors features	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**	**Standard**
Mobile hawkers				
Type	Fruit seller, groceries, other daily used items see	Balloon seller, ice cream seller, eatable seller, mobile vans ,	Fruit seller, eatable seller mainly	No standard is for them is given in the

	plate no.	goggles seller, toy seller etc.		road design
Space required				
Max.	200*150	300*500(maruti vans selling the things)	200*150	
Min.	100*100	60*60	60*60	
Place of occupancy	C.W.	C.W., footway near the school area, in front of the big show room, near cinema hall	C.W.	
Time of operation	2 pm. –8 pm	off time of school hours and in the evening	12 pm. –8 pm	
Services required	Lights, shade	Lights, shade,	Lights, shade	
Facilities required	Space near the public activity, in front of the shops etc.	Space near the public activity, in front of the shops etc.	Space near the public activity, in front of the shops etc.	
Safety	Safety from moving vehicles, and other users such as poles, animals etc.	Safety from moving vehicles, and other users such as poles, animals etc.	Safety from moving vehicles, and other users such as poles, animals etc.	
Static				
Types	Retail traders, eatable seller etc.	Retail traders, eatable seller, floweriest, etc.	eatable seller, floweriest shops, P.C.O.	No standard is for them in the road design
Space required				
Max.	150*300	500*20	150*300	
Min.	100*100	150* 100	100*100	

Place of occupancy	In front of the shops, along the foot path	In front of the shops, along the foot path, along the boundary wall of the offices and schools	In front of the shops the space in between the complexes and carriageway	
Time of operation	Daily 10 morning- 8 pm. evening	Daily 10 morning- 8 pm. evening	Daily 10 morning- 8 pm. evening	
Services required	Dustbins, light	Dustbins, light, display space	Dustbins, light	
Facilities required	Place near public movement, good environment, shade, display space	Place near public movement, good environment, shade, display space	Place near public movement, good environment, shade, display space	
Safety	Safety from moving vehicles, and other users such as poles, animals etc	Safety from moving vehicles, and other users such as poles, animals etc	Safety from moving vehicles, and other users such as poles, animals etc	

Source – Primary survey

The following are the problems faced by street hawkers and vendors -

i. They have not allocated space on the roads, however they exist on all Indian urban roads and as they are also not legal users of the roads and they have to pay Gunda Taxes to local police to use the roads for trading

ii. No safety provisions i.e. safety from vehicle

iii. They require space near public movement like schools, cinema halls etc.

iv. No basic and infrastructure facilities such as light, storage for them are provided.

5.2.6.4 Other users

The other users of the roads can be studied under street furniture, commercial use, building protrusions, structural member etc. The field survey is done along these stretches field and survey chart is shown below table.5.6

Table no 5.6 features of other users

Other users	Tulsidas Marg	M.G. Marg	Kapoorthala Marg	Standard

Street furniture				
Traffic safety devices			-	
Traffic signs	Nil	Edge of carriageway	Nil	
Traffic signals	Nil	Edge of carriageway	Nil	
Light poles	On the median	Edge of carriageway	On the median	
Transformer vault	On the carriage way in the mid it.	On the edge of carriage way and in the mid of footpath.	Nil	
Landscape elements				
Plantations	Footpath	Footpath	Verge	
Services	Toilet acquiring the footpath	Letter boxes in the mid of footpath	Nil	
Commercial use				
Advertisement display	In front of the shop on the footpath	In front of the shop on the footpath	Verge	
Store display	In front of the furniture shops acquiring the footpath	In front of the shops acquiring the footpath	Nil	
Work space	In front of the saw mills and furniture shop	Storage, guard sitting in front of the shops	Nil	
Building protrusions				
Columns	In front of the shops	Arcaded columns in between the C.W. and edge of footpath	-	
Stoops	Nil	Temple structure	Nil	
Stair way	In front of the shop on the foot path	In front of the shop on the foot path	In front of the complexes on the verge	

Other users		Temple, Temple bells, place for worship,		
Beggars	On the footpath, C.W.	On the footpath, C.W.	On the footpath, C.W.	
Animals	On the footpath	Nil	On the verge, C.W.	
Digged material, garbage	On the carriageway or on the footpath	On the carriageway or on the footpath	On the carriageway or on the footpath	
Parked vehicles	Parked on the footpath and on the carriageway	Parked on the footpath	Parked on the verge and on the carriageway	

Source – Primary survey

Other users problems –

i. They are also not considered while designing the roads and proper space has been given to them and hence they occupy the other users space.

5.2.7. Traffic management and regulation

The management and regulation of the traffic is done for the smooth flow of traffic restriction. In general certain rules are followed for all the inner city roads. And some specific road regulations are also followed depending on need of the road. The rules that is followed in all the three roads are-

- The Heavy Vehicles are not allowed to enter during the day time from 6.00 AM To 10 PM and this is checked by the traffic police of Lucknow.

The specific rules that is followed for M.G. Marg because of the heavy traffic are-

- The cycle rickshaw cannot go beyond the Shajanf road towards Allahabad bank. They are turned towards the has to the Shajanaf road leading to Leela cinema
- The slow vehicles such as bullock carts etc. are not allowed in the main market area.

Maintenance of the road

The public work department and the Lucknow nagar nigam maintain the roads. The construction work of the road is done by the Public work department at about two-year and rest of the maintenance is done by the Lucknow nagar Nigam. For digging of the road they have to take permission from the Lucknow Nagr Nigam and they have to pay charges for digging of the road. The charges are decided by the Officers according to the work. Average charges for cutting are 300Rs. Per mt. Square. But they are not properly maintained by the authorities.

Lucknow Nagar Nigam also charges the parked vehicles. They are different for different vehicle. The parking charges as decided by the Lucknow are-

For Cycle 2Rs.

For Scooter 3Rs.

For Car 5RS.

5.2.8. Black points

Black points are those points, which are liable for accidents or the place where the accidents take place. To study the extent and points of the problem on the roads the blacks points are find out by collecting the data from the local area police in al these stretches and they are shown in the below table. (Refer appendix-3)

Table no. 5.7 black point on the selected roads

Accidents characteristics	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**
No. of accidents in 2001	4	15	2
Dead	1	3	-
Injured	3	12	2
Fatal	2	10	1
Non fatal	1	2	1
Most likely time	Evening	Morning (8-12)	Morning
Most likely season	July	July/ Dec.	-
Most likely place	Near intersection	Near intersection	Near intersection

Near intersection	3	13	2
Other points	1	2, where the shopping complex is on the other side of the road and no pedestrian crossing is there	-
Damages	8	30	5
Pedestrians	2	4	2
Drivers	5	15	3
Vehicles	6	26	3
Slow	1	4	1
Fast	5	22	2

Source- Chowk police, Hajratgang police & Aliganj police chowki

Accident takes place mainly at the intersections of the roads and fast vehicular users are more affected.

5.3 Mixed Land Use: Stretch Between The Gol Darwaja And Akbari Gate

The Chowk is the oldest part of the town of the Lucknow it is likely that the Chowk , which means the space at the crossing of the road, existed as the linear market place before the beginning of the Nawabi rule, lying on the trade route the street was a natural place for commerce and grew spontaneously as did the city itself half mile stretched between two gate ways of Gol and Akbari Darwaza has become the symbolically of old Lucknow, selling even today the traditionally crafted goods and exotic delicacies.

Today the Chowk market still exists even though parts of its were demolished. However the half km. Strethch of the street between two gateways of Gol Darwaza has become symbolic of old Lucknow selling even today the traditionally crafted goods and exotic delicates.

It has the magnitude of the informal and wholesale activities and slow moving vehicle traffic has been increased unauthorized parking and encroachments are hindering the smooth flow of the traffic.

Earlier, The ground floor of the building was used for the shops and the upper floor was used as residents for the shopkeepers. Now, with the development and commercialization of the area, some of the upper floor of the building is turned in to shops. The access to the upper floor is through the shops and the shops here are mostly of Chiken clothes, shoes etc.

The selected stretch start from the Gol Darwaja to Akbari gate Intersection .The selected stretch is 512 meter. The main use along the road is commercial cum residential and shops presents there form

a group of particular type of shops. For e.g. the shops near Taqsheel masque are mainly floweriest shop.

The layout is shown in map no. 6.

5.3.11and / building features

The layout, building use/ land use features along these roads mainly commercial. The features along these roads are shown in the below table 5.8

Table no. 5.8 land use and building use features on the mixed developed road

Land/ building Features	**Stretch between the Gol darwaja and Akbari gate**
Building types	Shops of floweriest, Chiken Garments, Jaipuri Shoes, Gota seller etc.
Floors	
Max.	G+2
Min.	G
Land use	
Residential	56(31)
Commercial	106(60)
Religious	3(3)
Others	10(6)
Other features	The ground floor is used for shops, and the upper floors are used for residences

Source – Primary survey

5.3.2Design features

The design features identified in the chapter 3 are studied along these selected stretches. They are shown in the table no. 5.9

Table no.5.9 design features on the mixed developed road

Design features	**Stretch between the Gol darwaja and Akbari gate**
Detailed layout	Map no. 6
Cross section of the road	Fig no. 5.4
No. of intersection	
No. of lanes	As such no lane is defined
Cross sectional	

elements	
Width of road	3.0m.
Total C.W.	3.0m
Median	Nil
R.O.W.	3.5 m
Control of access	
Min. distance	15m
Max. distance	80m
Foot path	Nil
Street furniture	Nil
Traffic safety devices	Nil
Traffic signs	
Type Mandatory sign Warning Informatory	Nil
Position	Nil
Traffic signal	Nil
Type	Nil
Position	Nil
Road markings	Nil
Road light	Sodium vapour lamp
Type of arrangement	Staggered two side arrangement
Spacing	40m approx
Position	On the edge of the C.W. coinciding the building (see plate no.)
Other safety devices	Nil
Plantations	Nil
Advertisements	Hanging, on the C.W., on the top of the shops displayed in improper manner. See plate no.
Services Dustbins Toilets	 Nil Open drains on both side

Letter boxes Drain	
Facilities Taxi stands, Benches, Telephone, Police call boxes	Nil

Source – Primary survey

This also has the same problems as the above commercial roads

5.3.3. Road Users

In this the road users are being discussed under pedestrians users, vehicle users, street hawkers and vendors and other users.

5.3.3.1 Pedestrians

Pedestrian's users are of different character. They can be divided according to age, groups, purpose etc. The survey charts for each stretches are shown in appendix-3. The outcome in the respective stretches are shown in the table no. 5.10

Table no. 5.10 pedestrians features on the mixed developed road

Pedestrians features	**Stretch between the Gol darwaja and Akbari gate**
Age	
Children	20%
Youngsters	58%
Elderly	22%
Group	
Single	35%
Group	60%
Total pedestrians volume	300padestrians/ hour in both direction on the C.W.
Facilities	No facilities such as drinking water, benches, phone booths etc.
For special groups- disabled, elderly	Nil

Safety devices Guard rail Speed breakers Pedestrians crossing signal Pedestrians sign	Nil
Services Fire hydrant, Public booths	Nil
Level of service	F
Walking Speed	<0.75m/sec

Source – Primary survey

This also has the same problems as the above commercial roads

5.3.3.2.Vehicle users

The vehicles users on these stretches are surveyed in two groups: slow moving and fast moving. The vehicles consist only light vehicles such as cycles and cycle rickshaws, motor cycles/ scoter because the width of carriageway is very less. The survey is taken in three different times, morning 9-11 am., afternoon 1-3 pm. , evening 4- 6 pm. the field survey chart is shown in appendix –3. the modified out come on the selected stretches is shown below table. 5.11

Table no. 5.11 vehicles features on the mixed developed road

Vehicles features	**Stretch between the Gol darwaja and Akbari gate**
No of lanes	Nil
Peak Hour P.C.U.	520 P.C.U. per hour
No. of lanes required	2, 7 m
Peak hour Time	Morning
Normal P.C.U.(peak hour. *0.8)	416
Fast only	168 P.C.U.
No of lanes existing	Nil
No. of lanes required	One, 3.5 m
Slow only	398 P.C.U.
No of lanes existing	-nil

No. of lanes required	One, 3.5 m
Cyclist	480
No of lanes existing	Nil
No. of lanes required	2, 2m
Level of service	F
Average Speed	<5 km. Per hour
Safety devices	Nil
Traffic signs	Nil
Traffic signals	Nil
Road markings	Nil
Median	Nil
Lights	Installed afterwards, merging with the right of width, sodium vapour lamp at distance of the 40 meter
Hazardous elements Soil pits Open drains	 - In the C.W. (See Plate no.)
Services	
Route map	-
Road surface	Tarcol
Parking	No parking provision, the heavy vehicles are parked outside the Darwaja and the light vehicle are parked on the C.W.
Required	33 E.C.S. mostly two wheelers and for cycles
Existing	Nil
Special facilities for disabled	Nil

Source – Primary survey

This road is very narrow and the problems are the same as the commercial roads has but the extent of the problems is more.

5.3.3.3. Street hawkers and vendors

The street hawkers and vendors in the mixed land use along this stretch are very less as there is very limited space, but they encroached the inner roads adjoining this street. The types of street hawkers and their features are surveyed and field survey is shown in appendix-3. These are precisely put in the table below in all these stretches.

Table no 5.12 features on the mixed developed road

Street hawkers and vendors features	**Stretch between the Gol darwaja and Akbari gate**
Mobile hawkers	
Type	Fruit seller, groceries, cloth seller, eatables see plate no.
Space required	
Max.	150*200
Min.	60*60
Place of occupancy	C.W., and the niches of the building and road
Time of operation	12 pm. –8 pm
Services required	Lights, shade
Facilities required	Space near the public activity, in front of the shops etc.
Safety	Safety from moving vehicles, and other users such as poles, animals etc.
Static	
Types	Retail traders, eatable seller, cycle repairers etc.
Space required	
Max.	200*90
Min.	100*100
Place of occupancy	In front of the shops, along the foot path
Time of operation	Daily 10 morning- 8 pm. evening
Services required	Dustbins, light
Facilities required	Place near public movement, good environment, shade, display space
Safety	Safety from moving vehicles, and other users such as poles, animals etc

Source – Primary survey

Even though the street is very narrow the street hawkers and vendors do eixt and share the road with other users. The problems are same as on the commercial roads.

5.3.3.4 Other users

The other users of the roads can be studied under street furniture, commercial use, building protrusions, structural member etc. The field survey is done along these stretches field and survey chart is shown below table. 5.13

Table no 5.13 other users features on the mixed developed road

Other users	**Stretch between the Gol darwaja and Akbari gate**
Light poles	Along the building
Transformer vault	Near the gate
Services	Public tap, in the mid of carriageway
Commercial use	
Advertisement display	In front of the shop on the footpath, hanging from the building
Store display	In front of the shops acquiring the C.W.
Building protrusions	
Columns	In front of the shops
Stair way	In front of the shop on the C.W.
Other users	Cables wires in front of the building
Beggars	On the footpath, C.W.
Animals	On the C.W. (see plate no.)
Digged material, garbage	On the carriageway
Parked vehicles	Parked on the carriageway

Source – Primary survey

5.4. Residential Street

The design of he residential street are different from the commercial street and the users needs are also different (refer chapter –3 Sec:). So they haveseperately dealt here nad the residential street has been taken. The two stretches is taken in this sector :old residential , new residential street. The residential street should give the sense of belonging to the residents living here so it should be designed according to the residents needs.

5.4.1 Old residential street: Sarai Kale Khan road , Chowk

Besides being the ancient commercial center the Chowk area has also being developed as a residential area for the local population and the less privileged. The rulers being Muslims, the dominant characters of the urban genre are of Arab Islamic decent where the urban forms derives from closely knit structures organized in definite hierarchical order of spaces.

The residential areas are known, as Mohallas, which are predominately occupied by the people of single religion, Hindu or Muslims but the physical character, are always Islamic. This was because the rulers were and the impact of their traditions was always imparted to the subjects. However the identification of the Mohalla is transformed into Hindu or Muslim by the presence of the of a temple square complete with a Pepal tree and well or a mosque and the e size of the and nature of the street and the activities therein. The whole settlement is finely knit together to form a homogeneous a whole and boundaries of the Mohallas whole are by the street or natural barriers there is nod enmity between the Hindu and Muslims in theses area.

The area taken up for the parent investigation is broadly known as Sarai male khan. The selected stretch is 200 meter in length.

The layout is shown in map no. 9.

5.4.2. New residential street: Kapoorthala Residential Street:

Kapoorthala area is also developed as a residential area. The open spaces are the leisure parks and playgrounds and the plots are developed around the park and in the linear fashion. The Kapoorthala are is newly developed residential area, which is having the residences for all the types of the people for e.g. L.I.G. group, M.I.G. group and H.I.G. group etc. The residential areas are known, as sectors or colonies. The building or the houses have the façade with a modern outlook and they are of different character. The stretch is 180 m in length.

The main use along the road is residential, but the plot adjoining the main road and the residential road is used as the commercial center. Some of the residential plots are also being developed as the mixed land use (commercial and residential land use) however they are legally not permitted.

The layout is shown in map no. 10

5.4.3. land / building features

The layout, building use/ land use features along these roads mainly commercial. The features along these roads are shown in the below table **5.14**

Table no. 5.14 land use / building use features of the selected residential street

Land/ building Features	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
Layout	Map no. 9	Map no. 10
Building types	Mainly residential, the plot adjoining the main roads are residential cum commercial complex. See plate no.	Mainly residential only however 10% of the building are used as residential cum commercial
Floors		
Max.	G+3	G+1
Min.	G	G
Plot size	100-150 sq. meter	200- 355 sq. meter
Other features	No set back	The ground floor is used for shops, industries and the above floors are used for offices

Source – Primary survey & T.C.P.O.

No set backs in the core area are there.

5.4.4. Design features

The design features identified in the chapter 3 are studied along these selected stretches. They are shown in the table no. 5.15

Table no. 5.15 design features of the selected residential street

Design features	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**	**Standard**
Detailed layout	Map no. 9	Map no. 10	-
Cross section of the road	Fig no.	Fig no.	Refer fig no. 6,7
No. of lanes	Nil	2 lanes 6.0 meter	
Cross sectional elements			
Width of each		3.0 m	Varies from 3-

lane			3.5
Total C.W.	1.5 m	6m	5-7.5m
Median	-	-	-
R.O.W.	2 m	9m	8-13.5
Control of access			
Min. distance			300 m
Max. distance			-
Foot path	Nil	Nil	1.5m-3m.
Max width	3.0m	3.0	-
Min. width	1.5m	2.0	3m
Surfacing type	Nil		Refer section 2.44
Cycle track	Nil		Min. 2m
Street furniture			
Traffic signs			-
Type Mandatory sign Informatory	Speed limits, pedestrians sign are absent No sign regarding the turn or intersection Information regarding the residential zone are absent	Speed limits, pedestrians sign are absent Information regarding the residential zone are absent	Sign of pedestrians movement, speed limit etc (refer 2.6.1.1) Information regarding the residential zone should be before the residential area
Road light	Incandescent bulb	Tube light	Refer 2.6.4
Type of	One side arrangement	One side arrangement	

lane			3.5
Total C.W.	1.5 m	6m	5-7.5m
Median	-	-	-
R.O.W.	2 m	9m	8-13.5
Control of access			
Min. distance			300 m
Max. distance			-
Foot path	Nil	Nil	1.5m-3m.
Max width	3.0m	3.0	-
Min. width	1.5m	2.0	3m
Surfacing type	Nil		Refer section 2.44
Cycle track	Nil		Min. 2m
Street furniture			
Traffic signs			-
Type Mandatory sign Informatory	Speed limits, pedestrians sign are absent No sign regarding the turn or intersection Information regarding the residential zone are absent	Speed limits, pedestrians sign are absent Information regarding the residential zone are absent	Sign of pedestrians movement, speed limit etc (refer 2.6.1.1) Information regarding the residential zone should be before the residential area
Road light	Incandescent bulb	Tube light	Refer 2.6.4
Type of	One side arrangement	One side arrangement	

arrangement			
Spacing	30 m. approx	Approx 15	10-20m
Other safety devices	speed breakers for reduction in speed etc. are absent	speed breakers for reduction in speed etc. are absent	Speed breakers, etc. should be presents
Plantations	Haphazard trees	Planted at a distance of 12m approx	Planting at a distance of 6 m from light poles 1 m from kerb.(ref. No. 2.7.2)
Services Dustbins Letter boxes	Nil	Nil	Dustbins, letter boxes, (ref. Section 2.7)
Facilities Taxi stands, Benches Toddlers place Public transport Family occasion	Nil	Nil	Benches, police call boxes etc. (ref. 2.7)

Source – Primary survey & T.C.P.O.-

5.4.5. Road Users

In this the road users are being discussed under residents users, visitors users and other users.

5.4.5.1.Residents users

Among the residents users are the vehicles users and pedestrians users. The need of the residents cannot be just think of only cross sectional geometry and width of the road. Among the residents users the pedestrians users and vehicle users.

5.4.5.2. Visitors users

Among the visitors users are the pedestrians and vehicle users. They need the space for the parking and public transport accessibility. They use the street for meeting the residents and accessibility.

5.4.5.3Other users

The other users are the service group who provides the service to the users. The service group involves the street hawkers and vendors, garbage collector etc.

5.4.5.4.Pedestrians users

Pedestrian's users are of different character. They can be divided according to age, purposes. The characteristics of the pedestrians is shown below in table no. 5.16

Table no. 5.16 pedestrian's features of the selected residential street

Pedestrians features	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
Total pedestrians volume	100 pedestrians/hour	**85 pedestrians/hour**
Age		
Children	40%	41%
Youngsters	38%	35%
Elderly	22%	24%
Purposes		
Play	30%	25%
Mothers informal space	10%	10%
Walk	20%	25%
Social meetings	20%	8%
Accessibility	15%	22%
Other activity (hawkers)	5%	10%
Foot path width	-	-
Facilities	No facilities such as footpath, benches No facilities for public transport	No facilities such as footpath, benches public transport i.e taxi serves the street however no bays, no stoppage space
For special groups- disabled, elderly	-	-

Safety devices		
Segregation from vehicle	No segregation	No segregation-
Traffic calming devices	Poles are put to restrict the heavy vehicles in to the street see plate no.	-
Speed breakers	-	-

Source - Primary survey

The problems faced by the pedestrian's users

i. No space for activity of the pedestrians for the residents living there
ii. No footpath
iii. Sharing the road with other users such as parked vehicles, street hawkers and vendors and other users such as bells, letter boxes etc causing congestion and reduced speed due to reduction in effective F.W.
iv. No facilities for special groups i.e. Disabled and elderly
v. Absence of facilities such as drinking water, rest areas, benches etc. For pedestrians
vi. Absence of pedestrian's safety devices

5.4.5.5.Vehicle users

The vehicles users on these stretches are surveyed in two groups: slow moving and fast moving. The below table 5.17 shows the features of the vehicles users (refer appendix-3)

Table 5.17 vehicles features of the selected residential street

Vehicles features	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
No of lanes	-	2
Peak Hour P.C.U.	100 P.C.U per hour	286 P.C.U per hour
No. of lanes required	1,3.5m	1, 3.5 m
Peak hour Time	9-11. Morning	4-6, evening
Fast only	48	200

No of lanes existing	-	2,7 m
No. of lanes required	1,3.0 m	1,3.5m
Slow only	52	86
No of lanes existing	-	-
No. of lanes required	1,3.0 m	1, 3.0m
Cyclist	70	65
No of lanes existing	Nil	Nil
No. of lanes required	1 lanes, 1m	1 lanes, 1 m
Shared facilities	1.5 m	1.5 meter
Encroachment Other users	Animals, trees etc. (see plate no.), poles, parked vehicles	Transformer, animals, trees, etc. (see plate no.), poles, parked vehicles
Services		
Route map	-	-
Road surface	Brick	Tar coal
Special facilities for disabled	-	-

Source – Primary survey & T.C.P.O.

The problems faced by the vehicular users -

i. Insufficient C.W. resulting in congestion

ii. No traffic calming measures in new areas hence people used this roads because of short routes and congestion on the main roads

iii. Accessibility for the cars , etc, is not possible because of the insufficient C.W. in the old areas

iv. No cycle track. However according to I.R.C. standard the cycle track should be there seeing the no. Of cycles movement

v. Intrusions of other users such as street hawkers and vendors, pedestrians, etc. causing danger

vi. Absence of safety devices causing danger

vii. No parking facilities for the visitors

viii. No identification mark for the residential zone area

ix. Parking facilities are not serving meeting the required demand hence causing inconvenience

x. No parking facilities for the visitors

xi. No parking provision for special group such as disabled and elderly

xii. No basic and infrastructure facilities for them.

5.4.5.6. Other users

The other users will include the street hawkers and vendors and the other users of the road.

The street hawkers and vendors are the mobile vendors for selling the households goods to the residents. They include the fruit/ vegetable seller other household goods. They just require space to sell their thing to the residents.

The other users of the roads can be studied under street furniture, building protrusions, structural member etc. The field survey is done along these stretches field and survey chart is shown below table. no. 5.18

Table 5.18 other user features of the selected residential street

Other users	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
Street furniture		
Transformer vault, street poles	Edge of the carriageway	On the set backs along the road
Landscape elements		
Plantations	They acquire the corner of the path itself	They lies on the set back
Tree guard	-	Set back
Planter box	-	Set back
Building protrusions		

CHAPTER 6: ANALYSIS OF THE ROAD USERS

CHAPTER 6: ANALYSIS OF THE ROAD USERS

In the previous chapter the urban roads and its users has been studied in detail in the three sectors. In this chapter the selected road stretches are analyzed. The analysis of the roads users can be discussed in two ways one is related to the design and planning aspect of the road and another in consideration of the other users group in different sectors.

6.1 Commercial Roads

6.11Users of commercial roads

From the study of commercial roads in Lucknow, mainly four users have been find out which affect the planning and design of the roads-

- Pedestrians
- Vehicles
- Street hawkers and vendors
- Other users

6.12 Identification of variables for pedestrians

The variables, which affect the planning and design of pedestrians are as follows

a.)Dimensional standard– the insufficient footways and the absence of footways

b) Pedestrians safety devices- absence of pedestrian's safety devices such as pedestrian's signs, and signals, other safety devices etc.

c) Services and Facilities –dustbins, toilet, letter boxes, drinking water, taxi stands, benches, telephone, police call boxes, shade, rest areas

e) Special group Facilities- absence of facilities for special group such as disabled and elderly

f) Intrusion of other user – intrusion of footways by the other users group such as street hawkers and vendors, vehicles, and other users.

g) Maintenance and management mechanism

6.1.2.1 Problems caused by the above variables

- Accidents
- Inconvenience
- Bad environment

- ❖ Reduction in walking speeds

6.1.3. Identification of variables for vehicles users

The variables, which affect the planning and design of vehicle are as follows

a.) Geometry of the road – the insufficient C. W. and the absence separate track for slow vehicle.

b) Traffic safety devices- absence of traffic safety devices such as traffic signs, traffic signals, other safety devices etc.

c) Services and Facilities –route map, parking of vehicles, special facilities for disabled

e) intrusion of other user – intrusion of other users on C. W. by the other users group such as street hawkers and vendors, standing vehicles, pedestrians, and other users.

6.1.3.1 Problems caused by the above variables

- ❖ Accidents
- ❖ Inconvenience
- ❖ Bad environment
- ❖ Speed /delays

6.1.4.Identification of variables for street hawkers and vendors

The variables, which affect the planning and design of street hawkers and vendors are as follows

a.) Space– provisions of space for street hawkers and vendors.

b) Services and Facilities - storage, lights, drinking water, display space, shade, rest areas

d) Maintenance and management mechanism

6.1.4.1 Problems caused by the above variables-

- ❖ Insecurity
- ❖ Pays Gunda taxes to local police etc
- ❖ Inconvenience
- ❖ Bad environment
- ❖ Safety
- ❖ Loss

6.1.5. Identification of variables for other road users

The variables, which affect the planning and design of pedestrians are as follows

a.) Space–provision of space for other road users

6.1.5.1 Problems caused by the above variables

- ❖ Bad environment
- ❖ Safety

6.2 Residential roads

From the study of residential roads in Lucknow, mainly four users have been find out which affect the planning and design of the roads-

- ❖ Residents users- pedestrians users, vehicle users
- ❖ Visitors users- pedestrians users, vehicle users
- ❖ Other users – street hawkers and vendors, other users

6.2.1.Identification of variables for residents' users-

6.2.1.1Pedestrians-

The variables, which affect the planning and design of pedestrians are as follows

a.)Footways-absence of footways

b) Pedestrians safety devices- absence of pedestrian's safety devices such as pedestrian's signs, other safety devices etc.

c) Activity space- space for children plays, mother informal activity etc.

c) Accessibility – accessibility to public transport system, shops etc.

d) Special group Facilities- absence of facilities for special group such as disabled and elderly

f) Intrusion of other user – intrusion of other users on footways by the other users group such as street hawkers and vendors, vehicles, and other users.

g) services and facilities- garbage collection etc.

g) Maintenance and management mechanisms

6.2.1.2Problems caused by the above variables

- ❖ Accidents
- ❖ Inconvenience
- ❖ Bad environment
- ❖ Less social contact

6.2.2.Identification of variables for vehicles users

The variables, which affect the planning and design of vehicle are as follows

a.) Geometry of the road – the insufficient C. W. and the absence separate track for slow vehicle.

b) Traffic safety devices- absence of traffic safety devices such as traffic signs, other safety devices etc.

c) Intrusion of other users – intrusion of other users on C. W. by other users group such as street hawkers and vendors, standing vehicles, pedestrians, and other users.

d) accessibility- accessibility to the residences

6.2.2.1Problems caused by the above variables-

- ❖ Accidents
- ❖ Inconvenience
- ❖ Bad environment
- ❖ Speed /delays

6.2.3.Identification of variables visitors users

Pedestrians-

The variables, which affect the planning and design of pedestrians are as follows

a.)Footways-absence of footways

b) Pedestrians safety devices- absence of pedestrian's safety devices such as pedestrian's signs, other safety devices etc.

c) Accessibility – accessibility to public transport system etc.

d) Special group Facilities- absence of facilities for special group such as disabled and elderly

6.2.3.1Problems caused by the above variables-

- ❖ Accidents
- ❖ Inconvenience
- ❖ Bad environment
- ❖ Less social contact

6.2.4Identification of variables for vehicles users

The variables, which affect the planning and design of vehicle are as follows

a.) Geometry of the road – the insufficient C. W. and the absence separate track for slow vehicle.

b) Traffic safety devices- absence of traffic safety devices such as traffic signs, other safety devices etc.

c) Encroachment- encroachment of the C. W. by the other users group such as street hawkers and vendors, standing vehicles, pedestrians, and other users.

d) accessibility- accessibility to the residences

6.2.4.1Problems caused by the above variables-

- ❖ Accidents
- ❖ Inconvenience

- ❖ Bad environment
- ❖ Speed /delays

6.2.5Variables of the other users

The other users can be street hawkers and vendors and other users

The variables, which affect the planning and design of other users are as follows

a.) Space– absence of the space for the street hawkers and vendors, and other users.

b) Services-, lights, trade and commerce space

c) Facilities-facilities such as shade, rest areas

6.2.5.1Problems caused by the above variables-

- ❖ Inconvenience
- ❖ Bad environment
- ❖ Safety

6.3.Mixed land use roads

The users that have been identified in the mixed land use are both the users of the commercial roads and residential roads both. And the parameters are mixed parameters of the both residential and commercial parameters.

6.4 Analyses of the selected urban roads

in this section we will now analyzed the selected urban roads with respect to the above parameter discussed in different sectors.

6.5Analysis of the selected commercial roads

The selected commercial roads will be analyzed in terms of its users. The variables for the pedestrians have been identified and they are relatively weighted according to no. of variables under one problem or parameter. Accordingly the weight age is given to different stretches as follows-

3- bad

2 average

1 fair

After that they are multiplied by the weighted given to them.

6.5.1Analysis of the pedestrians

The below table no. 6.1 shows the analysis of pedestrians on the selected urban roads in commercial sector

Table no. 6.1 analysis of pedestrians on the selected urban roads in commercial sector

Factors	Weighted	Tulsidas Marg	M.G. Marg	Kapoorthala Marg
Safety				
Insufficient F.W	10	1	1	3
Segregation	9	1	1	3
Hazardous element	8	2	2	2
Maintenance and material	7	3	1	3
Safety devices				
Guard rail	6	1	1	3
Lighting	5	1	1	1
Pedestrians signal	4	3	3	3
Pedestrians markings	3	3	3	3
Pedestrians sign	2	3	3	3
Other safety devices (kerbs)	1	3	3	3
Total	**165(100% unsafe)**	**98(60% unsafe)**	**92(56% unsafe)**	**14786% unsafe)**
Environment				
Plantation/landscaping	3	3	2	3
Pollution	2	1	3	1
Advertisements	1	3	3	3
Total	**18 (100% polluted)**	**14(77% polluted)**	**15(85% polluted)**	**14 (77% polluted)**
Convenience and comfort				
Services (dustbins, toilet, letter boxes, drinking water etc.	3	2	1	3
Facilities (taxi stands, benches, telephone, police call boxes, shade, rest areas)	2	3	3	3
Special group Facilities	1	3	3	3
Total	**18 (100 % inconvenient)**	**15(77% inconvenient)**	**12(85% inconvenient)**	**1815(77% inconvenient)**
Speed				
Insufficient F.W.	4	1	1	3
E.F.W. due to intrusion of other user				
Street hawkers and vendors	3	2	3	1
Parked Vehicles	2	2	2	1
Other users	1	2	2	2
Total	**30(almost**	**16(speed**	**19(speed**	**19(speed**

	zero speed)	reduces by 53%)	reduces to 63%)	reduces to 63%)

The above table shows that the new roads where the footpath is not there are more dangerous for the pedestrians. More P.C.U. on the road means more polluted and activity of street hawkers and vendors affect the pedestrian's speed more than any other thing.

6.5.2Analysis of the vehicles users

The below table no. 6.2 shows the analysis of vehicles on the selected urban roads in commercial sector.

Table no. 6.2 analysis of vehicles on the selected urban roads in commercial sector.

Factors	Weighted	Tulsidas Marg	M.G. Marg	Kapoorthala Marg
Safety				
Insufficient C.W	12	1	3	1
Segregation	11			
Pedestrians		1	1	3
Slow moving		3	3	3
Street hawkers and vendors		3	2	3
Other users		2	1	1
Parked / standing vehicle		2	2	2
Material/Maintenance	10	2	2	2
Hazardous element	9	1	1	1
Median	8	1	3	1
Road light	7	1	1	1
Control of access	6	3	2	1
Building line	5	3	2	1
Traffic signal	4	3	2	3
Road markings	3	2	2	2
Traffic sign	2	3	3	3
Other safety devices	1	3	3	3

Total	**256(100%)**	**243(90%)**	**240(85%)**	**229(80%)**
Environment				
Plantation/landscaping	3	3	3	3
Pollution	2	2	3	2
Advertisements (Information, route map, restriction)	1	3	3	3
Total	**18(100%)**	**16(88%)**	**18(100%)**	**16(88%)**
Convenience and comfort				
Services (route map, information provider)	2	3	3	3
Facilities (parking, special facilities for disabled)	1	3	2	3
Total	**9(100%)**	**9(100%)**	**8(88%)**	**9(100%)**
Speed				
Insufficient C.W.	4	1	3	1
Sight distance	-	-	-	-
Cross falls and super elevation (drainage)	-	-	-	-
Lateral and vertical clearances	-	-	-	-
Intersection	3	1	2	2
Material	2	1	1	1
Control of access	1	2	2	1
Total	30 (	11(37%)	10(33%)	9(30%)
E.C.W. due to intrusion of other user				
Pedestrians	4	2	1	3
Parked Vehicles	3	3	2	1
Street hawkers and vendors	2	3	2	3
Other users	1	3	1	1
Total	**30(100%)**	**48(61%)**	**47(50%)**	**45(73%)**
		61%	**90%**	**85%**

The above table shows that the new roads are safer than the older roads for vehicles users as they have adequate carriage width according to present P.C.U. As far as environment is considered, all the three roads have the same environment and considering the comfort and convenience the new roads are more convenient to the older roads. Speed is mainly affected by the intrusion of other users.

6.5.3Analysis of the street hawkers and vendors

The below table no. 6.3 shows the analysis of street hawkers and vendors on the selected urban roads in commercial sector.

Table no. 6.3 analysis of street hawkers and vendors on the commercial roads

Factors	**Weighted**	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**
Safety & security				
Space allocation	8	3	3	3
Segregation	7	3	3	3
Maintenance and management	3	3	3	3
Trade & commerce	6	3	3	2
Variety	2	3	3	2
Public areas	5	3	3	2
Legal space allocation(pays Gunda taxes, shopkeepers)	4	3	3	2
Display area	1	3	3	3
Total	**108**	**108(100%)**	**108(100%)**	**91(88%)**
Convenience and comfort				
Services				
Storage space	5	3	3	3
Lights	7	3	2	3
Drinking water, toilets, dustbins	3	2	2	3
Display space	4	3	3	3
Facilities				
Information/ advertisements	1	3	3	3
Rests areas	2	3	3	3

Shade, weather from protection	6	3	2	3
Total	**84(100%)**	**81(90%)**	**68(66%)**	**84(100%)**
Environment				
Plantation/landscaping	3	3	2	3
Pollution	2	1	3	1
Advertisements	1	3	3	3
Total	**18(100%)**	**14(84%)**	**15(88%)**	**14(84%)**

The above table shows that the new roads are much safer than the older roads for street hawkers and vendors because of the less varieties of street hawkers and vendors. As far as environment is considered, all the three roads have the same environment and considering the comfort and convenience are older roads are more convenient to the new roads.

6.5.4 Analysis of the other users

The below table no. 6.4 shows the analysis of other users on the selected urban roads in commercial sector.

Table no. 6.4 analysis of other users on the selected urban roads in commercial sector

Factors	**Weighted**	**Tulsidas Marg**	**M.G. Marg**	**Kapoorthala Marg**
Safety and Security				
Space allocation	4	3	3	3
Segregation	3	3	3	3
Maintenance and management	1	3	3	3
Legal permission	2	3	2	3
Total	30(100%)	**30**	**28**	**30**

The above table shows that the all the three roads are having same conditions for the three users because there is as such no provision for other users on all three roads. As far as environment is considered, older roads are not having good environment for the other users.

6.6Analysis of the residential roads

The selected residential roads will be analyzed in terms of its users.

6.6.1.Analysis of the pedestrians

The below table no. 6.5 shows the analysis of pedestrians on the selected urban roads in residential sector

Table no. 6.5 analysis of pedestrians on the selected urban roads in residential sector

Factors	**Weighted**	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
Residents			
Safety			
F.W	10	3	3
Segregation	9	3	2
Hazardous element	8	3	2
Maintenance and material	6	3	2
Traffic safety devices			
Guard rail	5	3	3
Lighting	4	1	1
Pedestrians markings	2	3	3
Other safety devices (kerbs)	1	3	3
Intrusions of other users	7	1	2
Total	**165(100%%)**	**118(71%)**	**120(75%)**
Environment			
Plantation/landscaping	3	3	2
Pollution	2	1	3
Calming	1	1	3
Total	**18(100%)**	**12(66%)**	**15(83%)**
Convenience and comfort			
Activity space	3	2	3
Facilities	2	3	2
taxi stands, benches, telephone, police call boxes, shade, rest areas			
Accessibility to services (garbage etc)	4	3	1
Special group Facilities	1	3	3
Total	**30(100%)**	**27(90%)**	**20(66%)**
Accessibility		3	1
Residents			
To public transport	4	3	1
To other facilities	3	3	1
Visitors			
Accessibility to residents	2	2	1
Accessibility to public transport	1	3	1
Total	**30(100%)**	**28(90%)**	**10(33%)**

The above table shows that the older roads are more environment friendly as compare to the new roads and much secure than the new roads. But the new residential roads are much more

convenient than to older roads and accessible because the public transport facilities passes through it..

6.6.2.Analysis of the vehicular users

The below table no. 6.6 show the analysis of vehicle users on the selected urban roads in residential sector

Table no. 6.6 the analysis of vehicle users on the selected urban roads in residential sector

Factors	**Weighted**	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
Residents			
C.W	10	2	1
Segregation	9		
Pedestrians	5	3	2
Slow moving	2	3	3
Street hawkers and vendors	3	3	3
Other users	1	3	2
Parked / standing vehicle	4	3	1
Material/Maintenance	6	3	2
Hazardous element	5	3	1
Road light	4	1	1
Control of access	3	3	2
Building line	7	3	1
Parking	1	3	1
Accessibility	8	3	1
Safety devices	2	3	3
Total	**768(100%)**	**525(68%)**	**338(44%)**
Environment			
Plantation/landscaping	1	2	1
Pollution	2	1	3
Total		**3**	**8**
Convenience and comfort			
Services (route map, information provider)	2	3	3
Facilities (parking, special facilities for disabled)	1	3	1
Total	**9(100%)**	**9(100%)**	**7(80%)**
Speed			
Insufficient C.W.	7	3	1
Sight distance	3	-	-
Cross falls and super elevation (drainage)	1	-	-

Lateral and vertical clearances	4	-	-
Material	5	3	1
Control of access	2	3	1
Intrusion of other user	6		
Pedestrians	2	3	1
Parked Vehicles	3	3	1
Street hawkers and vendors	4	3	3
Other users	1	3	1
Mixed of fast and slow vehicle	5	2	3
Total	246(100%)	**234(95%)**	**212(86%)**

The above table shows that the older roads are more environment friendly as compare to the new roads but less secure than the new roads. The new residential roads are much more convenient than to older roads and accessible for vehicular users. The speeds of the vehicles on the new roads are more than the older roads this is because of the less C.W.

6.6.3.Analysis of the other users

The below table no. 6.7 shows the analysis of other users on the selected urban roads in residential sector.

Table no. 6.7 analysis of other users on the selected urban roads in residential sector.

Factors	**Weighted**	**Sarai Kale Khan road, Chowk**	**Kapoorthala Residential Street:**
Safety & security			
Space allocation	7	3	3
Segregation	6	3	3
Trade & commerce	4	1	1
Variety	1	3	2
Display space	2	3	3
Accessibility	5	3	1
Legal permission	3	3	1
Total	**84(100%)**	**81**	**59**
Convenience and comfort			
Rests areas	1	3	3

Shade, weather from protection	3	3	3
Other facilities	2	3	3
Total	**18(100%)**	**18(100%)**	**18(100%)**
Environment			
Beautification	2	1	1
Pollution	1	1	3
Total	**9(100%)**	**3(33%0**	**5(55%)**

The above table shows that the older roads are more environment friendly as compare to the new roads but less secure than the new roads but no facilities for the other users on both the street. The new roads are safer than the older roads because of the wide roads the setbacks. The setbacks are used as space for the other users.

6.7Analysis of the mixed land use road

The selected mixed land use will be analyzed in terms of its users.

6.7.1.Analysis of the pedestrians

The below table no. 6.8 show the analysis of pedestrians on the selected urban roads in mixed land use sector

Table no. 6.8 analysis of pedestrians on the selected urban roads in mixed land use sector

Factors	**Weighted**	**Stretch between the Gol darwaja and Akbari gate**
Safety		
Insufficient F.W	11	3
Segregation	10	3
Hazardous element	8	3
Maintenance and material	7	3
Traffic safety devices		
Guard rail	6	3
Lighting	5	1
Pedestrians signal	4	3
Pedestrians markings	3	3

Pedestrians sign	2	3
Other safety devices (kerbs)	1	3
Accessibility	9	2
Total	**198(100%)**	**179(90%)**
Environment		
Plantation/landscaping	3	3
Pollution	2	3
Advertisements	1	3
Total	**18(100%)**	**18**
Convenience and comfort		
Services (dustbins, toilet, letter boxes, drinking water etc.	4	3
Facilities (taxi stands, benches, telephone, police call boxes, shade, rest areas)	3	3
Special group Facilities	1	3
Activity space	2	3
Total	**30(100%)**	**30 (100%)**
Speed		
Insufficient F.W.	4	3
E.F.W. due to intrusion of other user		
Street hawkers and vendors	3	3
Parked Vehicles, vehicles	2	3
Other users	1	3
Total	**30(100%)**	**30(100%)**

This road is sowing all the three factors such as less safe, less convenience and less environment friendly to the residential roads as well as commercial roads.

6.7.2.Analysis of the vehicles

The below table no.6.9 Shows the analysis of vehicles on the selected urban roads in mixed land use sector

Table no. 6.9 analysis of vehicles on the selected urban roads in mixed land use sector

Factors	Weighted	Stretch between the Gol darwaja and Akbari gate
Insufficient C.W	13	1
Segregation	12	
Pedestrians		3
Slow moving		3
Street hawkers and vendors		3
Other users		3
Parked / standing vehicle		3
Material/Maintenance	10	3
Hazardous element	9	3
Median	8	3
Road light	7	3
Control of access	6	3
Building line	5	3
Traffic signal	4	3
Road markings	3	3
Traffic sign	2	3
Other safety devices	1	3
Accessibility	11	3
Total	**390(100%)**	**378(100%)**
Environment		
Plantation/landscaping	3	3
Pollution	2	3
Advertisements (Information, route map, restriction)	1	3
Total	**18(100%)**	**18(100%)**
Convenience and comfort		
Services (route map, information provider)	2	3
Facilities (parking, special facilities for disabled)	1	3
Total	**9(100%)**	**9**
Speed		
Insufficient C.W.	8	3
Sight distance	5	3
Cross falls and super elevation (drainage)	1	3
Lateral and vertical clearances	4	3
Intersection	2	3
Material	6	1
Control of access	3	3
E.C.W. due to intrusion of other user	7	
Pedestrians	4	3
Parked Vehicles	3	3

Street hawkers and vendors	2	3
Other users	1	3
Total	**285(100%)**	**285**

This roads is showing all the three factors such as less safe, less convenience and less environment friendly to the residential roads as well as commercial roads for vehicular users

6.7.3.Analysis of the street hawker and vendors

The below table no. 6.10 Shows the analysis of street hawker and vendors on the selected urban roads in mixed land use sector

Table no. 6.10 analysis of street hawker and vendors

Factors	**Weighted**	**Stretch between the Gol darwaja and Akbari gate**
Safety & security		
Space allocation	8	3
Segregation	7	3
Maintenance and management	3	3
Legal permission	6	3
Trade & commerce	2	3
Variety	5	3
Public areas	4	3
Display area	1	3
Total	**108(100%)**	**108**
Convenience and comfort		
Services		
Storage space	5	3
Lights	7	3
Drinking water, toilets, dustbins	3	2
Display space	4	3
Facilities		
Information/ advertisements	1	3

Rests areas	2	3
Shade, weather from protection	6	3
Total	**88(100%)**	**84(90%)**
Environment		
Plantation/landscaping	3	3
Pollution	2	3
Advertisements	1	3
Total	**18(100%)**	**18**

This roads is showing all the three factors such as less safe, less convenience and less environment friendly to the residential roads as well as commercial roads for vehicular users

6.7.4.Analysis of the other users

The below table no. 6.11 Shows the analysis of other users and vendors on the selected urban roads in mixed land use sector

Table no. 6.11 analysis of other users

Factors	**Weighted**	**Stretch between the Gol darwaja and Akbari gate**
Space allocation	4	3
Segregation	3	3
Maintenance and management	1	3
Legal permission	2	3
Total	**30(100%)**	**30**

This roads is showing all the three factors such as less safe, less convenience and less environment friendly to the residential roads as well as commercial roads for vehicular users.

6.8. Priortisation of Problems and Issues

In the previous chapter the analysis of roads users characteristics has been done which affect the design and planning of roads. By that some issues has come out. That will now transform in the parameter to priotise the problems. This will helps to decide the seriousness of problems and to implement it in the phase.

6.81 Issues and potentials

6.8.1.1 Issues

i. The users needs are considered the same and the parameter and variable are also the same in almost all the sectors in all design of the roads but some needs and priorities are different form the other sector i.e. activity area need for the pedestrians in case of residential area, traffic calming etc. are different from commercial sector.

ii. The users needs are different from each other but they are conflicting in the design of the roads for e.g. the space occupied by the street hawkers and vendors is mostly along the pedestrian area or the street hawkers and vendors require the space with the pedestrians

iii. If the street should be designed as the commercial roads and residential roads rather than the primary, secondary or tertiary.

iv. The necessity of the separate slow moving track on Indian roads

v. The legality of the street hawkers and vendors and space allocation for them

vi. How much the environment responsible for the users

vii. The users needs that should be given priorities

6.8.1.2 Potential

i. The limitations of the space available on the existing roads

ii. The cost of the roads according to the users choice

The soft multiple method is used to calculate the priortisation of problems. According to that the parameter are divided in respect to basic criteria's. These criteria will be different for different road users in different sectors.

6.9Commercial sectors

The criteria in the commercial sectors can be given for different users-

For pedestrians users-

6.9.1 Criteria for pedestrians

- Cost -*
- Safety/accident ****
- Convenience ***
- Speed /traffic flow **

- Environment *

The basic parameters to priorities are

P1- design elements of footpath

P2- segregation (from vehicle, street hawkers and vendors)

P3- traffic safety device

P4- Road infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

The weightage to the criteria should be given according to their preferences and importances in terms of economic social and health cost .The weightage to parameters should be given in respect to criteria's. The respective prioritization in terms of various criterias are shown in table no.

Table no. 6.12 Prioritization of problems and issues

Criteria / Parameter		Cost	Safety /accident	Convenience	Speed /traffic flow	Environment	Total
		-*	** **	***	**	*	
P1	Design elements of footpath	4	6	4	6	3	47
P2	Segregation (from vehicle, street hawkers and vendors)	5	7	5	7	2	54
P3	Safety device	2	5	1	3	1	28
P4	Footpath infrastructure (drainage, electricity etc)	7	3	6	4	5	36

P5	Facilities	6	2	7	2	6	33
P6	Plantations/ landscaping	1	1	3	1	7	18
P7	Maintenance and management	3	4	2	5	4	33

Segregation > footpath design> footpath infrastructure > maintenance and management> facilities> safety devices> plantations and landscaping (fig. 6.1)

6.9.2 Criteria for vehicles users

- Cost -*
- Safety/accident ****
- Speed /traffic flow ***
- Convenience ***
- Environment *

The basic parameters to priorities are

P1- design elements of C.W.

P2- geometric elements of C.W.

P2- segregation (from pedestrians, street hawkers and vendors)

P3- traffic safety device

P4- Road infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

Table no. 6.13 Prioritizations of problems and issues

Criteria / Parameter		Cost	Safety /accident	Speed /traffic flow	Convenience	Environment	Total
		-*	** **	***	**	*	
P1	Design elements of C.W.	6	8	8	8	4	70

	Geometric elements of C.W.	3	3	7	2	1	35
P2	Segregation (from vehicle, street hawkers and vendors)	5	7	6	6	3	56
P3	Traffic safety device	4	4	3	3	2	29
P4	Road infrastructure (drainage, electricity etc)	7	5	4	4	8	41
P5	Facilities	2	2	2	7	7	33
P6	Plantations/ landscaping	1	1	1	1	6	14
P7	Maintenance and management	8	5	5	5	5	42

Design of C.W. > segregation > maintenance and management> road infrastructure>geometric elements of roads> facilities> traffic safety devices> plantations and landscaping (fig. 6.2)

6.9.3. Criteria for street hawkers and vendors

- Cost -*
- Safety & security ****
- Socio- economic aspect***
- Convenience **
- Environment *

The basic parameters to priorities are

P1- proper space allocation (near public activity)

P2- segregation(from pedestrians, street hawkers and vendors)

P3- legality

P4-infrastructure facilities (lights etc.)

P5- facilities (storage, rest areas, shade)

P6- plantations/ landscaping

P7- maintenance and management

Table no. 6.14 Prioritization of problems and issues

Criteria / Parameter		Cost	Safety & Security	Socio – economic aspect	Convenience	Environment	Total
		-*	** **	***	**	*	
P1	Proper space allocation	7	6	7	3	6	50
P2	Segregation (from vehicle)	3	7	2	4	3	42
P3	Legality	1	5	6	2	2	45
P4	Infrastructure (electricity etc)	6	4	5	7	7	46
P5	Facilities	4	3	3	6	4	33
P6	Plantations/ landscaping	2	1	1	1	5	12
P7	Maintenance and management	5	2	4	5	1	26

Proper space allocation > > road infrastructure> Legality >Segregation>facilities> maintenance and management> plantations and landscaping (fig no. 6.3)

6.9.4 Criteria for other users

- Cost -*
- Safety & security ***
- Convenience **
- Environment *

The basic parameters to priorities are

P1- proper space allocation

P2- segregation

P3- legality

P4- maintenance and management

Table no. 6.15 Prioritization of problems and issues

Criteria / Parameter		Cost	Safety & Security	Convenience	Environment	Total
		-*	***	**	*	
P1	Proper space allocation	3	4	4	2	19
P2	Segregation	2	3	3	3	16
P3	Legality	1	1	1	1	8
P7	Maintenance and management	4	2	2	4	10

Proper space allocation > Segregation> maintenance and management> Legality(fig. 6.4)

6.10 Residential sectors

The criteria in the commercial sectors can be given for different users-

For pedestrians users-

6.10.1 Criteria for pedestrians

- Cost -*
- Safety/accident ****
- Convenience ***
- Speed /traffic flow **
- Environment *

The basic parameters to priorities are

P1- design elements of footpath

P2- segregation (from vehicle, street hawkers and vendors)

P3- traffic safety device

P4- infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

P8 – activity space

P-9 accessibility to residents

P10-traffic calming

Table no. 6.15 prioritization of problems and issues

Parameter \ Criteria		Cost	Safety /accident	Convenience	Speed /traffic flow	Environment	Total
		-*	** **	***	**	*	
P1	Design elements of footpath	9	9	5	10	3	65
P2	Segregation (from vehicle, street hawkers and vendors)	7	10	6	9	4	73
P3	Safety device	3	3	2	7	1	30
P4	infrastructure (drainage, electricity etc)	10	4	10	8	2	78
P5	Facilities	6	2	9	6	5	37
P6	Plantations/ landscaping	2	1	1	1	10	17
P7	Maintenance and management	8	5	3	5	8	45
P8	Activity space	5	7	7	2	7	55
P9	Accessibility to plot	4	6	8	3	6	56
P10	Traffic calming	1	8	4	4	9	60

infrastructure > Segregation > footpath design> Traffic calming > Accessibility to plot> Activity space> maintenance and management> facilities> safety devices> plantations and landscaping (fig no. 6.5)

6.10.2 Criteria for vehicles users

- Cost -*
- Safety/accident ****

- Speed /traffic flow ***
- Convenience ***
- Environment *

The basic parameters to priorities are

P1- design elements of C.W.

P2- geometric elements of C.W.

P2- segregation (from pedestrians, street hawkers and vendors)

P3- traffic safety device

P4- Road infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

Table no. 6.16 Prioritization of problems and issues

Criteria / Parameter		Cost	Safety /accident	Speed /traffic flow	Convenience	Environment	Total
		-*	** **	***	**	*	
P1	Design elements of C.W.	6	8	9	8	5	74
P2	Geometric elements of C.W.	3	2	8	2	3	36
P3	Segregation (from vehicle, street hawkers and vendors)	5	7	7	6	4	60
P4	Traffic safety device	7	5	5	3	4	38
P5	Road infrastructure (drainage, electricity etc)	9	6	4	4	8	43
P6	Facilities	4	3	2	7	7	35
P7	Plantations/ landscaping	2	1	1	1	9	16

P8	Maintenance and management	8	4	3	5	1	34
P9	Accessibility	1	9	6	9	6	77

Accessibility >design of C.W. > segregation > road infrastructure> traffic safety devices> geometric elements of roads> facilities> maintenance and management> plantations and landscaping (fig no.6.6)

6.10.3 Criteria for other users

- Cost -*
- Safety & security ****
- Socio- economic aspect***
- Convenience **
- Environment *

The basic parameters to priorities are

P1- proper space allocation (near public activity)

P2- segregation(from pedestrians, street hawkers and vendors)

P3- legality

P4-infrastructure facilities (lights etc.)

P5- facilities (storage, rest areas, shade)

P6- plantations/ landscaping

P7- maintenance and management

Table no 6.17 Prioritization of problems and issues

Criteria / Parameter		Cost	Safety & Security	Socio – economic aspect	Convenience	Environment	Total
		-*	** **	***	**	*	
P1	Proper space allocation	7	6	7	3	6	50
P2	Segregation (from vehicle)	3	7	2	4	3	42
P3	Legality	1	5	6	2	2	45

P4	Infrastructure (electricity etc)	6	4	5	7	7	46
P5	Facilities	4	3	3	6	4	33
P6	Plantations/ landscaping	2	1	1	1	5	12
P7	Maintenance and management	5	2	4	5	1	26

Proper space allocation > > road infrastructure> Legality >Segregation>facilities> maintenance and management> plantations and landscaping (fig no. 6.7)

6.11 Mixed land use sectors

The criteria in the commercial sectors can be given for different users-

6.11.1 For pedestrians users-

Criteria for pedestrians

- Cost -*
- Safety/accident ****
- Convenience ***
- Speed /traffic flow **
- Environment *

The basic parameters to priorities are

P1- design elements of footpath

P2- segregation (from vehicle, street hawkers and vendors)

P3- traffic safety device

P4- Road infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

P8- accessibility

P-9 – Resident's activity space

Table no. 6.18 Prioritization of problems and issues

Criteria / Parameter	Cost	Safety /accident	Convenience	Speed /traffic flow	Environment	Total
	-*	** **	***	**	*	

P1	Design elements of footpath	5	8	4	8	3	58
P2	Segregation (from vehicle, street hawkers and vendors)	7	9	5	9	2	64
P3	safety device	2	7	1	3	1	22
P4	Footpath infrastructure (drainage, electricity etc)	9	3	6	4	5	40
P5	Facilities	8	2	7	2	6	39
P6	Plantations/ landscaping	1	1	3	1	8	22
P7	Maintenance and management	4	6	2	7	4	44
P8	Accessibility	3	5	9	6	7	61
P9	Activity area	2	4	8	5	9	39

Segregation > accessibility> footpath design> footpath infrastructure > maintenance and management> activity area >facilities> safety devices> plantations and landscaping (fig no. 6.8)

6.11.2 Criteria for vehicles users

- Cost -*
- Safety/accident ****
- Speed /traffic flow ***
- Convenience ***
- Environment *

The basic parameters to priorities are

P1- design elements of C.W.

P2- geometric elements of C.W.

P2- segregation (from pedestrians, street hawkers and vendors)

P3- traffic safety device

P4- Road infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

P8- accesibilty

Table no. 6.19 prioritization of problems and issues

Parameter \ Criteria		Cost	Safety /accident	Speed /traffic flow	Convenience	Environment	Total
		-*	** **	***	**	*	
P1	Design elements of C.W.	6	8	9	8	4	65
P2	Geometric elements of C.W.	3	3	8	2	1	38
P3	Segregation (from vehicle, street hawkers and vendors)	5	7	7	6	3	55
P4	Traffic safety device	4	5	3	3	2	33
P5	Road infrastructure (drainage, electricity etc)	9	4	4	4	9	39
P6	Facilities	2	2	2	7	8	32
P7	Plantations/ landscaping	1	1	1	1	7	16
P8	Maintenance and management	8	3	5	5	5	36
P9	Accessibility	7	6	6	9	6	59

Design of C.W. > accessibility >segregation > road infrastructure > geometric elements of roads> maintenance and management> traffic safety devices> facilities> plantations and landscaping (fig no. 6.9)

6.11.3.Criteria for street hawkers and vendors

- Cost -*

P1	Design elements of footpath	5	8	4	8	3	58
P2	Segregation (from vehicle, street hawkers and vendors)	7	9	5	9	2	64
P3	safety device	2	7	1	3	1	22
P4	Footpath infrastructure (drainage, electricity etc)	9	3	6	4	5	40
P5	Facilities	8	2	7	2	6	39
P6	Plantations/ landscaping	1	1	3	1	8	22
P7	Maintenance and management	4	6	2	7	4	44
P8	Accessibility	3	5	9	6	7	61
P9	Activity area	2	4	8	5	9	39

Segregation > accessibility> footpath design> footpath infrastructure > maintenance and management> activity area >facilities> safety devices> plantations and landscaping (fig no. 6.8)

6.11.2 Criteria for vehicles users

- Cost -*
- Safety/accident ****
- Speed /traffic flow ***
- Convenience ***
- Environment *

The basic parameters to priorities are

P1- design elements of C.W.

P2- geometric elements of C.W.

P2- segregation (from pedestrians, street hawkers and vendors)

P3- traffic safety device

P4- Road infrastructure (drainage, electricity etc)

P5- facilities

P6- plantations/ landscaping

P7- maintenance and management

P8- accesibilty

Table no. 6.19 prioritization of problems and issues

Parameter \ Criteria		Cost	Safety /accident	Speed /traffic flow	Convenience	Environment	Total
		-*	** **	***	**	*	
P1	Design elements of C.W.	6	8	9	8	4	65
P2	Geometric elements of C.W.	3	3	8	2	1	38
P3	Segregation (from vehicle, street hawkers and vendors)	5	7	7	6	3	55
P4	Traffic safety device	4	5	3	3	2	33
P5	Road infrastructure (drainage, electricity etc)	9	4	4	4	9	39
P6	Facilities	2	2	2	7	8	32
P7	Plantations/ landscaping	1	1	1	1	7	16
P8	Maintenance and management	8	3	5	5	5	36
P9	Accessibility	7	6	6	9	6	59

Design of C.W. > accessibility >segregation > road infrastructure > geometric elements of roads> maintenance and management> traffic safety devices> facilities> plantations and landscaping (fig no. 6.9)

6.11.3.Criteria for street hawkers and vendors

- Cost -*

- Safety & security ****
- Socio- economic aspect***
- Convenience **
- Environment *

The basic parameters to priorities are

P1- proper space allocation (near public activity)

P2- segregation(from pedestrians, street hawkers and vendors)

P3- legality

P4-infrastructure facilities (lights etc.)

P5- facilities (storage, rest areas, shade)

P6- plantations/ landscaping

P7- maintenance and management

Table no. 6.20 prioritization of problems and issues

Criteria / Parameter		Cost	Safety & Security	Socio – economic aspect	Convenience	Environment	Total
		_*	** **	***	**	*	
P1	Proper space allocation	7	6	7	3	6	50
P2	Segregation (from vehicle)	3	7	2	4	3	42
P3	Legality	1	5	6	2	2	45
P4	Infrastructure (electricity etc)	6	4	5	7	7	46
P5	Facilities	4	3	3	6	4	33
P6	Plantations/ landscaping	2	1	1	1	5	12
P7	Maintenance and management	5	2	4	5	1	26

Proper space allocation > > road infrastructure> Legality >Segregation>facilities> maintenance and management> plantations and landscaping (fig no. 6.10)

6.11.4 Criteria for other users

- Cost -*
- Safety & security ***
- Convenience **
- Environment *

The basic parameters to priorities are

P1- proper space allocation

P2- segregation

P3- legality

P4- maintenance and management

Table no. 6.21 prioritization of problems and issues

Criteria / Parameter		Cost	Safety & Security	Convenience	Environment	Total
		-*	***	**	*	
P1	Proper space allocation	3	4	4	2	19
P2	Segregation	2	3	3	3	16
P3	Legality	1	1	1	1	8
P7	Maintenance and management	4	2	2	4	10

Proper space allocation > Segregation> maintenance and management> Legality (fig no. 6.11)

From this we will decide the priorities wise the proposals for the street according to users choice.

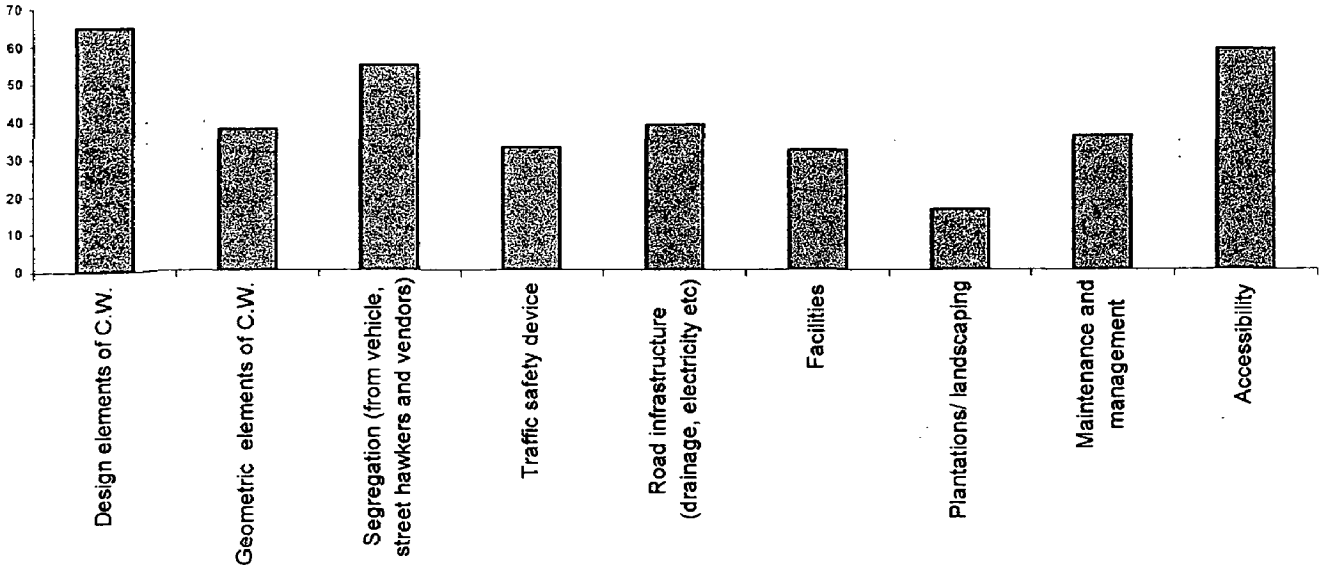


Fig 6.1 prioritization of variables for pedestrian's in commercial sector

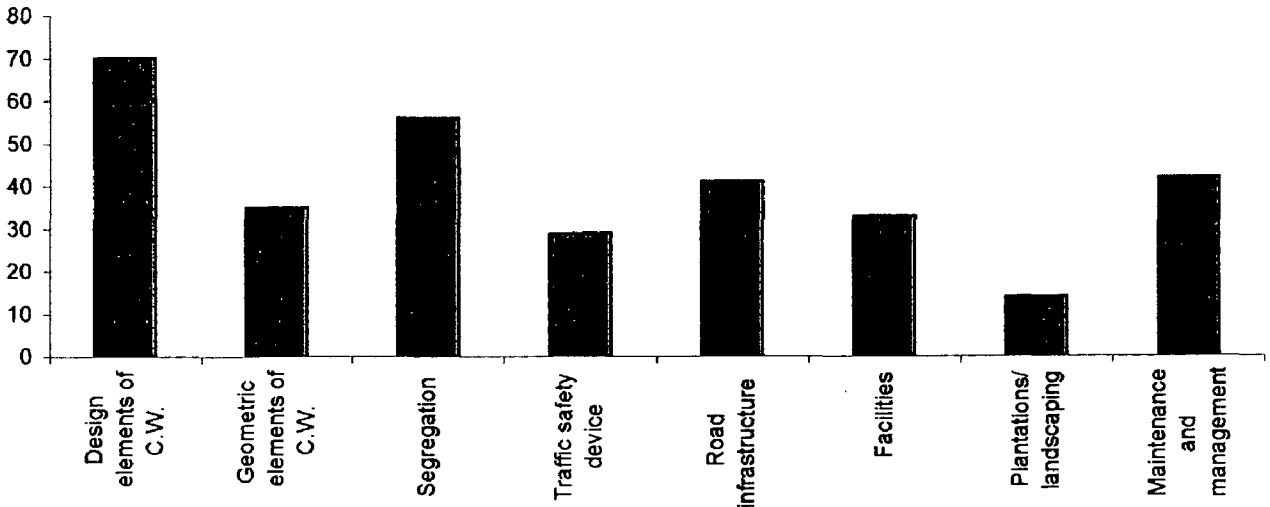


Fig 6.2 prioritization of variables for vehicles variables in commercial sector

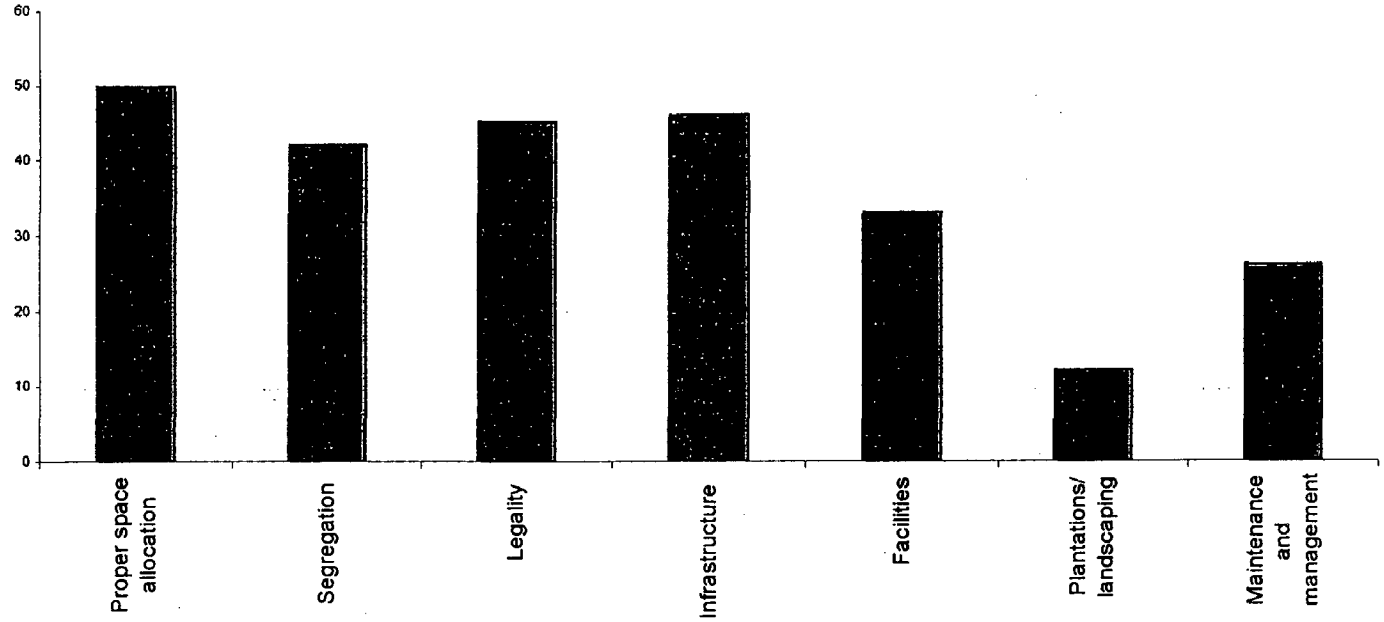


Fig 6.3 prioritization of variables for street hawkers and vendors in commercial sector

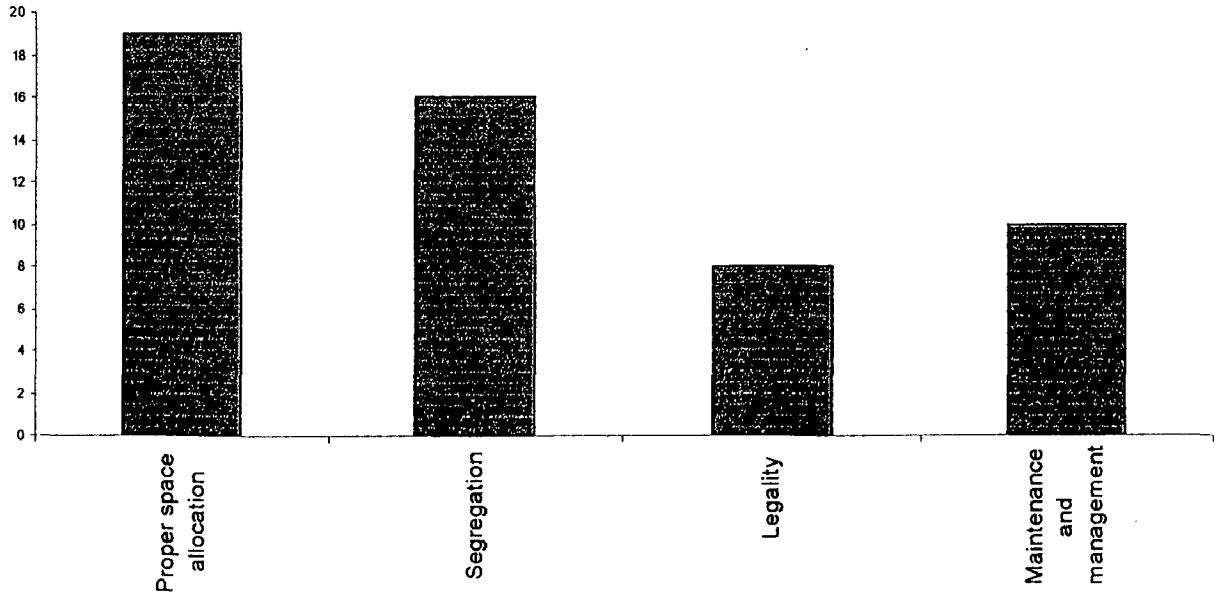


Fig 6.3 prioritization of variables for other users in commercial sector

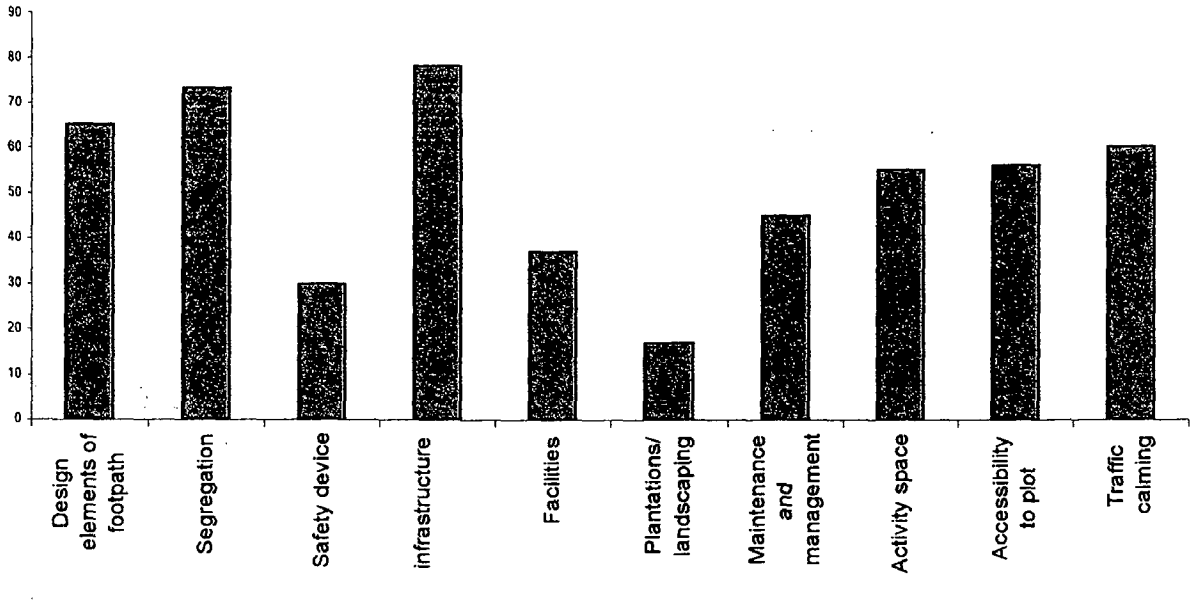


Fig 6.5 prioritization of variables for pedestrian's in residential sector

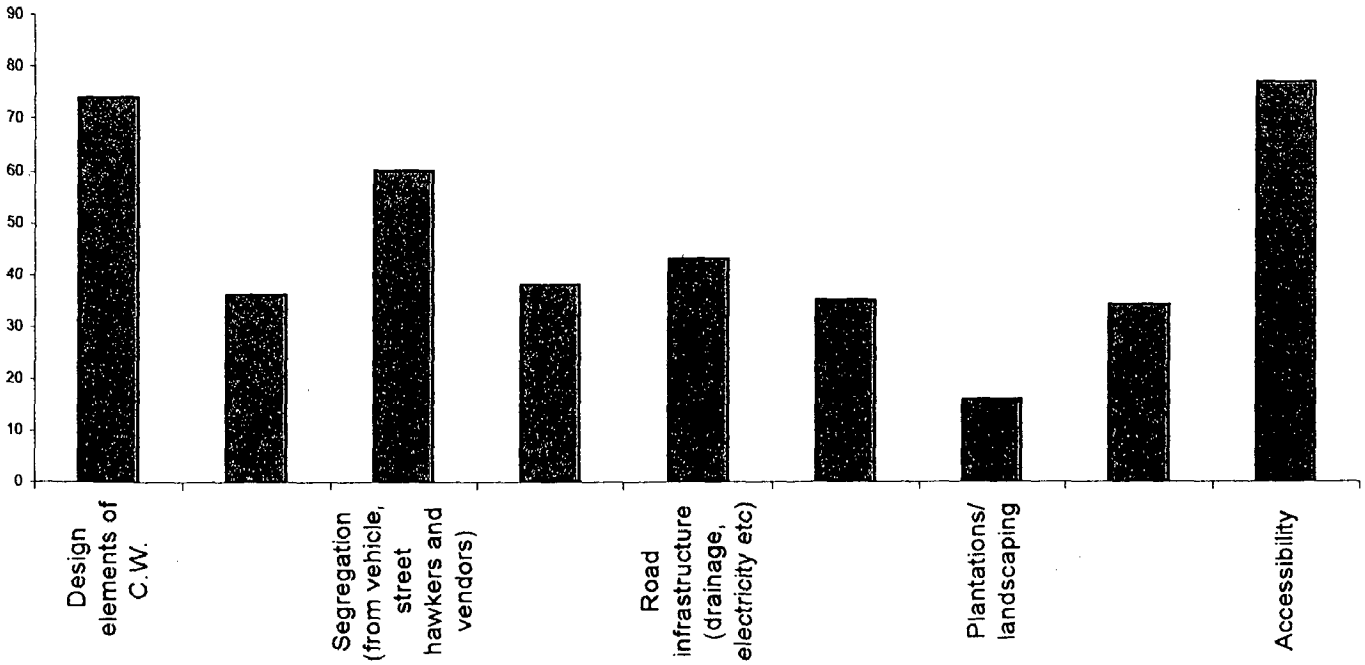


Fig 6.5 prioritization of variables for vehicles in residential sector

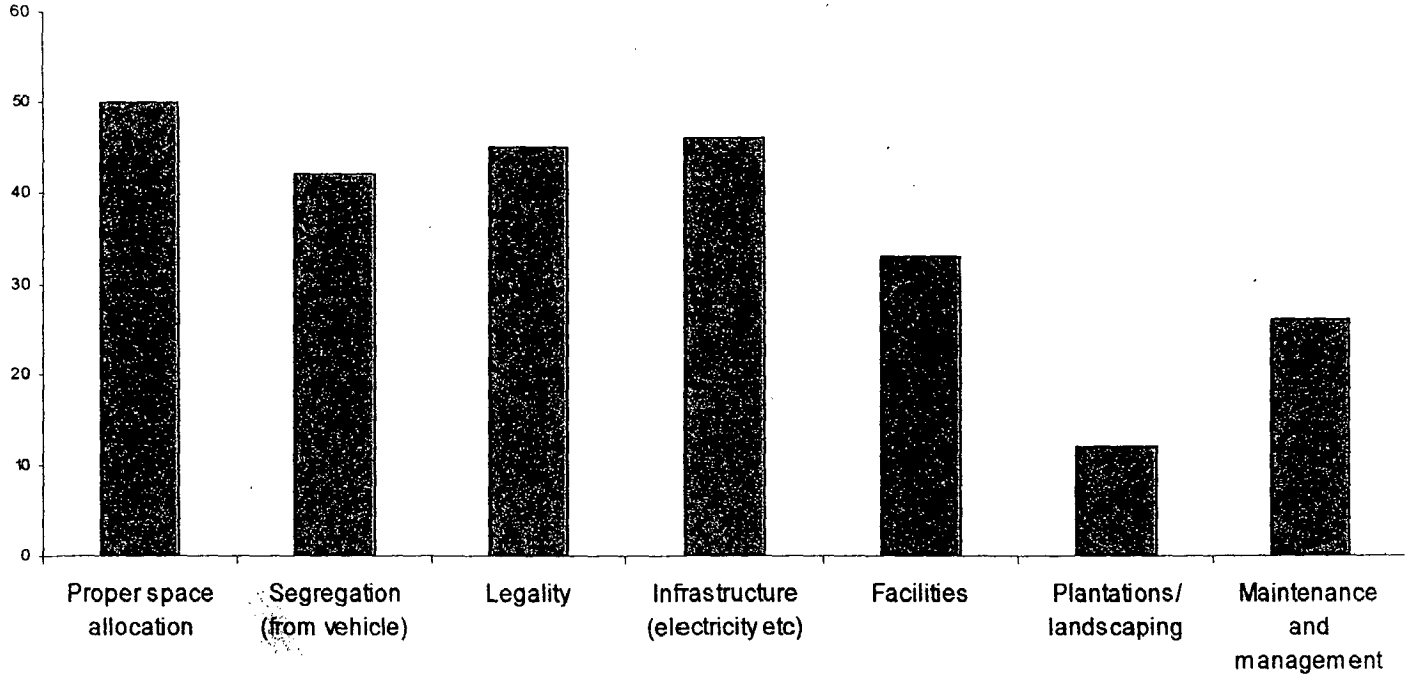


Fig 6.6 prioritization of variables for other users in residential sector

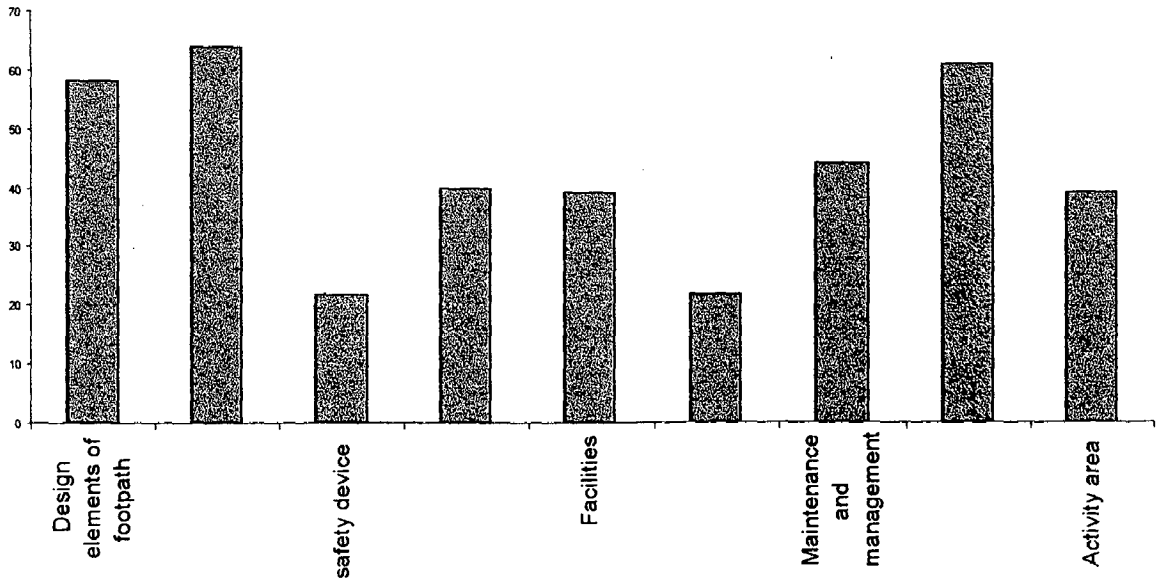


Fig 6.7 prioritization of variables for pedestrians in mixed land use sector

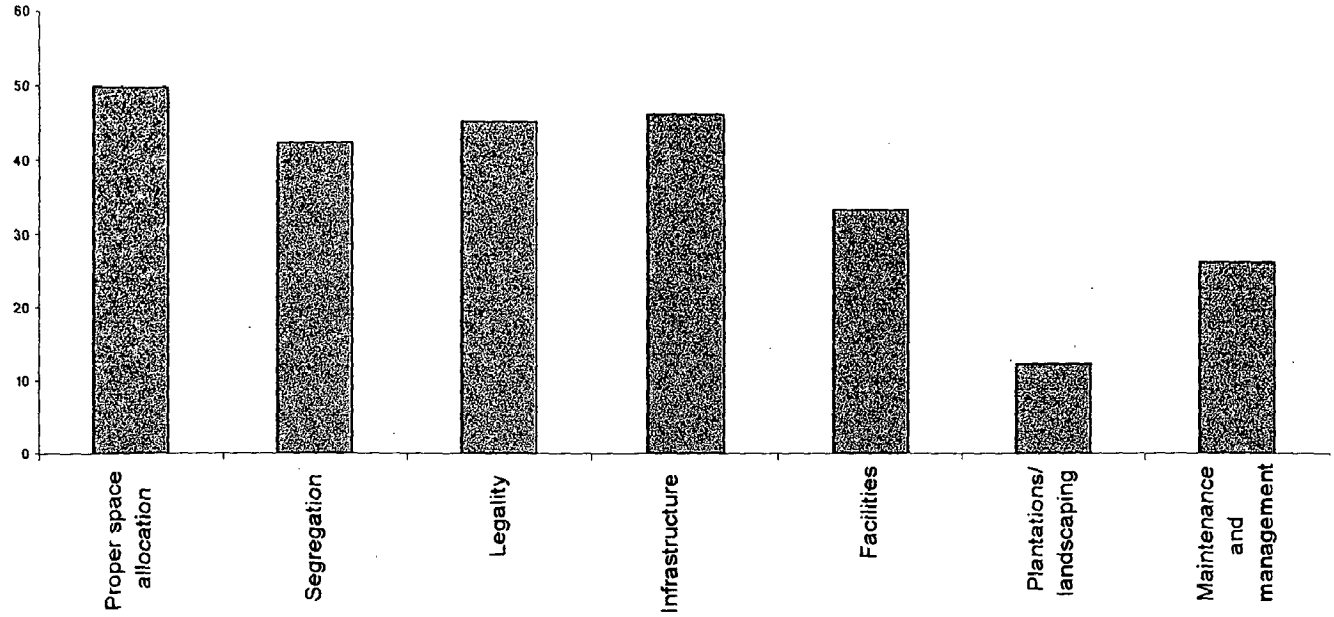


Fig 6.8 prioritization of variables for vehicles in mixed land use sector

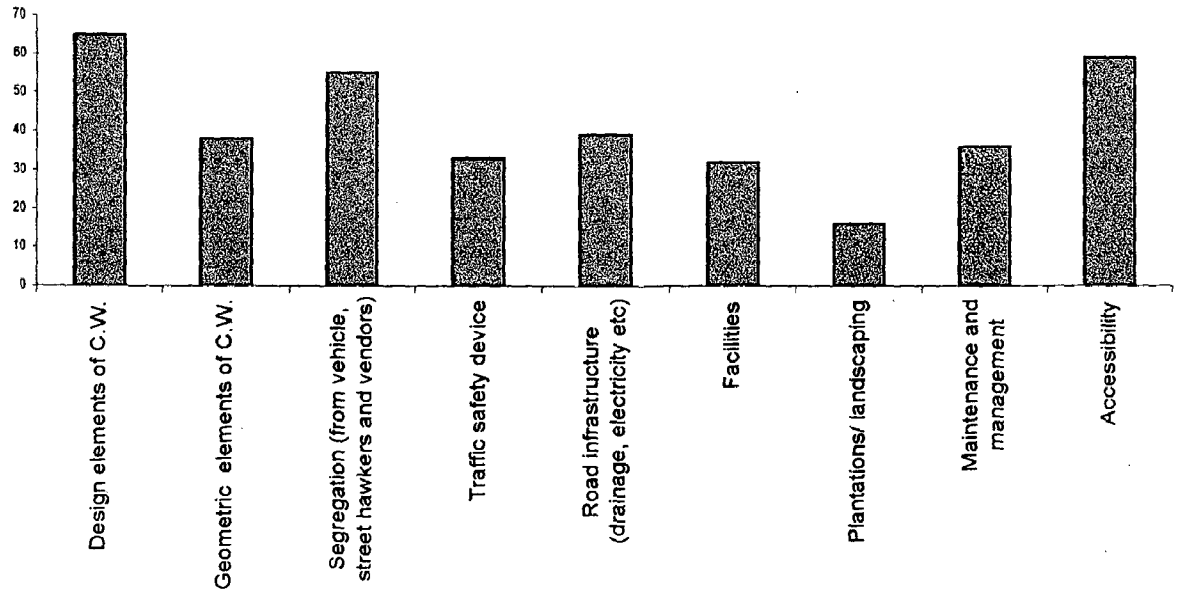


Fig 6.9 prioritization of variables for street hawkers and vendors in mixed land use sector

CHAPTER7: PROPOSALS FOR THE SELECTED STRETCH

CHAPTER7: PROPOSALS FOR THE SELECTED STRETCH

7.1 Introduction

The proposals are based on the collected data and analysis. Keeping in mind the existing Indian condition and the user needs the following proposals have been given.

7.2: Location of specific proposal

7.2.1Proposal for selected stretch of M.G. Road

Design proposals –

The cross sectional elements-

C.W. –

- On street parking from the Shajanaf intersection till Allhabad crossing should be removed so that six lane should be meant for the vehicular traffic. Out of six lanes two lanes should be provided for the slow moving vehicles and cycle rickshaw should not be allowed to move beyond the Parivartan Chowk.
- The cycle track should be constructed parallel to the carriage way at a distance of .75m from the C.W. This .75 m can be used for the installation of street furniture
- The median or the central divider should be placed from Shahjanf crossing to Allhabad crossing
- The installation of the traffic sign at proper place makes the movement easier and safe. For this the traffic sign should be installed at proper places. The following traffic signs should be placed at a distance of .5 m from the carriage way the lettering, height and color should be according to the IRC -67 (code of practices for signs)

  -Mandatory – prohibition of truck, no parking, speed limit sign of 35, probation sign of all heavy and slow moving such as Tanga, bullock carts, etc on the left hand sideof the carriage width at the entry and exit point of the street.

  -Cautionary – school signs near the school building
- Traffic signal at the Jan path market should be installed. It should have the padestrins-crossing signal also.
- Road makings such as left turn, right turn makings should be done at the intersection.
- Speed breakers in front of the school building
- The off street parking in front of the police Chowki should be removed and this can be used for the leisure center for the visitors and giving basics facilities such as drinking water, benches etc.

Vehicular users-

- Parking- the parking can be shifted TO Gandhi park for the vehicles coming from the Allhabad crossing to the Hajratgang area and for the vehicles coming form the Parivartan Chowk to Halwasiya they can be shifted to Begum Hajrat Mahal Park. And mere provision of adequate space the information regarding parking lots should be displayed through a map.
- On street parking on this lanes should be removed and the off street parking should be meant for the disabled group.
- The orange blades schemes can be followed for this street

Orange blade scheme-

-The disabled group can park for as long as they wish, where others may wait for a limited period only.

-They can park free of charge and without time limit at parking meters on street and pay and display on street parking

-They can park for three hours on single or double lines, when no waiting force restrictions are in force.

-Special sign system for them

-Lowered kerbs at adjacent footways to assist the wheelchair users.

Pedestrians-

- The footpath should follow a coherence and continuity. For this intrusion of other users should be strictly prohibited on the footways and they should be removed. The intrusions of street hawkers and vendors, parked vehicles and other users such as letter boxes etc. should be restricted.
- Pedestrians are concerned about the condition of the footways and footpath including un-evenness raised edges slipperiness broken paving slabs gaps and poor quality repairs there is a demonstrable need for the comprehensive strategy inspection and maintenance of footways and other pedestrians facilities.
- Corners of the building structures where individual might no be visible to others should removed.
- Dropped crossing to asset pedestrian and especially those with mobility impairment including those with pushchair.

Street hawkers and vendors-

- The space in between the columns can be allocated to small street hawkers and vendors in the evening the office, school etc. Compound can be used for the placing

of street hawkers and vendors the road, which are access to property that can be used for the street hawkers and vendors.

Other users-

- The road width of .75 m after the C.W should be allotted to other users such as light poles, signs etc. and the others can be restricted by bollards etc.

Traffic maintenance and management –

- The cycle rickshaw should be diverted at the Parivartan chowk and Allhabad crossing. And they should be allowed in the school hour time only
- The entrance facing towards the main street should be closed and the entrance of the Shajanaf road should be open
- The training programmed and propaganda regarding the traffic safety can be demonstrated in every two months. The cleaning and maintenance of the roads and its element should be done periodically and the adjoining property should be responsible for this.
- Penalties can put on the defaulters
- Provision of multistory parking can also solve the problem
- Proper maintenance of the roods should be done
- The restriction on the cycle rickshaw can solve the problem
- The restriction on entering into main market at the peak hour time
- The informal activities which are in the evening time they can be given place to school ground or the school ground can be used as parking space in the evening and the off street parking vcan be used as the place for informal activities
- The informal activities should be restricted in the other corridors
- The traffic laws should be followed carefully
-

7.3 Tulsidas Marg

Design detail

- The installation of the traffic sign at proper place makes the movement easier and safe. The traffic sign should be installed at proper places
- The path for the slow moving vehicles from the koneswar chowk till akabari gate is justified
- The ample width of 2.5 meter can be used as the slow moving vehicle track
- The parking place in the inner corridor

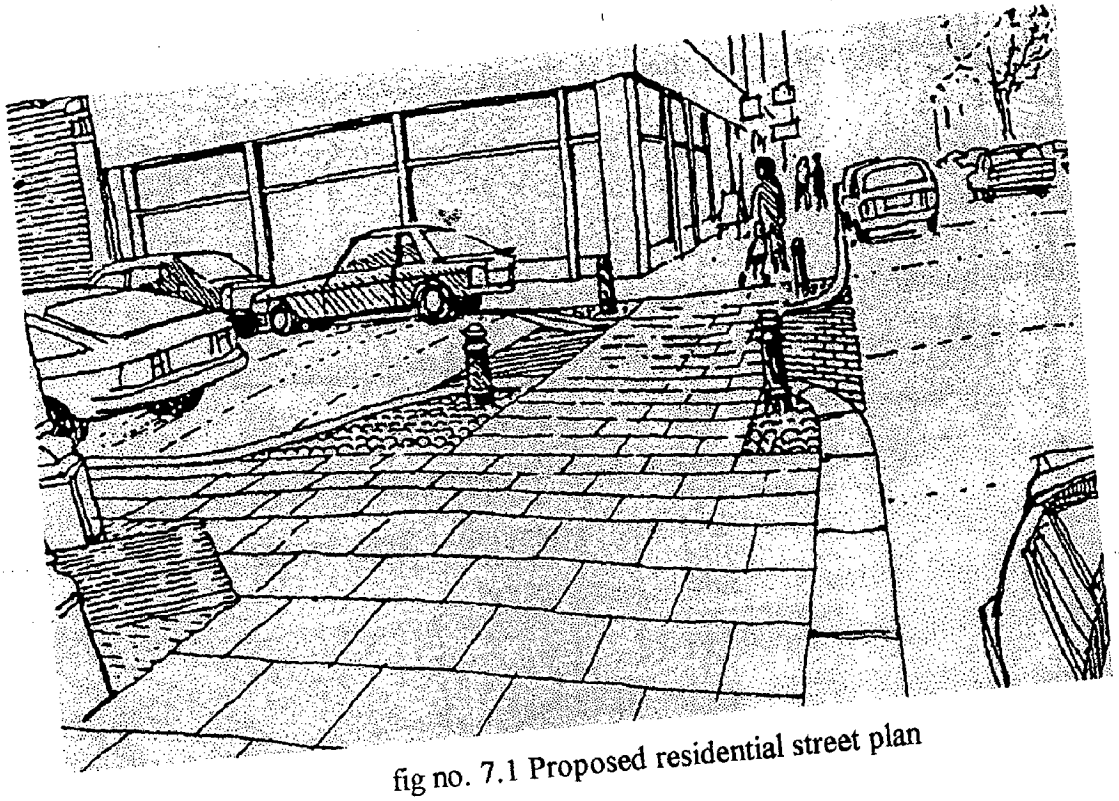


fig no. 7.1 Proposed residential street plan

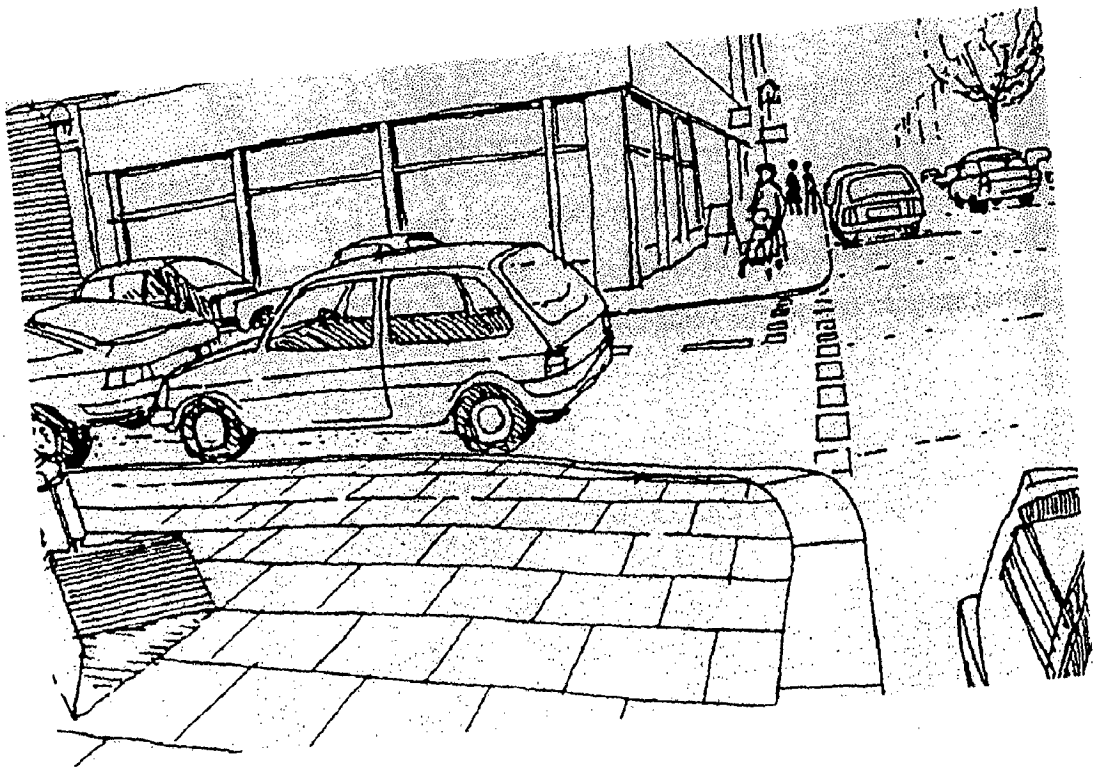


Fig n. 7.2 Existing residential street(new road)

of street hawkers and vendors the road, which are access to property that can be used for the street hawkers and vendors.

Other users-

- The road width of .75 m after the C.W should be allotted to other users such as light poles, signs etc. and the others can be restricted by bollards etc.

Traffic maintenance and management –

- The cycle rickshaw should be diverted at the Parivartan chowk and Allhabad crossing. And they should be allowed in the school hour time only
- The entrance facing towards the main street should be closed and the entrance of the Shajanaf road should be open
- The training programmed and propaganda regarding the traffic safety can be demonstrated in every two months. The cleaning and maintenance of the roads and its element should be done periodically and the adjoining property should be responsible for this.
- Penalties can put on the defaulters
- Provision of multistory parking can also solve the problem
- Proper maintenance of the roods should be done
- The restriction on the cycle rickshaw can solve the problem
- The restriction on entering into main market at the peak hour time
- The informal activities which are in the evening time they can be given place to school ground or the school ground can be used as parking space in the evening and the off street parking vcan be used as the place for informal activities
- The informal activities should be restricted in the other corridors
- The traffic laws should be followed carefully
-

7.3 Tulsidas Marg

Design detail

- The installation of the traffic sign at proper place makes the movement easier and safe. The traffic sign should be installed at proper places
- The path for the slow moving vehicles from the koneswar chowk till akabari gate is justified
- The ample width of 2.5 meter can be used as the slow moving vehicle track
- The parking place in the inner corridor

- ❖ Provision of multistory parking can also solve the problem
- ❖ The other users has also be considered
- ❖ Proper maintenance of the roads should be done
- ❖ The intersection signal at the akbari gate market should be installed
- ❖ The informal activities should be restricted in the other corridords
- ❖ The traffic laws should be followed carefully
- ❖ The propaganda regarding the traffic should be encouraged with the help of media
- ❖ The place on the footpath itself can be made for leisure
- ❖ The encroached footpath should be removed and proper maintenance should be done
- ❖ The speed breakers should be placed at the proper interval

7.4 Kaporthala Market

Design detail

- ❖ The installation of the traffic sign at proper place make the movement easier and safe . The traffic sign should be installed at proper places
- ❖ The open area should be used as the parking area and the parking from the front of the shops and complexes can be removed and they can used as the footpath
- ❖ The other users has also b considered
- ❖ Proper maintenance of the roads should be done
- ❖ The restriction on entering into main market at the peak hour time
- ❖ The street hawkers and vendors can be moved in the square of the building complexes
- ❖ The intersection signal at the Indian oil chauraha
- ❖ The informal activities should be restricted in the other corridors
- ❖ The traffic laws should be followed carefully
- ❖ The propaganda regarding the traffic should be encouraged with the help of media
- ❖ The place in front of the market square can be developed as the leisure area with the place for informal activities
- ❖ The placement of proper street furniture like dustbins etc should be placed at required place

7.5 Akbari Gate

Design detail

- ❖ The installation of the traffic sign at proper place makes the movement easier and safe. The traffic sign should be installed at proper places
- ❖ The area should be pedestrian fully and the traffic can be shifted to the tulsidas marg and the parking place should be placed outside the gate

7.6 Kapoortahla Residential

- Footpath should be designed
- Speed breakers placed near the adjoining of the road to the main road
- The bollards should be placed for the restriction of the other vehicles in the area
- The shared facilities of footpath and cycle track can be used in this zone
- The installation of the traffic sign at proper plce makes the movement easier and safe.
- The traffic sign should be installed at proper places
- The other users has also be considered
- Proper maintenance of the roads should be done
- The traffic laws should be followed carefully
- The propaganda regarding the traffic should be encouraged with the help of media

7.7 Chowk Residential Area

- ❖ The installation of the traffic sign at proper plce makes the movement easier and safe. The traffic sign should be installed at proper places

For residential areas to restrict the vehicular movement the fig. 7.1 Shows the ways.

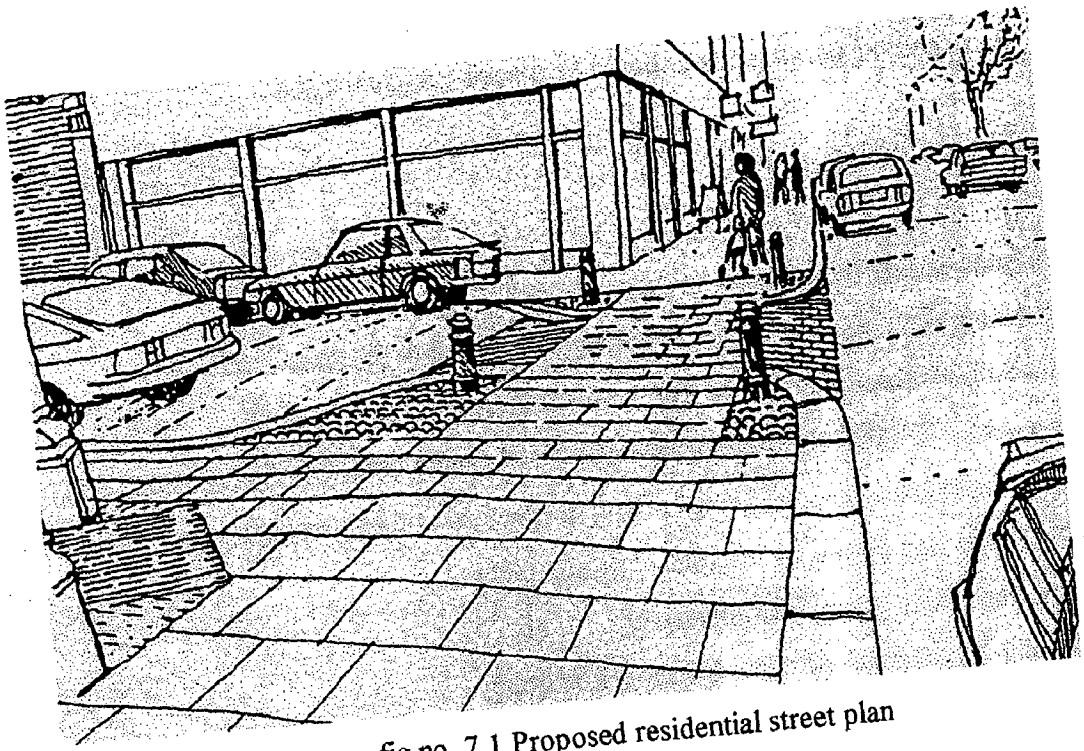


fig no. 7.1 Proposed residential street plan

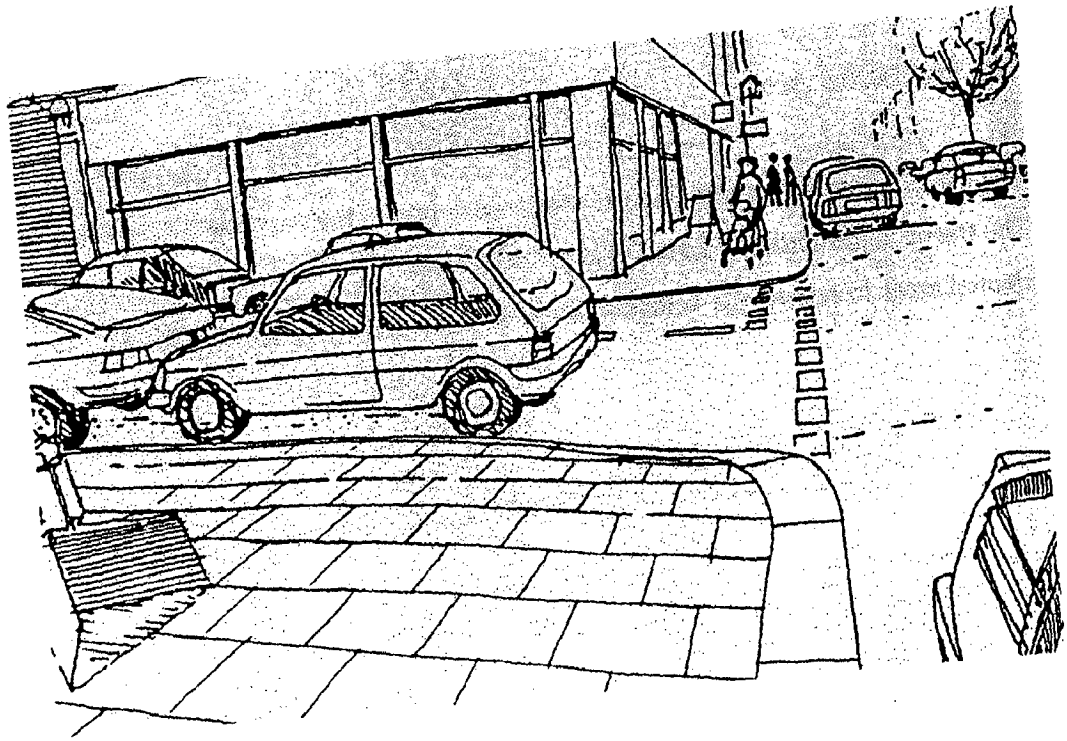
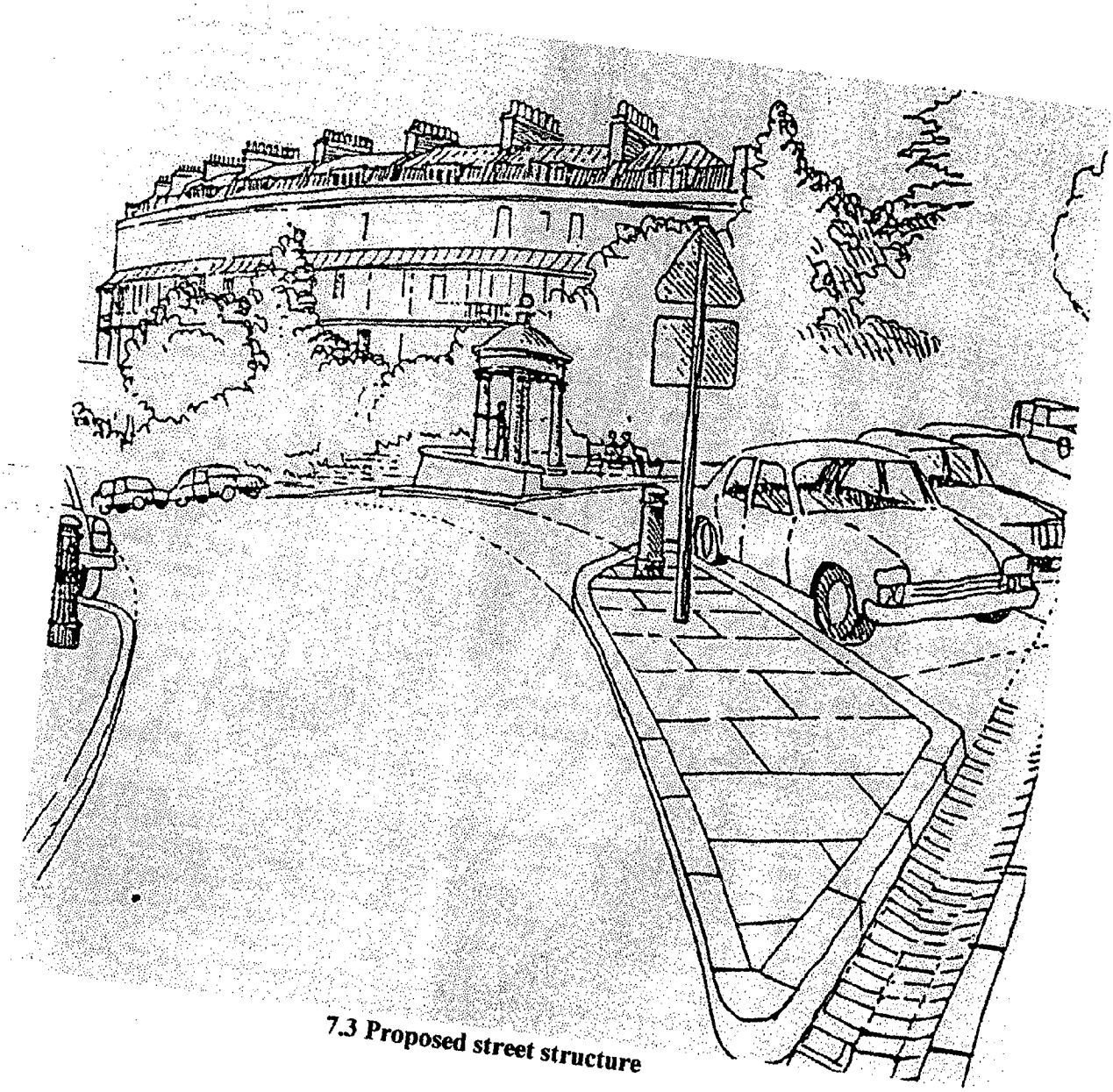
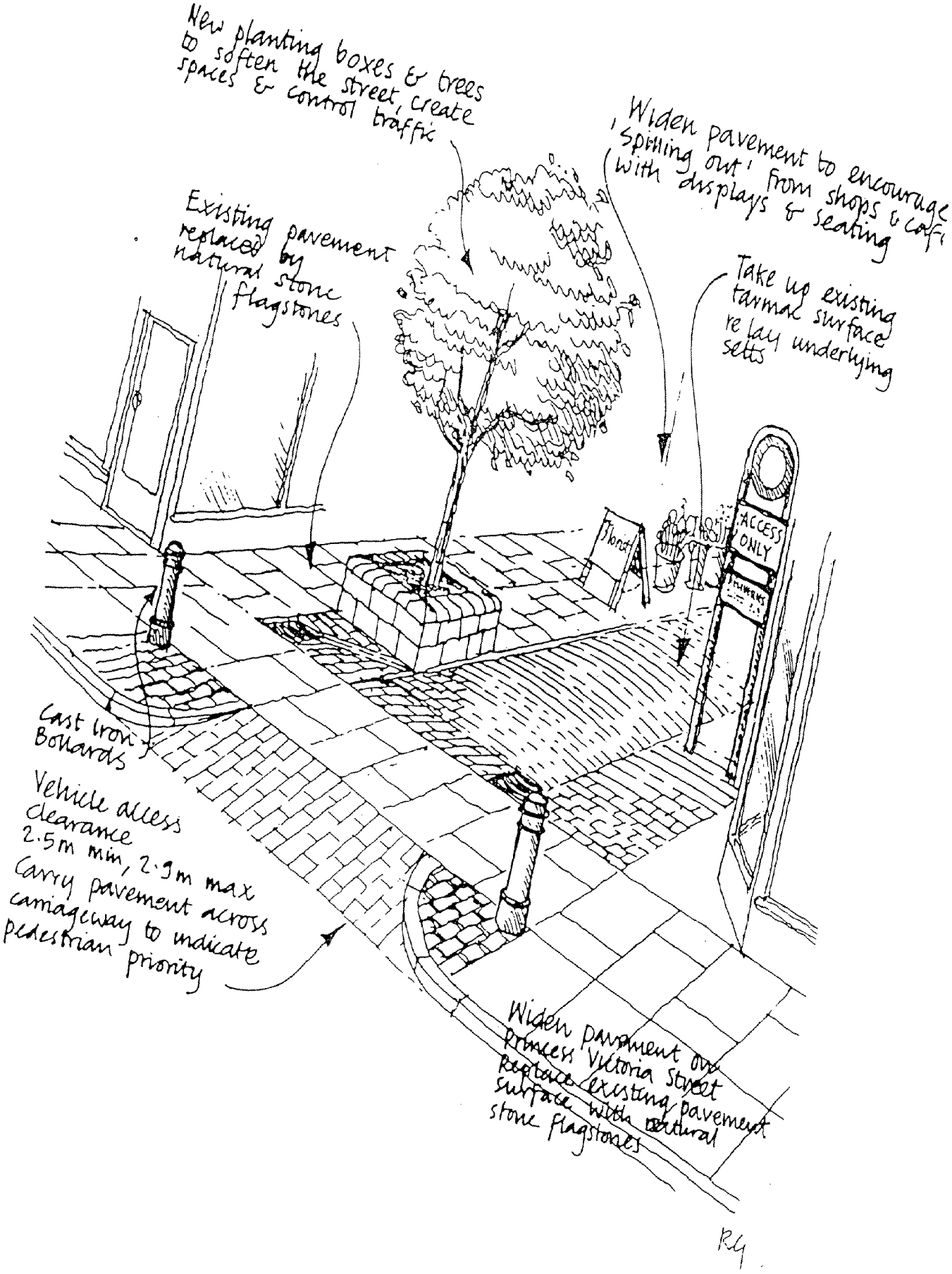
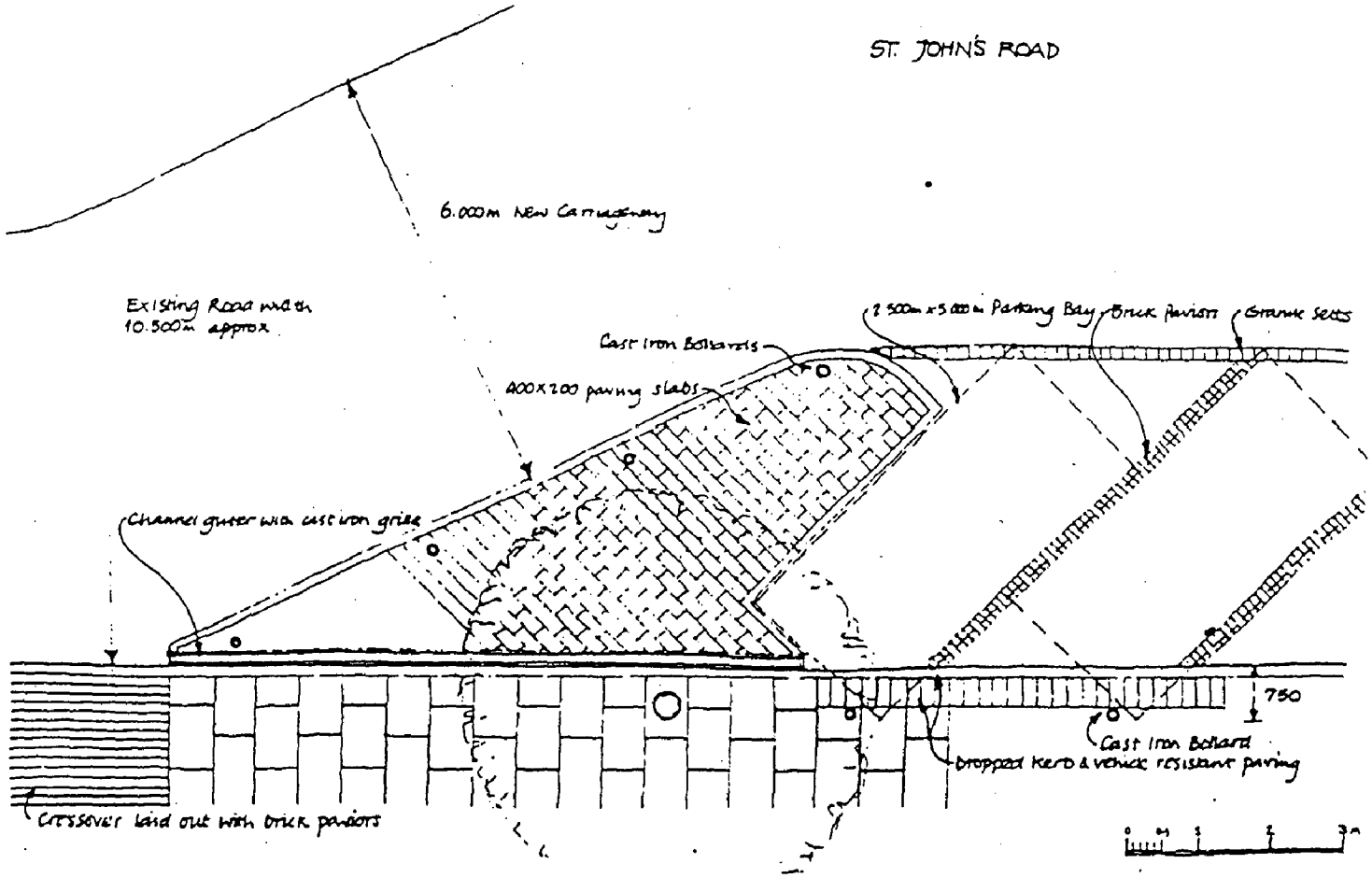


Fig n. 7.2 Existing residential street(new road)



7.3 Proposed street structure


New planting boxes & trees to soften the street, create spaces & control traffic
Widen pavement to encourage 'spilling out' from shops & cafe with displays & seating
Existing pavement replaced by natural stone flagstones
Take up existing tarmac surface re lay underlying setts
ACCESS ONLY
Cast Iron Bollards
Vehicle access clearance 2.5m min, 2.9m max
Carry pavement across carriageway to indicate pedestrian priority
Widen pavement on Princess Victoria Street
Replace existing pavement surface with natural stone flagstones
RG


ST. JOHN'S ROAD
6.000m New Carriageway
Existing Road width
10.500m approx
Cast Iron Bollards
400x200 paving slabs
Channel gutter with cast iron grille
Crossover laid out with brick paviors
750
Cast Iron Bollard
dropped kerb & vehicle resistant paving

CHAPTER8: RECOMMENDATIONS

8.1 Introductions

As in the previous chapters the characteristics of the urban road users and their problem have been identified. The discussion on their requirements and priorities has been dealt. these recommendations are applicable to other urban roads also, which are having the same road users. before giving the recommendation following parameters have been considered:

- The most important characteristics of the roads design are that they are land use specific. The users and their priorities in different land use sectors are different.
- Any proposals related to the design and planning of urban roads user needs has to be economically viable and practically applicable taking account of the physical conditions and existing resources.
- The safety and security, convenience, environment, cost and socio –economic benefits are taken as the primary parameter in deciding the priorities of the users of the urban roads.
- The sustainability of the design and planning measures of urban roads.
- facilities for disabled and elderly persons needs are also kept in mind while giving the design and planning measures for urban roads.

keeping all the aspect in the mind the recommendation has been given in three sections: design and planning of different users, financial prospects and legislative measures.

8.2 land use planning measures

- Priorities should be given to the to the public transport system in case of the dense development areas in case of the private vehicles
- Promoting pedestrianization and cycling by making pedestrians route and cycle routes with in the city and giving priorities to its user.
- Encouraging flexible hours to reduce peak period demand for travel and resulting congestion. Schools hours can be very conveniently planned to be sufficiently away form office hours
- Functional dispersal of business, commerce and commercial traffic.
- Encouraging development densities as higher journey may encourage shorter journeys and thus use of walking and cycling

- ❖ Increasing developers contributions for transport infrastructure, including public transport
- ❖ Controlling building line, set back distances, control line and height of building needs to be enforced strictly and timely.

8.2 design proposals for different street in different sector

Commercial sectors

- **Infrastructure facilities**
- Pedestrian's facilities
- Cycle routes
- Guided buses s
- Management measures
- Car sharing
- Bus priorities
- Controlling building line, set back distances, control line and height of building needs to be enforced strictly and timely.
- Municipal committees should be made responsible to maintain cleanliness and up-keep of areas between main road and service road, drains, parking, sign boards, etc. by adopting available means with them, i.e., either by regulation, education and motivation or by involving local inhabitants.

8.2.1 Role of private participation:

There are various incentives are also given to private parties listed in chapter –3

Lots of projects have been succeed by this scheme. Following points be implemented by government to attract private financing:

- Political and government support to private investor in land acquisition of right of way and protection from the risk of hampering construction by interested parties midway of the project completion.
- Transfer of assets to be completed. private entrepreneur to have full ownerships over the assets, which has created by him for the entire duration of concession period.
- Government should make the people aware through media about prospects of road development and ensure their willingness to pay for such facilities to the private entrepreneurs.

8.3 Pedestrians and cyclist

- Adequate widths and special routes often giving priorities to pedestrian and cyclist and slow vehicles user should be planned
- Central islands and clearly designated crossing arrangement
- Footways that maintain the same level at formal pedestrian crossing such as flat topped road humps
- Designated cycle facilities through out routes and as bypass at pinch points
- Arrangements to make access for mobility impaired people as easy as possible
- The introduction of traffic calming measures should be provide facilities to assist and protect vulnerable road users such as children the elderly and mobility impaired people
- Emergency services -consultation required with the emergency services for roads humps zone sign should be erected in to area and should be normally used in conjunction with the creation of gateways
- Zones should be not tot large and should impede access to hospitals and fire station
- There should be alternatives routes available for through traffic speed control in the zones should be self enforcing special sign at the entrance of the and at eth exist of the zones should be erected
- Enforcement of the speed limit cameras
- Site consideration should be examined carefully in this some of the factor such as-

    1. A history of speed relate accidents
    2. Police agreement on site location and operation
    3. Large no. of vehicle traveling in excess of the speed limits
    4. Site condition which would affect such as gradients , the presence of the parked cars

- Special carriageway markings should be laid near camera for the checking of tit by the police.

8.4 Pedestrians only

- A complete transportation strategy would include the development and maintenance of a comprehensive safe, well signed and well lit network of pedestrians routes providing easy access to major attraction
- Pedestrians are concerned about the condition of the footways and footpath including un-evens ness raised edges slipperiness broken paving slabs gaps and poor quality repairs there is a demonstrable need for the comprehensive strategy inspection and maintenance of footways and other pedestrians facilities
- All pedestrian are should be inspected at regular interval the strategy should identify the materials which are bi\both economical and appropriate to the location and use of pavement
- Developing pedestrians network
- Pedestrian network should be p[planned carefully and implemented incrementally they should be related to cycling and should be incorporated with town centers strategies unlike vehicles the pedestrians dories not confine to themselves to specific routes but rather follow the shortest routes and direct path min width of 1,.8 meter should be there
- most of the pedestrian's journeys begins and ends in the building or transport interchanges the relationship between the entrances to the buildings and pedestrians network is of particular significance
- Change in level should be avoided the quality of the street scenes is important this should be planned so as to allow both close and distant views of features of interest
- The boundary of the footways should be of high quality
- Pedestrians tend to be concerned about the personnel security routes should be developed that will be used by reasonably substantial and predicts the flow of the pedestrians
- Corners of the building structures where individual might no be visible to others should be avoided
- Key pedestrian destination and the quest route to them should be signed a carefully demonstrating wide system
- Dropped crossing to asset pedestrian and especially those with mobility impairment including those with push chair

- To allow vehicles to gain access across footways into building or onto land care should be taken to assist people with visual impairment and dropped kerb at the crossing

8.5 Cycling

- A good cycle network having the coherence, directness, attractiveness safety and comfort

Coherence means the cycle infrastructure should form a coherent entity linking major trips origin and destination routes should be continuous and constituents

- Routes should be direct as possible
- Routes should attractive with good lighting personnel safety aesthesis and integration with the surrounding area are important
- Safety design should be minimum causalities and perceived danger for the cyclist' well maintained surface
- Cycle network should be planned on seeing traffic network
- Quickest route
- The surface smooth macro texture to give comfortable rides
- Color different to distinguish between the cycle path materials with gravel content should be avoided red has been commonly chose to indicate the cycle lanes
- Efficient drainage e system well constructed and maintained gullies
- Provision should be made for regular cleaning of the surface
- Cyclist dismount sign for e.g give way to the cycle
- Raised rib kerb marking safety of the cyclist
- Training publicity and promotion promoting cycling
- Traffic claming measures
- Cycle by pass also incorporated into signal controlled junction
- Staggered stop lines where the cycle lane is continued one or two meters ahead of the main stop line but without widened reservoir
- Where space permits the cycle track should be away from the carriageway by 2-3 meters

8.6 Cyclist And Pedestrians

- If no satisfactory on carriageway solution can be found it may be appropriate to used the shared facilities.
- The cycle with pedestrians is not always desirable they can be combine shared at some particular hour
- Cycle parking
- God quality of the cycle parking will encourage the cycle use and low payment
- Residential area can have the shared facilities

8.7 Enforcement

- Compliance with the traffic regulation by road users is essential for road safety and efficiency of movement little enforcement is required where the disadvantage of breaking traffic regulations are significant and obvious, such as driving against the prescribed direction of flow in a busy one way street or driving through a substantial road closure barrier such regulations are refereed as the self enforcing compliance with the traffic regulations where not self enforcing depends largely on drivers perception of the risks and implication of being subjected to enforcement action
- Deterrence can also be enhanced by makings the penalties for contravention severe
- Policy issue

The increase in traffic volumes with its associated adverse effects on traffic flow, road safety and the quality of the environment has led to a reassessment of transport policy the responsibility for introducing traffic regulation lies with the local authorities while police should be responsible for the enforcement of such regulations the problems of the drinking and driving has been tackled by the combination of media campaigns and police enforcement etc. they are funded by the department of transport the education regarding the traffic rules and traffic weak campaign

- Legislative responsibly
- The police and the traffic wardens are primary responsible for the enforcing the traffic regulations, including waiting and loading restrictions they should be given power to issue and fixed penalty notices

- Enforcement of speeds limits

Video cameras, hand held radar etc should be used

Enforcement of parking regulation

Design issue

- Traffic calming schemes such as speed humps, speed tables , rumble strip which make difficult to driver to traveled at excessive speed
- guard railing raised to discourage the illegal kerb side parking
- Clear sign and road making are necessary for the drivers and other traffic users to under stand the traffic regulations and to handle by them
- Particular attention should be paid to design and maintenance and instillations of the mandatory, regulatory and warning signs

8..8 Financial Consideration

- This can quantified in terms of the reduction in accidents and other benefits revenue consideration should no determine policy but need to be considered together with the benefits of achieving compliance in deciding on the appropriate level of resources to be allocated to traffic and parking enforcement
- Seating transport policy
- Reduction of traffic congestion
- Enhanced quality and choice in the provision of public transport services
- Reduction in the no, of the personnel injuries
- Enhancement of the attractiveness of less environmentally damaging modes particularly cycling and walking making it easier for the people to switch between different forms of the transport
- Improvement of the provision for the needs of the people, pedestrians pedal cyclist and other vulnerable road users
- They should be accessible, economic efficiency and economic generation
- Environmental protection
- Equity
- Financial
- Practicability
- Safety and security
- Sustainability

8.9 Residential development

- Housing courts can be planned
- People with disabled person design of the shared surface access roads meant for the disabled person
- Vehicular aces to development sites]
- First the traffic capacity of the roads should be seen and alternatively the vehicles are allowed to move at junction special consideration should be given
- Cul-de-sac also provide security as the house overlook each other traffic speeds
- Drives need to aware of the
- Provision for the cyclist and pedestrians
- Sufficient no of parking space for the person living in the residences

8.10 Conclusion

To understand and solve the problems related to design and planning of urban roads for uses needs, a sincere effort is required this is because of its different users having different types of needs

From all the studies, it can be proved that problem can be solved through planning proposal and proposal can be made into reality if

- The laws are framed, enacted and implemented.
- There is an integrated planning done.
- Financial viability is seen.
- A single separate organization at national level and state level is setup to plan, implement, and enforce highway roadside development.
- Privatisationis actively involved etc.

Now that groundwork for the entry of private sector has been laid, the government is busy working on feasibility study and tender conditions. Some MOUs have all ready been signed for bypasses and bridges and new era of traveling on roads after paying the tolls or as worked out.

Appendix –1

(Glossary of terms)

1. Cross sectional elements

- **Edge strips/ marginal strips**

Besides providing lateral support to the pavement, edge strips/marginal strips enhance comfort in driving and provide lateral space for the errand vehicle to safe manoeuvre to the lane. The values are-

-.5m on the outer/ verge side, followed by paved/hard shoulder.

-.7 m on the median side on Indian road.

- **Shoulders/paved and verge**

The shoulder is that pat of the roadway contiguous with the travelled way and is intended for accommodation of stopped vehicles, emergency use and lateral support of base and surface course.

1. Paved shoulder- paved shoulder of 2.7 meter and standing vehicle maintain a distance of .3m to .6 m from the running vehicle

Recommended width of paved shoulders including edge/ marginal strips

- On verge side a width of min. 3.0 m and desirable 3.5m
- On median side a width of min.7m and desirable 1.2m

- **Verge (earth shoulder)**

Verge as the extension of the roads way beyond the paved shoulder, provides lateral support to the paved shoulder and also space to accommodate safety barriers, signs etc.

Recommended usable verge widths are-

-On fill minimum width of 1.5 and a desirable width 2.0m to 2.5mm depending on the requirement of the roadside appurtenances

- **Central reservations (median)**

It is the longitudinal space separating dual carriageway in opposite direction. The median width is expressed as the dimension between the through lanes edges including the paved/hard shoulder. Median width based on the requirement of barrier or without barrier and future widening consideration are in urban areas are 5.0 meters (desirable) and min. is 1.2m in India.

In America min value is 1.2 m.

Raised medians with mountable curbs may be provided in urban areas. Suitable railings/ crash barrier shall be provided. Narrow medians should be paved and wider medians should be surfed and lightly planted, using plant species which might not cause interference with the water balance in the pavement sub grade system.

❖ **Right of width**

The road land width or the width secured and preserved to the public for other purposes. The R.O.W accommodates all that makes the cross section of the road.

❖ **Building line**

It is gap between the R.O.W. and the building or it is a line prescribing the nearest limits of the future buildings in relation to the road. It should be wide enough not only as a measure of spatial insulation, but also to accommodate frontage roads to serve the presents or future connectivity needs.

❖ **Control line**

It is a line, which represents the nearest limit of the uncontrolled building activities in relation to the road. This signifies that the building activity is not banned between the building line and control line; the nature of the buildings permitted is controlled.

❖ **Control of access**

Cross road at near intervals impede the safe movement of traffic and control of access checks it.

Standards for building lines, control line and control of access

S.N.	Type of street	Building line (m)	Control line (m)	Control of access
1	Sub arterial street	2-5	5-10	300
2	Collector street	2-5	5-10	150
3	Local street	2-5	5-10	Free access

Source L.R. Kadiyali 2000 "traffic and transportation engineering

❖ **Parking lanes**

Parking lanes are provided on roads to allow kerb parking. 3.0 meter width is required for parking.

❖ **Lay byes**

They are provided near public convenience to enable the drivers to stop off the carriageway. They are normally 3.0m widths and at least 30 m length with 15 m tapers on both sides

❖ **Bus bays**

They are provided by recessing the kerbs to avoid conflict with moving traffic.they are located at least 75 m away from intersections

- ❖ Horizontal alignment

Side friction factor

The coefficient of friction, f is defined as the friction force divided by the mass perpendicular to the pavement. This depends on the speed of the vehicle, tyres condition, and type of the pavement surface.

Table no. –8 sight distances

Design speeds (kmph)	50	60	80	100
Side friction factor	.16	.15	.14	.12

Source: high way eng. By Justo and Khanna

- ❖ Cross fall and super elevation

1. Cross fall or camber

Cross fall is the slope of the surface of a carriageway measured normal to the centre line to drain off the water from the road surface.

Table no. 9 Cross fall on carriageway

S.N.	Surface type	For rainfall	
		>=100 cm.	<100 cm.
1	High type bituminous surfacing	2.5%	2.00%
2	Concrete pavement	2.00%	2.00%
3	Thin bituminous surfacing	2.75%	2.50%
4	Water bound macadam, gravel, earth	4.00%	3.00%

Source: high way eng. By Justo and Khanna

In abroad the min. cross fall is 2.5% and max. Cross fall is 2.0%

2. Super elevation

In order to counteract the effect of the centrifugal force and to reduce the tendency of the vehicle to overturn the outer edge of the pavement is raised to inner edge, thus providing a transverse slope through out the length of the horizontal curve.

Table no. 10 camber on carriageway

Camber	Radius in meter for the design speed (kmph) of					
Design speed (kmph)	20	25	30	40	50	60
4%	50	70	140	180	280	470
3%	60	90	180	240	370	620
2.5%	70	110	220	280	450	750
2%	90	140	270	350	550	950

Source: high way eng. By Justo and Khanna

- Kerbs

A kerb is the vertical or sloping member along the edge of a pavement or shoulder forming a part of gutt(165 mm or protecting the edge, and clearly defines the edge to vehicle operators.

- Lateral and vertical clearances

1. Lateral clearance is the distance between the extreme edges of carriageway to the face of the structure.

Table no. 11 design standard for lateral clearance in India

	On divided carriage way		On non divided carriage way	
Types of street	Pavement with foot path	Pavement without footpath	Pavement with foot path	Pavement without footpath
Sub arterial	No extra clearance	Left-1m Right-1 m from edge of pavement	No extra clearance	Left-1m Right-1 m from edge of pavement
Collector and local street	No extra clearance	Left-.5m Right-.5 m from	No extra clearance	Left-.5m Right-.5 m from

		edge of pavement		edge of pavement

Source IRC-541974

Lateral clearance in abroad depends on the design speed and cross fall.

2. Vertical clearance is the height above the highest point of the travelled way to the lowest point of the overhead structure. Min. vertical clearance is 2.5 m. In abroad it is min. 5m.

❖ **Some technical term**

- Time cycle

The total time period required for one complete sequence of signal indications

- Traffic phase

A part of the time cycle allocated to any traffic movement receiving the right of way or to any combination of traffic movements receiving the rights of way simultaneously during one or more intervals.

- Vehicular phase

A traffic phase allocated to vehicular phase

- Pedestrians phase

Traffic phase allocated to pedestrians.

- Green signal

Traffic facing green signal are allowed to move in the pointed direction

- Red signal

Traffic facing red signal shall stop at clearly marked stop line

- Amber signal

They traffic facing amber signal are warned that the related signal is going to get red

- Pedestrian signal

Movements of the pedestrians are controlled through this.

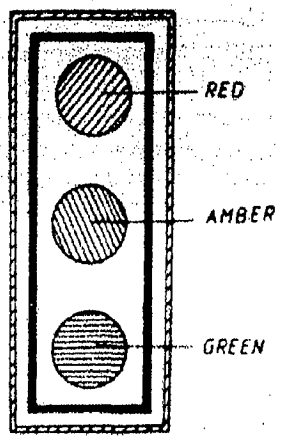


Fig no. 18 Signal Face

Traffic signal should be installed when certain warrants are required. These warrants establish the specific conditions and operational situations under which a traffic sign is necessary. The following are the warrants for use in according to the need for traffic signal.

1. Warrant 1 minimum vehicular volume

The traffic volume on the major street and the higher volume minor street for each of any 8' hours of an average day for the warrant 1 should be equal to the values indicated below:

Table no.14 Min. vehicular volume for installation of warrant 1

S.n.	No. of lanes on each approach		Vehicles per hour on major street	Vehicles per hour on minor street
	Major street	Minor street	p.c.u	p.c.u
1	1	1	650	200
2	2 or more	1	800	200
3	2 or more	2 or more	800	250
4	1	2 or more	650	250

Source IRC93-1985

2. Warrant-2 no interruption of continuous traffic

The traffic volume on the major street and the higher volume minor street for each of any 8 hours of an average day should be equal to the values indicate below:

Table no 15 Interruption of Continuous Flow for Warrant 2

No. of lanes on each approach		*Veh. per hour on major street (both Directions)*	*Veh. per hour on minor street (one direction only)*
Major street	*Minor street*		
1	1	1000	100
2.or more	1	1200	100
2 or more	2 or more	1200	150
1	2 or more	1000	150

Source IRC93-1985

3. Warrant 3 minimum pedestrians volume

	Spacing in Straight section	50-60 m.
	Spacing in curved section	Depends on the radius of the curved section. For 30 m radius 6 meters and for 1000 meters radius its 50 meters
	Distance from the kerb	50 cm.
1.2	Hazard Markers	Fig no. 24
	Function	Intended to define the objects like guard rails and abutments adjacent to the carriage way
	Shape	Rectangular
	Size	90*30 cm.
	Height	30 cm. from the ground
	Distance from the kerb	50 cm.
1.3	Object markers	Fig. No. 25
	Function	To indicate the obstruction in the vehicle path e.g. Mark Channel sing island close to intersection
	Shape	Triangular
	Size	30*30cm.
	Height	40-50cm
	Distance from the kerb	50 cm.
2	Speed controllers	
2.1	Speed breakers	Fig no. 26
	Function	Speed control humps used near the schools and universities where the speed is to restrict.
2.2	Rumble strips	Fig. No. 27
	Function	Speed controller's strips produce noises causing sensation to the drivers.
	Spacing	At a distance about 100 m.
3.	Barriers	
3.1	Guard-rails	Fig no. 28
	Function	Guides pedestrians to subways, footbridges and surface crossings and for preventing them from spilling into the carriageway.
	Distance from the	50 cm.

For each of any hour of any 8 hours of an average day the following traffic volume must exist. On the major street, 600 or more vehicles per hour enter the intersection (both approaches) ; or where there is a raised median island 1.2 m or more in width, 1000 or more vehicles per hour (both directions) enter the intersection.

4. Warrant 4 school crossing

This is near the school vicinity.

5. Warrant 5 progressive movements.

6. Warrant 6accident experience

Five or more reported accidents, of types susceptible of correction by traffic signal control have occurred within a period of 12 months, each accident involving personal injury or property damage to an apparent extent of Rs. 2000 or more.

7. Warrant 7encouragement of concentration and organization of traffic floe network

The minimum traffic flows for which the signals are justified are according to UK norms

Table no.16 Min. vehicular volume for installation of traffic signal in U.K.

S.N.	Type of area	Average hourly flow in V.P.H. to exceed	
		Total entering intersection	Total contribution from side roads
1	Large urban area	500	150
2	Sub urban and small area	400	125

Source traffic eng. By L.R. Kadiyali

Table no.20 other safety devices

S.N.		
1	Visual marks	
1.1	Delineators	Fig .no 23
	Function	Provide visual aids to the driver concerning the alignment of the road, especially at night.
	Shape	Curved section and straight section
	Features	Distance
	Section	84cm.*10 cm

	kerb	
	Height	121 cm.
	Location	Hazardous location, at junction/ at intersection, school, bus stops, / railway station, / overpass/ subways/ central reserve.
3.2	Safety Barriers	
	Function	To prevent vehicles accidentally leaving the carriageway.
3.3	Barricades and Channelisers	Fig no. 29
	function	To control and divert traffic on construction zones and temporary diversions.
3.4	Traffic Attenuators	Fig no. 30
	Function	Absorbs the energy of impact of vehicles that go out of control.

Modified from IRC-code no79, . And traffic eng. By L.R.Kadiyali

Appendix –ii

Space standard for R.O.W. urban roads

S.N.	Category of road(India)	Minimum space (m)	Category of road (Abroad)	Minimum space (m)
1	Sub arterial street (4-lane divided)	30-40	Primary distributors	40
2	Collector street (4 lane divided)	20-30	District distributors	Residential-12 Commercial-21 (without cycle track)
3	Local street	10-20	Local	12-18

Modified from-IRC -86 -1983 and roads in urban areas

Table no. –8 sight distances

Design speeds (kmph)	50	60	80	100
Side friction factor	.16	.15	.14	.12

Source: high way eng. By Justo and Khanna

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2	2 or more	1	800	200
3	2 or more	2 or more	800	250
4	1	2 or more	650	250

Source IRC93-1985

2. Warrant-2 no interruption of continuous traffic

The traffic volume on the major street and the higher volume minor street for each of any 8 hours of an average day should be equal to the values indicate below:

Table no 15 Interruption of Continuous Flow for Warrant 2

No. of lanes on each approach		*Veh. per hour on major street (both Directions)*	*Veh. per hour on minor street (one direction only)*
Major street	*Minor street*		
1	1	1000	100
2.or more	1	1200	100
2 or more	2 or more	1200	150
1	2 or more	1000	150

Source IRC93-1985

3. Warrant 3 minimum pedestrians volume

For each of any hour of any 8 hours of an average day the following traffic volume must exist. On the major street, 600 or more vehicles per hour enter the intersection (both approaches) ; or where there is a raised median island 1.2 m or more in width, 1000 or more vehicles per hour (both directions) enter the intersection.

4. Warrant 4 school crossing

This is near the school vicinity.

5. Warrant 5 progressive movements.

6. Warrant 6accident experience

Five or more reported accidents, of types susceptible of correction by traffic signal control have occurred within a period of 12 months, each accident involving personal injury or property damage to an apparent extent of Rs. 2000 or more.

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Table no.20 other safety devices

S.N.		
1	Visual marks	
1.1	Delineators	Fig .no 23
	Function	Provide visual aids to the driver concerning the alignment of the road, especially at night.
	Shape	Curved section and straight section
	Features	Distance
	Section	84cm.*10 cm
	Spacing in Straight section	50-60 m.
	Spacing in curved section	Depends on the radius of the curved section. For 30 m radius 6 meters and for 1000 meters radius its 50 meters
	Distance from the kerb	50 cm.
1.2	Hazard Markers	Fig no. 24
	Function	Intended to define the objects like guard rails and abutments adjacent to the carriage way
	Shape	Rectangular
	Size	90*30 cm.
	Height	30 cm. from the ground
	Distance from the kerb	50 cm.
1.3	Object markers	Fig. No. 25
	Function	To indicate the obstruction in the vehicle path e.g. Mark Channel sing island close to intersection
	Shape	Triangular
	Size	30*30cm.
	Height	40-50cm
	Distance from the kerb	50 cm.
2	Speed controllers	
2.1	Speed breakers	Fig no. 26
	Function	Speed control humps used near the schools and universities where the speed is to restrict.
2.2	Rumble strips	Fig. No. 27
	Function	Speed controller's strips produce noises causing sensation to the drivers.
	Spacing	At a distance about 100 m.

3.	Barriers	
3.1	Guard-rails	Fig no. 28
	Function	Guides pedestrians to subways, footbridges and surface crossings and for preventing them from spilling into the carriageway.
	Distance from the kerb	50 cm.
	Height	121 cm.
	Location	Hazardous location, at junction/ at intersection, school, bus stops, / railway station, / overpass/ subways/ central reserve.
3.2	Safety Barriers	
	Function	To prevent vehicles accidentally leaving the carriageway.
3.3	Barricades and Channelisers	Fig no. 29
	function	To control and divert traffic on construction zones and temporary diversions.
3.4	Traffic Attenuators	Fig no. 30
	Function	Absorbs the energy of impact of vehicles that go out of control.

Modified from IRC-code no79, . And traffic eng. By L.R.Kadiyali

MANDATORY/REGULATORY SIGNS

SIGNS GIVING ORDERS - Mostly Circular

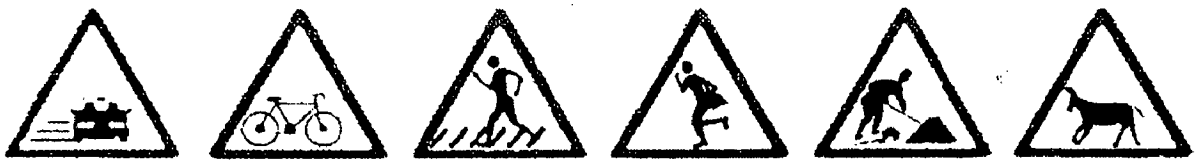
Plate no. 6 (Source -urban roads manual and code of practices for signs -IRC -67 -1977)

CAUTIONARY/WARNING SIGNS

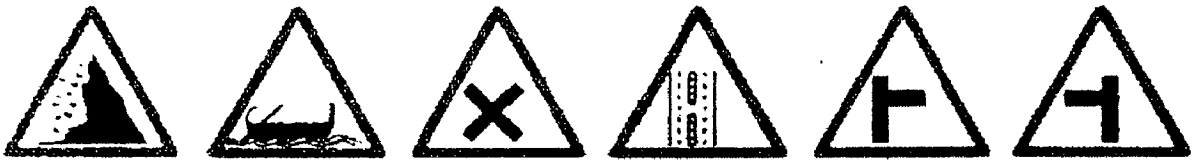
- Mostly Triangular

Right hand curve | Left hand curve | Right | Left | Hair pin bend | Right | Left | Reverse bend

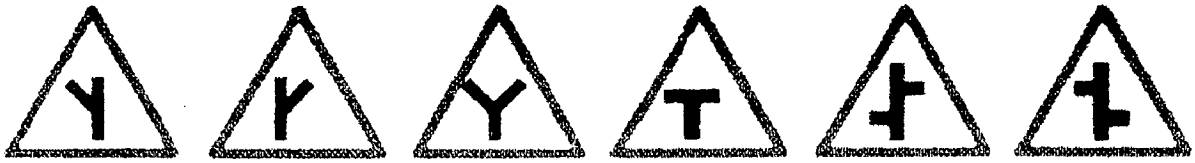
Steep ascent | Steep descent | Narrow road ahead | Road widens ahead | Narrow bridge | Slippery road



Loose gravel | Cycle crossing | Pedestrian crossing | School | Men at work | Cattle

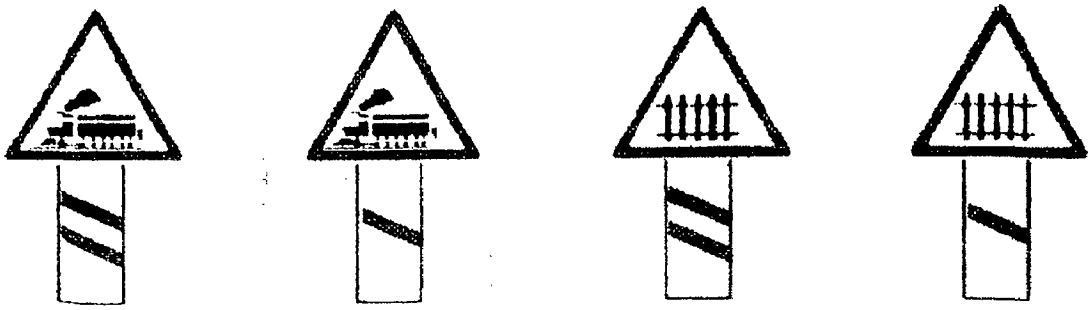


Falling rocks | Ferry | Cross road | Gap in Median | Side road right | Side road left



Y-Intersections | T-Intersection | Staggered Intersections

Major road ahead | Roundabout | Dangerous dip | Hump or rough road | Barrier ahead

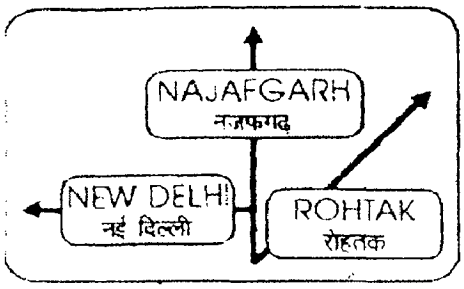


(200 Metres) (50-100 Metres) Unguarded Railway Crossing | (200 Metres) (50-100 Metres) Guarded Railway Crossing

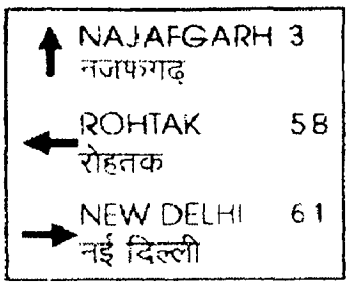
Plate no. 7 (Source -urban roads manual and code of practices for signs -IRC -67 -1977)

INFORMATORY SIGNS

- Mostly Rectangular

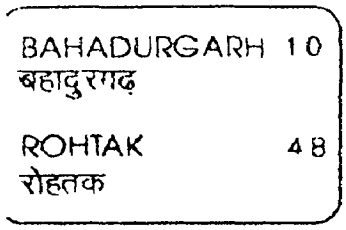


Advance direction sign



Destination sign

Direction sign



Re-assurance sign

Place Identification sign

Public Telephone

Petrol Pump

Hospital

First-aid post

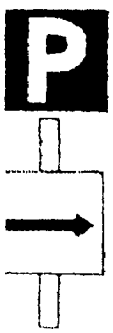
Eating place

Light refreshments

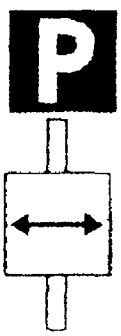
Resting place

No through road

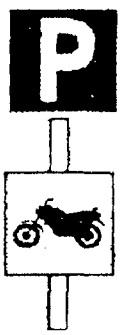
No through side road



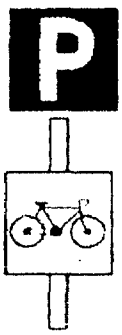
Parking this side



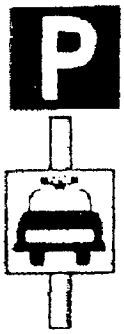
Parking both side



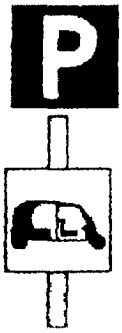
Scooter & motor cycle



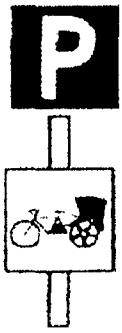
Cycle stand



Taxi stand



Auto rickshaw stand



Cycle rickshaw stand

Flood gauge

Plate no. 8 (Source -urban roads manual and code of practices for signs -IRC -67 -1977)

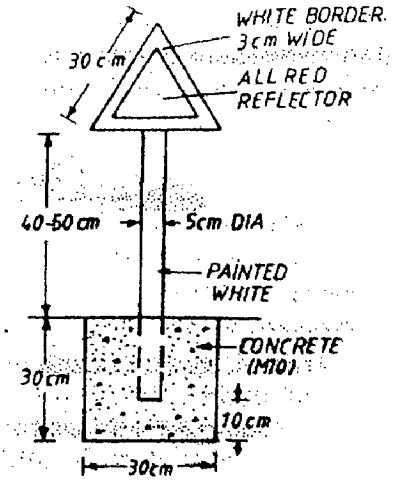


Fig no. 25 Object Markers

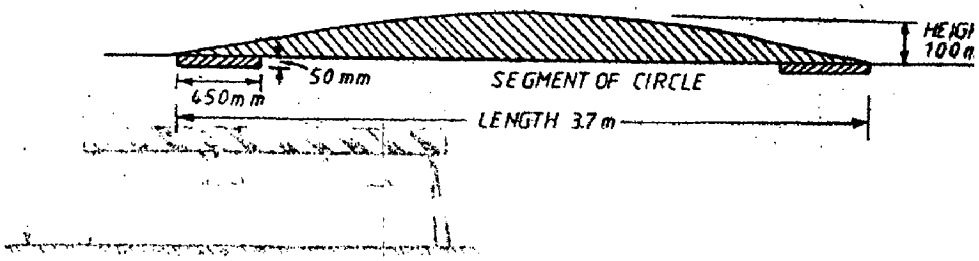


Fig no. 26 Speed Breakers

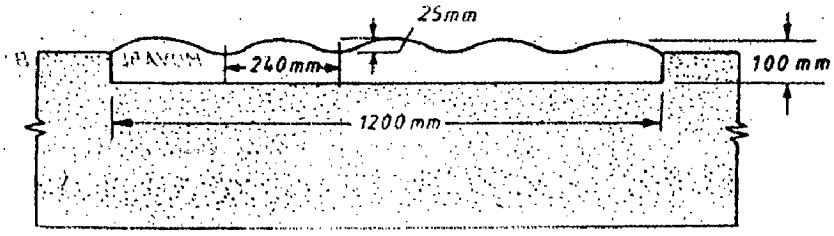


Fig no. 27Rumble Strips.

(Source -Traffic and Transportation Engineering By L. R.Kadiyali)

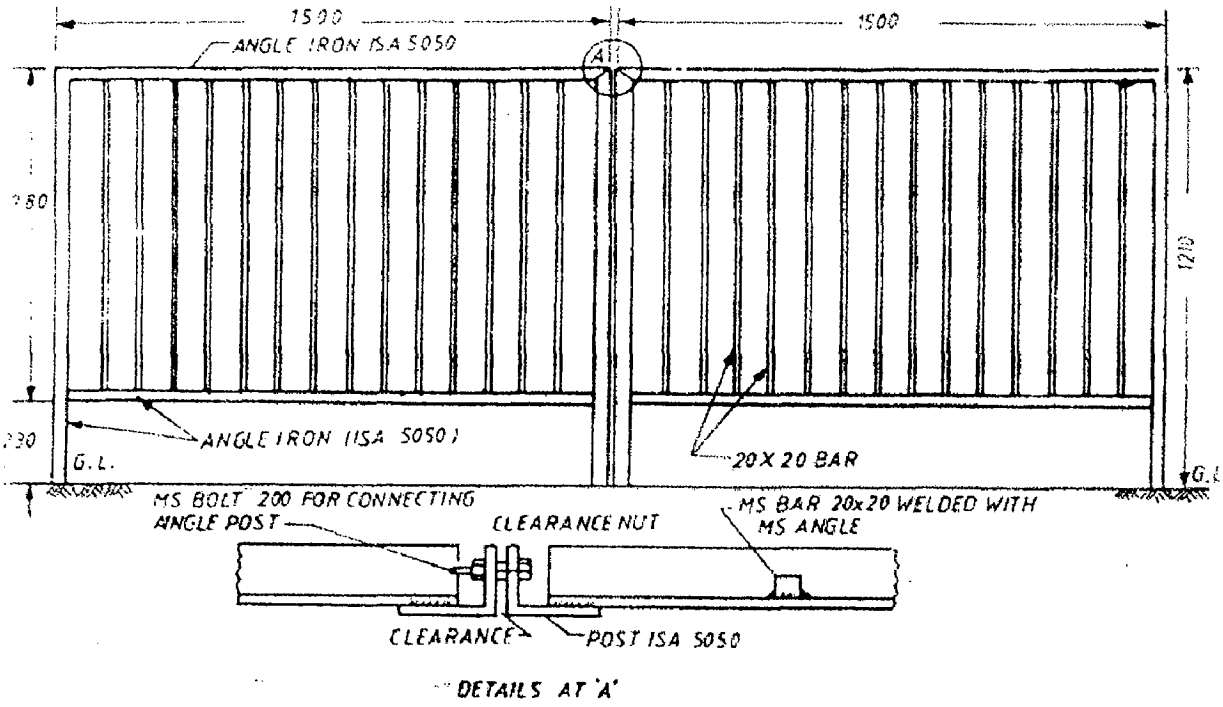


Fig no. 28 Guard Rail

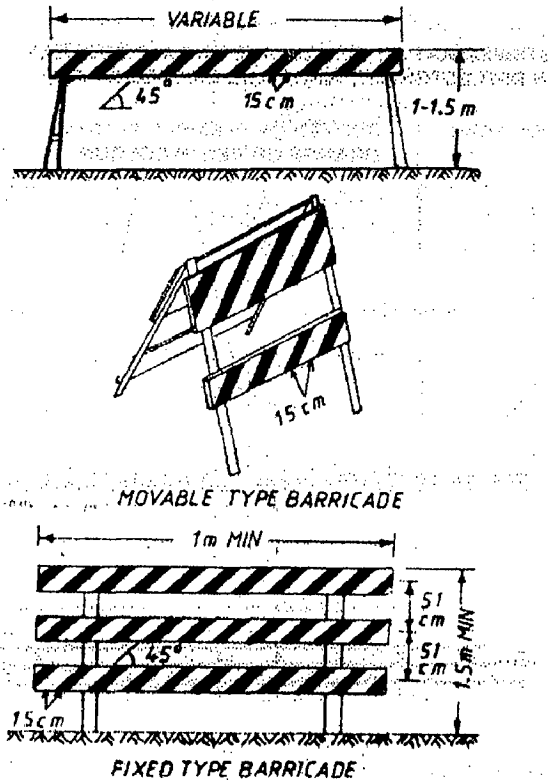


Fig no29Barricades and Channelisers

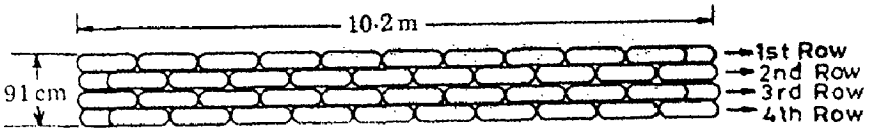
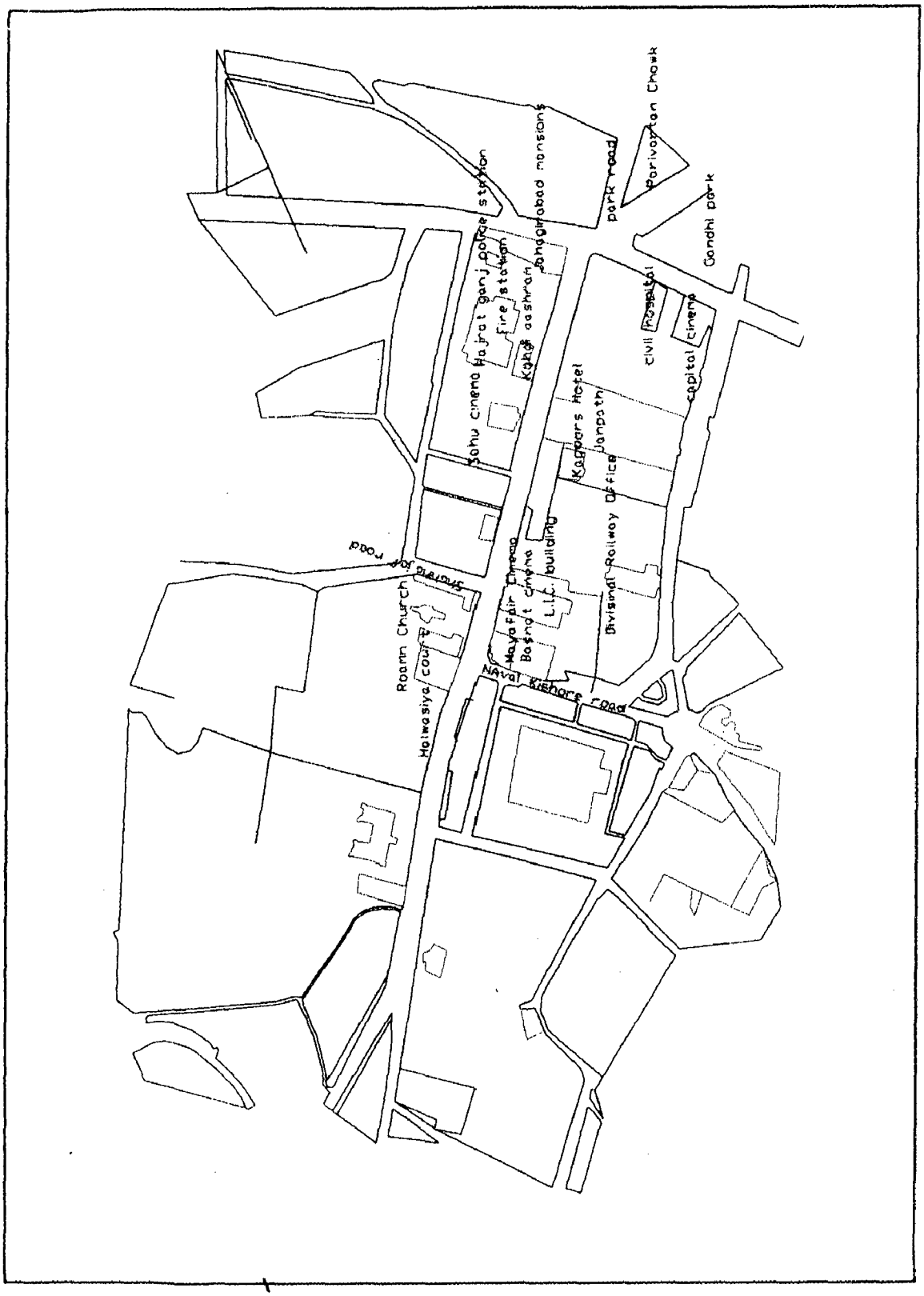


Fig no.30 Traffic Attenuators

(Source -Traffic and Transportation Engineering By L. R.Kadiyali)

MAP No 1

LAND USE MAP OF LUCKNOW CITY



MAP 3: LOCATION PLAN OF HAJRAGANJ AREA

THESIS TOPIC

PLANNING & DESIGN OF URBAN ROADS FOR USER NEEDS

TITLE

Detailed layout of the M.G. Marg

DWG. NO.

4

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