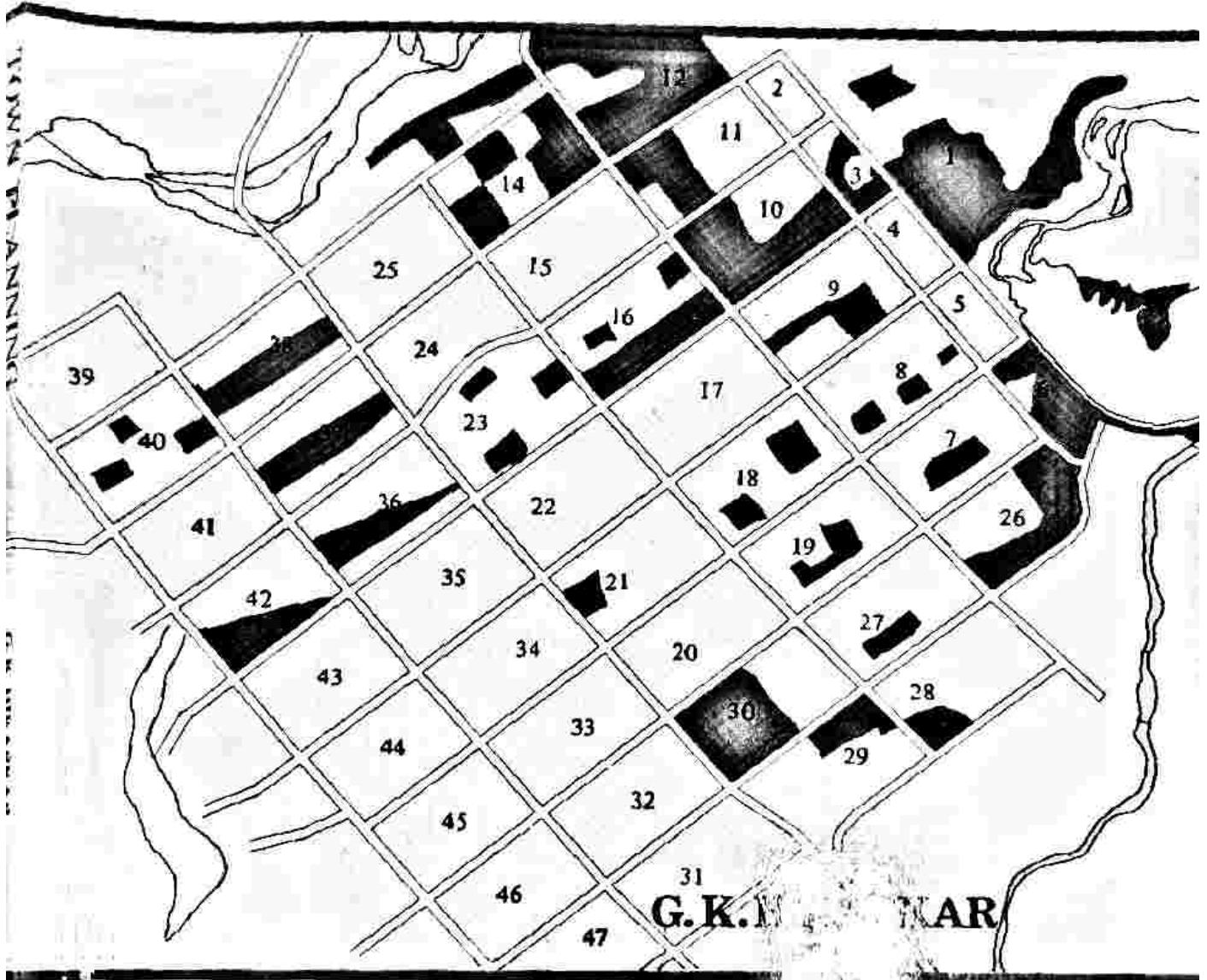


FUNDAMENTALS OF TOWN PLANNING



DHANPAT RAI PUBLICATIONS

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Preface to the First Edition

Since the time immemorial, man has been living in hamlets, villages, towns and cities. Human settlements such as these have been developed according to the changing needs of one generation to another. The needs which were once modest have undergone sufficient changes due to advent of time and at present the needs have been multiplied to a large extent.

Though efforts have been made from time to time at various levels to satisfy the living conditions, yet these, in majority of the towns and cities are most deplorable. The intensity of the problem has been aggravated due to the tremendous growth of urban population all over the country which has produced all sorts of evils such as overcrowding, congestion, shortage of housing, high rise in land cost, encroachment of industries on residential units, lack of utility services, inadequate recreational facilities, traffic problems and many more to mention, as a result that the living conditions in the towns and cities are fast deteriorating to an alarming degree.

Hence large scale efforts are necessary to provide a healthy environment that would ensure a fuller, richer and happier life. There is therefore an urgent need for a comprehensive planning of the towns, with suitable measures of a long term nature. This poses a major problem and its solution calls for the active services of the Town Planners. It is therefore necessary for them, in this difficult task, to have full understanding of the problems and thorough knowledge of the principles of Town Planning, its Laws, Technique, Methodology and also Land Acquisition Acts as well as Valuation of the properties etc.

In this book attempt has been made to bring out to the knowledge of the students, the true concept of Town Planning and its fundamentals in bold relief and at the same time to contain the full aspects of the syllabi of various Indian Universities. Attempt has also been made to enlarge its scope so as to make it useful to the Councillors, Local Bodies, Legislators, Civic Officials and Community Development Authorities.

A further noteworthy feature of this book is that it deals thoroughly with the Village Planning which will be found very valuable for those interested in Rural Development work, thereby making the book self-contained, up-to-date and complete in every sense.

The subject-matter is treated in a lucid manner and presented in the form which could be easily understood by even the lay reader. Further emphasis is given on self-explanatory and neatly drawn sketches and lay-outs. It is therefore hoped that the book will be found useful not only for the students of Town Planning but also to every alert citizen who has a civic sense and spirit of local services in the improvement of his town.

I take this opportunity to express my thanks to all those who gave me impetus and encouragement in bringing out this book.

Lastly, I have to thank Sri O.P. Kapur of Dhanpat Rai & Sons, Delhi for his hearty co-operation and for making every effort to bring out this publication to my entire satisfaction with decent printing and attractive get-up in a short time.

INTRODUCTION

1.1 Planning Age. Never in the history of man, planning has been so much in the forefront as it is today. The whole world is now passing through the planning age. Without planning, nothing succeeds. So we have Defence Planning at national level, Regional Planning, Urban and Rural Planning at state level so on and so forth to Family Planning at domestic level. Our India has so far already implemented its Seventh Five Year Plan (1985-90) for the development of the country in all its fields.

1.2 Concept of Planning. Planning means pre-thinking and pre-arranging things before an event takes place so as to achieve good results in health, convenience, comfort and happiness of all living beings. By careful planning, we can eradicate the mistakes of the past and be wiser in the future.

1.3 Concept of a Town & Town Planning. Town or city is a place of urban living. Urban means an environment in which natural surroundings have been dominated by artificial or man-made surroundings, which man builds for himself – for his living, working and recreation. As per census of India, a place becomes urban if it has more than 5000 population, more than 75 percent of which are engaged in non-agricultural occupation and the density is more than 1000 persons per sq. km. However there are exceptions.

A city also means a place, in which citizens with rights of citizenship, live a civil life. The words citizenship, civic, civilised, denote the most advanced state of social organisation and behaviour that man has now attained, and it is against this background that the word 'city' or 'civic' is understood.

Town planning is considered as an art of shaping and guiding the physical growth of the town creating buildings and environments to meet the various needs such as social, cultural, economic and recreational etc. and to provide healthy conditions for both rich and poor to live, to work, and to play or relax, thus bringing about the social and economic well-being for the majority of mankind. Aristotle once said: "A city should be built to give its inhabitants security and happiness" while Plato describes it as "a place where men had a common life for a noble end".

Though the term applies to planning of new towns, cities on virgin land, it also equally takes into account their development, improvement of the existing towns and their extensions.

1.4 Aims and Objectives of Town Planning. The planner before taking up any planning work, must have definite aims and objectives with regard to the town planning.

According to the Town Planning Acts, the main objectives of the town planning may be summarised in three words viz. Health, Convenience and Beauty.

(1) **Health**: (i) To create and promote healthy conditions and environments for all the people — rich and poor, to live, to work, to play or relax.

(ii) To make right use of the land for the right purpose by proper division of land called zoning such as Residential, Commercial, Industrial, Institutional and Recreational etc. in order to avoid the encroachment of one zone upon other for smooth and orderly development of the town or city without causing future conflicts.

(2) **Convenience**: The object of convenience is meant in the form of various needs of the community such as social, economic, cultural and recreational amenities etc. Public amenities required for the proper upkeep of the citizens include water supply, sanitation, electricity, post, telegraph, gas, etc., proper sites for industrial, commercial, business enterprises to encourage them in trade with cheap power, transport services, drainage etc.

Recreational amenities include open spaces, parks, gardens and playgrounds, for children, and town-halls, stadiums, community centres, cinema houses, theatres for adults.

(3) **Beauty**: (i) To preserve the individuality of the town by developing it on its most suited natural conditions.

(ii) To preserve the aesthetics in the design of all elements of town or city plan, which include preservation of trees, natural greenery, improved types of domestic buildings and buildings of civic dignity and beauty, architectural control on public as well as semi-public buildings, ancient architectural buildings, temples, churches, mosques and buildings of cultural and historical importance.

1.5 Principles of Town Planning. The main principles of Town Planning are as below:

- (a) There should be no haphazard (*laissez faire*) method in planning process.
- (b) Housing accommodation to various classes of people should be allowed to develop. If slums are existing, they should be pulled down by making some alternate arrangement of accommodation in transit camps for disoused persons.
- (c) Civic amenities like shopping centres, dispensaries, schools, nursery etc. should be provided to all the residents.
- (d) Adequate open spaces should be reserved for public recreation centres and also for future expansion of the town.
- (e) Public and semi-public buildings should be grouped and distributed neatly throughout the town.
- (f) The system of zoning should be strictly followed. The town should be divided into suitable zones such as residential zone, commercial zones, industrial zone and recreational zone etc.
- (g) The growth of the town should be controlled by the provision of green belt, which is an open strip of land all round the town or city reserved for special purpose of limiting the growth of the city. It is primarily meant for intensive cultivation of vegetables, fruits, farm.

industry like poultry farms, dairies etc. It also provides sites for recreational amenities like parks, playgrounds and picnic spots etc. It also serves as a sanitary cordon to prevent the formation of slums. At least it keeps its growth away from the town.

Most of the evils of urban planning lie in the gigantic size of the city due to tremendous growth in the population. The remedy lies in limiting its continuous growth. The main purpose of green belt is to prevent urbanisation beyond its outer periphery and also to allow for extension during emergency period. It therefore prohibits conurbation (con = together and urb = city) i.e. linking up of urban areas.

The touch stone of what constitutes planning is the matter of proper relationship and provision of several units to make a harmonious whole. The words of Aristotle, who summarised all principles of city planning may be quoted here "A city should be built to give its inhabitants security and happiness".

To make the town a pleasant place of living, the authorities of the town should follow these dicta: Unity in Diversity; Nip in the bud; Prevention is better than cure are its catchwords. Health, Convenience and Beauty are its watchwords.

1.6 Necessity of Town Planning. The 'Industrial Revolution' that took place in 1760-1820 is an important epoch in the history of growth of towns and cities. No country is free from the galloping multiple crises of our time, due to over-crowding in the towns and city areas in particular. This has resulted in the haphazard (*laissez faire*) development, chaos and disorder in the town.

Some of the evils from which the town suffers in absence of town-planning are as below:

(1) The suburban sprawl has entirely engulfed every town and city. The life inside the town often seems to close to being snuffed out completely. The people therefore have to go far off in the countryside to get open air, breeze.

(2) The people will have to take long uncomfortable journey from place of residence to the place of work. As such there is waste of time, money and energy.

(3) Every road has become highway, increasing the traffic congestion, resulting in accidents.

(4) Noisy traffic has almost disturbed the peace of the city dwellers.

(5) Indiscriminate siting of industries in the heart of the city has resulted in producing smoke, dangerous gas, bad smell, etc. Improper disposal of industrial waste has caused pollution of water, air etc.

(6) Increased industrial population has given rise to the formation of squatter settlements, slums etc.

(7) Insufficient open spaces, parks, playgrounds have caused unhealthy conditions of living.

(8) Lack of public amenities such as water supply, drainage, sanitation, electricity etc.

In short the present picture is gloomy and dull. We have therefore to put tremendous efforts for the proper shaping of towns creating buildings to meet the various needs such as social, cultural, economic and recreational thus bringing general welfare of the majority of mankind. Winston Churchill once said: "We shape our buildings and then our buildings shape us". The buildings should be built in good environment which will influence to build up of good character, civic consciousness and civic ideas or the making of good citizen and citizenship. Good environment is essential for the

well-being of the people for they in turn will collectively contribute to the well being of the state. Lewis Mumford quotes a Chinese proverb: "If you are planning for one year, plant grains, if you are planning for ten years, plant trees, if you are planning for a hundred years, plant men". The Capital criticism of Indian planning of towns is that the planning is not done for a period of many years. As such apart from human suffering, it has resulted in heavy liabilities. To avoid these in future, it is found extremely necessary to prepare a comprehensive planning taking into account a number of years for an overall development of towns and country as a whole.

1.7 Town Planning as a Team-work. Even as recently in the beginning of the 20th century, town plans were prepared exclusively by civil engineers, architects who paid attention only to the design of buildings, streets, squares, terminals, etc. and in general to the beauty and grandeur of the town or the city.

If really useful plans are to be prepared then we require a team of experts in different fields. Such a team consists of (i) Engineer (ii) Architect (iii) Landscape Architect (iv) Sociologist (v) Geographer (vi) Ecologist and (vii) Administrator.

A Civil Engineer is necessary to design the buildings, roads, bridges, water supply and drainage system etc.

An Architect will advise on aesthetics of the town such as buildings of architectural aspects.

A Landscape Architect is necessary to fix up the location of the sites considering the landscape of the country, and to lay out the parks, gardens, trees and shrubs etc. to create cheerful environment.

A Sociologist is necessary to give report on social and cultural stature of the city dwellers. He is also useful to prepare the 'socio-economic' or 'civic-survey'.

A Geographer is necessary to give report on the natural configuration and natural resources etc.

Now-a-days an Ecologist is also required to study the total environment—ecology—that influences people's life, work and play.

An Administrator will have to look after the proper and orderly development of the town. He is usually assisted by an Economist and a Legal Adviser to help solving the economic and legal problems.

1.8 Duties and Powers of Town Planning Officer. The various duties of the Town Planning Officer are :

- (1) to conduct the survey and collect the data for carrying out development schemes inside and outside the limits of the towns and cities.
- (2) to demarcate the boundaries of the land reserved for public purpose.
- (3) to allot the constituted plots among the original owners.
- (4) to prepare detailed estimate and to work out the cost of any proposed schemes.
- (5) to determine the compensation to be paid to the owners for acquisition of their property.
- (6) to determine the betterment contribution to be recovered from the owners of the land who are benefited with the development scheme.
- (7) to act as expert valuer and financial adviser in land acquisition cases.
- (8) to guard the interests of the citizens of the town as a whole.

1.9 The Great Town Planners of Modern Age. The social concept of the town or city marks the final stage of its progress. It started in the early days of 20th century, when eminent sociologists like Sir Patrick Geddes, Sir Ebenezer Howard, Lewis Mumford entered the field of Town Planning for the first time. Other eminent Town Planners who deserve mention are Le Corbusier, Griffith Taylor, Clarence Stein, Henry Wright, Sir Patrick Abercrombie, Charles Correa and many others.

(a) **Sir Patrick Geddes:** The well-known town planner, sociologist of Scotland, Sir Patrick Geddes (1854-1932) came to India in 1915 at the invitation of Lord Pentland, the then Governor of Madras. He gave his expert advice for the improvement of about eighteen major towns in India. He laid emphasis on 'Survey before Plan' i.e. diagnosis before treatment to make a correct diagnosis of various ills from which the town suffers and then prescribe the correct remedies for its cure. These are the physical and social economic surveys. He was the first man who introduced the sociological concept in the town planning. Before coming to India, he had successfully overcome the horrors of Edinburgh slums.

The principles of planning enunciated by Sir Patrick Geddes are as below:

(1) The town planning primarily meant establishing organic relationship among 'Folk, Place and Work' which corresponds to triad (Geddesian triad) of Organism, Function and Environment, Folk organism (social aspect); Place (physical aspect); Work (economical aspect). Accordingly the city came to be looked upon, as a physical utility, for collective living and a living organism which like all other living creatures, is governed by definite laws of growth and where Environments played a great part.

(2) The city is no longer a mere physical structure but it is now meant the people, their families and communities they formed, their places to live, to work and to play. Hence here human needs are most important than physical aspects. This epitomises the essence of planning.

(b) **Sir Ebenezer Howard:** The another well-known sociologist was Sir Ebenezer Howard (1850-1928) who after studying the industrial evils in Britain gave the concept of 'Garden City'. It soon became the landmark in the history of town planning. He had an idea which he set forth in a little book entitled 'To-morrow', published in 1898 which later republished under the title of 'Garden City of To-morrow'. He explained his idea of 'Garden City' by an impressive diagram of **The Three Magnets** shown in Fig. 1.1, namely the town magnet, country magnet with their advantages and disadvantages and the third magnet with attractive features of both town and country life. Naturally people preferred the third one namely Garden City. It made a deep impression in the field of town planning. Letchworth, Welwyn and many other cities were planned on this principle.

The main features of Garden City principles are:

- (i) The dwellings for all classes of people should be distributed about a large central court in which the public buildings would be located.
- (ii) The shopping centre to be located on the edge of the town.
- (iii) The employment facilities for all the people to be provided by starting a variety of industries.
- (iv) The industries to be located on the outskirts of the town.

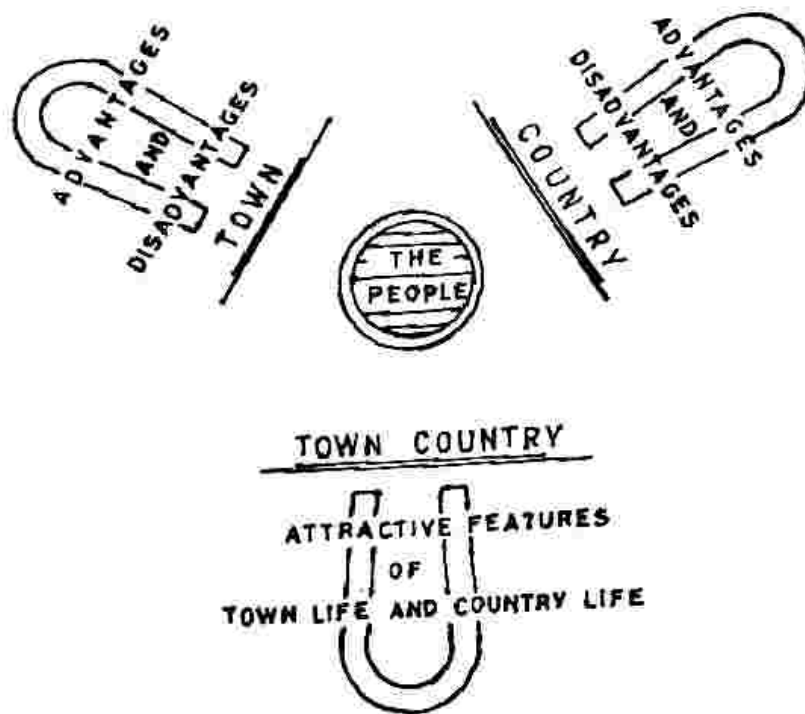


Fig. 1.1 Garden City Principle

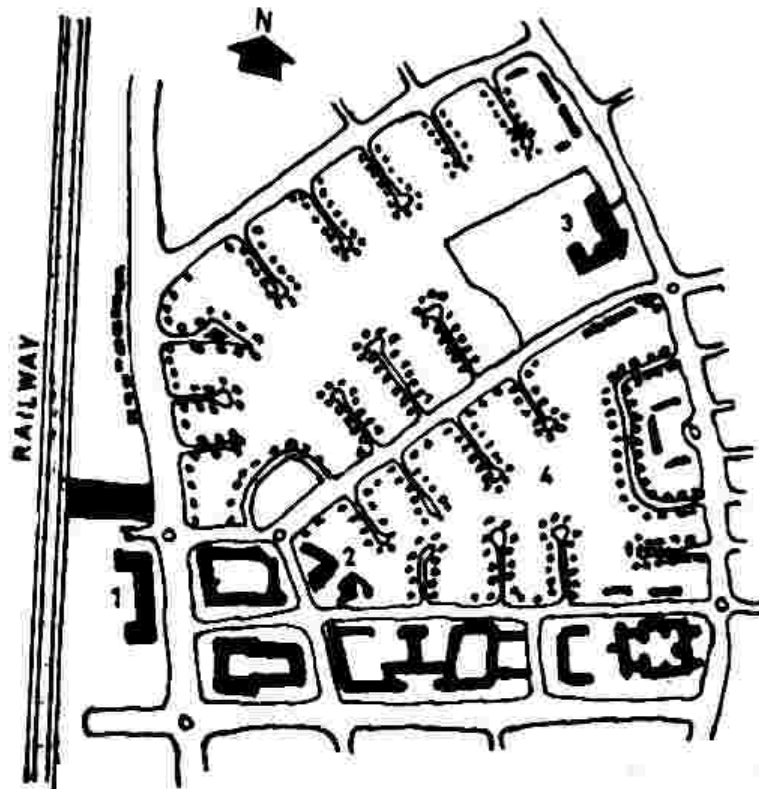
- (v) The city should have a maximum population of thirty to thirty-five thousand people in an area of one thousand acres.
- (vi) The city should be surrounded by a permanent belt of agricultural land of three to five thousand acres.
- (vii) The city should have the advantage of both rural life such as fresh air, gardens, playfields, cottages etc. and amenities of urban life such as schools, theatres, hospitals, recreation centres etc.
- (viii) To eliminate the private ownership and whole of the land to be brought under co-operative basis or held in trust for the community in order to have the control on finance and the profit gained thereby be utilised for uplifting the community itself.

(c) **Clarence Stein:** He is an American architect and planner. He was much influenced by the concept of Garden City of Sir Ebenezer Howard. He alongwith Henry Wright, also an American architect and town planner, prepared the town plan for a city Radburn in New Jersey in 1928. See Fig. 1.2.

The principles of planning advocated by Stein are as below:

- (i) No grid-iron road pattern be provided in the road system. In his dictum, it is the greatest enemy of traffic and road users.

- (ii) Planning not in term of single block, sector etc. but overall planning of the whole neighbourly area or 'super block'.
- (iii) The super blocks to be enclosed by main roads which in turn enclose the narrow lanes or alleys.



- 1. SHOPPING CENTER
- 2. APARTMENT GROUPS
- 3. SCHOOLS
- 4. PARK SPACE

Fig. 1.2 Radburn, New Jersey

- (iv) Expressway or parkway for high speed traffic with limited access from and to neighbourhoods. The footpath for pedestrians should be safe and segregated from other vehicular traffic.
- (v) Houses to be turned inside out. Usually the roads and back of the houses are not kept clean. For this reason the working areas like store, kitchen, bath etc. should face the front roads whereas living areas like drawing, dining, bed rooms should be on the rearside of the roads. This is known as 'Radburn idea', which earned the name of "The Town for the Motor Age".
- (vi) A community park spreading on whole of the area of the town instead of providing one big park at some distance which may not be used by all. The park should be well balanced and spread throughout the town.

(vii) **Cul-de-sac streets.** These are loop streets of 'dead end' streets. The idea is not to allow through traffic to go to the houses. See Art. 7.7 (ii).

(d) **Sir Patrick Abercrombie:** He is an eminent town planner and worked as Head of the Town Planning Department in London University. He is the planner of many cities like Greater London, Bristol etc. He synthesised the theories of Sir Patrick Geddes and Sir Ebenezer Howard. He is the pioneer planner to advocate regional planning.

His town planning principles are:

- (i) 'Civic Survey' to be carried out before planning i.e. diagnosis before treatment like the 'Diagnostic Approach' of Sir Patrick Geddes.
- (ii) Planning not to be done on piece-meal basis. Instead the town shall be considered as a whole unit with respect to the entire region.
- (iii) Uncontrolled growth of cities should be stopped.
- (iv) Industries should be located on the outer areas of the town.

(e) **Le Corbusier:** Another giant in the field of architecture and town planning was Charles-Edourd Jeanneret better known as Le Corbusier (1887-1965). According to him, a city is a living organism. He says, "Towns are biological phenomena, such as head, heart, limbs, lungs and arteries. Govt. buildings like High court, Legislative Assembly, Secretariat, Raj Bhavan constitute the head; City centre with commercial buildings and shops represent heart; Industries and Educational institutions represent limbs; park, playfields, green belt are the lungs; Roads, footpaths are arteries". He advocated the following principles of town planning.

- (i) Core of the city should be decongested by removing the excess of population and should be inhabited at the outer countryside in satellite towns which are linked to the main city.
- (ii) Provision of speedy transportation.
- (iii) Provision of plenty of open spaces in the form of gardens, parks etc. round the tall buildings throughout the length and breadth of the city.
- (iv) Population control. The high density should be spread over the entire area of the town. He suggested a plan for Paris city with buildings 24 No. sky-scrapers, 215 m high, 400 m apart with about 1500 to 2000 persons in each. These high rise buildings are linked underground with one another by central area such as shopping centres, civic centres etc. Plenty of open area with parks, gardens and recreational centres is to be provided all round these high rise buildings.

As per his dictum, a residential building may be 9 to 10 storied about 33 m high. He opined that one lakh or more should be minimum size of the town but he also suggested that 20 to 30 lakh is a good size. He was the progenitor of high-rise, high density development of cities. His sky scraper, the 'United habitation' at Marseilles (1946-52), emphasizes the importance of community living. He considered the family home in garden cities, a waste. He dealt boldly with the sky, meadows and hills. He said 'family should not be enclosed in a compound wall'. Instead it is to be lifted up on pillars (pilotis) in high buildings so that the landscape goes below and the occupants can enjoy the

beauty of the surrounding country. He was the main brain behind the planning of Chandigarh, once the capital of Punjab (1953) now under Union Govt. See Art. 3.6 (II).

1.10 Individuality of Town. Every town has its own individuality, personality or character. Every town differs from another in its climatic condition, geographic condition, natural features and topography. The changing factors largely influence the growth of a town. So every town should be allowed to develop on a pattern best-suited to its geographical, economic and social conditions.

However, it would not be wise on the part of town planner to shake into a bottle the features of American Civic Centres, with continental Park System or the Parisian Boulevard and Vista with English Garden Village, to produce a mechanical mixture which might be indiscriminately applied to every town with the hope that such a town could be the ideal one as it is conceived on the guiding principles of town planning, providing all facilities and amenities so indispensable to modern life.

1.11 Forms of Planning. According to Planning Authority, the planning is divided into the following categories:

(i) Local planning (ii) Country planning (iii) Regional planning (iv) National planning and (v) International planning.

(i) **Local Planning:** It is largely influenced by the economic conditions for the development of the town. Keeping in view of these, the development plan is prepared. The population is spread over the town uniformly keeping the density of population as low as possible. Zones are formed and traffic regulations are maintained.

(ii) **Country Planning :** The country is allowed to develop in an orderly manner and on pre-determined lines. There should be no haphazard (*laissez faire*) methods in the planning. The town should be linked with the surrounding villages by suitable transport facilities. Scope should be given to village industries in the form of poultry farms, dairies, weaving industries maintaining a proper balance with the agriculture in the village development scheme.

(iii) **Regional Planning:** Regional planning means planning of a much larger unit than a town called 'region'. The planning is done more or less on the same principles of town planning. Region includes the territory lying within easy reach such as 15 to 50 km and containing number of villages and townships. The regional planning helps to develop the region in a co-ordinated manner. It deals with planning of regional highways, regional transport, regional water supply, drainage etc. It also takes into account the overall development of towns, villages in the region and provides sites for new towns for rehabilitation for the displaced persons from the main city.

(iv) **National Planning :** The planning process is done on a national level. It considers the resources, potentialities in different fields of the nation as a whole. It helps to utilise the national resources in the best possible way for the development of the nation. Works of national importance such as Railways, Irrigation, Heavy Industries, Hydro-electric Works come under National Planning. Our various Five Year Plans can serve as an example of National Planning

(v) **International Planning :** International planning came into existence with the establishment of United Nations Organization or UNO. It aims at promoting co-operation, goodwill among different nations of the world. UNO has appointed various agencies to conduct the surveys in different fields of human life, like health, housing, food, education etc. and to provide suitable solutions to these problems at international level.

GROWTH OF TOWNS

2.1 Origin of Towns. In the cultural evolution of mankind we come across mainly three stages such as 'Stone', 'Bronze and 'Iron Ages' according to the type of materials and weapons used at that time. The 'Ages' have different periods in different parts of the world. The earliest forms of dwellings of 'Savage' hunter were rock-caves. Next job he did was to change the face of the jungle and create the huts of reeds and tents, to protect against weather, wind, beasts and enemies. He started living a settled life mostly on the banks of rivers, which he found to be lifegiving source—water for drinking and rich fertile land for cultivation.

Man is primarily a social creature. On account of this nature, he always preferred to live in groups, forming camps, hamlets, villages. Human settlements like these as the population increased expanded into towns and towns into cities and finally cities turned into highly populated metropolitans, like Bombay, Calcutta, Madras, Delhi etc.

2.2 Types of Towns. The factors that distinguish one town from another are: (i) Location (ii) Function (iii) Shape and (v) Size.

Hill stations, river banks, sea fronts suggest their respective locations.

Pilgrim towns, health resorts, education, fishing, industrial, commercial and political towns indicate their function.

The shape or pattern of the town is determined by the type of road system which depends upon topographical features.

A town is known as linear, rectangular, radial, star, circular or radial & circular ('spider's web') according to the road system (Ref. Art. 12.7).

The size of the town is fixed by the population such as a community with more than five thousand but not more than about one lakh population may be roughly called as a town, that with population of one to ten lakh a city; that with population more than ten lakh may be called 'metropolitan city'.

2.3 Stages in the Growth of Towns. A town is classified into various categories according to the different stages of development.

Sir Patrick Geddes has given three categories such as primary, secondary and tertiary.

The primary town is one which produces human necessities such as agricultural village.

The secondary town is one which functions as centre of exchange such as marketing town.

The tertiary town is one which provides residential, educational and recreational facilities. In reality a town is a mixture of all the above categories.

Lewis Mumford has given six categories which are as follows:

- (i) *Eopolis* : Here town grows as one entire unit. Its economy is based on agriculture.
- (ii) *Polis* : Here town grows into a small urban unit of self-contained community. It has a commerce and industry etc.
- (iii) *Metropolis (Mother city)*: Here the city grows to its full stature, with high population density and large potentialities, with all facilities like water supply, drainage, electricity, transport, commerce and industries etc. (London, Bombay and Calcutta etc.)
- (iv) *Megalopolis* : It is an over-grown city into a mess due to growing expansion of industries, high-rise buildings, multi-track roads, mass housing, mass transportation. In its overgrown nature, lie the germs of its decay which begin to creep in all the portions of the city.
- (v) *Tyrannopolis* : The city shows further decay in all the fields like trade, commerce, military power etc.
- (vi) *Necropolis* : The city is in the worst stage and unfit for dwelling. So it is the city of the dead where one finds disease, famine, economic breakdown etc. (Persepolis, Babylon etc.)

2.4 Methods of External Growth. With the passage of time, no towns for long remained in static condition. The towns behave like living creature and have their methods of growth on account of new industries, factories, educational institutions, aided by transport facilities, etc. The growth of towns can be classified in two ways:

- (i) Growth according to origin
- (ii) Growth according to direction.

(I) Growth according to origin. The growth of town according to origin is further divided in two types such as (a) Natural Growth and (b) Planned growth.

(A) Natural growth : Here the town is the result of evolution, rather than pre-thought or pre-planned development. The towns have developed as a matter of chance than design. Here the primary factors are availability of water, rich soil, immediate comfort and convenience of the people, rather than other amenities like schools, playgrounds, hospitals, theatres, transport system, commerce and industries, etc. There are four types of natural growth such as:

- (i) Concentric spread (ii) Satellite growth (iii) Ribbon development and (iv) Scattered growth.

(1) Concentric spread: Here the town develops in the form of concentric rings, with nucleus as town since the natural tendency of the people is to keep the centre, nucleus or heart of the town as near as possible. Such a town soon suffers from improper houses, concentration of the people in the heart of the town, congestion of the traffic and accidents.

(2) Satellite growth: The satellite growth implies dependency on the parent city but still possessing its own identity. See Fig. 2.1. When a town reaches a certain size, satellite devolution must take place, to break the suburban sprawl beyond that size. Since its periphery falls away from the heart of the parent city, it becomes less convenient and uncomfortable for the distant people.

A number of satellite towns have been created in India since independence, such as Faridabad near Delhi, Marimalai near Madras etc.

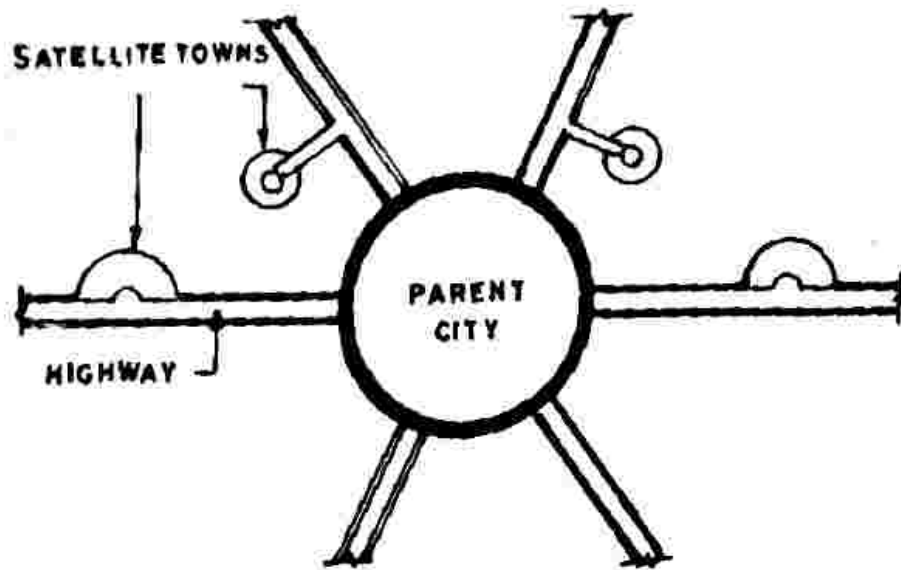


Fig. 2.1 Satellite Town

The satellite town will have the following features:

- (i) The satellite town is also a full town in true sense but depends to certain extent on the parent city for higher education, employment, etc.
 - (ii) It is however independent in its economic, social and cultural activities.
 - (iii) It is a pure residential unit with civic amenities like small shopping centres, dispensary, primary or nursery schools etc.
 - (iv) Here no industries are permitted, hence the people will have to depend on parent city for any workshop and employment facilities.
 - (v) It must be linked with parent city by easy transport facilities like buses, local trains etc. There will be only one arterial road for communication.
 - (vi) It may or may not consist of zoning.
 - (vii) Every house may or may not have gardens.
 - (viii) It is generally situated in an open country beyond the green belt of the parent city.
 - (ix) Its size and development should be controlled and not allowed to grow more than its parent city. Otherwise it would grow to become a rival to the parent city and would create the same problems of control in future.
- (3) *Ribbon Development* : Here the development is in the form of a ribbon or line i.e. a single row of houses along the bus-stops, bus routes, railway lines, railway stations. See Fig. 2.2.

In the beginning this growth is very small along the roadside but soon it occupies whole of the area. It happens especially in newly developing towns where rules and zoning regulations have not been strictly enforced.

Ribbon development has become a regular feature where we find overcrowding of all types of buildings such as schools, factories, petrol pump etc. This type of development is more dangerous from traffic point of view.

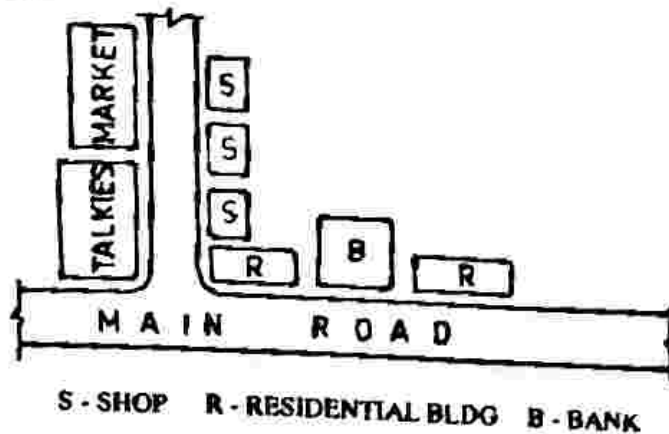


Fig. 2.2 Ribbon Development

Following are the disadvantages of ribbon development:

- (a) Everybody wants to take advantage of the frontage of the main road. The interior is therefore left undeveloped, causing wastage of valuable land.
- (b) Overcrowding on the road side. Streets become narrow and give rise to accidents.
- (c) All types of buildings creep in, at the frontage, such as schools, factories, bus stops, petrol pump, theatres, etc. with no regard to zoning regulations. All these affect health conditions of the residents.
- (d) The town spreads far and wide which is costly to maintain.
- (e) Future improvements become very costly. Ribbon development is the inverse of planning and is not desirable. Hence it is necessary to nip it in the bud or check its development, in its early stage.

(4) *Scattered growth*: Here the town shows erratic growth, scattered here and there, in a very irregular way, without any order. It results into traffic congestions, stums and lack of open spaces.

(B) *Planned growth*: In this case, the town develops on pre-determined line as prepared by the town planner. The development is in orderly fashion. The following points shall be considered for the planned growth of the town.

(a) *Selection of site for the town*: The physical features play an important role in selecting the site for the town. The important factors to be considered for selection of site for an ideal town are:

- (i) Availability of good surroundings, climatic conditions, contours of the area, streams and lakes, fertile land, etc.

- (ii) Facilities of drainage, sewage disposal.
- (iii) Availability of water sources, electric power, means of communication, transport etc.
- (b) *Features to be embodied in the plan:*
 - (i) Areas for residence, public, commerce, and industry based on zoning.
 - (ii) Essential public services like water supply, drainage, electricity, telephone, gas service etc.
 - (iii) Public amenities like post offices, police station, petrol pumps, fire brigade stations, dairies, dhobi ghats etc.
 - (iv) Educational institutions like schools, colleges etc.
 - (v) Recreational amenities like parks, gardens, play grounds, stadiums etc.
 - (vi) Good network of roads.
 - (vii) Provision of future expansion.

The important points to be considered in the planning of the modern town are as follows:

- (1) Public utility services should be liberally provided.
- (2) Efficient and speedy communication arrangement should be made.
- (3) Plenty of open space such as parks, play grounds and recreation centres should be provided.
- (4) Industries should be properly located on the leeward side of the town.
- (b) Residential area should be planned in peaceful surroundings taking full advantages of the natural features.
- (c) Public buildings should be properly located to impress the visitors.

The concept of town planning as applied for the planned growth can be very well observed in the planning of the recent new towns in India such as Gandhinagar and Chandigarh, the capitals of Gujarat and Punjab respectively, the latter now is under Union Govt. See Art 3.6 II.

(II) Growth according to direction. The growth of towns considering the direction takes place in two ways. They are, (i) Horizontal growth and (ii) Vertical growth.

(i) *Horizontal growth:* The city can grow horizontally in all directions, to accommodate the growing population. It is clear that such horizontal growth is economical at places where the land is cheap.

The advantages of horizontal growth can be stated as follows:

- (a) Since the building has only one storey, the wall could be made thinner and this results in savings in masonry and foundation.
- (b) It does not require high technical personnel.
- (c) It is possible to have roof ventilation and maximum use of roof lighting.
- (d) There is a lot of economy in space since there is no necessity of a lift or supporting column or walls.

- (e) There is also economy in cost as the provision of lift, columns, cross walls will not be required.
- (f) The density of population is generally low.
- (g) The marginal space surrounding the building can be used for garden.

The disadvantages of horizontal development can be stated as follows:

- (a) It requires more land for the same space area.
- (b) The foundation cost per unit area used is more, since the area is spread throughout,
- (c) It is uneconomical where the land is costly,
- (d) There is absence of group living.

(ii) *Vertical Growth*: Here city grows vertically which is done by adding more floors to the existing buildings or by constructing high rise or multi-storeyed buildings. This type of growth is suitable where the land is costly.

The advantages of vertical growth can be stated as below:

- (a) Since the same area is used for foundation, the foundation cost per unit area is within reasonable limits.
- (b) There is a lot of saving in land so it is economical to use multistoreyed building where the land cost is high. It leaves plenty of space available for amenities like gardens, playgrounds etc.
- (c) There is also economy in the construction cost.
- (d) As the building goes above, the landscape goes through underneath and the occupants enjoy the beauty of the surrounding country.
- (e) Since number of people utilise the common amenities of the same building, it develops a sense of group living.

The disadvantages of vertical growth can be stated as follows:

- (i) Getting up and down is difficult in case of failure of lifts.
 -) In case of fire, the occupants staying in upper floors find it difficult to escape.
- (iii) In case of earthquake, the liabilities will be more.
- (iv) Due to wind, terrific down drafts sometimes develop which knock the pedestrians off their feet. So these should be checked through wind tunnel tests before their construction.
- (v) There is some wastage of floor space due to provision of supporting pillars, lifts, elevators etc.
- (vi) The density of population is very high.
- (vii) The design of all flats is same or stereotyped, hence there is no choice of likes or dislikes.

The suburban sprawl—the unco-ordinated inefficient scattering of residential areas over the country side—has proved the folly of horizontal development. Naturally, vertical development in the form of skyscrapers is seen to be popular though the buildings require large investments of funds

and high technical knowledge. Modern town planning is no more a control of two dimensions i.e. length and breadth, but it must be considered from third dimension also, i.e. height.

2.5 Causes of Expansion of Towns. The growth of towns and growth of population always go together. Their causes are therefore similar or almost identical. These causes are as below:

- (i) The expansion of towns is mainly the result of communication facilities such as buses, trams road-ways, railways, like suburbs, etc.
- (ii) Waterways and airways help to develop harbours, ports, airports etc.
- (iii) Vertical development in the form of skyscrapers with the help of vertical transportation such as mechanical elevators, lifts, escalators etc.
- (iv) Attraction of modern amenities for comfort, convenience, recreation combined with employment opportunities, lucrative professions.
- (v) Facilities for higher education, research etc. help migration of rural population to the cities.

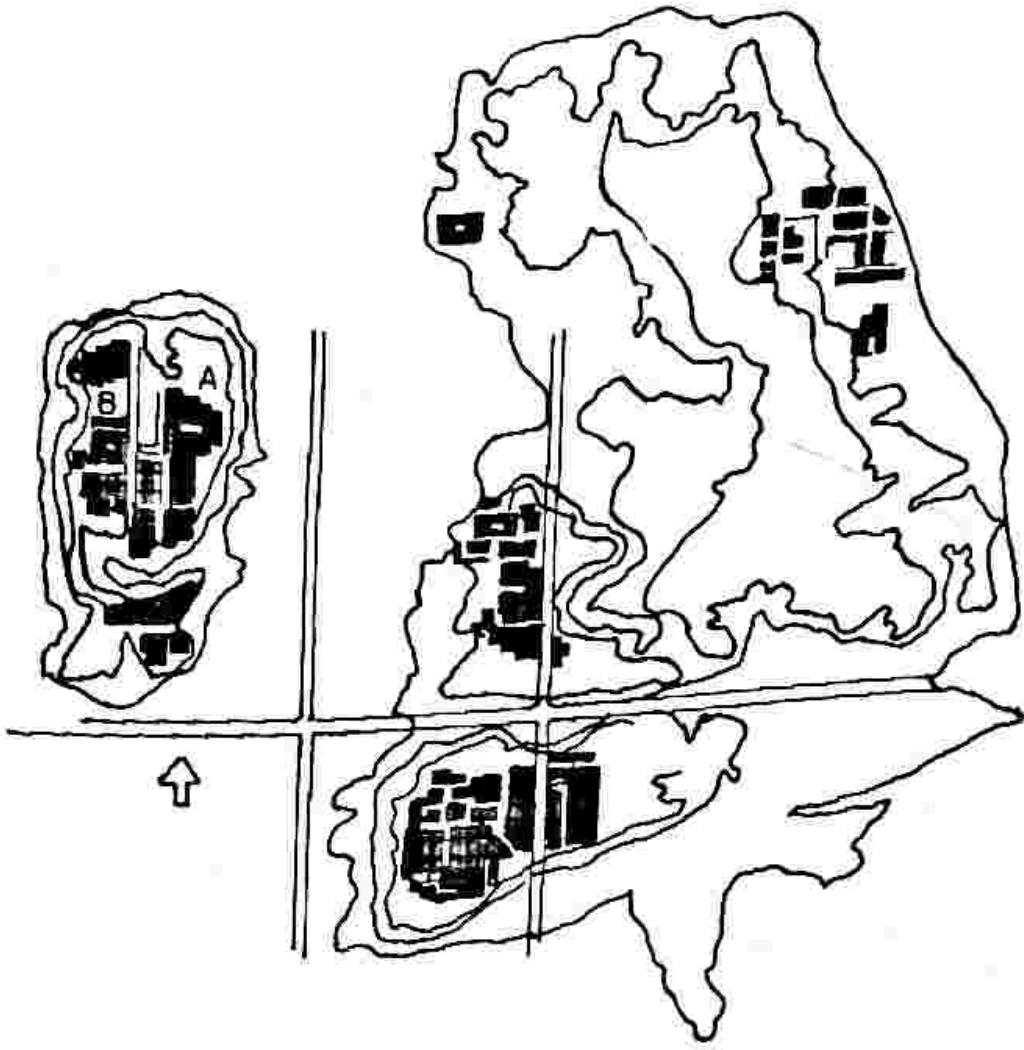
HISTORY OF TOWN PLANNING IN INDIA

3.1 General. Town planning is not new idea or science in India. It is as old as its rich culture and tradition. Following is the brief history of town planning at different periods in India.

3.2 Development of Town Planning in Ancient India. (i) *(Indus-Valley Civilisation (3000 B.C.)* : The Indo-Gangetic region formed the cradle of Indus Valley Civilisation, nearly five thousand years ago, though no one had heard of such civilisation till the 1920's. However, the excavations carried out in the latter half of twenties at Mohenjo-Daro (Hill of the Dead—on the Indus bank) covering an area of about 260 hectares and Harappa (on the bed of river Ravi) now in Pakistan; Kalibangan in Rajasthan; Lothal, Sukortada and Dhoulavira in Gujarat; Rakhigadhi in Haryana, show that the Indus Valley Civilisation had its beginning between 4000-3000 B.C. The civilisation had greatly developed as that of ancient Mesopotamia. The cities had highly advanced system of town planning. The city Mohenjo-Daro, shown in Fig. 3.1, was located on two mounds, one 1183 m x 546 m and other 364 m x 273 m with the population of 70,000 (the same as Harappa). The city was built systematically. The street 9 m wide divided the city in 12 blocks each 365 m x 244 m. The layout of streets was based on 'Grid-iron' plan. Houses were of varying sizes and storeys, constructed with brick walls. A series of rooms were arranged around an open-to-sky central court. The residences had no direct entrance opening to the main streets; and no windows were provided towards the subsidiary walkways.

They depended entirely on roof lighting and ventilation. Almost every house built of kiln-brick, had complete bathing establishment. A common well was provided to the groups of the buildings. The city had an effective system of drainage. The drainage lines were running under walkways and finally connected to the main sewers laid under main roads. There were manholes located at different places for cleaning and inspection. Market-halls, granaries, offices were neatly planned. The Great Bath was 7 m wide, and 12 m long and 2.4 m deep. The Great Bath had a remarkable system of filling and emptying and meticulously joined at the bottom with bricks. It was made watertight with layers of bitumen, and was surrounded by toilets and private baths. It was a prototype of ritualistic bathing tank which was the part of Hindu temples. The Indus-Valley culture collapsed due to the natural catastrophe. After centuries later, it was occupied by the Aryan invaders in 1500-1000 B.C.

(ii) *Vedic Period (up to 400 B.C.)* : Even in Vedic period, the town planning was done on scientific footing. The principles of town planning are mentioned in some sacred books. In 'Visva Karmaprakash' it is stated that 'First layout the towns and then plan the houses'. This principle holds good even today. 'Mansara Silpashastra' (Architecture by Mansara) deals with many aspects of town



A—MONASTERY

B—BATH

■—EXCAVED PARTS

Fig. 3.1. Mohen jo-Daro

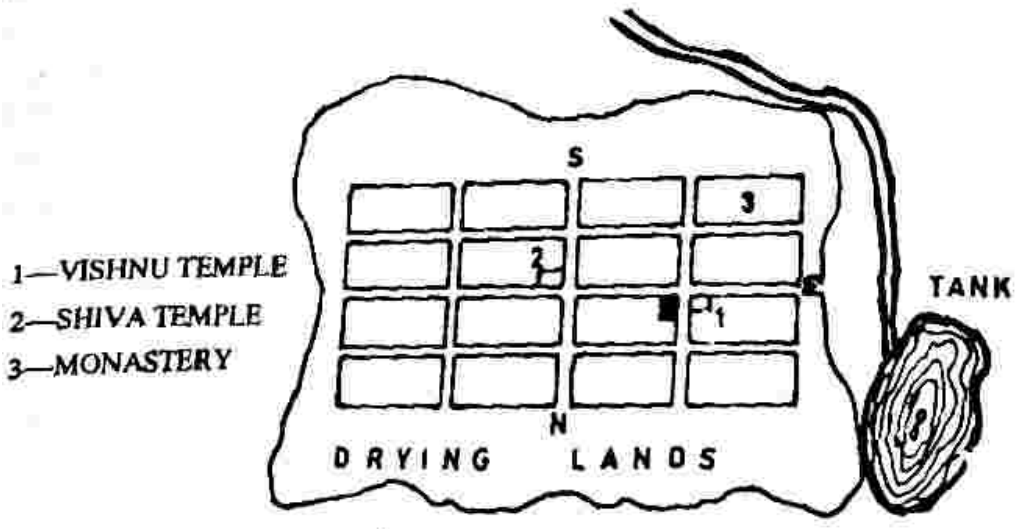
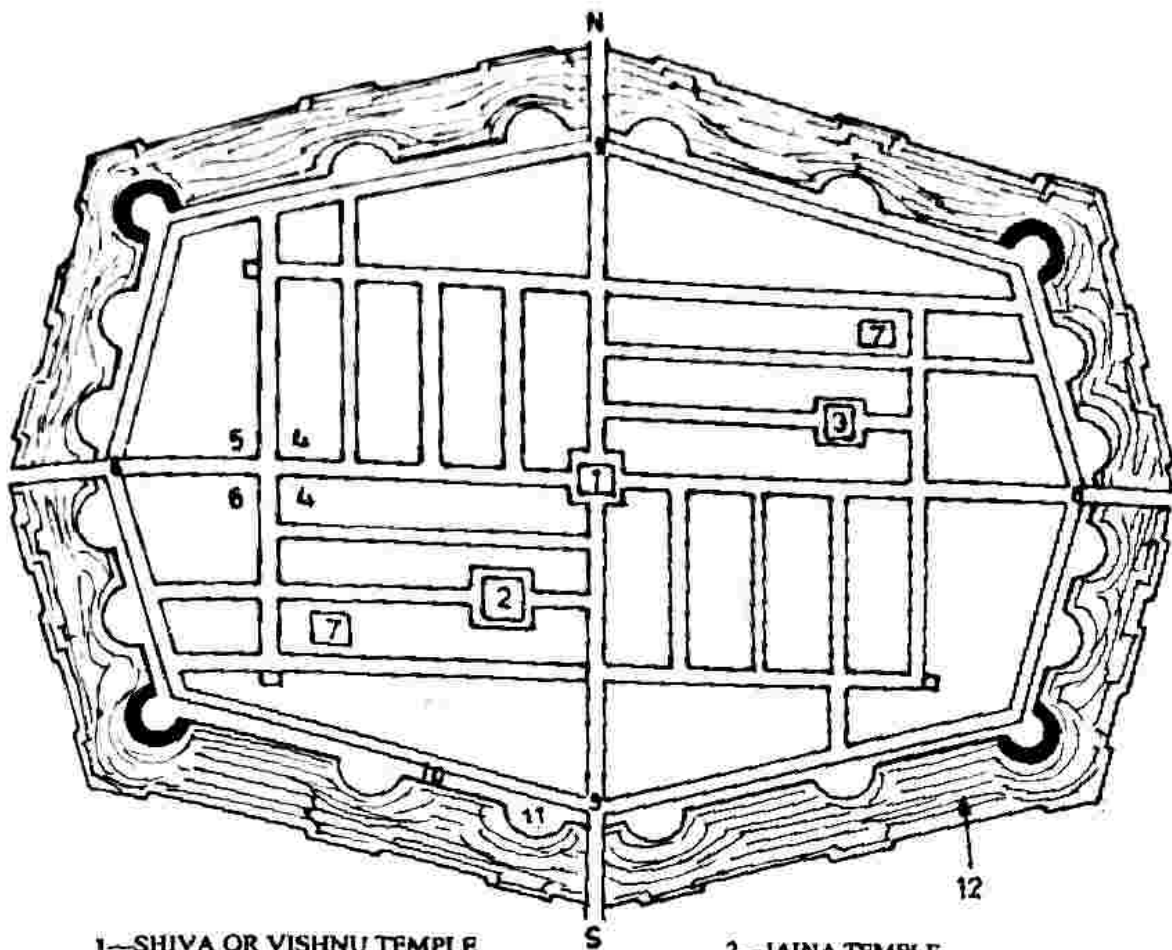


Fig. 3.2. Dandaka Type

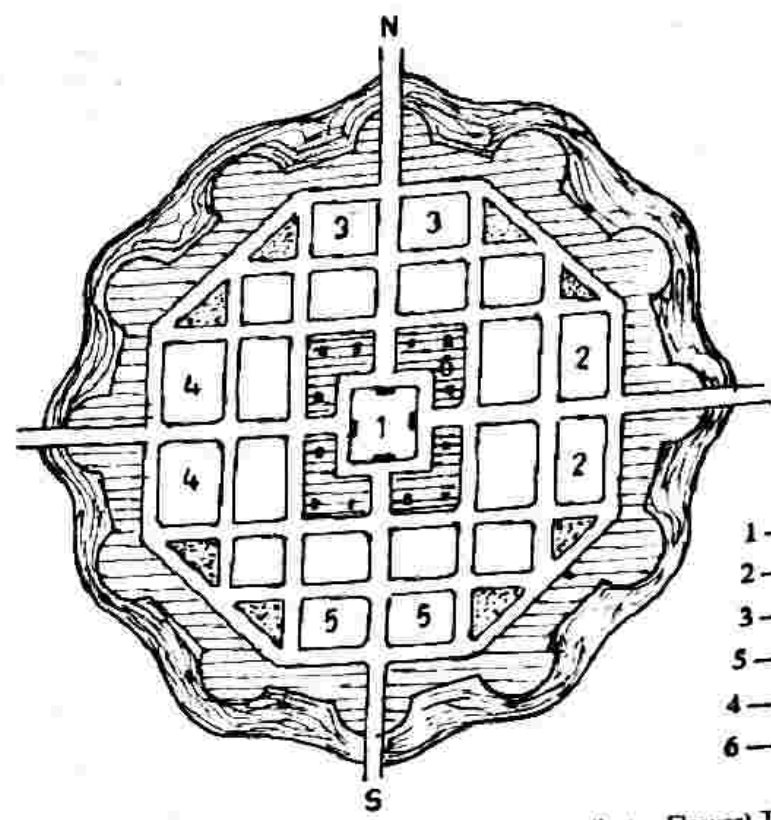


- | | |
|--------------------------|---------------------------|
| 1—SHIVA OR VISHNU TEMPLE | 2—JAINA TEMPLE |
| 3—BUDDHIST TEMPLE | 4—OFFICE AND COURT |
| 5—KING'S PALACE | 6—PRINCES PALACE |
| 7—TANK AND GARDEN | 8—GANESH TEMPLE |
| 9—KALI TEMPLE | 10—RAMPART WALL |
| 11—BASTION WITH ARMOURY | 12—MOAT FILLED WITH WATER |

Fig. 3.3. Swastika Type

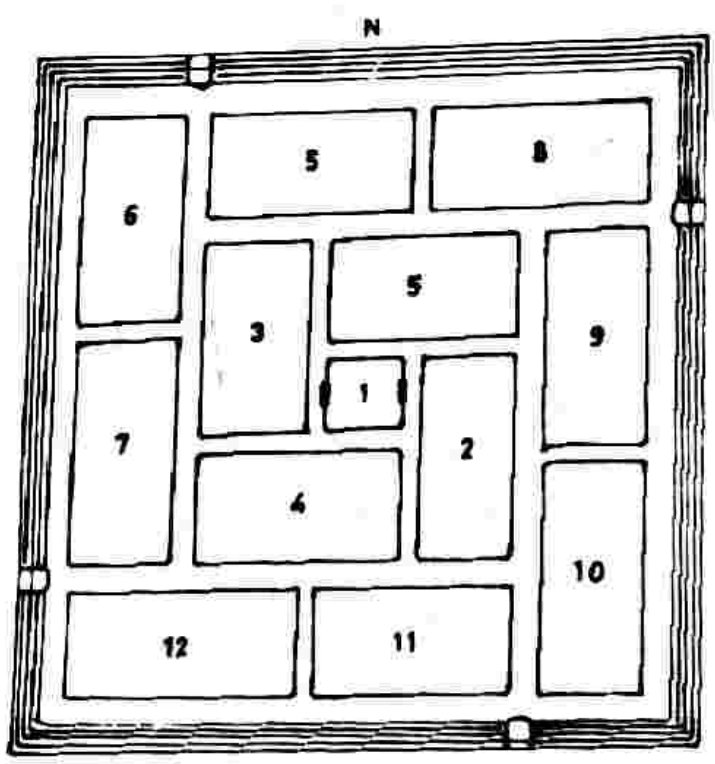
planning, such as study of soil, climatic condition, topography, fixing orientation to get maximum advantage of the sun and wind, and layout of various types of town plans such as Dandaka, Swastika, Padmaka, Nandyavarta, Prastara, Chaturmukha, Karmuka.

See Figs. 3.2 to 3.8. The main or king streets (Raja Marga) were aligned East-West to get the roads purified by the sun's rays; while the short roads were aligned North-South. The roads running around the village called 'Mangal Vithi' were reserved for priests. These books also refer to the qualification and moral qualities of the town planner (Sthapati) emphasizing that he must have



- 1 — TEMPLE
- 2 — SHOPS AND VEGETABLE STALLS
- 3 — PALACE
- 5 — SHOPS FOR OTHER ARTICLES
- 4 — MEAT MARKET
- 6 — TANK

Fig. 3.4. Padmaka (Lotus Flower) Type



- 1 — TEMPLE
- 2 — TANK
- 3 — PALACE
- 4 — COURT
- 5 — BRAHMIN QUARTERS
- 6 — SCHOOL, COLLEGE
- 7 — MONASTERY
- 8 — HOSPITAL
- 9 — THEATRE
- 10 — RESIDENCE FOR ARTISTS
- 11 — QUARTERS FOR OTHER CASTES
- 12 — QUARTERS FOR HUNTERS AND FISHERMEN

Fig. 3.5. Nandyavarta (Flower) Type

mastery over the science of planning, and thorough knowledge of culture, social and religious conditions.

In 'Ramayana' and 'Mahabharata' we come across the descriptions of the cities of Ayodhya and Indraprastha (ancient name of Delhi) respectively that the cities had neatly laid out houses, palatial buildings, spacious thoroughfares, tanks, lakes, beautiful gardens and parks etc.

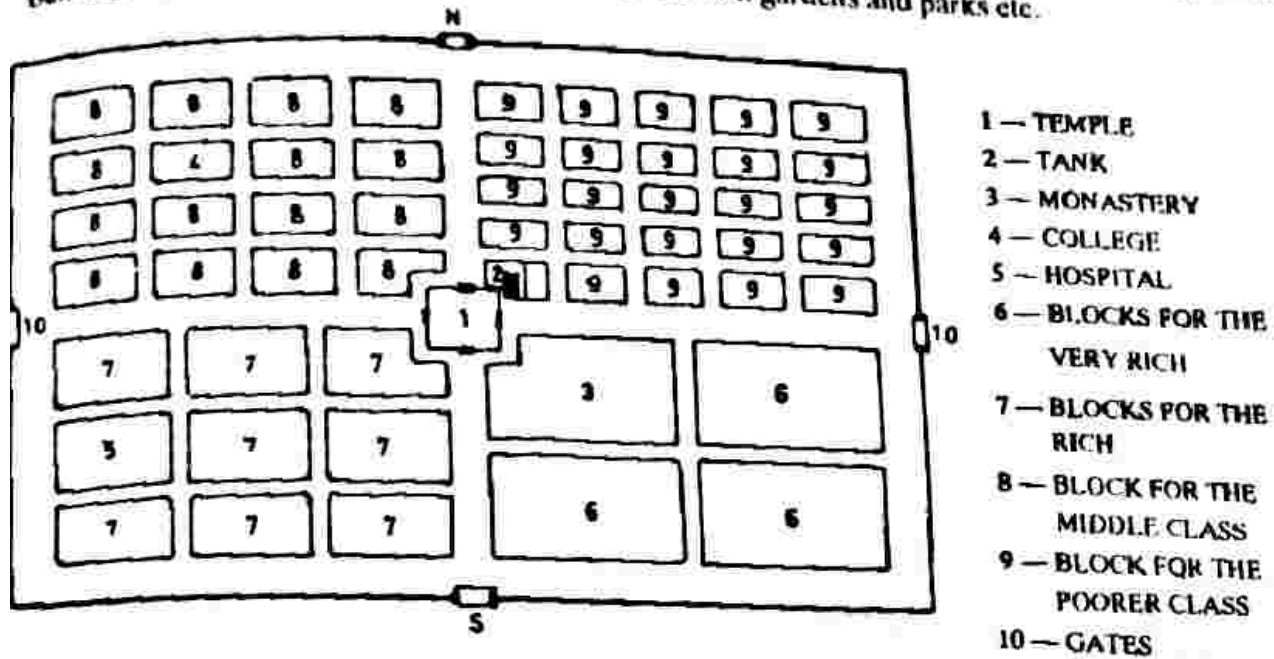


Fig. 3.6. Prastara Type

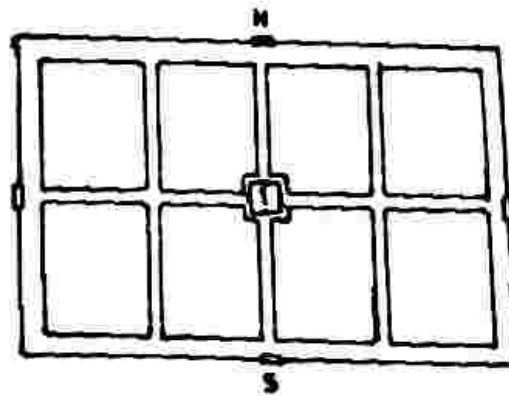
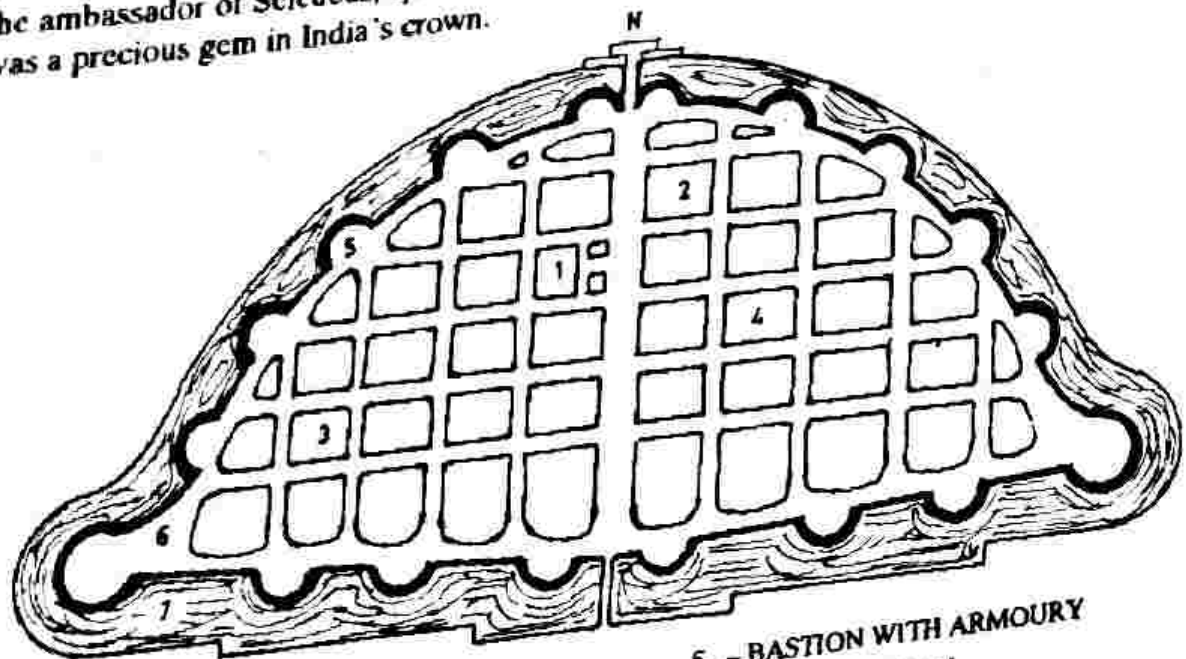


Fig. 3.7. Chatumukha Type

(iii) *Buddhist Period (upto 320 A.D.)* : During the period of Emperor Chandragupta Maurya (321 B.C. - 185 B.C), Kautilya or Chanakya was the chief minister who wrote the famous 'Arthashastra' (Economics by Kautilya), a treatise on Town Planning. It states the regulation of zoning depending on communities; highways (Rajamarga) to be parallel to the main cardinal direction i.e. Grid-iron

pattern; Rajamarga to be not less than six 'clandas' i.e. 30 ft. or nearly three lanes of traffic. It clearly shows that the art of town planning had made much progress as long back as third century B.C.

The excavations carried out at Patliputra (modern Patna), the capital of Magadha, show evidence of advance knowledge of town planning. The capital was laid on grid-iron pattern consisting of 12 sectors. Most of the houses had gardens with wells and ponds. Waste water was carried by means of underground drainage and finally to the river Ganga. The city as long as 16 km and 3.5 km wide was surrounded by a deep moat 180 m wide and further protected by ramparts stretching more than 4 km long studded with 64 gates and 570 towers. The four main gates were oriented to the cardinal points of the compass and were wide enough for the elephants to pass through easily. Megasthenes, the ambassador of Seleucus, speaks highly of Mauryan capital city Patliputra which in those days was a precious gem in India's crown.



- 1 — TEMPLE
- 2 — COLLEGE
- 3 — HOSPITAL
- 4 — MONASTERY WITH TANK

- 5 — BASTION WITH ARMOURY
- 6 — RAMPART WALL
- 7 — MOAT FILLED WITH WATER

Fig. 3.8. Karmuka (Bow) Type

Taxila (Taksa-Sila) as shown in Fig. 3.9 and Nalanda were also founded in this period. Nalanda was a renowned place of learning. Its name and fame swept across the whole of the known world. The site Nalanda measured about 487 m long and 244 m wide and contained three main essentials—stupas, temples and hostels for monks. It had three hundred halls accommodating more than ten thousand pupils. The libraries were nine-storeyed high. The famous Chinese traveller Hiuen Tsang writes 'the soaring domes reached to the clouds and pinnacles of temples seemed to have lost in the mists of morning'.

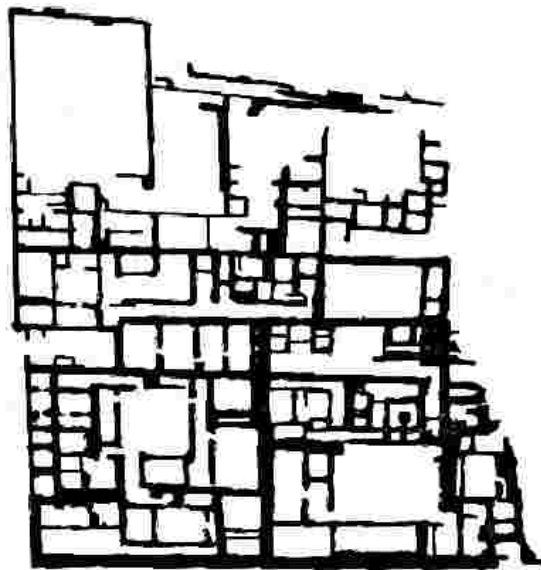


Fig. 3.9. Plan of 250 B.C. city of Taxila, the ancient capital of Gandhara (near Rawalpindi) covering an area of 30 sq.km. contained many shrines and temples. Here the axial main roads are divided by streets and regular blocks of buildings.

3.3 Medieval Period (upto 14th century). There was gradual development of trade and commerce. In this period we have the famous cities such as:

- (i) Dhaka (Now in Bangladesh) for Malmal.
- (ii) Krishnanagar for clay models.
- (iii) Agra for marble and perfumery.
- (iv) Murshidabad for silk.
- (v) Jaipur for palatial buildings of artistic excellence (see Fig. 3.10).

3.4 Moghul Period (1526 - 1707 A.D.). Cities like Agra, Delhi were re-developed. Fatchpur-Sikri was entirely planned. Fortification strengthened Bijapur, Lucknow. Other important thing started in this period was laying of gardens and parks. It was a new trend in planning many ornamental gardens of Moghul period. Some of them are still in good conditions. For example

- (i) Kabul Bagh at Panipat by Babar.
- (ii) Shalimar Bagh or Garden of Bliss and Nishat Bagh at Kashmir by Shah Jahan.
- (iii) Lal Bagh at Bangalore by Haider Ali.

3.5 Pre-Independence Period or British Period (till 1947). When the Britishers first settled in India, they found most of the conditions of the towns to be unhealthy. So they started independent colonies on the outskirts of the existing towns. These extensions were known as 'Cantonments' and 'Barracks' for the military occupied area and 'Civil Lines' for the residence of civilians and well-to-do people.

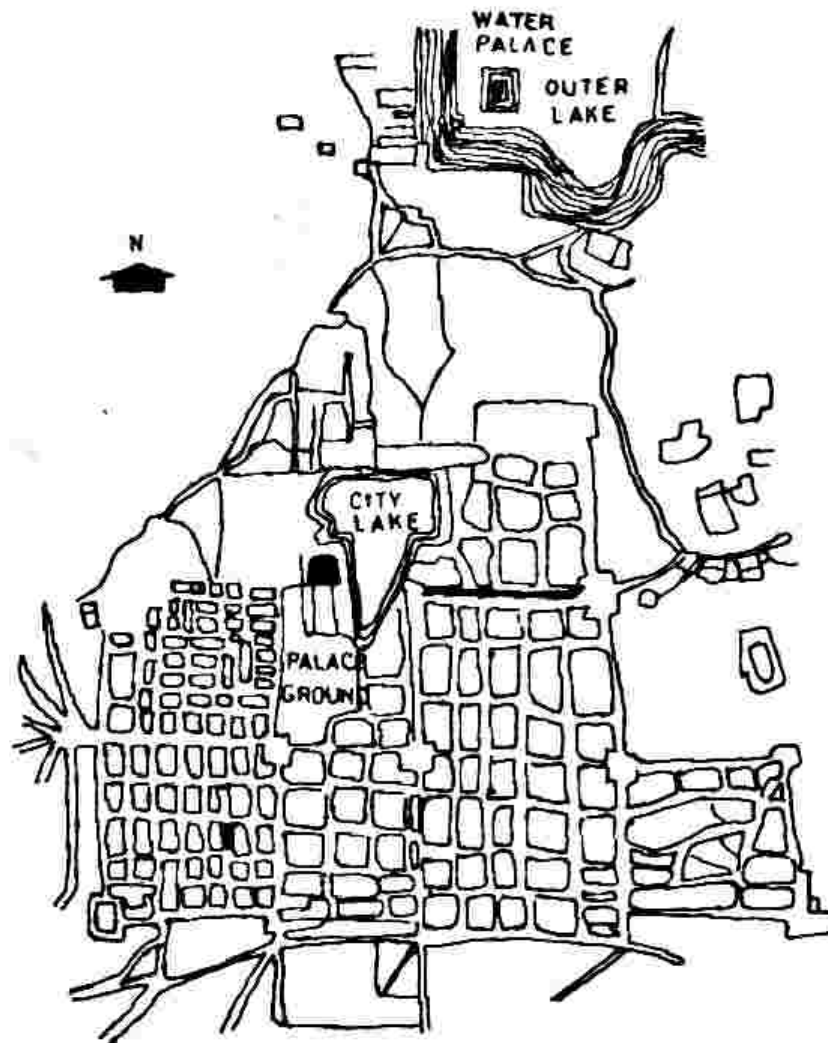


Fig. 3.10 Plan of medieval city of Jaipur showing grid-iron pattern.

Next they took to street planning. They adopted straight roads regardless of the cost or damage to social structure of the town. But no large town planning schemes were taken till the end of 19th century. However, in the first decade of 20th century, they took up the outstanding work of building of New Delhi — the new capital of India. See Fig. 3.11. The plan was prepared on modern town planning principles by an eminent town planner Edwin Lutyens assisted by Baker. The capital group of buildings like Government House, Council Hall, Secretariat has been designed with their monumental architecture, industrial buildings are separated from residential sector, and arranged around the commercial and civic buildings. It was more a planning and designing of Administrative centre than a new town as such. This, however, does not reduce its importance as a great work of art.

3.6 Post-Independence Period (After 1947). Many industrial towns were planned after post-independence period. A few of these can be mentioned as below:

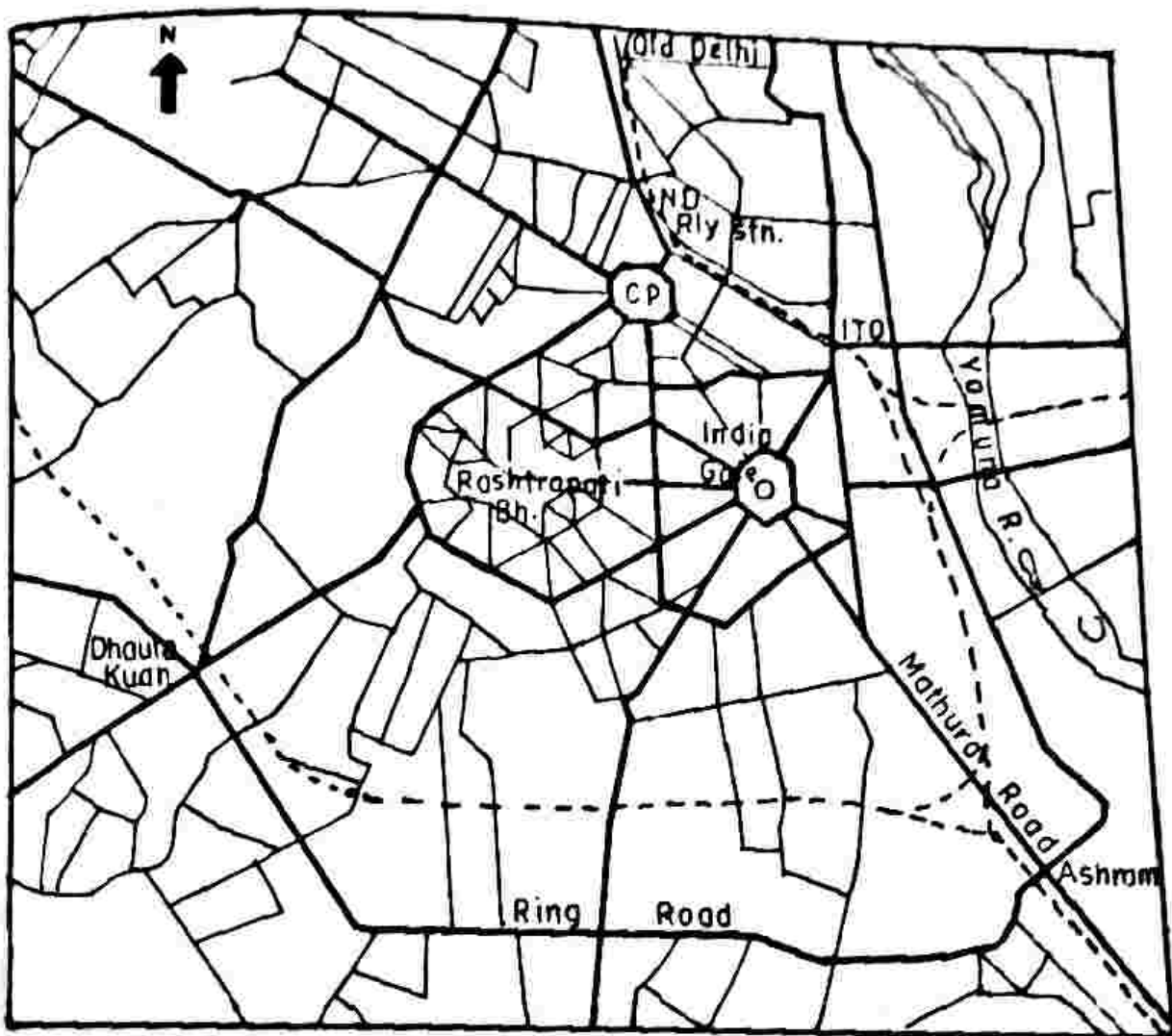


Fig. 3.11. New Delhi

(1) Steel Towns

- (i) Durgapur — West Bengal
- (ii) Bhilai — Madhya Pradesh
- (iii) Rourkela — Orissa

(2) Industrial Towns

- (i) Jamshedpur — Bihar
- (ii) Bhadravati — Karnataka
- (iii) Chittaranjan — West Bengal

(3) Capitals

- (i) Gandhinagar — Gujarat
- (ii) Chandigarh — Punjab, now a Union Territory

(I) **Gandhinagar**. After bifurcation of bilingual Bombay State, new state of Gujarat was formed on 1st May, 1960, and a new capital was made at Gandhinagar. The salient features of Gandhinagar are:

(i) **Landscape**: The capital city is located on the western bank of Sabarmati River, 24 km to the north of Ahmedabad.

The site has gentle slope from N.E. to S.W. Soil is mostly sandy loam hence there are no problems for serious foundation. It is linked by roads, rails and air with all parts of the state.

(ii) **Climate**: Climate is healthy.

(iii) **Population**: The town plan is designed for 1,50,000 to 1,75,000 population and also for future expansion.

(iv) **Residential Units**: These are planned in good surroundings with all facilities of water supply, electricity, drainage, shopping centres. Separate houses are provided by the Government for their employees.

(v) **Zonal Centres**: A zonal centre for every 4 to 5 sectors is provided which includes cinemas, dispensaries, bank, post office, police station, etc. It also serves a large population of neighbouring villages.

(vi) **Town-Centre**: About 75 hectares have been allotted to accommodate civic, commercial and cultural facilities. One main bus terminus is also included in the town plan for communication facilities in the state and region.

(vii) **Public Buildings**: These include schools, colleges, town halls, hospitals to satisfy the social, cultural and medical needs.

(viii) **Communication**: Roads for various traffic are provided separately. The roads leading to Govt. offices and approach roads are 100 m wide. The peripheral roads and those providing access to town centre are 65 m wide. The remaining roads are 45 m wide. The roads are oriented at 30° north of west and 60° north of east to avoid direct facing of morning and evening sun. The traffic is well distributed. The cycle ways and motor roads are segregated with grade separators thus minimizing the road accidents. Gridiron pattern is adopted for road system. The roads dotted with road side trees of different types are about 275 km. in length.

(ix) **Open spaces**: The open space is about 1.5 to 2 hectares per 1000 population excluding playgrounds and parks etc.

(x) **Industries**: Light industries are provided in an area of 120 hectares. About ten thousand workers are engaged in these industries.

(xi) **The Capital Complex**: It includes buildings like high court, secretariat, assembly hall, legislative and heads of different offices. The entire complex is located in pleasant surroundings with traffic facilities.

(II) **Chandigarh**: India became Republic in 1947 with the formation of Pakistan as sovereign state in the same year. As a result of partition Punjab was divided into two parts. One part went to Pakistan with Lahore as its capital, and another part of Punjab came in Indian territory. Therefore it was found necessary to establish another new capital for the state of Punjab. The decision was taken

to construct the new capital at Chandigarh in 1948 but was implemented in 1950. The plan of the capital city is shown in Fig. 3.12. It was named after the temple of Goddess Chandi.

It took three years to complete. And the capital was declared open by the then President of India, Late Sri Babu Rajendra Prasad on 7th October, 1953. It is now a Union Territory under the administration of Union Government.

The celebrated architect and town planner Le Corbusier (1887-1965) was the main brain behind planning of Chandigarh. He came to India on the invitation from Jawaharlal Nehru, the then Prime Minister of independent India. He was assisted by Jane Drew, Maxwell Fry of England, P.N. Thapar and P.L. Verma, the Chief Engineer of Punjab. Albert Mayer, an American planner, was originally selected to be the town-planner who provided the basic plan for the city and a detail architectural scheme for one super-block but his name was dropped for variety of reasons.

The salient features of Chandigarh are:

(i) *Landscape* : The town is bounded on the north by double rows of low picturesque Siwalik Hills and enclosed on either side by two river beds nearly 5 km apart, with the Himalayas as a permanent background. The town is located some 8 km off Delhi-Kalka road. Maximum advantage is taken of its wealth of natural beauty. Its scenic charm is further enhanced by forming an artificial lake on its northern part by obstructing the Sukhna-Choe River. A beautiful park now surrounds the lake.

The capital has a planned landscape. The landscape architect has determined what kind of trees should grow and where. It has given Chandigarh distinctive character from architectural point of view. For example, a particular avenue has only one kind of trees and even an illiterate person can easily identify a road from the kind of trees that grow along the sides. All open spaces along the roads are grassed. Water basins and fountains are laid at suitable places.

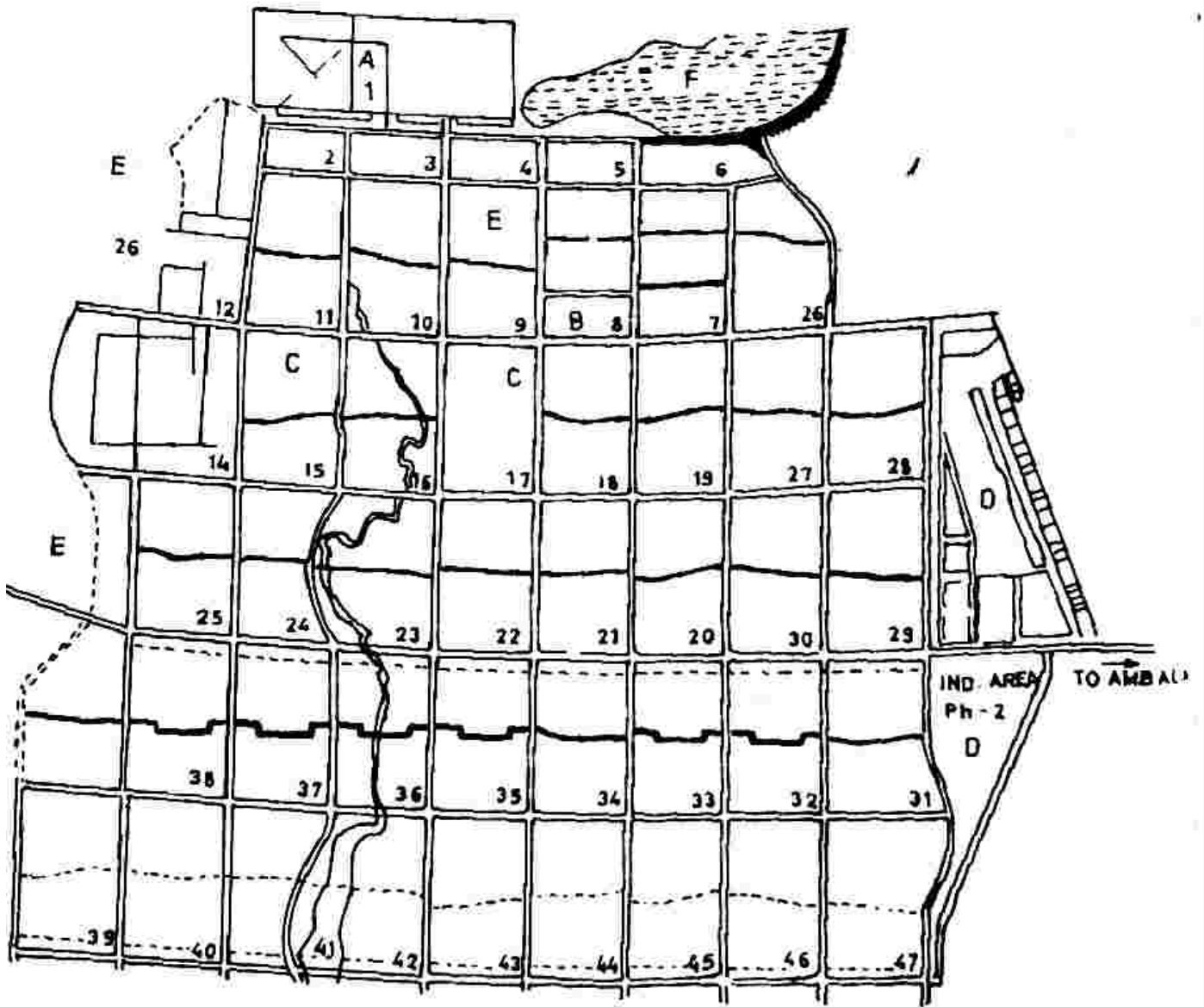
(ii) *Climate* : The town is situated in a submountainous tract. Hence it has a salubrious climate. Rainfall is 115-120 cm a year. The soil is quite suitable to grow mango trees, shrubs and plantations.

(iii) *Population* : The area of the town is 9000 acres. The master plan aimed to accommodate a population of 1.5 lakh only in its first phase of development but intends to provide accommodation for 5 lakh population in future.

(iv) *Sector Planning* : The town is planned on the principle of super block or sector planning. This is altogether a new concept as applied to the art of town planning, to get maximum comfort and convenience of the residents. The town is divided into 47 sectors; there being no No. 13 sector, each sector is 1.25 km long and 0.81 km wide accommodating population ranging from 10000 to 15000. There are three to four neighbourhood units in each sector.

Each sector is made virtually self-sufficient by providing all the daily needs like shopping centres, hospitals, meeting places, nurseries, schools etc. All the schools are within 15 minutes walkable distance and it takes hardly half an hour to walk round the whole sector. A central continuous green band of open space passes through one sector to another which enables the pedestrians to walk in perfect safety and in comfort, along the shaded footpaths.

(v) *Town Centre* : This is located in the central sector. It includes civic and commercial buildings



A — GOVERNMENT OFFICE

B — TOWN CENTRE

1,2,3,.....47 — SECTORS OF CITY (SECTOR 1 RESERVED FOR GOVT HOUSE AND SECTOR 13 OMITTED)

C — LOCAL SHOPS

D — INDUSTRY

E — GREEN BELT

F — LAKE

Fig. 3.12 Chandigarh

(vi) *Communication* : Le Corbusier's system of 7 types of roads (7 V's) for different kinds of traffic is perhaps the first of its kind as applied to town planning in India. Roads for fast moving traffic are located at the periphery of each sector, with shops at various places which are within 10 to 15 minutes walkable distance. The roads for slow moving traffic are inside the sector. There are shaded footpaths for pedestrians and tracks for cycles. The inhabitants are in perfect safety from vehicular traffic and there are practically no problems of traffic due to its efficient segregation.

(vii) *Open Spaces* : A green band of open space runs from one sector to another through the residential units to the commercial centres. There is provision of large central park and sufficient open spaces in all the sectors, with a view to provide community and health centres; playgrounds and swimming pools.

(viii) *Residential Units* : Housing accommodation is neatly planned, in beautiful surroundings. All houses partake in the gardens and parks located at convenient places. Even the class IV Govt servants are provided with well furnished quarters with all the basic amenities like water supply, electricity, sanitation etc. A peculiarity of these residential units is that on exterior plain surfaces of the houses, 'sun-breakers' have been provided which are projections of brick and concrete fins set at particular angles to the walls. These sun-breakers not only produce the charming effective play of light and shade but also absorb the rays of the sun and keep the houses cool during summer but warm in winter. It is indeed the realistic planning for the people in democracy. Hence, Chandigarh has become a landmark in the history of town planning.

(ix) *Industries* : Though Chandigarh is planned as the capital city, yet it has potentialities to provide industries. About 600 acres of land have been set aside for factories and industrial centres situated near the Railway Station.

Industrial buildings are located in the Southern sector but segregated from residential sector by a wide green belt 100m x 150 m and is served by a Railway Siding. The industrial sector is planned leeward of the city and as such wind will not blow towards the residential units. They are therefore absolutely free from noise, undesirable smells and obnoxious dust etc.

(x) *Capitol Complex* : Le Corbusier designed the four Govt. buildings which he called as 'Capitol'. The capitol includes High Court (9 storeys high with peculiar parasol roof); Assembly Hall Secretariat (7 storeys high) and Raj Bhavan. These buildings have their monumental character to which he added a symbolic sculptural feature — the "Open Hand" monument which stands in the Trench of Consideration and represents the concept of "open to give, open to receive" — to the group to be distinguished for their architectural beauty. These 'foreground' buildings are carefully placed to contrast against the 'background' buildings like office buildings, hospitals, factories etc. A 90 m wide avenue with beautifully designed parkway leads to the capitol.

It is no doubt that Chandigarh symbolises the heroic endeavour to rebuild the shattered social, cultural life of the Punjab. It is indeed an epitome of Town Planning.

ELEMENTS OF CITY PLAN

4.1 Introduction. All the individual objects that are included in an urban area are the elements of city plan. These objects include residential buildings, public buildings, parks, factories, roads etc. For all these, land is required in plenty. The land is mainly divided in two categories, such as (i) Built-up lands, (ii) Open lands. Built-up lands include all areas used for buildings of all types. Open lands include roads, gardens, parks and playgrounds.

A town generally consists of the following:

(i) **Town centre** : It is the central core of the town containing business centres, civic centres and light shopping centres.

(ii) **Suburbs** : These suburbs contain all types of houses with small shops and social amenities.

(iii) **Industrial areas** : These areas contain different industries and factories with communication facilities.

(iv) **Network of Roads** : These roads run between the built-up areas and connect them with each other.

(v) **Open spaces** : These include parks, playfields etc.

4.2 Elements of City Plan. The main elements of city plan are generally classified as:

(i) **Communications** : These include (a) Roadways (b) Railways (c) Airways and (d) Waterways.

(ii) **Built-up areas** : These include,

(a) Residential buildings

(b) Public and semi-public buildings

(c) Commercial buildings and

(d) Industries.

(iii) **Open areas** : These include

(a) Open space for recreation like gardens, parks, playfields etc.

(b) Open lands, other than the above, for graveyards, cremation grounds, burial places etc.

(iv) **Public Utility Services** : These include

(a) Water supply, (b) Drainage (c) Electricity (d) Gas (e) Telephone

(v) **Public Amenities** : These include a large number of items. The most important are as follows:

- (a) Post office (b) Police station (c) Petrol pump (d) Fire Brigade Station (e) Dairies (f) Dhobi ghats (g) Refuse deposits etc.

4.3 Distribution of Land. The distribution of land for the built-up areas and open areas is as below:

(a) **Built-up areas.**

(1) Single-family houses	36.5%	
(2) Two-family houses	5.0%	57% Residential
(3) Multiple family houses (Flats)	15.5%	
(4) Business shopping centres	3.0%	Non Residential
Total	60%	

(b) **Open areas**

(1) Parks	20%
(2) Roads	20%
Total	40%

Fig. 4.1 shows the distribution of land. From the figures it is clear that the residential areas require as much as 57%. That is why the planning of the residential areas is most important aspect of town planning. The rest 3% covers the business, shopping and other public amenities.

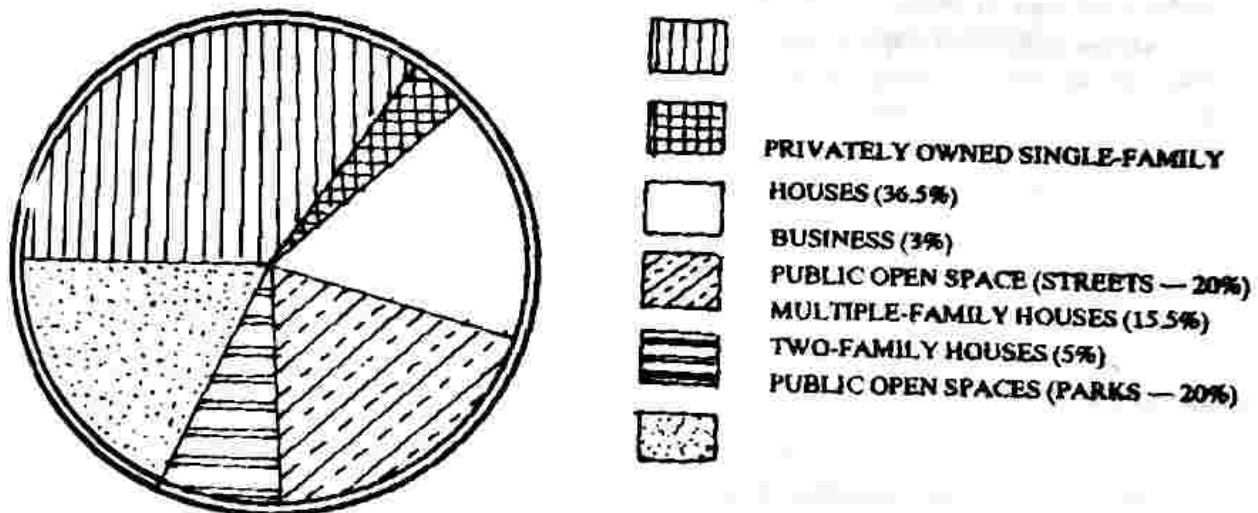


Fig. 4.1. Land Distribution

4.4 Method of Financing a Town Planning Scheme. The sources of finance of any local body are:

- (i) Revenue from non-tax sources.
- (ii) Taxes levied by the local body and collected by the State Government.
- (iii) Taxes levied by the local body but collected on behalf of State Government.
- (iv) Grant-in-aid or loan by State or Union Government
- (v) Taxes on goods or passengers carried by railways, sea or airways.
- (vi) Taxes on railway fares and freight charges.
- (vii) Taxes on lands and buildings.
- (viii) Entry of goods in the city area.
- (ix) Consumption and sale of electricity.
- (x) Vehicles, animals.
- (xi) Professional taxes.
- (xii) Taxes on luxurious items.
- (xiii) Advertisements in the local city (other than in papers).
- (xiv) Capitation and Toll taxes.

4.5 Aesthetics of Town Planning. Man has a natural love for 'Beauty' and so utility and beauty must be considered in the civic design to satisfy the aesthetic aspirations of the citizens. The aim of town design is to see that the urban elements not only function properly but also in a pleasing way. They should promote the sense of beauty and love of nature to secure satisfaction. According to Keats's saying: "A thing of beauty is a joy for ever".

All the individual objects that we see in the urban scene are the elements of civic design or town-design. Hence utmost care should be taken on the aesthetic side of town planning to introduce the element of beauty. Almost every element, right from lamp post to public buildings in the layout of city, should be planned beautifully with careful consideration and architect's professional skill. This is accomplished by three ways namely Creative, Preventive and Destructive measures. Creative in the sense that the city can be made beautiful by enriching the plan pictorially, Preventive, by way of control and Destructive, by way of removal of everything which is ugly and objectionable from point of civic aesthetics.

Each measure will now be briefly described, as:

- (1) **Creative measures:** (1) Buildings either private or public should be insisted to be built to satisfy certain architectural standards.
- (2) Residential neighbourhoods should be neatly planned.
- (3) Every residential building should be compelled to have a garden around it.
- (4) Art Galleries, Museums must be designed with architectural excellence to attract the visitors and to encourage local industries and manufacturers.

(5) Planning of trees of appropriate colour, shade and growth should be done on either side of the roads. Proper illumination should be done with street lamps of artistic design to enhance the beauty of the town.

(6) All public buildings should be designed with the element of beauty and located at focal points or main squares.

(7) Main squares should be adorned with fountains which can be gracefully designed with variety of coloured marbles, either as a basin or as spouting jets, or sometimes gushing water from fish or such other object supported by the bronze statue of nymph etc.

(8) All open spaces should be converted into parks, gardens or at least converted into lawns, colourful shrubs which may be interspaced with small lakes, pools etc. in the landscape layout. See Art 9.7.

(II) Preventive measures: The concerned authorities can restrict or prevent the construction of certain structures in the city. They can allow such works which can be constructed in accordance with approved elevations. Some sort of control can be exercised about advertising in public places. They should be displayed judiciously so as to increase the beauty of the surroundings.

(III) Destructive measures: Under this, any structure found to be ugly and unsightly and therefore objectionable from point of view of beauty can be removed gradually. For example, open drains can be replaced by underground drains, to carry refuse of towns such as garbage, storm-water, subsoil water, sullage etc. Overhead telephone lines can be replaced by underground cables etc.

Today the aesthetics of the town are no more considered as luxuries. They serve as great assets, increase cheerfulness and happiness of mankind. They symbolise the pride and dignity of the city and outward expression of highly cultured society. The more the cultured a society is, the better it can express its aesthetic sense in private, public and civic buildings.

We will now describe the details of these elements in the proceeding chapters.

SURVEYS

5.1 Necessity. By survey is meant to collect the data and information based on spot observation. To draw a mental picture of the region, the town and its various elements like residential and working areas, the survey serves a broad canvas picturing the present state of the town and to provide proper means for its development, in future.

'Survey before Plan' the principle advocated by Sir Patrick Geddes, is emphasised by many town planners. It is the 'Diagnosis before Treatment' or 'Diagnostic Approach' without which no adequate planning scheme can be prepared for a town. The survey data so collected can be analysed and will be represented in the form of maps, charts, tables, and models. Such a fully illustrated and clearly documented survey is helpful and advantageous in the following way:

- (i) It helps to provide the data of the existing town and corroborative evidence for the concerned authority. Thus the planning work becomes easy.
- (ii) It helps to know exactly what is lacking and what is needed for the development of the town.
- (iii) It throws light on the inter-relationship of activities of the town life, i.e. whether a particular development has produced a favorable or adverse effect on its surroundings.
- (iv) It helps to know the evils from which the town suffers and provides a proper treatment to be given, i.e. it helps to diagnosis before treatment, as pioneered by Sir Patrick Geddes.
- (v) It helps to build up the public opinion and appreciation in favour of town planning scheme.

5.2 Collection of Data. Collection of information and data is necessary for framing the planning proposals. The basis data to be collected include (i) the present land use (ii) population growth (3) traffic system (4) industrial position (v) economic base (vi) origin, history and growth of the town.

5.3 Types of Surveys. These are broadly classified as (i) Town or City Survey (ii) Regional Survey (iii) National Survey and (iv) Civic Survey.

(A) Town Surveys. Following surveys are conducted to collect the information and data necessary to prepare an upto date base map in the scheme of town planning : (i) Physical Survey (ii) Social Survey (iii) Economic Survey

1) **Physical Survey.** The data can be collected either by Land Survey or Aerial Survey.

(a) **Natural features:**

- (i) Location in relation to other major towns in the region.
- (ii) Topography, types of soil, rock, contours of the land, plain, wooded, forests etc.
- (iii) Climatology i.e. rainfall, humidity, temperature, wind-direction etc to fix up best orientation

(b) **Land Use:** By land use is meant the use of the land or plot specified in the town. These are classified as under:

- (i) Residential: For living purposes like houses, hostels, lodging etc.
- (ii) Commercial: Work-shops, mills, factories
- (iii) Public and Semi-public: Govt. & Semi-Govt. offices, schools, colleges, libraries, hospitals, museums, assembly halls, shrines, historical monuments etc.
- (iv) Open spaces: Parks, playgrounds, stadiums, race-course etc.
- (v) Transportation: (a) Road, their widths, tree planting (b) Railways, level crossings, goods yards, (c) Airports and seaports, (d) Waterways and canals
- (vi) Agriculture: Cultivated land, nurseries, orchards etc.
- (vii) Watersheets: Rivers, lakes, tank.
- (viii) Vacant: Barren land.
- (ix) Other uses: Refuse disposal area; cemeteries, grave-yards, area under defence etc.

(c) **Conditions of the buildings:** Here the gradation of the buildings is done on its future life.

(1)	Very Good	Future life	50 yrs and above
(2)	Good	Future life	30 to 49 yrs
(3)	Moderate	Future life	15 to 29 yrs
(4)	Bad	Future life	5 to 14 yrs
(5)	Poor	Unfit for inhabitation hence to be pulled down	

(d) **Communication :**

- (i) Highways connecting the town.
- (ii) Traffic on roads and railways and at junctions.
- (iii) Parking survey.
- (iv) Origin and Destination survey (O & D Survey).
- (v) Accident study.
- (vi) Future trends in the traffic.

(II) Social Survey**(a) Population :**

- (i) Trends in population growth for at least 40 to 50 years.
- (ii) Characteristics of present population.
- (iii) Future growth of population considering rural migration, development of new industries.
- (iv) Demographic survey i.e. classification of population by sex, literacy of different age groups.
- (v) Distribution and density of population in the town.

(b) Housing :

- (i) Housing condition.
- (ii) Density of accommodation.
- (iii) Height of the buildings.
- (iv) Materials used for construction.
- (v) Tenancy status; Rented or owned

(c) Community facilities :

- (i) Education: Schools, colleges, institutions, and libraries,
- (ii) Health: Hospitals, dispensaries, clinics
- (iii) Recreational : Parks, playfields, clubs, theatres, stadiums, boating
- (iv) Others: Museums, historical and religious buildings.

(III) Economic Survey.

(a) Occupational condition : Workers classified according to the nature of employment. Workers employed in

- (i) Household industry
- (ii) Cultivation
- (iii) Agriculture
- (iv) Trade & Commerce
- (v) Construction work
- (vi) Manufacturing industry
- (vii) Transport and Communication
- (viii) Quarrying
- (ix) Other services.

(b) Survey of Industries

- (i) Classification of industries

- (ii) Location of industries
- (iii) Availability of raw material
- (iv) Workers employed
- (v) Quantity of goods produced
- (vi) Type of nuisance created.
- (c) *Survey of Commerce*
 - (i) Type of commodities handled
 - (ii) Wholesale or Retail
 - (iii) Quantity of commodities, its import and export
 - (iv) Its transportation by Road, Railway, Airway, Waterway etc.
 - (v) Employment facilities.
- (d) *Financial position of local authority* :
 - (i) Income & Expenditure
 - (ii) Taxation
- (e) *Utility services* :
 - (i) Water supply: Industrial purpose, domestic purpose, source of supply, capacity per capita consumption
 - (ii) Drainage & Sewerage system: Disposal system
 - (iii) Electricity: Source, supply
 - (iv) Telephone
 - (v) Fire protection
 - (vi) Street lighting

(B) Regional Survey. The regional surveys carried out on much larger unit than a town called 'region' which may consist of number of townships and villages. The investigations carried out are of general nature such as social, physical, economic conditions of region. Surveys for regional highways, regional transport, regional water supply come under regional survey. It helps to develop the whole region in a co-ordinated manner.

(C) National Survey: It helps to collect information regarding natural resources and potentialities and to locate the industries in different regions. Care should be taken to see that no one region is allowed to develop at the cost of other regions. Survey for fixing Railway alignment Irrigation, Hydro-electric works, Heavy industries come under national survey

(D) Civic Survey or Socio-economic Survey. The type of survey conducted at local level for re-development scheme, slum improvement scheme and Master Plan is different from town survey. Here house to house survey conducted for this purpose is the socio-economic survey which is the foundation stone of the planning structure. It is from this survey the town planner can make a correct diagnosis of various ills from which the town is suffering and prescribe the correct remedies for their

cure. It is therefore like the diagnostic approach enumerated by Patrick Geddes and emphasized by Patrick Abercrombie. It covers a vast field hence a mere list would be sufficient to know its wide scope.

1. *Physical features :*

- (a) Geological structure : showing the arrangement of the underlying rocks and their formation
- (b) Contours showing variations of ground surface
- (c) Rainfall and wind charts
- (d) Rivers, flood ranges, tides

2. *Communications :*

- (a) Roads with traffic details, widths, tree planting
- (b) Railways
- (c) Waterways, canals, rivers
- (d) Airways, indicating aerodrome sites
- (e) Accessibility by different ways and time and distances

3. *Traffic problems :*

- (a) Type of roads
- (b) Traffic congestion, its causes
- (c) Remedies for traffic congestion
- (d) Traffic control

4. *Open spaces :*

- (a) Parks, gardens
- (b) Playgrounds, playfields
- (c) Common and other special types of areas

5. *Industrial survey :*

- (a) Local industries, classification; their position and labour employed
- (b) Commerce: Including shops, business areas, docks

6. *Housing :*

- (a) Types of building
- (b) Insanitary areas - conditions of building
- (c) Rents

7. *Population :*

- (a) Population: existing, increase and decrease
- (b) Occupations and diurnal movements
- (c) Density

8. *Health conditions :*

- (a) Birth rates
- (b) Death rates
- (c) Disease diagrams

9. *Landscape survey :*

- (a) Types of country
- (b) Landscape features
- (c) Soils and vegetation
- (d) Disfigurement

10. *Land-cultivation :*

- (a) Agriculture
- (b) Afforestation

11. *Public services :*

- (a) Water supply
- (b) Electricity
- (c) Gas
- (d) Drainage

Before carrying out the survey, it is necessary to divide the town in wards or blocks and each block is further sub-divided into street units. The houses to be surveyed are given survey numbers both on the street unit plan and survey proforma. The data for each street unit is collected in the prescribed proforma and analysed for each street unit.

(a) Proforma for Socio-economic Survey*Surveyor's Name**Supervisor's Name*

(a) Ward No.

Street unit No.

Block No.

Date of Survey

(b) Housing Characteristics :

- (i) House No. Address
- (ii) House condition
- (iii) No. of floors
- (iv) Age of the house
- (v) Area of the plot
- (vi) Rented or owned
- (vii) Rent paid per month

ZONING

6.1 Definition. Zoning is defined as the creation by law, of the Sections or Zones such as residential, commercial, industrial, civic, institutional and recreational in which the regulations prevent misuse of lands and buildings and limit their height and densities of population differing in different zones.

6.2 Importance of Zoning. Zoning is an important adjunct of any town planning. Zoning sets apart different areas in the town for specific purposes. It prevents encroachment of one zone upon another adjacent to it. For instance, the industrial area is located away from the residential area so it is not affected by dangerous gases, smoke etc.

Business or Commercial areas are also separately located with their garages and service stations at a distance from the residential areas. As such the residential areas are free from noise, bustle of the road traffic.

The population is distributed throughout the town by zoning regulation so that there is no concentration of population in any one particular zone.

Height zoning regulates the height of the buildings. Hence high rise buildings will not be allowed to construct near small houses. Otherwise they cut off the sunshine, air and breeze thereby making the life of the residents uncomfortable. A land in the form of recreational area is also set aside providing therein the playgrounds, parks, stadiums, theatres, etc. in pleasing surroundings. Zoning helps proper co-ordination of various public amenities like water supply, drainage, electricity, transport etc. In short zoning secures orderly growth of the town, promotes health, safety, order, it increases utility, beauty, efficiency of the town in general. In fact it is the very life and soul of the successful town-planning.

6.3 Classification of Zoning. Generally zoning is classified as under:

- (i) Use Zoning
- (ii) Height Zoning and
- (iii) Density Zoning

(i) **Use Zoning.** The main principle of use zoning is to divide the city into different sections or zones, and utilising of each of the zone to the right purpose and in correct location with respect to others so as to avoid the encroachment of one zone upon another adjoining it.

Under use zoning the town is divided into various sections or zones for specific purposes as given below:

- (i) Residential zone
- (ii) Commercial zone
- (iii) Industrial zone
- (iv) Civic zone
- (v) Institutional zone
- (vi) Recreational zone

(i) **Residential Zone:** This is the most important section or zone where the people of the town live together in large number. The buildings coming under this zone are detached single family houses, semi-detached houses, group housing, chawl, flats, sky-scrapers, etc and accordingly this zone is further sub-divided into suitable sections. This zone covers an area of 40% to 50% of the total land. That is why planning of residential areas should be done with the utmost care. It should be located in peaceful surroundings, and as far as possible away from business or industrial zones. It should have a certain amount of privacy and therefore be separated from other zones by a wide strip of green belt which should contain parks, parkways. It should also have speedy communication facilities.

(ii) **Commercial Zone:** This covers an area of 2% to 5%. This zone consists of markets, ware-houses, godowns, business offices, banks and residential buildings for the employees there. These should be located near the centres of traffic and as far as along the road-sides.

(iii) **Industrial Zone:** This zone covers an area of 5% to 20%. This is next to the residential zone in importance. Hence great care should be exercised in locating the industries. As a rule this should be away from other zones and planned leeward of the town so that no dangerous gases pass over it. This zone is further divided into sections containing minor, light, medium and heavy industries.

Minor industries like bakeries, dairies, laundries may be grouped and located close to the residential zone for the benefit of inhabitants.

Light industries and factories like manufacture of glass, porcelain, and ice etc. which use only electric power and not solid fuel do not cause any real nuisance. Hence they may be located anywhere on the periphery of the town.

Medium industries such as cotton mills, oil mills, sugar mills produce noisy atmosphere and undesirable wastes.

Heavy industries which manufacture cement, steel and such other materials, give out obnoxious gases and fumes. These should be located on the outskirts and placed leeward of the town.

(iv) **Civic-Zone :** This zone covers an area of 2% to 3%. This contains all public buildings like townhall, court, public libraries, post office, museum, auditorium, bank, show-rooms, stores and houses for those employed there.

(v) **Institutional Zone :** This zone covers an area of 1% to 2%. This zone contains schools, colleges, institutions etc.

(vi) **Recreational Zone :** This is planned in the remaining area of the town, usually 15% to 20%. This is also an important zone since it provides healthy environment for the people. It includes mainly

parks, playgrounds. However, it includes town-halls, stadiums, cinemas, theatres, and community centres.

Advantages of Use Zoning are :

(i) It permits the right use of the land for the right purpose, i.e. big factories which produce dangerous gases, smoke and noise at all untimely hours will not be allowed inside the residential zone; business areas will not invade or encroach upon the residential areas.

Hence it provides the residents a good amount of privacy, open spaces, and healthy environment.

(ii) Since the use of land is known definitely beforehand, it is possible to arrange traffic facilities, water-lines, sewer lines and other public utility services in an efficient way.

(iii) As it prevents the encroachment of one zone over the other, the land values are stabilized.

Many times to have a smooth and gradual change from one zone to another, a transition zone is provided which links up the neighbouring zones with a boundary line of plots.

(II) **Height Zoning.** Besides the use of land, there are other factors such as height, volume of the building, which need to be controlled. It is done by means of height zoning.

Tall buildings impair the value of small neighbouring houses by cutting off sunshine, air, breeze etc. and thus make the small houses unsuitable for inhabitation. They make the streets narrow and increase the congestion of traffic. They should therefore be arranged judiciously in the layout of proper grouping so as to blend harmoniously with the smaller buildings.

There are various methods used to control the heights of high rise buildings. In first method the height of the building is regulated according to the width of the abutting road. Generally 45° and $63\frac{1}{2}^\circ$. Air plane Rules are adopted. See Figs 6.1 and 6.2.

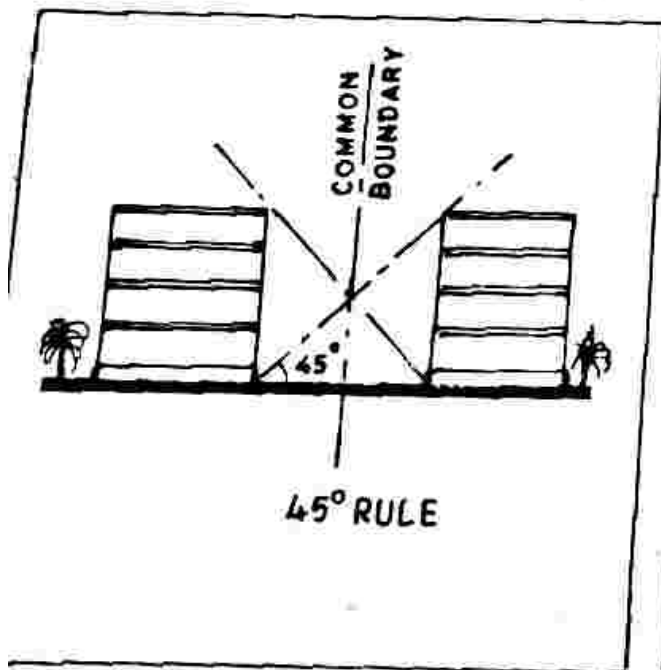


Fig 6.1

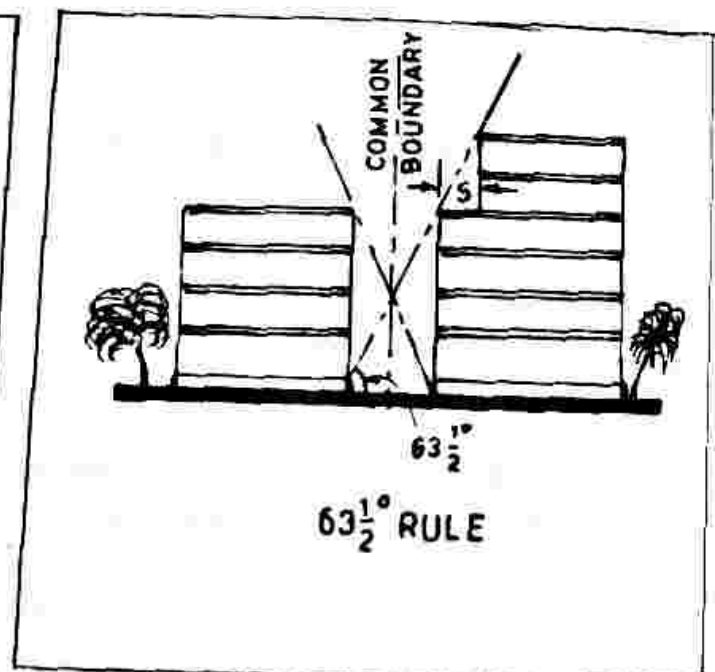


Fig 6.2

The rule states that no part of the tall building should cut the plane drawn from the boundary of the plot at an angle either 45° or $63\frac{1}{2}^\circ$ to the horizontal, as the case may be. The ratio of height to width of the road will be 1 : 1 in case of 45° air plane rule and 2 : 1 in case of $63\frac{1}{2}^\circ$ air plane rule. Hence the latter is very commonly used. But setback shown as S in Fig. 6.2 is necessary as soon as the building attains its maximum permitted height.

Another method adopted here is called bulk-volume method. In this case the volume of the building is made equal to the volume of the prism with plinth area as base and height, equal to the width of the road ($1/3 \times \text{Area} \times \text{Height}$). Now-a-days the Floor-Space-Index (FSI) is used to limit the total floor area of the building in relation to open plot area. Ref Art. 15.6 (4).

As a result of height zoning, there is considerable setback in the design of high rise buildings or modern sky-scrapers.

Advantages of height zoning

- (i) It does not allow the tall buildings to grow near by buildings of lesser height.
- (ii) It establishes minimum standards in terms of light, air and space, thereby creates healthy conditions.
- (iii) It controls the setback from roads.
- (iv) It helps to construct the buildings with uniform height. And its harmonious grouping makes the street picture as pleasing as possible.

(III) Density Zoning. The population per unit area or acres is defined as density of population. This density may be either gross or net density.

The gross density is the average density of population per unit area of the residential zone, including open spaces, and area under non-residential use such as schools, shops, and other public institutions.

The net density is the average density per unit of the housing area including local roads only. As density of population indicates whether there are normal or over-crowding conditions, it has an important place in almost every planning, or replanning scheme.

The town-planner has to fix certain standards of gross and net densities for various areas to suit the conditions. To control the population, following points are noted:

- (i) The minimum size of the plot for each house is fixed.
- (ii) The number of houses per unit area is specified.
- (iii) The ratio of total plot area to the total built-up area is fixed.

A gross density of 50 per acre is permitted within the city limits. It means that the residential area is half or 50% of the gross area. So also the net density will be 100 per acre. Generally in cities like Bombay, Bangalore, a gross density of 50 per acre is allowed. For two-storey buildings it is about 100 to 125 per acre. For garden type apartment, it is about 35 per acre.

The following table gives the size of plots and the percentage area occupied by them. This allotment is found to be suitable in a developing town:

Size of plot	No. of plot	Percentage Area
7 m × 10 m	15	15
10 m × 10 m	30	30
12 m × 20 m	35	35
15 m × 25 m	7	7
20 m × 30 m	6	6
25 m × 40 m	4	4
30 m × 50 m	3	3
Total 100 plots		100 %

Considering a family consisting of 5 persons living in a plot, the population in 100 plots will be $5 \times 100 = 500$. If 20 plots are arranged per acre, the land required will be $100/20 = 5$ acres. Hence the net density of population per acre will be $500/5 = 100$. If an area of 5 acres is reserved for parks, playgrounds, recreation, then the gross density of population per acre will be $500/10 = 50$.

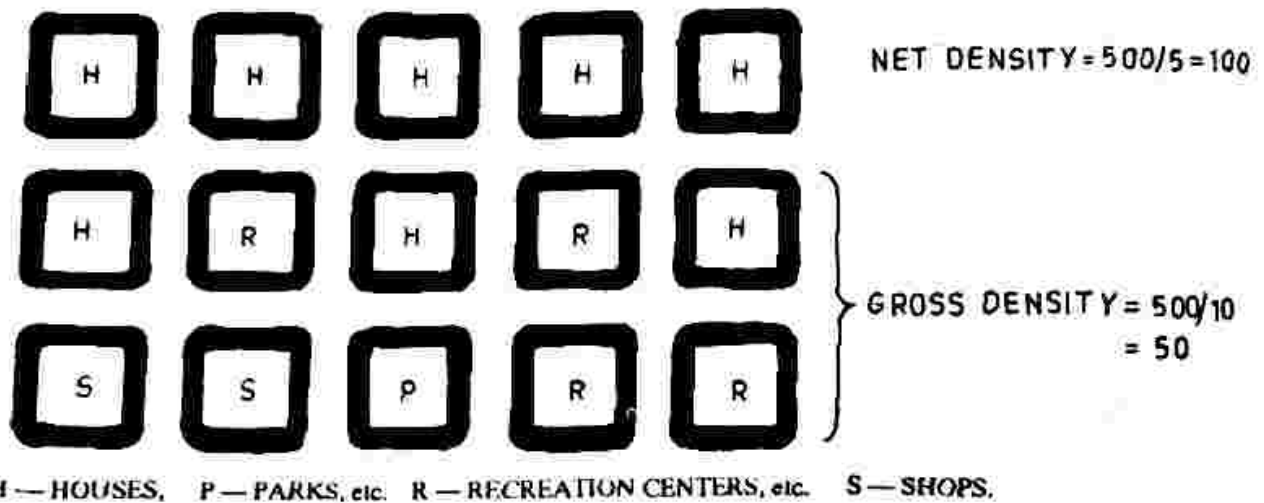


Fig. 6.3(a) and (b) Net Density and Gross Density.

With the rapid growth of population in the last three decades, the planners have a second thought to the problem of density, since it is found necessary to accommodate more and more people in cities and metropolitans in particular. The rational solution is to allow high and medium rise buildings with

plenty of space between them, as advocated for the past 50 years by the great architect, town planner Le Corbusier. Net density as high as 300 to 400 per acre is not inhuman, as long as the distribution of high-rise buildings versus park areas is handled carefully and skillfully.

Advantages of density zoning are:

- (i) It governs the density of population.
- (ii) As population is distributed throughout the town, it promotes healthy conditions.
- (iii) It prevents over-crowding.

6.4 Zoning Powers. It is necessary to enforce the rules and regulations of zoning from time to time by the local authorities. Actually the powers may be on a liberal scale to exercise control on the use of land under their jurisdiction. Such powers decide:

- (i) Which kind of zone may be located in particular locality of the town.
- (ii) The percentage of land to be used for buildings, their heights, etc.
- (iii) Approval of plans for proposed buildings.
- (iv) Prohibition of undesirable use for land.

Zoning is an important adjunct of any city plan, like Master-Plan, Re-development Plan etc. So it need not be too rigid. It should be to a certain extent flexible in order to benefit the people living in the locality. If in a residential zone, there are already a few industries, which are not harmful to health of the inhabitants, they would be allowed to continue as 'non-conforming' use even though such uses are undesirable. But they will not be permitted to expand under any circumstances. On the contrary the policy will be to remove them in due course of time by providing facilities in industrial zone.

Sometimes it is found necessary to have schools, libraries, community halls, shopping units in the residential zone. For these, a special permission is necessary and will be granted by the authority. But such of the factories, industries which produce noise, odour and smoke will be strictly prohibited.

So under zoning powers there are three categories as under:

- (i) Uses that are permitted under 'non-conforming' types.
- (ii) Uses that are permitted with special approval by local authority.
- (iii) Uses that are strictly prohibited.

The competent authority should act on the zoning powers from time to time otherwise there will be regular chaos and disorder in the town. Most of the evils of the present-day towns are due to lack of zoning and that is why zoning is considered as the main tool in the hands of the town planner to achieve his goal by making the town planning scheme effective and successful.

HOUSING

7.1 Introduction. The place of housing is next only to food and clothing amongst the primary necessities of human life i.e. "Roti, Kapda Aur Makan" A shelter is necessary for protection against wind, rain etc. But man does not need a mere shelter or roof over his head with haphazard collection of building materials, instead he needs a cheap but cozy house affording the maximum utility, safety, comfort and convenience with a background of serenity.

Man is primarily a social creature. He loves to live in society or community. Hence housing does not mean a covered roof for every family. It is a social unit, planned on neighbourhood or community principle. Housing, in general sense, is the layout and development of residential units in which people can live in pleasant, peaceful and healthy surroundings with social, cultural and recreational facilities.

7.2 Layout of Residential Units. The important points to be considered in the planning of residential units are as below:

- (i) Houses should be designed in different types with pleasing elevations.
- (ii) Houses should be planned in harmony with the surroundings like lake, streams, greenery etc.
- (iii) Houses should be properly oriented to get maximum advantage of the sun, wind and topography.
- (iv) Density of population should be in accordance with the standards specified by the competent authority.
- (v) Houses for different income groups should be grouped together to build the spirit of neighbourhood.

7.3 Neighbourhood Unit Planning. All the residential units are now planned on neighbourhood principle. It is a small unit which serves the local community and encourages them to foster neighbourhood spirit or relationship which seems to have been lost in the modern city life. It should possess the best qualities of small town to facilitate the acquaintance and neighbourly relations and also be broad enough to accommodate sufficient people to enable each individual to come in contact with people of different strata of society and compatible tastes. (Unity in Diversity)

7.4 Principles of Neighbourhood Planning. The principles of neighbourhood planning are:

(i) **Size:** The town is divided into self-contained units or sectors of 10,000 population and this is further divided into smaller units called neighbourhood unit with 2000 to 5000 population based on the requirement of one primary school. The size of the unit is therefore limited to about 1 to 1.5 sq km. i.e. within walkable distance of 10 to 15 minutes. See Fig. 7.1

(ii) **Boundaries:** The unit should be bounded on all its sides by main road, wide enough for through traffic.

(iii) **Protective Strips:** These are necessary to protect the neighbourhood from annoyance of through traffic and to provide suitable facilities for developing parks, playgrounds and road widening scheme in future. These are also called : "Minor Green Belts".

(iv) **Internal Streets:** The internal streets are designed to ensure safety to the people and the school going children in particular since the mothers are anxious every day till the safe return of the child.

The internal streets should circulate throughout the unit with easy access to shops and community centres. No through traffic is allowed here.

(v) **Layout of buildings:** To encourage neighbourhood relation and secure social stability and balance, houses to suit the different income groups should be provided such as single family houses, double family houses, cottages, flats etc.

(vi) **Shopping Centres:** Each shop should be located on the circumference of the unit, preferably at traffic junctions and adjacent to the neighbourhood units.

(vii) **Community Centres:** Each community will have its centre with social, cultural and recreational amenities.

(viii) **Facilities:** All public facilities required for the family for their comfort and convenience should be within easy reach. These include the primary school, temple, club, retail shop, sport centre etc. These should be located within 1 km in the central place so as to form a nucleus to develop social life of the unit.

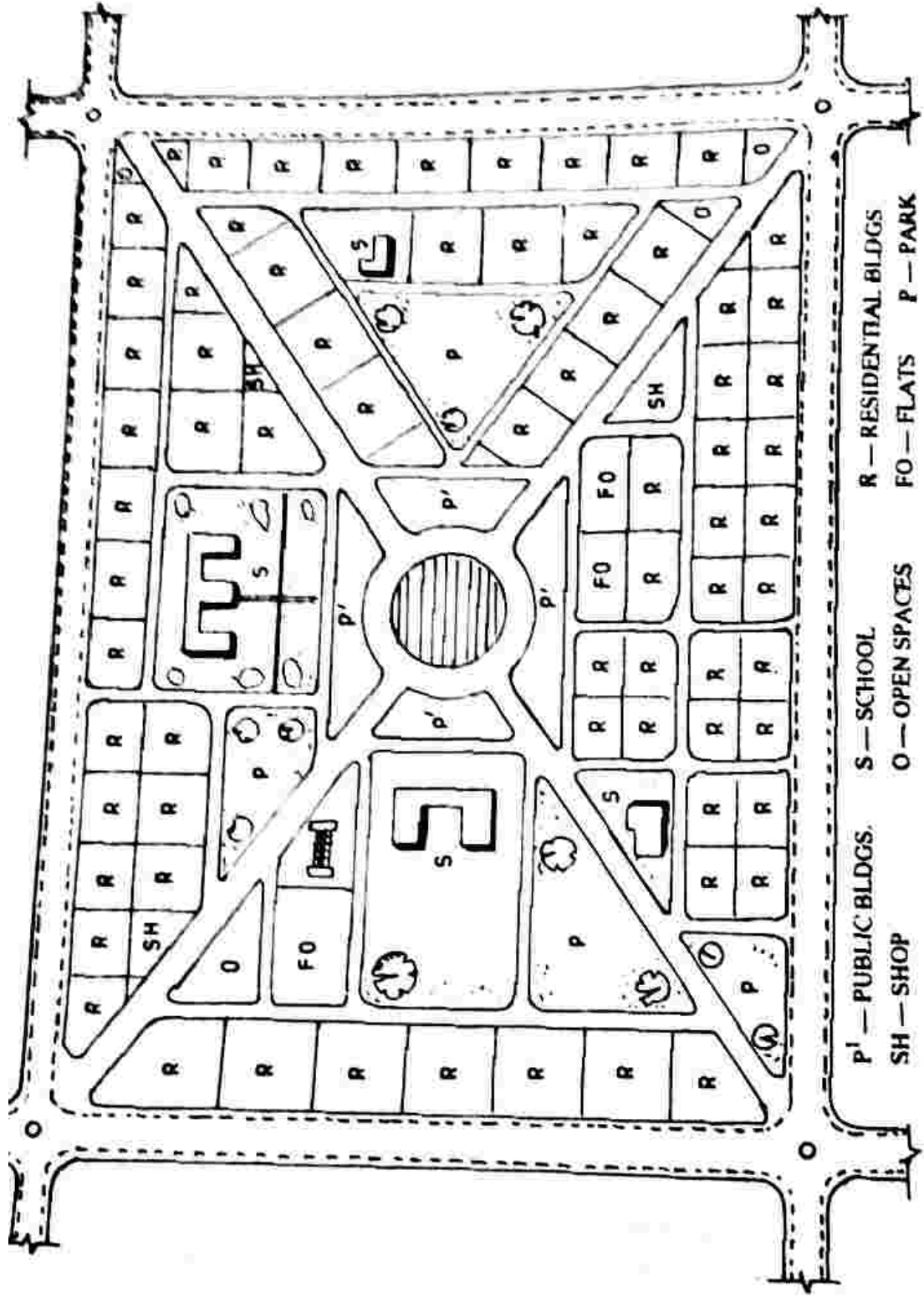
7.5 Reilly Plan. The Reilly Plan known after the town planner Reilly is also based on the community planning, and neighbourhood described above. The Reilly unit consists of about 1000 persons arranged in the shape of the petals of the flower, in a group of a unit consisting of about 250 persons. The main centre is situated in the heart of the city of such ten units with about ten thousand population. The main centre consists of shops, temples, clubs, sport centres, administrative blocks, clinic etc.

It is claimed that the Reilly plan develops community spirit, creates an ideal physical environment and ensures proper distribution of the population.

7.6 Radburn Plan. This is also a new type of design for community planning. Ref. Art 1.9(c).

7.7 Types of Layouts. The general layout of the houses should have variety, economy and convenience of the community. The layouts differ for different shapes of sites such as square, semi-circular, triangular, trapezoidal etc. A few of the well recognised layouts are as below:

(i) **Rectangular or Grid-iron Pattern:** The layout plan shown in Fig. 7.2 is almost square with roads meeting at right angles. This pattern is suitable for flat country, but is not suitable from the point of view of traffic.



P' — PUBLIC BLDGS. S — SCHOOL R — RESIDENTIAL BLDGS
 SH — SHOP O — OPEN SPACES FO — FLATS P — PARK

Considering density at 25 persons per acre, the land required = 10000/25 = 400 Acres.
 The land distribution will be as under

- 1. Single Family Unit = 36.5% = 146 Acres
 - 3. Flats = 15.5% = 62 Acres
 - 5. Parks = 20% = 80 Acres
 - 2. Two Family Unit = 5% = 20%
 - 4. Shops = 3% = 12 Acres
 - 6. Roads = 20% = 80 Acres
- Total = 400 Acres

Fig. 7.1 Plan of Neighbourhood Unit for 10,000 population.

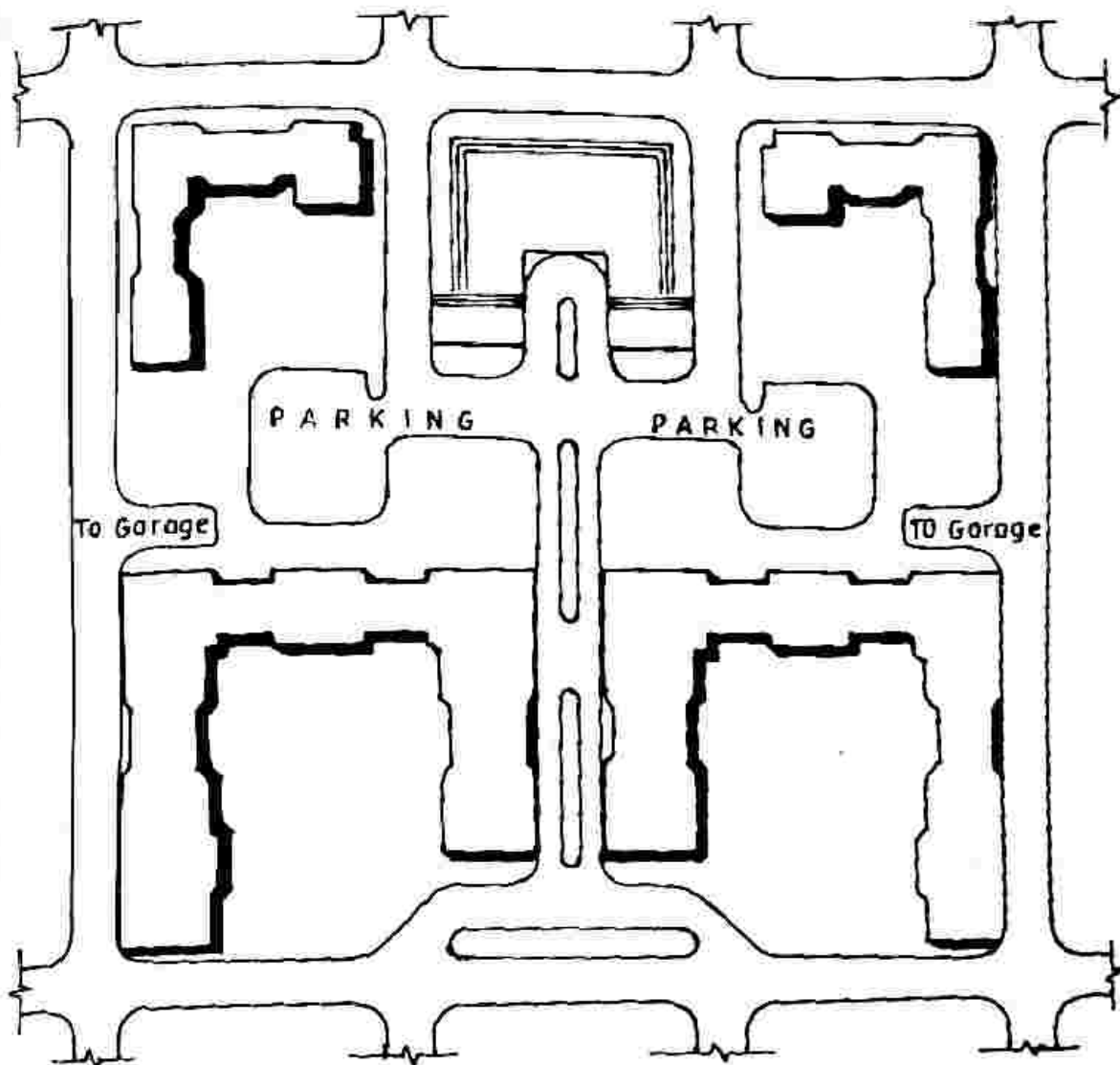


Fig. 7.2 Rectangular Pattern.

(ii) *Cul-de-sac*: This type consisting of approach road with a dead end is suitable for a small estate (See Fig. 7.3). In this case the houses are arranged to face a dead road branching from the main road at right angles. At the dead end of the road, a roundabout is provided so that the vehicles can go round and return to the main road. A fountain or such other feature can be provided at the dead end to make it pleasing and attractive.

The following points are considered in the layout of cul-de-sac:

- (i) The length of the cul-de-sac should not be more than 80 to 100 m to serve its purpose.

either side of the common wall. By providing common amenities like water, drainage lines etc semi-detached houses can be built economically. See Fig. 7.5(b).

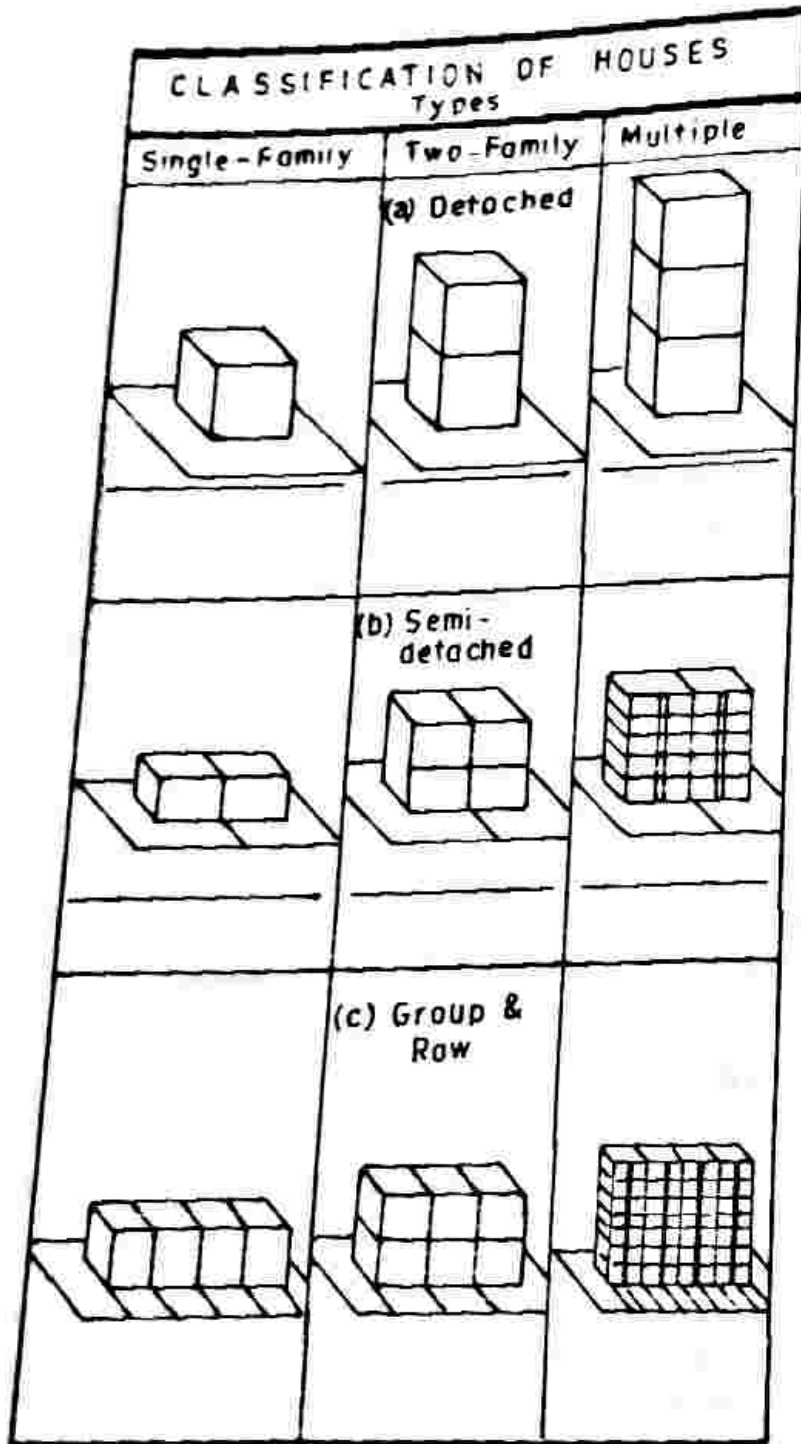


Fig. 7.5(a), (b) and (c)

(iii) *Group housing*: A number of houses can be grouped together. It is preferred for low-income group such as labourers or workers. The houses may be single or double storeyed, in later case, the front facade can be improved much. See Fig. 7.5(c).

(iv) *Apartments or Flats*: A flat consists of number of storeys in which accommodation is provided in an independent suite of three to four rooms, such as a living room, kitchen, bath, w.c. etc. It is suitable for better income group people and is most popular in big cities.

Due to the influx of rural population in the cities, the prices of land have sky-rocketed. Hence resort is made to flats so as to accommodate as many units as possible on the same land.

Now-a-days ownership flats are being constructed economically where the public amenities are shared by all the occupants. However, individual as owner has no chance for any extension in future. Yet these types of apartments have become popular in cities where the land cost is very high. Fig. 7.2 shows an attractive and pleasing lay-out for apartment houses or flats.

(v) *Sky-scrapers*: To accommodate the growing population in metropolitan cities, the sky-scrapers or high-rise buildings are being built with multistoreys soaring high in the sky. The first sky-scraper was built during 1884-88 by William Le Barron Jenney in Chicago. The sky-scraper is the skeleton of steel and R.C.C. clothed in thin pristine glass to coax as much light as possible.

The vertical development in the form of sky-scraper is seen to be popular as people found it more useful by going up and down with the help of lifts than walking on side-ways, even though they are facing some problems.

One is fire problem. For this proper precaution should be taken by providing emergency stair-case. Also the building should be well equipped with first-aid fire extinguishers, heat and smoke detectors, and fixed fire protecting system.

Wind is another problem. Due to wind terrific down drafts develop which knock the pedestrians off their feet. So the sky-scrapers are now-a-days checked through wind tunnel test before their construction. The wind problem can be avoided by careful massing of sky-scrapers. These glass sky-scrapers of new international style are therefore sure to govern the shape of our buildings to come in future.

(vi) *Pre-fabricated house*: The nation-wide housing crisis is now sought in prefabrication, the process by which the different parts of the house are made in the factory and merely assembled later. This is also referred by many as 'instant' housing, factory-built housing and in America it is called as Systems building.

There are various methods of construction. In skeleton method, first a frame of pre-fabricated posts and beams is prepared and then factory built walls, floors, stair-cases are fitted. In slab method, the precast walls support the whole load of the building. But the most quickest method is the box or 'module' method in which the entire rooms are stacked together like a child's building blocks. In this method each box or module consisting of a living room, dining room attached bedroom, kitchen room etc. is transported to the site separately, and lowered by crane over the previously prepared foundation bed. In few hours a three room house is made ready for its occupants. One U.S. firm built at the Hemisfair in Texas in 1968, a 500-room Hilton Hotel in 51 days only.

The main advantages of this systems building are:

- (i) High speed in construction, so saving in time.
- (ii) Use of highly developed construction technology.
- (iii) Use of improved quality of building materials manufactured in the factory.
- (iv) Minimum use of labour.

India — a developing country, is also taking active interest in the construction of the prefab houses. The Hindustan Housing Factory, based at New Delhi, a Central Government Undertaking, has built number of prefab houses in the last 20 years.

In the beginning the prefabricated houses were rather expressionless monotony with no aesthetic appeal. But recently U.S. Architect Paul Rudolph has designed ready-to-live-in boxes with regard to beauty, convenience and cost. Hence pre-fab houses have become more and more popular in western countries.

7.9 Housing Problem in India. The housing is an important social welfare measure and is an integral part of the nation's economic development. As such housing deserves a high priority in planning. But housing industry received little attention in the past. The situation has deteriorated over the last thirty years. Main reasons can be stated as the tremendous growth in population, scarcity of land and rise in cost of construction and materials. It is estimated that the present population in India is about 750 million, spread over an area of 3.28 million square kilometers and by the end of this century it would be above 1000 million, next in size only to China.

Industrial growth and employment opportunities, excellent facilities for Higher education, Research, lucrative careers, infrastructural development and social welfare in the towns and cities have acted as powerful magnets to attract the rural population. All people looked forward to the metropolitan cities for opportunities to make money to exercise influence and to enjoy, all pleasures of life. In short the metropolitan cities were considered as 'Heavens'. No doubt they did continue to remain so, till such time, the growth of the cities were within reasonable limits of 8 to 16 km round the centre but very soon the limits were over-stepped and the over growth cities became a mess and muddle. The urban population has therefore increased by about 30 million in the last decade and now about 150 million people live in towns and cities, ranging in population from 5000 to 5 million. This has resulted not only in over-crowding and congestion in the towns and cities but also aggravated acute shortage of housing. Recent surveys conducted state that in metropolitan cities above 45% people live in one room tenements; about 15% in two room tenements; about 10% in three room tenements, a lucky lot of 5% live rather comfortably, in four or more roomed flats or bungalows, while the remaining unfortunate 25% live in squatter settlements, slums and on foot-paths.

With regard to the quality of urban housing, it is estimated that about 45% of the urban population live in pucca (durable) houses, 35% live in semi-pucca (semi durable) houses and 20% live in kachcha (non-durable) houses.

With growing urbanisation India's housing problem has still increased. Seven years back, i.e. in 1985 the urban housing shortage was about 5.4 million units. At present the shortage is about 7.5 million units.

The Planning Commission had provided in the Sixth Plan period (1980-85) an outlay of Rs. 9400 crore for urban housing. Despite this, the backlog of housing increases by a million units every year.

and it makes one wonder if we can ever get over it. The condition of housing is therefore still in doldrums.

The housing problem revolves around three important factors such as poverty, transportation and low investment. All these must be accounted for, in a successful urban strategy. The Government has to purchase lands and provide cheap building materials and financial assistance to the builders. Recently many building organisations experimented with the manufacture of the building materials using local material and modern technology. The National Building Organisation (NBO) established in 1954 has helped in manufacturing cheap materials using new techniques for building low cost housing. Similarly Central Building Research Institute [CBRI], Roorkee and Structural Engg. Research Centre [SERC], Madras have developed building material manufacture techniques and standardisation of production for mass housing projects. A few states have undertaken large Housing Schemes using local skills and local materials. Laurie Baker, an England born Architect who lived in India for the major period of his professional career has evolved techniques and designs which are not only economical but also extremely felicitous and pleasant to live in. But these efforts are found to be insufficient for the economic solution for mass housing. The Government resources are found to be inadequate and the shortage of housing is still mounting.

As cities grow the land values also rise up in the heart of cities and its fringe area. When the state organs or private agencies invest money in housing, the cost of adjacent plots rises up. The more we invest, more expensive the land becomes. Hence urban housing policy is not possible without urban land control. Moreover the poor people have low paying capacity hence the Government has to control rent, enforcing the rent control acts. To meet the growing demand of houses for the millions, we have not only to build houses but also new planned towns near existing urban areas. Neighbourhood Units, Satellite Towns, Suburbs, Garden Cities seem to be a reasonable solution for the housing problem. In short, we need a properly planned long term housing strategy.

7.10 Agencies for Housing Schemes. The following are the agencies established with a view to tackle the housing problem under various housing schemes:

- (a) State Housing Board
- (b) Co-operative Housing Societies
- (c) Private Enterprises
- (d) Individuals

(A) *State Housing Board:* To undertake housing programmes, to arrange finance, to work in liaison between the central agencies and the state, housing boards have been set up in many states. The Board is constituted by a Chairman and a few members viz. the Chief Engineer of the State, the Director of Industries and Commerce, the Commissioner of Labour, the Director of Town Planning, one Architect, Chairman of City Improvement Trust, one Advocate, two M.L.As and other city dignitaries. The jurisdiction of the Board extends to the whole of the state.

The functions of the Board are:

- (i) To construct new houses to reduce the shortage of houses.
- (ii) To increase the standard of the types of houses to be constructed through other agencies.

- (iii) To implement the Housing Schemes of State and Central Government as are entrusted to it from time to time.

The Housing Board undertakes the execution of the following Housing Schemes:

- (i) Integrated Subsidised Housing Scheme:
 - (a) The Subsidised Industrial Housing Scheme.
 - (b) The Subsidised Rental Housing Scheme.
- (ii) The Low Income Group (L.I.G.) Housing Scheme.
- (iii) The Middle Income Group (M.I.G.) Housing Scheme.
- (iv) Plantation Labour Housing Scheme.
- (v) Land Acquisition and Development Scheme, Supervision of work done by Local Bodies under the Slum Clearance Scheme.

Government of India under the Plan funds provides funds for the implementation of Housing Schemes. These are augmented by loans got from the Life Insurance Corporation of India.

(i) *Integrated Subsidised Housing Scheme (I.S.H.S.):* The scheme was formulated in 1952 by Ministry of Works, Housing & Supply. The houses for industrial workers are provided under subsidised housing scheme and for economical weaker section houses are provided under subsidised rental housing scheme with a uniform pattern of central assistance i.e. 50% loan and 50% subsidy. For employees the maximum period of repayment is 25 years at the rate of interest of 7% and 11% in case of default in payment.

(a) *Subsidised Industrial Housing Scheme:* The assistance for housing construction for labour is provided by the Government of India.

The Board has suggested the following types of accommodation:

- (i) Small two-roomed houses with minimum plot size of 232 sq. ft. (21.56 sq. m.)
- (ii) Regular two-roomed houses with minimum plot size of 356 sq. ft. (33 sq. m.)
- (iii) Hostel with minimum plot size of 112 sq. ft. (10.40 sq. m.)
- (iv) Dormitories with minimum plot size of 87 sq. ft. (8.08 sq. m.)

The eligibility for occupation is as under:

- (a) For small two-room houses, the maximum wages of the workers should not exceed Rs. 250 p.m.
- (b) For regular two-room houses the maximum wages of the workers should not exceed Rs. 350 p.m.

A worker whose wages fall above Rs. 350 p.m. but do not exceed Rs. 500 p.m. may continue to occupy subject to his capacity to pay the economic rent.

- (c) No worker whose wages exceed Rs.500 p.m. is eligible to occupy the house.

(b) *Subsidised Rental Housing Scheme:* The houses are provided on rental basis for the economically weaker sections of the community, whose annual income is below Rs.4200. The loan

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assistance is based on ceiling cost of standard rents. The ceiling costs are also revised for different types of accommodation and places.

(ii) *Low Income Group Housing Scheme*: The L.I.G. Housing Scheme was introduced in 1954 for the persons whose annual income does not exceed Rs. 7200 and who do not own houses either in their own names or in the names of their wives/minor children. Long term house building loans are given to eligible persons. The loan assistance is restricted to 80 per cent of the estimated cost of construction which should not exceed Rs. 12,500.

The rate of interest is 7% for the repayment period of 10 years and 7½% if the period exceeds 10 years or of any other rate that the Board may prescribe from time to time. However, the maximum period for repayment is 25 years. The rate of penal interest is 11% on overdue instalments.

The accommodation to be provided in each house built under this scheme should not be less than 232 sq. ft. (21.56 sq. m.) and not more than 1200 sq. ft. (111.54 sq. m.) of floor area.

As far as possible two-roomed houses are built and costly structures are discouraged. Suitable type designs are prepared by the Board and are made available for sale.

Whenever houses are ready the Board calls for applications by way of Notification published in Government Gazette and in the local papers. Eligible persons who do not own houses or sites either in their names or in the names of their wives/minor children can apply for allotment of the houses in the prescribed form accompanied by the necessary deposit. The houses are disposed of on lease-cum-sale basis as per the allotment rules and regulations of the Board. In the case of allotted houses, supervision charges at 9% on construction cost and centage at 1% are levied for providing civic amenities.

Cash loans are admissible to eligible persons and institutions like Local Bodies, Co-operative Housing Societies, Public Institutions run on 'No Profit No Loss' basis and Non-Government but recognised Health Institutions and Hospitals. A scrutiny and inspection fee of 1½% of the sanctioned loan will be levied.

(iii) *Middle Income Group Housing Scheme*: The M.I.G. Housing Scheme was introduced in 1959 for the persons whose income is between Rs. 7200 to Rs. 15000 per annum and who do not own houses either in their names or in the names of their wives/minor children. The loan assistance is restricted to 80 percent of the estimated cost of construction which should not exceed Rs. 25000. The maximum period of repayment is 25 years at a rate of interest of 7% for the first 10 years and 7½% or any other rate that the Board may prescribe from time to time for the remaining 15 years and 11% in case of default in payment on overdue instalments. The accommodation to be provided in each house built under this scheme should not be less than 700 sq. ft (65 sq. m) of floor area.

(iv) *High Income Group (H.I.G.) Housing Scheme*: Under this scheme, the persons whose annual income is between Rs. 15000 to Rs. 25000 are eligible to get a loan upto Rs. 60,000.

(v) *Plantation Labour Housing Scheme*: This scheme is provided to benefit the plantation labour. The ceiling cost is limited to Rs. 3200 per house. The central loan is upto 50% and subsidy is 37½%. The remaining 12½% has to be borne by the Planters. The plantation area should not be less than 25 acres. The assistance for house construction to a planter sanctioned during any financial year should not exceed the amount admissible for the construction of houses for 8% of the total number

of resident workers employed on the plantation on an average during the preceding financial year. The rate of interest is $6\frac{1}{4}\%$ or as prescribed by the State Government from time to time and maximum period of repayment is 25 years. Penal interest at 11% is levied on overdue instalments.

(vi) *Land Acquisition and Development Scheme*: Under this scheme financial assistance is given to the State Government as a loan repayable in a period of 10 years at interest of $6\frac{1}{2}\%$ or any other rate prescribed by the Government for acquiring and developing lands in selected areas. A penal interest at $10\frac{1}{2}\%$ is levied on defaulted repayments. The land acquired is to be used for house building under different schemes and for providing community facilities like schools, playgrounds, parks, shops, hospitals, offices etc. The Housing Board is the Central Agency for giving loans to City Improvement Trust Boards, Local Bodies etc. Now the Housing and Urban Development Corporation (HUDCO) founded in 1970 by Government of India is also providing finance to promote housing and area development activities. HUDCO which is primarily a funding agency does not undertake any direct construction but acts through State Housing Boards, City Improvement Trusts, Development Authorities, Municipal Corporations etc.

For the purpose of loans, HUDCO has categorised four types of housing as below:

- (i) For economically weaker sections whose income is not exceeding Rs. 350 p.m., the ceiling cost is Rs. 8000 per house, inclusive of land cost. The period of payment is 20 years at a rate of interest of $5\frac{1}{4}\%$ and a rebate of $\frac{1}{4}\%$ for prompt payment.
- (ii) For low income group whose income ranges from Rs. 351 to Rs. 600 p.m., the ceiling cost is Rs. 18,000. The period of payment is 15 years at a rate of interest of 7% .
- (iii) For middle income group whose income ranges from Rs. 601 to Rs. 1500 p.m., the ceiling cost is Rs. 42000. The period of payment is 12 years at a rate of interest of $9\frac{1}{2}\%$.
- (iv) For high income group whose income is above Rs. 1500 p.m. the ceiling cost is Rs. 100,000. The period of payment is 10 years at a rate of interest of $11\frac{1}{2}\%$. HUDCO also provides financial assistance for shops and commercial facilities. The period of payment of loan is 10 years at a rate of interest of 14% .

HUDCO has sanctioned a number of schemes for the construction of dwelling units and development of residential plots.

(B) *Co-operative Housing Societies* : It is a society or a legal body indulging in house construction on co-operative basis. The legal body functions according to the rules and regulations framed by the society. A number of Housing Societies have come a long way in solving the housing problem successfully.

(C) *Private enterprisers*: Now-a-days many private enterprisers have entered the field of house construction. They invest their own money for the construction of houses, flats which are later sold at fancy prices. Usually these enterprisers are interested to get high returns. They build about two lakh units per year which is a meagre share in solving the crises in the cities.

(D) *Individuals*: Many individuals also try to contribute their effort to solve the housing problem. They generally get their funds from life-time savings or get partly from loans. The individual feels that one's own house is a status symbol and an object of pride, however small but it is one's own sweet-home.

SLUMS

8.1 Meaning of Slum

- (i) A slum is predominantly an overcrowded area which is in an advanced state of decay where dwellings are unfit for human habitation.
- (ii) It is an area where basic amenities like water supply, drainage for standard living are lacking, insanitary conditions prevail and diseases flourish.
- (iii) It is poverty-stricken area, where there is a high rate of birth, infant mortality, illegitimacy, juvenile crime, delinquency and death, thus representing a state of hell on the surface of earth.

Slum is a menace to health, safety, morality and general welfare of the inhabitants. Slum and squatter settlements are too common in India. It is estimated that about twenty-five percent population of any city in India live under sub-human conditions of slums. These are commonly called as bustees in Calcutta, jhoparpattis in Bombay, Jhuggi jhonpries in Delhi, cheries in Madras and ahatas in U.P. It is estimated that more than 6 lakh persons live in bustees in Calcutta, 2 lakh in jhoparpattis in Bombay, 1.5 lakh in jhuggi jhonpris in Delhi, and 1.2 lakh in Cheries in Madras. That is why Bombay is dubbed as a city without 'Soul' and its beauty only skin-deep, although it is one of the finest cities, in the world.

As back as 1930, the Whitley Commission had given a vivid description of the living conditions in Bombay, Calcutta, Madras in the following words:

"Neglect of sanitation is often evidenced by heaps of rotting garbage and pools of sewage, whilst the absence of latrines enhances the general pollution of air and soil. Houses, many without plinths, windows, and adequate ventilation, usually consist of a single small room, the only opening being a doorway often too low to enter without stooping. In order to secure some privacy, old kerosene tins and gunny bags are used to form screens which further restrict the entrance of the light and air. In dwellings such as these, human beings are born, sleep, live and die".

Dante's statement may be quoted here that 'he saw hell in the city around him'.

Cowper once said: "God made the country, man made the town" and a wag added: "The Devil made the slums." This devil who made the slums is avaricious, anti-social, lacks civic sense, and is beyond the ordinary means of control.

It is disgrace to both the dwellers and the town authorities who allow them to grow. It is therefore a black spot on the city's face.

8.2 Causes of Slums. following are the main causes for the formation of slums:

(i) *Rapid Industrialisation:* Industrial growth and employment opportunities in towns and cities have acted as powerful magnets to attract the rural population.

The workers employed in the factories generally make their habitation as near as possible to the place of work. They are low waged persons and cannot afford daily travelling from the distant places in the city. Hence in a short time the available land or open space is occupied by the buildings without any proper planning. This gives rise to the formation of slums. Finally the industrial town taken together constitutes a 'Slumdom'.

(ii) *Population Growth:* There is a lag between the tremendous growth of population and the construction of houses. These shortages manifest themselves in creating slums.

(iii) *Lack of Zoning:* If zoning regulations are not enforced in the early development of town, there are chances for industrial area to encroach upon residential areas. Very soon there will be overcrowding with the formation of slums.

(iv) *Decentralization:* By decentralisation, the rich and middle class people move out to the extension areas leaving the poor in the overcrowded part of the town to make it more insanitary. As a result the slum colonies start mushrooming at a fast rate.

(v) *Lack of Education:* If the inhabitants are lacking in education, they may not pay attention to improve the living conditions, lose civic interest and neighbourhood spirit. They are therefore easily attracted by social evils, vice and delinquency.

(vi) *Poverty:* The main cause for the slum formation can be described in one word as poverty. The meagre and unsteady income leaves the family with no other choice but to direct all the energies in earning their daily bread and some minimal clothing. It is difficult for them to pay heavy rent for a decent living. They therefore move in slum areas, for nobody with black money builds decent houses for the slum-dwellers.

(vii) *Repair and Maintenance:* There is nothing wrong with old houses if they are looked after from time to time. But in India, repair and maintenance are the foreign words. Hence most of these buildings remain in a state of decay to favour the formation of slums.

(viii) *Inadequate Powers:* Lack of adequate powers and enforcing the same by the local authorities turning Nelson's eye for the proper development of the town are also the reasons for the formation of slums. If preventive measures are not taken in time, the decent localities of the town will be the slums of tomorrow. Even Chandigarh which is a planned capital is growing beyond the bounds of rigid planning in suburbs and slums.

8.3 Effects of Slums on Town-life. The effects of slums are summarized as below:

- (i) Unhealthy conditions are created due to absence of public facilities like water supply, drainage, sanitation and light etc. The sub-human conditions of the slums considerably affect the health and life of the people.
- (ii) There is complete absence of social and cultural life.

- (iii) The mental outlook of the slum dweller is affected. He develops low moral character as such he is easily attracted by vice, delinquency, crime and clandestine activities in bootlegging, narcotics, drugs, adulteration, etc.
- (iv) The overcrowding area is full of noise, smoke and congestion. This affects considerably on the working conditions of the people in offices, schools, hospitals etc.
- (v) The roads tend to become highways so there is danger from traffic accidents.
- (vi) All open areas being attacked, there is no open space for recreation, pure air etc.
- (vii) A slum dweller loses his ambition, civic interest as well as wholesome neighbourhood spirit.

In short a slum as such forms a black spot and spoils the healthy environment of the city as a whole.

8.4 Precautions to be Taken against Formation of Slums. The slums in the towns gradually grow and as such the concerned authorities should keep watch on such growth and try to take precautions to prevent them. Slums are health hazards to the cities which later on create serious socio-economic and political problems. 'Nip in the bud' or 'Prevention is better than cure' are the watch words against the formation. First of all, the authorities should make provision for healthy conditions of living and working. The subsidised cheap housing in sufficient number should be provided for the workers, labourers, and poor people with all civic amenities and utility services. The authorities should enforce the law that the employers should provide better housing facilities for their labourers. They should have power to control the rents under Rent Restriction Act. They should arrest the sub-standard and unauthorised constructions on vacant lands.

Proper wages should be provided to the labours to improve their standard of living. The labourers in return should maintain and carry out repairs whenever required so as to keep the existing building in a good condition. The labourers should be properly educated to take care of health, cleanliness and general welfare of their families.

8.5 Slum Clearance. The slum clearance may be affected in one of the two ways:

- (I) Improvement Method.
- (II) Complete Removal Method.

(I) *Improvement Method:* One method of not aggravating the housing shortage is to take up slum-improvement scheme. This method has an added advantage of not causing much disturbance to the slum dwellers. Here the slums are due to poor drainage system and unhealthy conditions. Hence the drainage arrangement is modified and improved. Public utility services like water, drainage, electricity, gas may be provided in the affected area. Here the housing conditions are also fairly good. Only a few houses need some improvement to make them slightly more habitable. Further, any impending structures coming in the way may be removed. Low portions of the old slums like ditches, or swamps may be filled up and then the existing roads may be widened. With proper planning and improvement works it is possible to make the slums slightly more habitable at the minimum cost.

(II) *Complete Removal Method:* Here the congested area may be completely cleared out of the existing locality. In this case only such buildings which are really in good condition are retained and

all other dilapidated structures are pulled down. Transit Camps in the form of temporary buildings near the slum areas should be constructed to accommodate those dishoused in the process of slum clearance.

Any stinking factories may be shifted to some other more suitable areas.

The areas thus cleared up may be used as open spaces (lung spaces) and site for new buildings or part of it may be used for widening the streets.

With the existing old good buildings, the houses may be grouped together into neighbourhoods. Care should be taken to keep the density within the limit in accordance with the standard specified.

The population should be provided with amenities such as water supply, drainage, sanitary arrangements, electricity, gas etc. Lastly the legal aspect of this scheme while shifting the population should receive due attention. The legal aspects include publication of the slum clearance scheme; acquiring the land, paying compensation for the acquired land, making accommodation for the dishoused persons in the process of slum clearance etc. The slum eradication by this method proves to be very costly, but it is certainly worth-while to bear it in the interest of the community.

8.5 Financial Assistance for Slum Clearance Schemes. The scheme introduced in 1956 contemplates the grant of financial assistance by the Central Government to State Government and Union Territories for slum clearance and improvement schemes. The main principles of the scheme are

- (i) there should be minimum dislocation of the slum dwellers. They should be rehoused in nearby area of the existing sites.
- (ii) To keep down rents within paying capacity of the slum dwellers and emphasis is given on the provision of minimum standards on environmental hygiene and utility services rather than on construction of costly structures.

The scheme is implemented by the State Government through local bodies under supervision of State Housing Boards, Slum Clearance and Improvement Boards. The scheme deals with the following:

- (a) the acquisition of slum areas and re-housing the slum dwellers whose income does not exceed Rs. 350 p.m.
- (b) the improvement of environment conditions
- (c) construction of Night Shelters to provide sleeping accommodation to pavement dwellers on nominal charge.

The Government of India provides financial assistance to the State Government in the form of block grants and block loans and the State Governments are free to make use of as per their requirements.

The State Government and local bodies can provide dwelling units viz. open developed plots, skeletal house, pucca tenements, hostel dormitory type and Night Shelters, to slum dwellers. These units will be provided with independent lavatory, pucca bath, and washing platforms connected with drains and taps.

The cost of these dwelling units ranges from Rs. 1850 to Rs. 8750 per unit and the subsidised rental ranges from Rs. 6 to Rs. 39 per month, depending upon the type and place of construction. The existing ceiling cost for normal two-roomed house is Rs. 5000 and that for a small two-roomed house is Rs. 4000. In case Night Shelters are constructed, the ceiling cost is limited to Rs. 727 and the rent chargeable for sleeping accommodation for the pavement dwellers should not exceed 25 paise per person per night including service charges.

Financial assistance is admissible under the scheme which is repayable by slum dwellers in 25 years with the rate of interest fixed by the Central Government from time to time.

Such colonies will be provided with water mains, drainage, sewerage, community baths, latrines, water taps, properly paved roads with adequate widths, street lighting etc.

The Government of India has also approved a scheme in 1960 to remove jhuggis and jhonpris which is applied only to New Delhi. The plots were given on lease for 99 years on paying the cost (with 50% subsidy) in a lump sum or in ten equal annual instalments. Likewise Central Government is making all possible efforts by providing financial assistance to slum dwellers for the improvement of their living conditions.

PARKS AND PLAYGROUNDS

9.1 Necessity of Recreational Facilities. Recreation is one of the important parts which contribute to the general health and well-being of the community. It brings enjoyment of living, encourages relaxation, helps to utilise the leisurely hours of all the age groups young and old alike into the desirable activities thus making the people to live a richer and contented life.

Recreational facilities are scarce in most of the towns and cities and in many towns and cities, road is the only open space where the children can play.

In absence of wholesome public recreations, the children are likely to spend time in undesirable activities which finally drag them towards delinquency and juvenile crime. Hence the town planning authorities should make provision of a variety of wholesome public recreations. It must be remembered that no town planning scheme is complete without the provision of parks, playgrounds or such other recreation system.

9.2 Features of Public Recreational System. The essential features of public recreational system are:

1. There should be proper provision of year round recreational activities for all the age groups and for all the communities
2. It should be located within easy reach of all the habitants, generally within half to one km with easy accessibility and safety.

9.3 Selection of Sites for Parks and Playfields. The points to be considered in selecting the sites for parks and playfields are:

1. To acquire easily accessible strip of land which can be cheaply adopted, to serve as a park, playfield etc.
2. To acquire such lands which are not suitable for streets and buildings.
3. To acquire as much land as required for large parks in advance before the cost of the land increases due to any proposed development scheme in the town planning.
4. By filling the pools, ponds and old insanitary tanks etc, in the city.
5. By clearing the slum areas in the city and then the land available may be converted into parks, gardens, playfields etc.

9.4 Types of recreation Systems. There are two types of recreation systems. They are:

1. Passive type such as parks, gardens etc.

2. Active type such as playfields, Akhadas, Gymkhana, Stadium, Boating & Swimming Clubs etc.

(1) *Parks* : These are necessary to meet the needs of open spaces, to get fresh air, evening rest and relaxation for all the sections of the community. The parks and gardens should be made more attractive by planting all types of flowers, trees, bushes in the pleasing layouts with fountains, lawns etc. These parks, gardens form the passive type of recreation.

(2) *Play-fields* : These help to provide the physical growth of the body and hence offer the active type of recreation.

Both the types of recreation play an important part in the social, physical and cultural aspect in the town-design. There is hardly a narrow gap between the two types and such they seem to overlap each other many times.

9.5 Various forms of Recreation Amenities. The amenities for outdoor recreation to be provided in the city are as follows:

(1) *Children's Park* : It should have easy accessibility and safety. It is to be noted that such parks meant for children should be well equipped with modern types of sporting apparatus such as merry-go-round, see-saw, slide etc. The size of this park should not be less than 0.17 hectare or 500 sq. ft. It comes under small size park.

(2) *Neighbourhood Parks and Gardens* : These are medium size parks and serve the residential of the neighbourhood units. They can provide passive as well as active recreation. They should not be less than 1 hectare or 2.5 acres.

(3) *Town Parks* : These are large-sized parks and serve the whole city with number of neighbourhood units. These act as reservoir of fresh air for the city, and are therefore called as "lungs" of the city. Here there should be provision for sporting items such as boating, riding and swimming facilities for the adults. They should also be provided with paved foot-paths, a drive way, shelters, car parking places, drinking water, a restaurant etc. If the cities are located at sea front, then large beaches can be included in these parks. The size of this park should not be less than 10 to 12 hectares, or 25 to 30 acres.

(4) *Reservations* : These parks are generally located outside the city limits. These cover a wide area full of natural scenery and beauty. These serve as places of picnics and pleasure trips for the people of the town. The size of this park should not be less than four hundred hectares.

(5) *Botanical Parks* : These are mainly meant for the study of specimens of plant life and therefore have high educative value. They should therefore be made more attractive and pleasant.

(6) *Zoological Parks* : These parks which provide for all specimens of animal life are called zoos. People generally like to visit the zoos along with their children as a picnic or outing, as such it should be laid out on pleasant surroundings.

(7) *National Parks* : These parks are very large in areas which run into lakhs of hectares and include within them the forests, wild life, waterfalls, rivers etc.

These parks provide an opportunity to study the natural flora and fauna, for the scientists as well as students of science such as ecology, entomology, meteorology, etc. These should therefore be planned carefully throughout the country, with transport facilities from a number of towns.

(i) **Park Design.** As for the design of park concerned, there is abundant scope for careful thought for imagination and individual ideas. For satisfactory design, it requires collaboration of many disciplines from various fields. It requires a team work of the arboriculturist, the architect, the horticulturist, the hydraulic engineer, headed by the landscape architect. The team can work out and exploit the potentialities of a site to the fullest extent and better results are obtained.

A careful study of the soil conditions helps to know the type of existing trees and tree-clusters and possibilities for preserving as many of the existing trees as possible. It helps also to decide the kind of grass, shrubs, and trees to be planted on the site to increase the architectural effect, after studying the climatic condition, water supply etc.

The next point is to select the flowering trees like Mass Golden, Gulmohr, Marigolds, Jacaranda, Laburnum, Cassias Clarkias, Cundytuft, Temple Tree, Silk Cotton, Coral, Yellow Elder and shrubs like Oleander, Poinsettia, Hibiscus, Ixoras, Queen of Night, Bougainvillea and many others, and plants which offer flowers like Corn flowers, Peacock flowers, Narcissus, Oris, Tulips, Rose, Lilies, Jasmine, Pink, and Aromatic plants etc.

Next important point to be considered is the correct arrangement of the plant and trees. They should be carefully planted so as to give a picture of enchanting beauty in harmony with the surroundings.

Another required feature of park is the layout of paved paths with a good variety of pattern to give a pleasant effect.

There are many other accessory details which add to the beauty of the gardens such as fountains, statues, pergolas, arbours, loggias, kiosks, lamp posts, summer houses, bird rests etc.

Parks and gardens are certainly conspicuous elements of beauty in the city plan and should therefore receive all emphasis in the Town Design.

(ii) **Park Systems.** The park system should serve the large number of persons. It should have arrangements to connect the open spaces together. These arrangements can be had in the form of green-belt, avenues, boulevards and parkways. Following are the three important types of the park system:

(a) **Belt or ring system:** In this case the parks are generally provided on the periphery of the town in the form of a belt or ring, and to act as a means of defence to the town.

(b) **Wedge or radial system:** In this case wedged shaped strips of open spaces radiate through the town centre to the rural areas. They help to bring the fresh air from rural areas right to the town centre. These wedge shape strips are many times developed into parkways, avenues or boulevards.

(c) **Combination of belt and wedge system:** It is an ideal park system as it combines the advantages of both the belt and wedge system, See Fig. 9.1

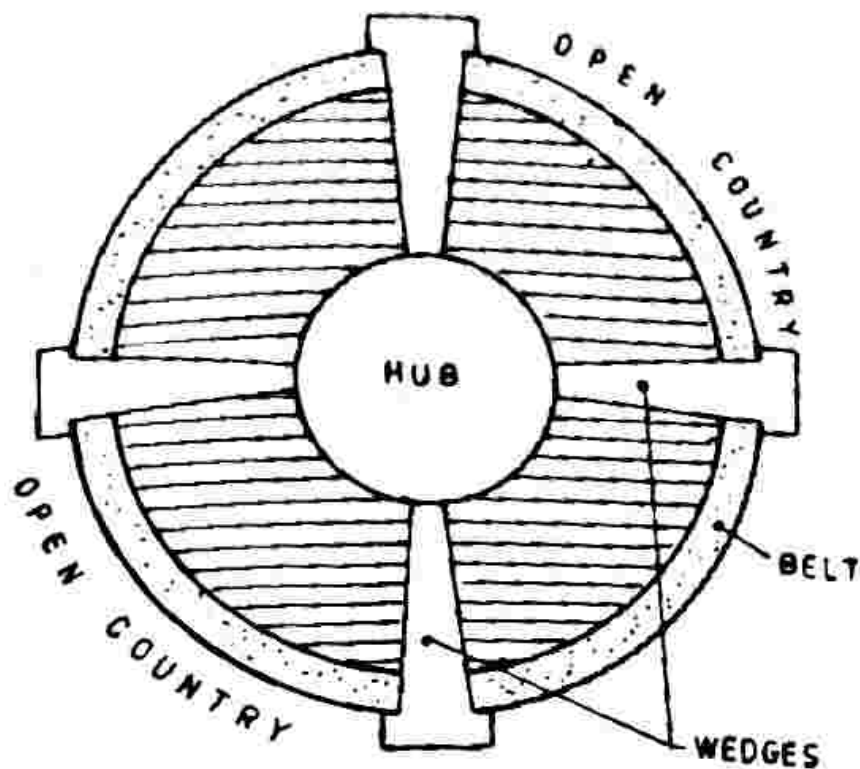


Fig. 9.1. Combined Belt and Wedge System.

It is designed by Mr. G.L. Parkar, and is particularly suited for a radial road plan. The circular parkways and wedges of park land help to form an inter-connected park system and people can travel from one part to the other part of the town through shaded parkways or boulevards.

(d) **Boulevards**: The word boulevard has come from Paris, France. The ring roads of Paris were once acting as defensive walls but later on they were demolished, and the roads thus formed came to be known as boulevards. Now in town planning, boulevards are connections between the large and medium sized parks and act as a wide tree-lined avenue in a town. They enable the busy people who have no time to visit parks to drive in carriage through the parks and enjoy the natural surroundings. They are therefore also called as the city streets with good landscape and floral embellishments. They carry large amount of traffic hence they must be sufficient in width to provide separate tracks for pedestrians, cyclists, vehicles etc. Usually the ornamental buildings face the boulevards. They have become an integral part of the park system and elements of beauty in the town design.

(e) **Park-ways**: These have formed due to the advent and development of automobiles and rapid growth in traffic. In America, automobile is from the beginning considered as a means of recreation and entertainment. Hence beauty and comfort were considered as the main criteria in the design of highways, that provided an access to these recreational areas, which finally gave rise to the concept of the present day park-ways. A park-way may be defined as the elongated park through which passes a road-way which denies right of access from abutting land. These are ingeniously spaced depending

upon the topography and scenery so as to connect all large parks into a system. These are restricted only to the private vehicles whereas commercial traffic is usually excluded.

The park-ways are becoming more and more popular in India. They are however intended for all types of traffic. The parkways are ingeniously laid out to make the journey as pleasant as possible. So they follow the natural stream, valleys, sea-shore. They make little contact with or the ordinary roads, crossing them at different grades thus segregating the private vehicles. The planting of trees along the sides of the park-way should be done carefully so as to avoid overhanging growth that may interfere vision, sight distance near curves and intersections. As park-ways carry large amount of traffic, they should be sufficient in width and in no case be less than 100 m.

The Americans were the pioneers in the development of park-ways in the metropolitan areas of New York in 1920. Since then the park-ways are finding considerable favour among planners in all the countries because many motorists love to drive in the beautiful landscape splendour of the park-ways.

(8) *Play-grounds* : The main consideration in selecting the side of play-ground for children is easy accessibility and safety. The children should not have to walk more than 500 m from their home and that they are not at all required to cross any arterial road, on their way to school. The area required should not be less than 1 acre. It should be equipped with swings, slides etc. For youths and adults they should be within a distance of 2 to 3 km. There should be provision for organised games like Kho-Kho, Kabaddi, etc. These games provide opportunities to foster team-spirit, sportsmanship and fellow feeling. High School and College playgrounds also help in their own way in creating love for good physique.

(9) *Multipurpose Stadium* : The multipurpose stadium helps to serve the needs of all types of games, athletics and wrestling alike. The area required will not be less than 20 to 50 acres including the parking spaces, pavillions, field building, accommodation of the visiting teams, restaurants etc.

The parks, playfields and other recreational amenities are now-a-days no more a luxury but are essentials of the city life. They play important role in creating love for good health, body building, team-spirit, sportsmanship, and above all self-defence.

The importance attributed to physical education and training is rightly expressed in the famous wordings of the great Duke of Wellington that "The battle of Waterloo was won on the playfields of Eton."

9.6 Standards of Open Spaces. Different standards of open spaces have been adopted from time to time by different planning authorities. The main factor that is considered for open spaces is the density of population, which is generally accepted by the planners. According to this standard, the open space for outdoor recreational purpose should not be less than 1.0 hectare or 2.5 acres for 1000 population. Hence the requirement of open spaces for a residential neighbourhood unit of ten thousand population will be as under:

Category	Unit No	Hectares per unit	Total Hectares	Remark
1. Parks for children	2	1	2	Within 0.5
2. Parks and Gardens	1	2	2	Within 1 km.
3. Playgrounds for High School	1	2	2	Within 1 km.
4. Common Gymkhana for adults	1	2	2	Within 1 km.
5. Akhadas and other institutions catering to Physical Culture and Indian Games	4	0.5	2	Within 1 km.
Total			10 hectares	

This is exclusive of open spaces for Tot lots, Town-Park, Crematorium, Burial ground etc.

9.7 Landscape Architecture. The art of landscape architecture plays no less important role than building architecture in the aesthetics of town design. Man must live in harmony with nature. Poet John Ruskin says "man in his ignorance crushes natural sublimity and in return nature crushes human beings." Hence it is of utmost importance that he must try to keep a perfect ecological balance which has the influence on peoples' "life, work and play". When man builds, he must take both nature and society into account. Landscaping is not limited to design of gardens and parks but it takes into account the entire area of the city and countryside, characteristic of its physical features, topography etc. If a country is located along the hillside, it should be planned in the layout as a rock garden. If a town is located on the bank of a river, stream, pool, care must be taken to lay out thereon, the pleasure walks, boulevards, open spaces, planted with beautiful trees. Even though there are no such natural features, the landscape architect can create beauty and loveliness artificially by providing a fragrant avenue of flowering trees amidst spacious and beautiful lawns with water channels etc. There is even greater need of planned landscape for factories and industries. Cities, factories planned in this manner have shown improved morale and much cheerfulness among the people. "If one can step for a moment into an outdoor space, no matter how small," Lawrence Halprin, the eminent landscape architect says "and get a glimpse of sky, and the smell of earth, trees and flowers, then the overwhelming scale and density of urban life can be largely overcome."

PUBLIC BUILDINGS AND TOWN CENTRES

10.1 General In old days, architecture was a commodity of the rich and powerful and so it was mainly confined to the construction of religious buildings, palaces, castles, mansions, monuments etc. The construction was based on the principle of social pyramids with small minority of rich powerful on top and large majority of common people at its bottom. Now the social pyramid's peak has disappeared and at the same time the base has been broadened. To-day nobody desires palaces, castle, mansions etc. but instead their place is taken by public buildings like town halls, libraries, office buildings, markets, shopping centres, municipalities, colleges, hospitals, museums, and city centres etc. These have been found to be more and more useful which symbolise new spirit and achievement of modern age. These buildings perform in different functions and their requirements are so diverse that they should be provided to serve their purpose in the most picturesque environment in the town. It is the focus of the town life, so the buildings should be planned beautifully with careful consideration and architect's professional skill.

10.2 Importance of Public Building. From the point of view of planning, buildings are divided into three broad divisions, such as

- (a) Public Buildings,
- (b) Semi-Public Buildings, and
- (c) Private Buildings.

The public buildings are known as an Index of the civilisation and cultural attainment of the citizens of the country. They therefore should impress every visitor to the town with their architectural beauty and grandeur. They should be the object of pride to every citizen in the sense what 'Acropolis' was to the Athens or 'Forum' to the Rome.

10.3 Selection of Site for Public Buildings. The public buildings are located considering the factors like the foreground, character, function, parking space, calm and quiet atmosphere, transit facilities etc. Considering these, the public buildings are located as below:

- (1) Buildings such as municipality should be located near the main business area of the town
- (2) Building such as public libraries, museums should be located on the public square and the road should cross through it.

(3) Buildings such as Town-Halls, Assembly Halls should be located at the focus of the main roads and should be accessible from different parts of the town. They should also have adequate parking space around them.

(4) Monumental buildings should be located at the summit to face the natural features like river or sea so as to produce a picturesque effect.

(5) Buildings such as Secretariat should be located on high ground like 'Acropolis' of Athens to dominate the entire surroundings and be visible from distant parts of the town.

(6) Schools and small educational institutes should be located near the residential areas, and away from main arterial roads and free from noise, bustle of traffic.

(7) Colleges and University campus should be located on the outskirts of the city in calm and peaceful surroundings, and approached by wide tree-like avenues.

(8) Hospitals, Sanitoria, should be located away from the town-centre and be free from noise, bustle, dust, etc.

10.4 Grouping of Public Buildings. Eventhough a building is individually beautiful, it may not produce as much impression as it would do if not grouped with similar type of buildings. On the contrary, such buildings if scattered here and there throughout the town, will lose their beauty and grandeur. As such care should be taken to group such similar buildings to make a beautiful composition in harmonious surroundings to produce the most charming effect.

The public buildings are therefore grouped in the following categories and each group is located in the centres or zones as described below:

(1) *Administrative Buildings* : Buildings such as Municipality or Corporation Town-hall, Secretariat, Law Courts, Post Offices, Public Library, Auditorium etc. are included in this category and are known as 'Civic Centre' or 'Community Centre'.

(2) *Educational Buildings* : Buildings such as Schools, colleges, University buildings, Central Libraries, Research buildings etc. are included in this category and known as 'Educational Centre'. These should not be located directly on thoroughfare.

(3) *Medical and Health Institutions* : Buildings such as Clinics, Child-welfare centres, Nursing homes and Hospitals etc. are included in this category and are known as 'Health Centre'. They should be located in calm and quiet atmosphere.

(4) *Social and Cultural Institutions* : Buildings such as Art Galleries, Museums, Musical Academies etc. are included in this category and are known as 'Art and Cultural Centre'.

(5) *Recreation Institutions* : Buildings such as Cinema Halls, Music Halls, Opera Theatres etc. are included in this category and are known as 'Recreational Centres'.

10.5 Town Centres. A town centre is the main administrative, business, entertainment and cultural centre of the town. It serves the large population as a whole and so should be provided with traffic facilities like central bus terminus, railway stations etc.

As an Administrative centre, it is the meeting place for all the citizens of the country and it includes Municipality, Town Hall and Civic Square where public functions can be held.

As a business centres, it is the place where the people go to purchase costly and luxurious goods, together with a wide variety of articles which are made available than in the neighbourhood units.

As an entertainment and cultural centre, it is the place where the people go to enjoy a movie, to listen to music, and to visit the exhibitions of pictures, paintings, or sculptures etc.

From the point of view of planning, it is the usual practice to divide the various functions into three groups as below:

1. Business Centre
2. Light Shopping Centre
3. Civic Centre

(1) *Business Centre* : Business or Commercial Centre includes a big shops, ware-houses etc. It can be considered as a main shopping centre or the Central Business District (C.B.D.) which is meant to serve the entire town. The location of business centre is determined by streets, their widths and transportation facilities etc. The shops are to be designed considering the community needs, purchasing capacity of the customers, and traffic facilities etc.

The goods that are sold here are divisible into three broad categories:

- (a) Essential day-to-day goods, such as vegetables, fruits, breads, sweets, groceries, tobacco, toilet requirements, stationery etc.
- (b) Goods, which are not frequently required, such as clothes, radios, clocks, furniture, shoes, cycles, etc.
- (c) Goods and articles of luxury such as jewellery, ornaments, perfumes and other kinds of costly goods which are purchased on special occasions like marriage etc.

(2) *Light Shopping Centre* : A light shopping centre is one where various categories of articles are sold on a small scale as compared to the business centre.

There are mainly four forms of shopping facilities such as:

- (i) Market
- (ii) Shopping Streets
- (iii) Departmental Stores and
- (iv) Shopping Precinct.

(1) *Market* : The market is the oldest form of shopping activity which consists of series of stalls or booths, arranged in row in open or sometimes covered place, around which the buyers can circulate. (See Fig. 10.1). Here the cheap goods are generally arranged either on the ground or in stalls. Such type of market requires a flat unobstructed space, on which the stalls or booths can be set up, surrounding the buildings. The parking facilities with sufficient space outside the market should be provided.

Where enough space is not available, the streets are utilised as market place especially for weekly bazar but such type should not be encouraged by the town authorities since it results in traffic congestion and accidents.

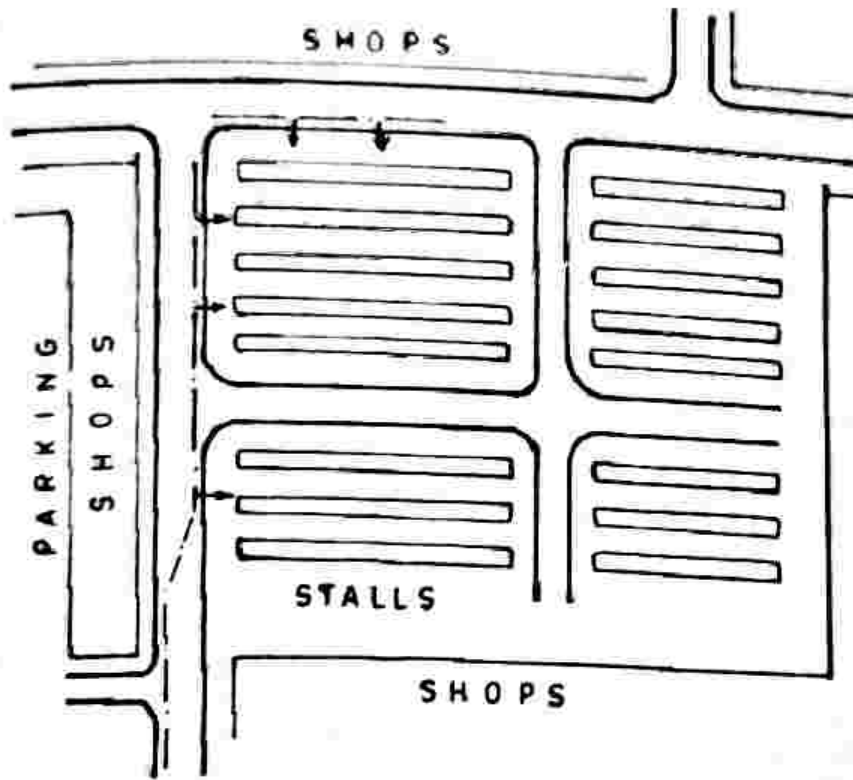


Fig. 10.1 Market.

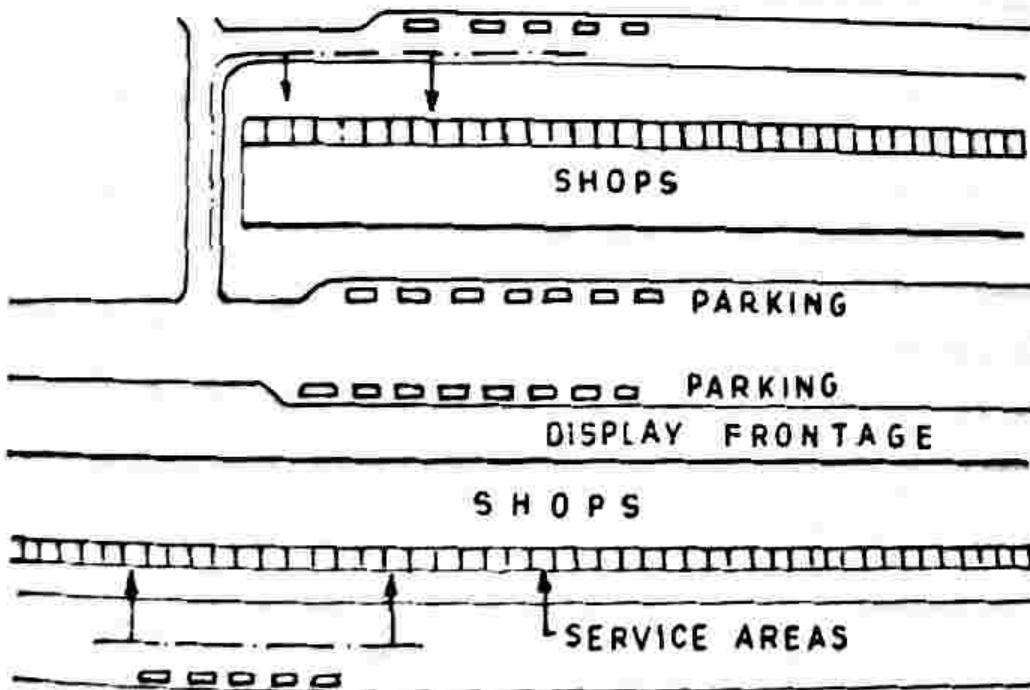


Fig. 10.2 Shopping Streets.

(II) *Shopping Streets* : These have developed through old market stalls, due to the constant use of the streets for shopping spaces. These have now become the most popular form of shopping units and are becoming permanent structures. (See Fig. 10.2). Here the shops are arranged on one or both the sides of the streets, with show windows and entrance door, at the end of the pavement and have enough storage space and good access at the rear side.

(III) *Departmental Stores* : The departmental store consists of all kinds of shops under one roof and has therefore both the characteristics of a market and the shopping streets. Different stores may sell different types of articles and goods. But a typical departmental store will sell all kinds of goods from pins to pianos and from ribbon to refrigerator, to suit everybody's pocket. The selling stores are nicely arranged so as to have easy circulation for the customer during his shopping hours. These stores require a continuous window display, show cases and large spacious selling space, and car parking facilities. They are generally located in the heart of the heavily populated area where land values are very high. So now-a-days these stores are constructed as multi-storied buildings with lifts, escalators, restaurants, water supply and sanitary arrangements.

(IV) *Shopping Precinct* : The word precinct was originally used for the enclosed space surrounding a church. It is now used in town planning as an artificially enclosed space, to divert noise and bustle of the traffic. Hence precinct is a quiet area of buildings in which through traffic is not allowed. (See Fig. 10.3). Here the shopping precinct is an open shopping area where the through traffic is excluded. It is superior to shopping streets. It is less costly than Departmental Store. It requires a paved rectangular open space surrounded by shops with their show windows facing it from which wheel traffic is excluded. The service and access roads are outside the shopping frontage. Parking facilities are provided off the road around the periphery of the precinct. Since shopping is mainly pedestrian activity, number of pedestrian connections are provided between the roads and precinct.

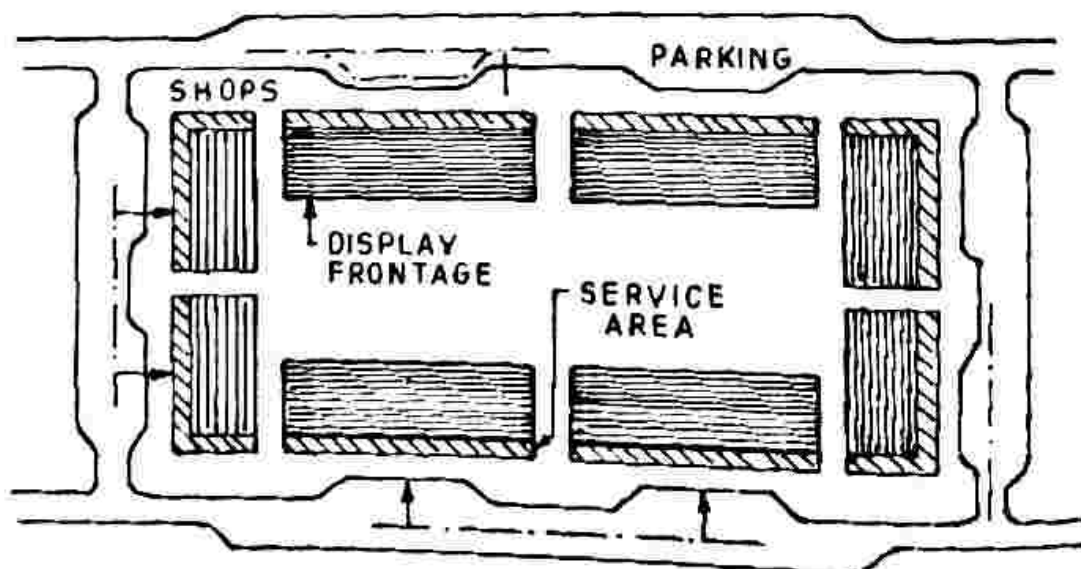


Fig. 10.3 Shopping Precincts

(3) *Civic Centre* : Civic centre or community centre is the most important centre in the town as it is intimately connected with the life of the citizens. It includes all the public buildings mostly administrative buildings such as Municipality or Corporation, Town Hall, Secretariat, Law Courts, Post Offices, Public Libraries, Auditorium etc.

The most important of them must be located at the commanding position so as to dominate the entire group. Moreover, the buildings should form an attractive composition and should have very few or no bisecting streets to interrupt the continuity of line and mass in the group.

The Civic centre is an index of pride and dignity of the city and outward expression of civilisation and cultural attainment of the citizens. It should, therefore, be designed with careful consideration so as to impress every visitor to the town with its high standard of architectural excellence.

INDUSTRIES

11.1 General. India which is essentially an agricultural country has shown rapid development in industrial field after its independence. Many important industries have grown largely during the past period of 15 to 20 years. India has abundant resources of raw materials which were a few years back exported to get finished goods in return from outside. But today the picture has changed with the rapid growth of technology. But at the same time the industries have not been set up in their proper places. Some of the industries seem to have swallowed the entire residential areas, leaving no open spaces but only obnoxious gases, smoke, noise and dust etc. Such is the sorrow state of affairs in the developing towns and cities where zoning regulations have not been strictly applied. This has given rise to haphazard ribbon development and slums around the whole area. The highways have become over-crowded giving rise to traffic congestion and accidents. This unorganised and uncontrolled growth of industries has produced considerable effect on the social and economic conditions of the town as a whole. Hence to achieve a balanced, coherent and orderly growth of industries, we need a comprehensive planning of industrial estate. The overall prosperity of the city and full employment of the people depend largely upon the industries, hence priority should be given to industries in the town planning scheme, and located in the industrial zone.

11.2 Classification of Industries. The industries are broadly classified as under:

1. Manufacturing industries,
2. Service industries, and
3. Special industries,

(1) *Manufacturing Industries*: The manufacturing industries fall into four categories according to the size of the plant, its H.P. and number of workers employed there. These are namely

- (a) Minor industries.
- (b) Light industries.
- (c) Medium industries.
- (d) Heavy industries.

Minor industries include bakeries, dairies, laundries etc. They do not produce any nuisance to the inhabitants. So they can be grouped together and located close to the residential zone for the benefit of the citizens.

Light industries and factories include manufacture of furniture, knitted goods, glass, porcelain, ice, etc. These use only electric power, and not solid fuel. So they do not cause any real nuisance. Hence they can be placed anywhere on the periphery of the town.

There are also what are known as 'Noxious Industries' such as soap industry, candle works, tanning and Extractive industries like brick works, lime kilns etc. These should be located outside the town-limit.

Medium industries include cotton mills, oil mills, sugar mills etc. They produce noisy atmosphere and undesirable wastes. These should be invariably located away from the residential zone. Arrangement to dispose of the undesirable wastes should be made as they cause adverse effect on the town life.

Heavy industries include manufacture of cement, steel, etc. which give obnoxious gases and fumes. Hence these should be located on the outskirts and planned leeward of the town, so that foul gases or smoke would not travel over the town. The location of heavy or key industries is based on National Planning and National Industrial Policy and will be governed by the factors like availability of raw materials, transport facilities, cheap electricity, water supply etc. So the work of the ordinary town planner is mainly restricted to the planning sites for light and medium industries.

(2) *Service Industries*: These include workshops, flour mills etc.

(3) *Special Industries*: These include quarrying and mining and require special treatment for their locations. Practically there is no choice for alternate locations. So they are to certain extent treated as fixed industries.

11.3 Selection of Site for Industries. The selection of site depends upon the kind of industry, whether small scale industries or large scale industries. The former can be located in the city itself near the residential zone. This saves time, money and energy of the residents.

As regards the large scale industries, the following points should be considered:

(1) Availability of cheap site, power and all public utility services like water supply, drainage, public transport, telephone etc.

(2) Availability of raw materials.

(3) Availability of skilled and unskilled labour at moderate rates.

(4) Availability of easy transport of both raw and finished products by road, rail or ship, with loading and unloading facilities.

(5) Nearness to market and related industries.

(6) Facilities to dispose of waste products by way of streams etc.

(7) Favourable climate of the surrounding locality to house the labourers of the industry.

(8) Favourable topographic conditions such as level, firm soil.

(9) Availability of sufficient land not only for the present requirement but also for future expansion.

(10) The site should be favourable for wind i.e. It should be planned leeward of the town (wind should not blow from the factory to the town) so that the foul gases or smoke would not travel over the town.

11.4 Planning of Industrial Estate. An industry is not a structural erection of four walls and a roof for merely sheltering machinery and labour. But general arrangement of office, workshops, godowns, the colonies for the officers, labourers, with all amenities should be based on well-thought-out plan in a cheerful surroundings for the co-ordination of various activities and manufacturing processes. The factories should have also large storage space to facilitate easy loading and unloading of goods.

The size of the factory largely depends upon the employed labourers and the space required for various manufacturing processes. In general a light industry requires not less than one hectare of land whereas a medium size industry requires two to four hectares.

(1) *Grouping of Factories:* If the factories are grouped together on a common industrial estate, it would be possible to provide all amenities economically, such as canteens, playgrounds, schools, health centres, bus stand, creches for female workers, parks, theatres and other recreational facilities. It also helps to exchange the ideas and joint efforts in sale and export deals.

(2) *Industrial Housing:* Lack of good housing has adverse effect on the efficiency and morale of the workers. Hence more attention should be paid for industrial housing. There should be obligation on the part of the management of the estate to provide every worker with a decent quarter at a short distance from the factory. He should also be provided with other utility services like ample water supply, electricity, drainage etc. and civil amenities like shops, health centres, schools, temples, theatres and other recreational facilities.

Such improved living and working conditions will certainly promote happy relations between the employer and the employees which is no doubt necessary not only for the efficiency and high standard of increased products, but also for the economic prosperity of the nation as a whole. In view of this the Government is now providing financial assistance to the industrial worker for his house construction under Subsidised Industrial Housing Scheme (Ref Art. 7.9).

11.5 Industrial Wastes. There are as many kinds of wastes as there are different categories of industries. Each one industry produces its characteristic wastes depending upon its quantity and quality. The industrial wastes are classified according to the type of the main constituents such as vegetable, animal, mineral etc.

Some wastes are classified as under:

1. Laundry wastes like soap suds, bleach water etc.
2. Milk wastes from dairies like milk-drying plants, creameries, etc.
3. Paper wastes like water containing wood fibres, sulphites etc.
4. Tanning wastes like lime, acid and alkaline solution, pigments, soap etc.
5. Chemical wastes like phenol, tars, etc.
6. Paint manufacture wastes like inks, resins, dyes etc.
7. Refinery wastes like electro-plating wastes.

8. Brewery and distillery wastes like waste malt, yeasts etc.
9. Organic wastes like waste meat, etc.
10. Textile wastes like waste cotton, wool, dyes, grease, caustic solutions etc.

11.6 Effects of Industrial Wastes. The following are the effects of industrial wastes:

1. Wastes containing decomposed organic animal and vegetable matters produce offensive odours.
2. Some wastes produce large scum which render water unsuitable for bathing and washing.
3. Chemical wastes are detrimental to the aquatic animals like fish etc.
4. Caustic wastes cause skin erosion and cause unpotable

11.7 Treatment of Industrial Wastes. The various treatments adopted are:

1. Precipitation of coagulants like alum, gypsum and ferric chlorides.
2. Screening, filtration, sedimentation, etc.
3. Chemical coagulations for tannery wastes.
4. Anaerobic digestion for sludges.
5. Aerobic biological oxidation.
6. Chemical oxidation.

The industries concentrate only on production of goods and never take care to dispose of their wastes properly. As such restrictions should be imposed on the industries to give the outline of the treatment for their wastes before they are disposed of in the sewers. The authorities should impose certain codes suitable for wastes and their disposal methods for the general welfare of the citizens.

COMMUNICATION AND TRAFFIC CONTROL

12.1 Need for Communication and Transport Facilities. For a rapid growth of city, a good net-work of roads is essential. It is the basis of the existence of the city. The importance of the city depends mainly on the methods of communication. As parks, gardens, open spaces are the 'lungs', so also roads are the 'arteries' of the city. Its layout is determined by the zones into which the city is divided, whereas the type of local roads or minor roads, determine the shape and size of the housing plots. As such the road or street plan is considered as the foundation of the town plan.

In old days the transport was on head-load and animals like horses, bullocks, camels, mules, elephants etc. Next came animal driven vehicles like bullock carts, tongas, etc. In all these, the speed of communication and carrying capacity was very much limited. Later on due to invention of steam engine, local trains came into existence in 18th century thereby mass transportation of goods and passengers became possible at a fast rate. Due to electricity, trains started running on roads. On account of internal combustion engine, automobiles like motor cars, buses and trucks became popular means of transportation.

The automobiles have become more and more popular on account of their high speed and flexibility. Now the city has become overcrowded with these automobiles and further all the open lands are utilised for railways, tube railways, a rapid transit system. The latter, with no interference from the road traffic, became most suitable in metropolitan cities. In all these developments, the development of road system always lagged behind the development of transport system. In many western countries the automobile population now amounts to approximately half of the human population, but the space requirements of these are in excess of those of their human masters. The roads have failed to fit in with the requirements of these automobiles and created a number of traffic problems which every growing city is facing today.

12.2 Functions of Roads. The main functions of roads are:

1. To provide a channel for movement of people and goods between various centres of the town.
2. To provide means of approach to all the residential places.
3. To provide air and light to the buildings abutting on their edges.
4. To provide space for laying the public utility services such as water mains, drainage pipes, telephone lines, cables, both overhead and underground.

12.3 Requirements of Ideal City Road. Haulage and speed are the most important requirements that the ideal road must cater to, satisfactorily.

The other requirements are:

1. It should have sufficient width to accommodate good traffic without congestion of traffic.
2. It should have impervious wearing surface with required camber to keep the base course dry which further increases the life of the road.
3. It should rest on unyielding soil.
4. It should have straight alignment, easy gradient.
5. It should have smooth curves, good visibility and properly designed junctions.
6. It should have good plantations on either side, parking spaces, traffic signs and proper lighting etc. so as to make the journey enjoyable.
7. It should afford maximum safety to the pedestrians and vehicles with the provision of footpath, sign boards etc.

12.4 Aesthetics of Road. To make the journey more pleasant, the following aesthetics of roads are required:

1. The surface of the road must be maintained clean and tidy.
2. The footpaths should be provided with nicely dressed curb stones to represent a neat alignment.
3. The traffic islands at the road crossing should be beautified with statue, fountain, monument etc.
4. Beautiful trees and greenery should be planted on either side of the roadway. The overhanging branches should be periodically pruned.
5. Ornamental lightings with proper spacing should be installed.
6. The curves along the road should be smooth and graceful.
7. The vistas through which the road passes should be pleasing.

12.5 Factors to be Considered in the Design of Town Road. The following are the points to be considered while designing the town road:

1. *Nature of Traffic* : This is the most important point to be considered in the design of town road. The traffic to be carried by the road is studied here considering the type of vehicles, intensity, peak hours, parking facilities etc.
2. *Utility Services* : Here the utility of the road that serves the neighbouring areas is considered and accordingly dimensions and facilities are determined.

12.6 Classification of Roads. The roads are named according to the type of constructions, jurisdiction and important function etc. Names like earth, murum roads, metalled roads, asphalt roads, and concrete roads indicate the type of constructions.

Names like local roads, district roads, state highways, national highways indicate their jurisdiction.

Names like rectangular roads, ring roads, diagonal roads, radial and circular roads indicate their geometric shape.

Names like Avenue, Promenade (a pleasure drive, with water front at least on one side), Boulevards, and Parkways indicate their dominant function.

(1) *Classification of urban roads* : The urban roads are classified as per their importance such as:

- (i) Arterial roads
- (ii) Secondary or sub-arterial roads
- (iii) Local roads
- (iv) Other roads

(i) *Arterial Roads* : These are that roads which connect the town to a state highway or a national highway. They pass through the city limits and carry a large amount of traffic from one part to the other part of the town. These are meant solely for fast moving traffic and therefore should be planned as straight as possible, avoiding sharp curves. Change in direction should be accompanied by smooth curves. These should not enter into the heart of the city at any cost, should have very few road junctions, which should be controlled by roundabouts or fly-overs. They should have no obstructions such as frontage of buildings, loading or unloading areas, parking places, and pedestrians on the carriage way. Further these roads may be made more pleasing creating squares, erecting public and semi-public buildings at the focal points to invite through traffic and encourage speedy transportation by removing all types of traffic barriers. The width of these roads should not be less than 25 m. to 30 m.

(ii) *Secondary or Sub-arterial Roads* : Also known as major roads they run within the limits of the town connecting its important centres. They are designed for slow moving traffic over a short distance. The sub-arterial roads act as a link between the arterial roads and local roads. The sub-arterial roads should be improved and provided with safety measures at intersections.

(iii) *Local Roads* : These roads, also known as minor roads, are meant to provide approach to the buildings, offices, shops, schools, colleges etc. There should be no through traffic here and so the local roads are not linked with the arterial roads. These roads need not be straight but can follow the contours of the land.

These roads are used for residential units, shopping and business centres. They therefore form the pocket or precinct roads mainly to serve the non-vehicular traffic. The width of these roads should not be less than 7 m to 10 m.

(iv) *Other Roads* :

(a) *By-pass Roads* : When the main or through roads pass through the congested areas of the towns, there will be considerable reduction in the speed of the vehicles and the smooth flow of the traffic is largely affected resulting loss of time and fuel. In order to maintain the smooth and speedy flow of traffic, bypass roads are constructed. See Fig. 12.1. These are also called as loop-roads through which the main traffic can pass from one side and again join on the main road on the other side thus avoiding the congested area or ribbon development of the town.

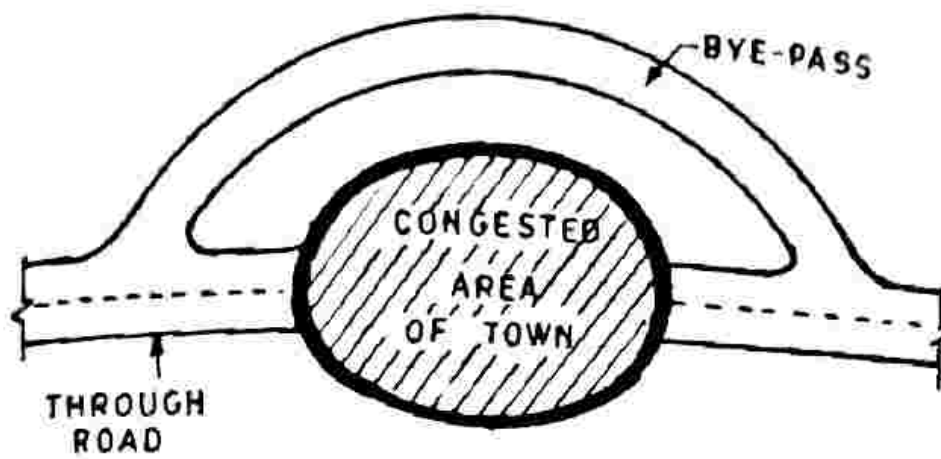


Fig. 12.1 By-Pass Road.

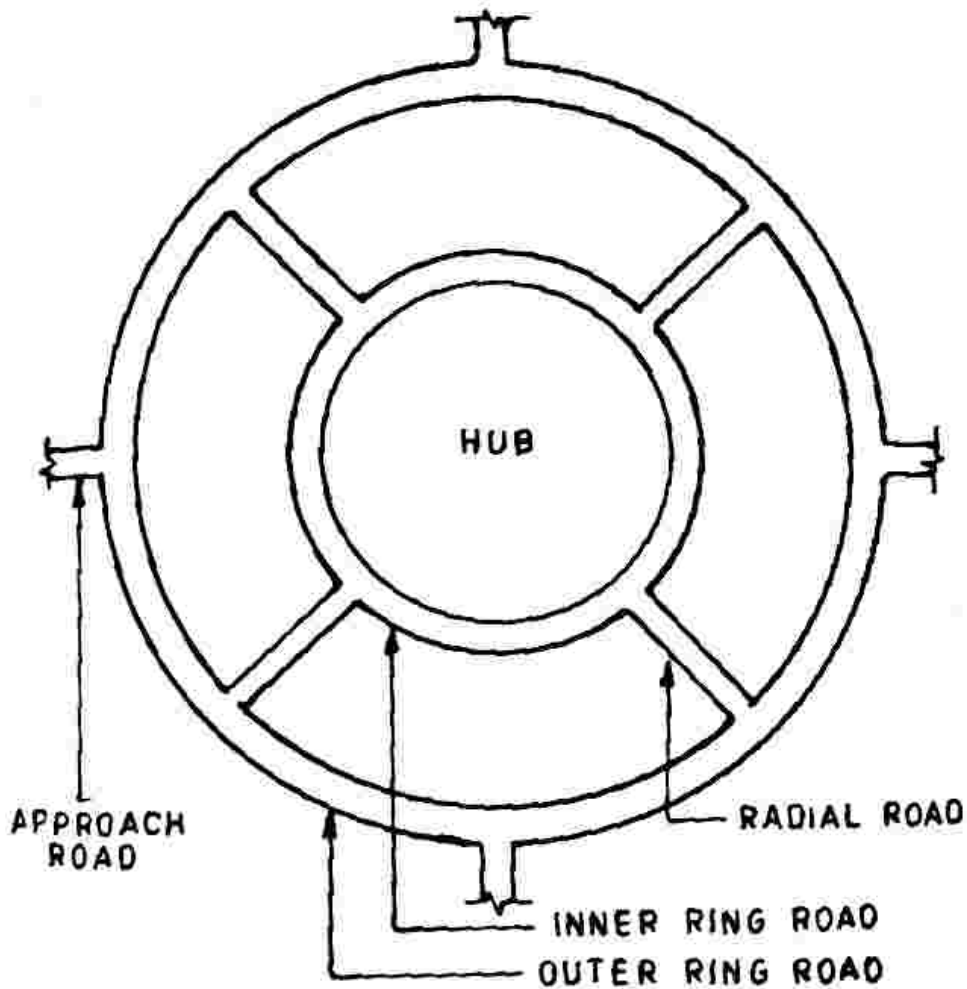


Fig. 12.2. Outer and Inner Ring Roads.

(b) *Outer and Inner Ring Roads*: These roads are in the form of circles or rings and hence the name. See Fig. 12.2. The outer ring road is meant to divert the through traffic from the town. It therefore acts as a by-pass road for the through traffic approaching the town.

The inner ring road is meant to divert the local from the through traffic.

These ring roads help to reduce the traffic congestion of the large towns.

(c) *Express-ways*: The express-way is meant to function as arterial road for the movement of fast moving traffic in the big metropolitan cities like, Bombay, Calcutta, Delhi etc. Two to three such express-ways are necessarily to be provided around big cities of modern days to face the tremendous growth of the traffic. They however should not form a part of the regular street system, although they should be suitably joined and linked with them. Express-ways are designed with easy gradients and smooth curves so as to carry the traffic speedily and safely.

These are originated from the German *Autobahnen* and Italian *Autostrade*. These are comparable next to railways in cost and carrying capacity of traffic.

(d) *Free-ways*: These are the special routes meant to carry fast moving traffic and therefore designed with high standard of alignment, clear visibility, wide carriage way, easy gradient and smooth curves etc.

There is no access from adjacent properties as a result full width of free-way is made available for the fast moving vehicles without any obstruction. The free-ways function as arterial roads passing around the city with controlled access. They also act as main entrances and exits as such they form a part of major road system.

12.7 Types of Street or Road Systems. Following are the different systems of streets or roads commonly adopted in the city:

1. Rectangular or Grid-Iron street system.
2. Rectangular combined with Diagonal street system.
3. Concentric and Radial street system.
4. Rectangular combined with Radial street system.
5. Organic street system.
6. Irregular Medieval street system.
7. Combination of Rectangular and Irregular street system.

(1) *Rectangular or Grid-Iron street system*: This system is suitable for a fairly plain country, without any predominant natural features. Here the streets have equal widths and they cross each other at right angles. See Fig. 12.3 e.g. Jaipur (India) (Fig.3.10).

The advantages of this system are:

- (i) It is convenient to traffic and so a speedy and free traffic can be maintained.
- (ii) The houses are constructed in rectangular blocks so convenient, economical and most suited for building construction.
- (iii) There is no wastage of land since no irregular portions are left out.
- (iv) The maximum area is used for construction. It is therefore most advantageous for private land-owners.

The disadvantages of this system are:

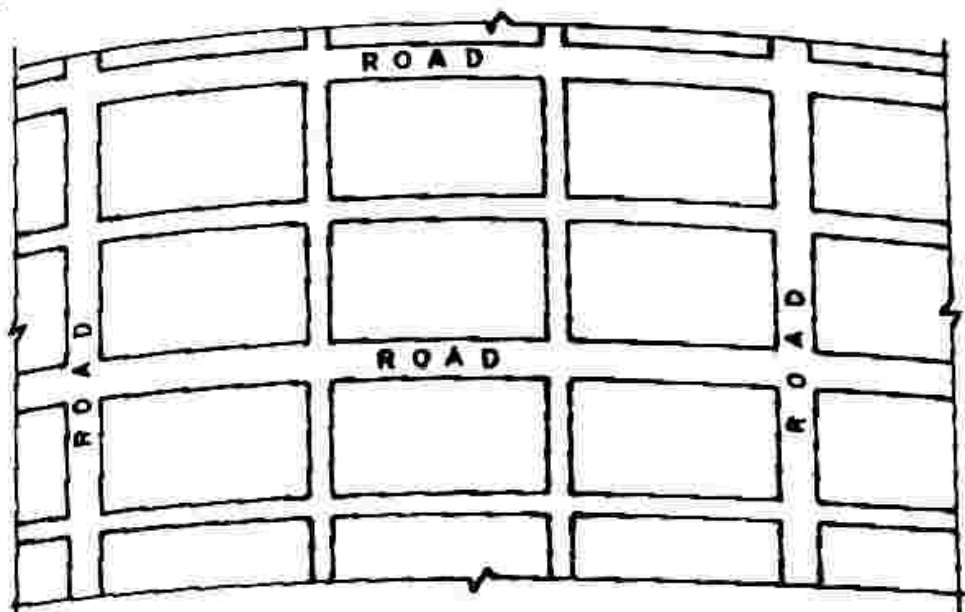


Fig. 12.3. Rectangular or Grid-Iron System.

- (i) This system does not provide short cuts which provide a direct access to trade and shopping centres.
- (ii) In uneven country, this system leads to inconvenience, discomfort and moreover it becomes expensive.
- (iii) This system has too many junctions and crossings. So there are more chances for road accidents. Hence it is most unsatisfactory from traffic point of view.
- (iv) This system is too mathematical and produces monotonous effect since the roads are straight as a result the *vistas* are open, devoid of interest and variety.

(2) *Rectangular combined with Diagonal street system*: It is an improved type of rectangular system. See Fig. 12.4. *Enfant* was the first town planner who designed it.

The advantages of the system are:

- (i) This system provides direct communication from distant parts of the town.
- (ii) At the place where the diagonals meet, a park, garden, fountain or memorial can be set up to add aesthetics to the town.
- (iii) This system is most practicable as there are very few obstacles.

The disadvantages are:

- (i) This system gives rise to many dangerous intersections at the junctions of diagonal streets and rectangular streets and so most unsatisfactory from traffic point of view. E.g. Washington, the Capital of U.S.A.

(3) *Concentric and Radial street system*: In this system the circular or ring roads are connected to radial roads. It is also called '*Spider's Web System*'. See Fig. 12.5(a) and (b).

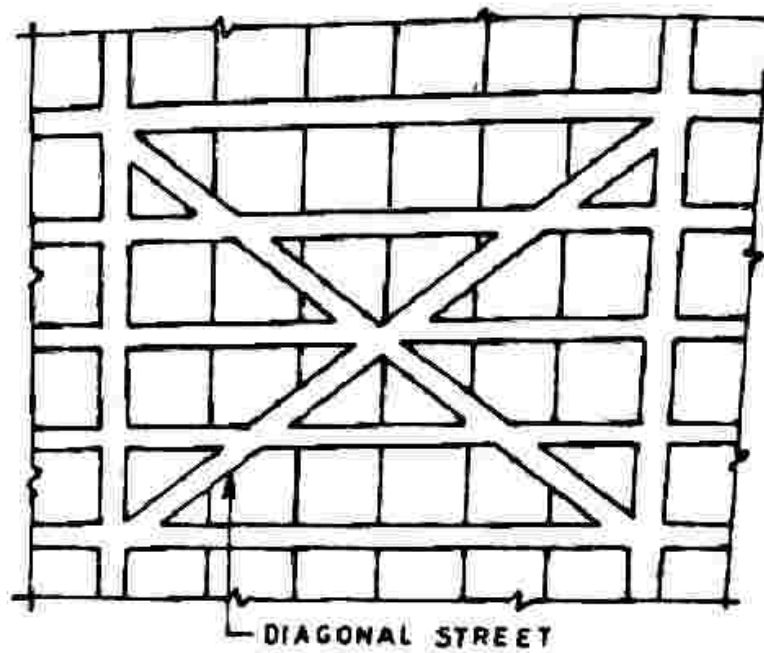


Fig. 12.4. Rectangular Combined with Diagonal System.

This system represents the most natural growth as many cities roughly possess a part of this feature. Here the town grows in the form of concentric ring roads round the hub of the town so that each growth or part, is as near to the town centre. E.g. Vienna, Austria.

- (i) The radial roads provide direct access to the heart or central part of the town and are earmarked for fast moving traffic. Hence these ring roads can be designed as arterial roads.
- (ii) The circular roads function as the intermediary between diagonal roads and local roads.

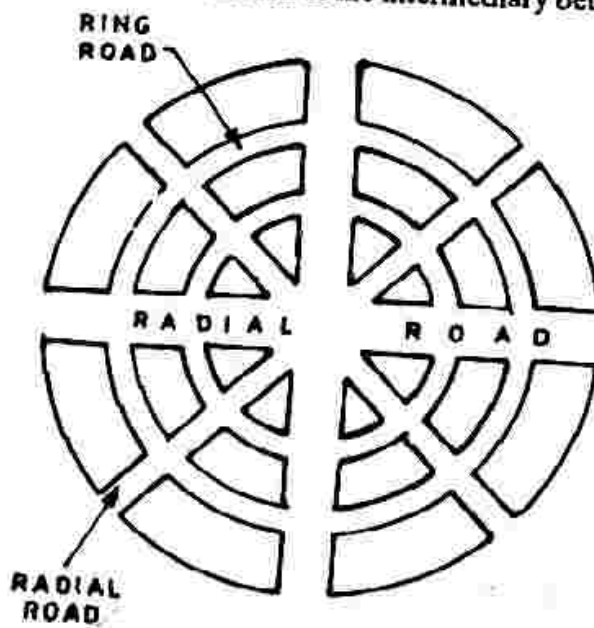


Fig. 12.5. (a). Concentric and Radial System.

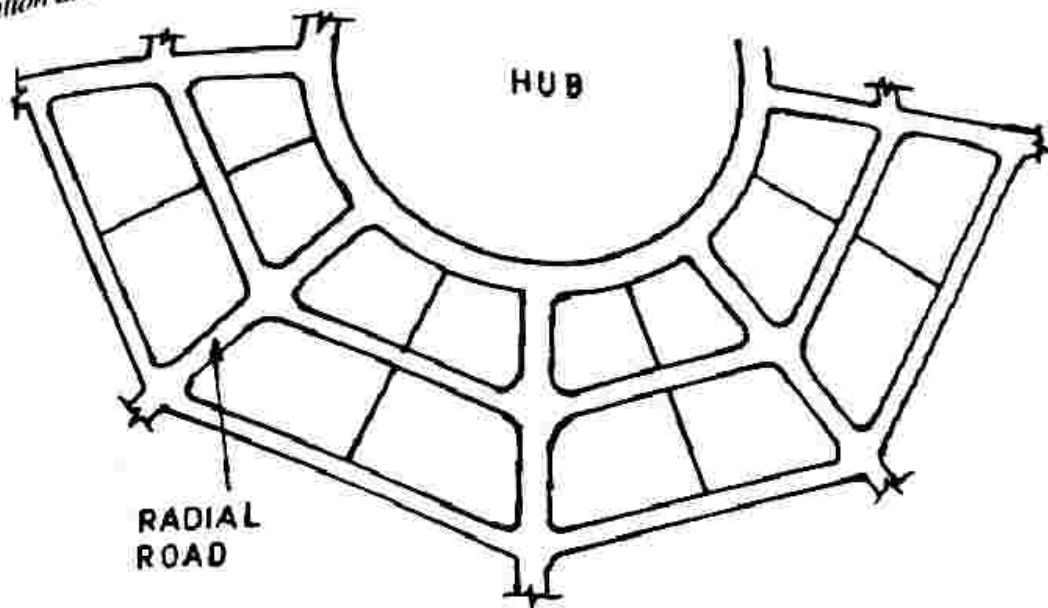


Fig. 12.5(b). Spider's Web System.

- (iii) The circular roads help to distribute the local traffic to the different thoroughfares. Hence it is most suitable from traffic point of view.
- (iv) This system is found to be more useful for the economic expansion of the town particularly if the town has central features such as important public buildings, market etc.

The disadvantages of this system are:

- (i) The plots are formed trapezoidal in shape. So a lot of space is wasted due to irregular portions left out.
- (ii) It is not economical for the construction of houses, since maximum area is not utilised.

(4) *Rectangular combined with Radial street system:* In practice a combination of rectangular and radial systems can be adopted if the topographical features are favourable to suit the local requirements of each place. See Fig. 12.6. It has both the advantages of rectangular roads and radial roads. E.g. New Delhi (India). See Fig. 3.11.

(5) *Organic street system:* It is also called as Topographical and Informal street system. The name 'Organic' is applied because the plan resembles to a microscope slide, presenting the cell structure of animal or vegetable tissues. Here the street system is entirely unplanned with all irregularities, and hence the name "Studied Irregularities". The streets are curving, sometimes discontinuous, with variable width and irregular open spaces at some intervals.

To make this system attractive and pleasing with good scenic effects, the streets are planned in conformity with natural surroundings, such as river, lake, hillock, sea-shore etc. E.g. Carcassonne, France. See Fig. 12.7.

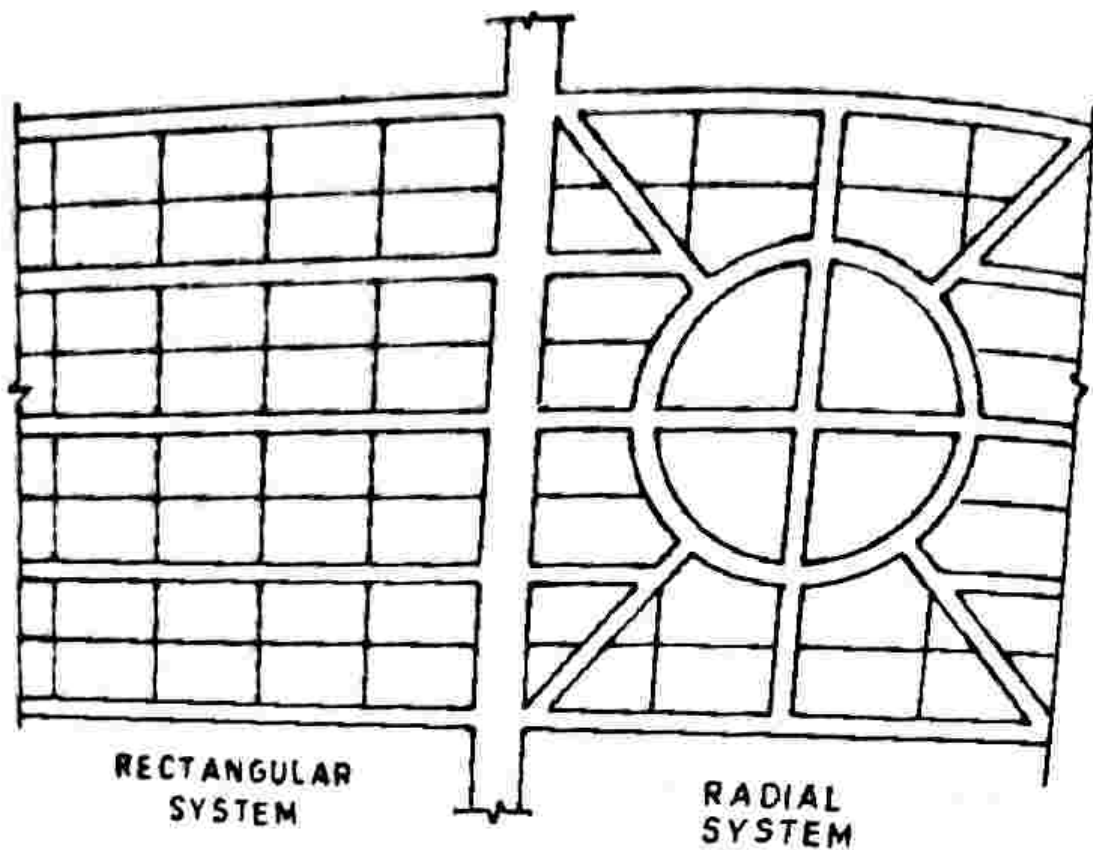


Fig 12.6. Rectangular and Radial System.

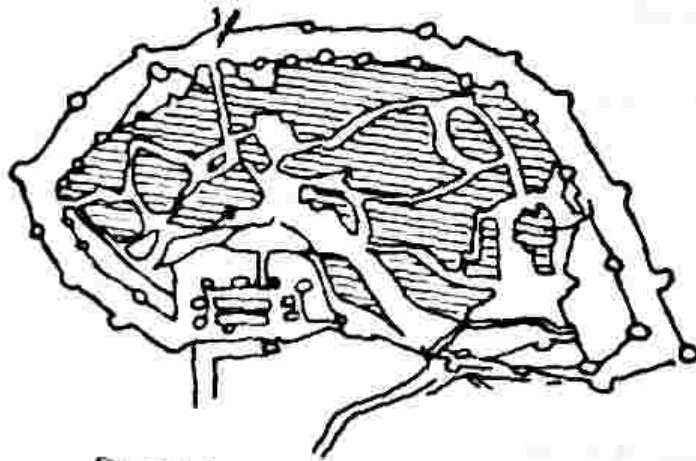


Fig 12.7. Organic Pattern. Carcassonne France.

- (6) *Irregular Medieval street system:* Many of the old cities of the middle ages have grown in this irregular way without any planning. They have developed unmethodically and illogically beyond control. E.g. Nasik, Varanasi, India.
- (7) *Combination of Rectangular and Irregular street systems:* The irregular type is of earlier development whereas the rectangular type is of recent development of the town. When the old system is found difficult to rectify to suit the modern needs, the combination is adopted, E.g. Edinburgh, U.K.

12.8 Traffic Management. The road systems in old days were primarily meant for slow moving traffic for pedestrians and animal driven vehicles. The means of transport was quite adequate, the vehicular speed was also slow. There was no fear of traffic accidents. But due to the advent of fast moving automobiles, in the last few decades, it has changed the whole picture. The solution does not lie in mere widening the roads nor by providing additional roads, but the traffic should be managed efficiently. By traffic management is meant to utilise the road system to the fullest extent in comfort, convenience and safety. Traffic management covers a vast field of traffic measures such as the study of regulation, controlling, guiding measures of traffic, flow of traffic at junctions, providing parking facilities, etc.

The main objects of traffic management are:

- (i) to ascertain a smooth, easy flow of traffic at all places.
- (ii) to increase the speed of the vehicles.
- (iii) to improve and increase the haulage capacity of the roads.
- (iv) to provide safety to the pedestrians and vehicles.
- (v) to avoid delays in transport.
- (vi) to adopt the traffic segregation to remove traffic congestion.

12.9 Traffic Surveys. It includes the following:

- (1) **Traffic volume study:** It represents the number of each type of vehicles passing a traffic station.
- (a) **Annual Average Daily Volume of Traffic or ADT:** It represents the average of 365 days. For finding ADT, 24 hours counts are made at five or fifteen minutes' interval. Traffic census stations are installed and either week days or Sundays are chosen for finding the ADT. This helps for planning of major roads.
- (b) **Seasonal Average Daily Traffic:** At places like business, commercial, recreational centres, traffic surveys are conducted to find out the maximum volume of seasonal traffic. This helps for planning of roads to serve the particular centre.
- (c) **Hourly-Average Traffic Volumes:** The traffic census is conducted for peak hours of the day in different months to determine the maximum average traffic volume per hour. It helps for planning of traffic lanes of the particular road.
- (d) **Pedestrian Volumes:** The volume of pedestrian traffic is found out which helps to determine the widths of footpaths, pedestrian crossings, etc.
- (e) **Classified Traffic Volumes:** Here the intensity or number of vehicles of different categories is determined, such as bullock-drawn carts, tongas, cycles, rickshaws, buses, cars, trucks etc.
For this, either manual counting or automatic recording is resorted to. This helps to fix up the geometric as well as structural design of the road.

(f) **Origin-destination Studies or O and D Surveys:** Here the study is made for the origin and destination of passengers and goods traffic, mode of travel of people i.e. on foot, or by cycles, buses, direction, time, purpose of travel and halts made in the travel by them. It helps to provide speedy

transport, necessary thoroughfares to fix the routes for different traffic to avoid congestion, and to specify one-way traffic wherever needed.

Following methods are used for making O and D surveys:

- (i) *Roadside interview method*: The drivers and persons are contacted to know their origin and destination, past, present and future trips to be carried out.
- (ii) *Parking method*: The drivers of parking vehicles are contacted to collect similar information as above.
- (iii) *Licence-Plate method*: Here the registration number of the vehicles, time of entering or leaving the area under survey are recorded.
- (iv) *Return Post Card method*: Here the pre-paid blank post cards with return address are distributed to drivers of vehicles with a request to fill in the questionnaire and to return it duly completed by mail. This method is adopted where the traffic is heavy.
- (v) *Tag on card method*: Here the precoded cards are tied on the vehicles when they enter the area under survey. When the vehicles leave and reach the cordon area, the tags are removed and the time, destination, route of travel are recorded on the tags. This method is suitable where the traffic is heavy.
- (vi) *Home Interview method*: The drivers and vehicle owners are contacted in their homes and necessary information is collected.
- (vii) *Workspot Interview method*: Here the necessary information is collected by personal interviews at the workspots like offices, factories, etc.

The statistics so collected in O and D surveys can be represented in the form of maps, charts etc. and used for recommending the measures of improvements for the roads under considerations.

12.10 Traffic Congestion in Cities. In old days the means of transport were simple like bullock-carts, tongas etc. as such the question of traffic problems like congestion or accidents never arose. But due to the advent of automobiles there took place rapid development of traffic system during the last few decades. In this 20th century, speed has become the order of the day which is the potential source of danger on the roads. This has brought the question of safety to the forefront which is the main cause of our present-day traffic problems. The chief trouble of most of the important roads is that they are non-descript in character i.e. they are not functionally differentiated. As a result there is a jumble of mixed traffic like pedestrians, bullock-carts, tongas, cycles, rickshaws, buses, cars, heavily laden trucks, and sometimes herds of animals like sheep, cows, buffaloes etc. All these drive carelessly and recklessly ignoring the traffic rules which cause disorderly traffic and congestions. During rush hours there is also the tendency of the motor vehicle drivers to 'get through first' at any rate which results into serious accidents.

There is thus indiscriminate mixture of slow and fast moving traffic, which moves about without separation and required space. This is further coupled with the conflicting directions of travel resulting in traffic congestions. This happens in broad daylight. The condition during night traffic is still worse. There is continuous flow of overloaded carts, vehicles with projecting hay, sugarcane or logs of timber, steel etc. even without lights which obstruct the view of motorists and invite accidents.

Many of the bullock-cart drivers are found to be sleeping or resting during night journey, permitting the bullocks to slowly drive along. Many of the vehicles do not have tail lights or have wrongly fixed head lights, and their overspeeding habits cause traffic hazards during nights. This is coupled by fatigue, alcohol, drugs, illness etc. by the road users. It is seen that many times the signs and signals are installed at incorrect positions. So also badly located advertisements divert the attention of the drivers thus inviting the accidents.

It seems the civic and traffic sense is badly lacking in the road users. And, in general, there is no strict traffic control and enforcement of the rules resulting in the present-day chaotic and congested conditions in the city.

12.11 Disadvantages of Traffic Congestions. (1) There are more chances of road accidents.

(2) The driving through traffic congestion is very tedious, and very wearing on nerves as it adversely affects the health of the road users of living.

(3) Traffic congestion delays urban people in going to the place of work. It increases cost of living.

(4) The average automobiles use more petrol and gasoline, on congested roads, than on the same when clear.

There is thus national waste of fuel. The amount of losses due to traffic congestion in the metropolitan cities of U.S.A. amounts to billions of dollars.

(5) The city areas are being polluted with undesirable gases, odours etc.

(6) All the streets have become highways full of noise, bustle of the vehicles.

12.12. Remedies for Traffic Congestion. (1) Providing different roads or routes for different types of traffic.

(2) Providing the movements of vehicles by making one-way traffic.

(3) Creating car parks or side-bays at convenient places along the road.

(4) Providing terminal bus stops.

(5) Providing parking places in the shopping, commercial, recreational centres.

(6) Providing proper facilities for the pedestrians at all crossings and junctions of the roads.

(7) Prohibiting the parking of cars on the road sides.

(8) Adopting place and time segregation of traffic, which is the best.

(9) Providing education methods like lectures, films creating public opinion to abide by the traffic rules and regulations, etc.

(10) By enforcing traffic rules and punishing the defaulters.

12.13 Traffic Control. The various methods of traffic control are :

(1) adopting time and space segregation of traffic,

(2) imposing speed restrictions wherever required,

(3) installing controlling devices such as signs, signals and markings at appropriate places to regulate, warn or guide the traffic,

(4) making one-way traffic,

(5) providing junctions with adequate traffic islands, roundabouts, grade-separators etc.

(6) providing change of direction by smooth curves with good visibility,

(7) imposing heavy penalties on the defaulters of the rules and regulations of traffic,

(8) controlling the traffic at junctions either manually or by automatic devices.

12.14 Principle of Segregation of Traffic. The main cause of a number of road accidents is the inter-mixture of traffic, slow and fast, local and through. Hence the remedy lies in the segregation or separation either on separate track on the same road or entirely on separate road. There are two ways of segregation of traffic.

(1) *Place Segregation:* Under these measures, there are several ways of separating or segregating the track on the same road, viz.

(i) by keeping the track on different levels one at higher and other at lower level called grade-separators,

(ii) by keeping the tracks on the same level but separation is caused by a physical obstruction such as raised islands, footpaths, fencing, or colour bands. These come under constructive measures.

(2) *Time Segregation:* As per this type, the traffic at crossings is allowed to pass at different timings or intervals, as such the traffic in one direction is entirely stopped, for a short time while the cross traffic is allowed to pass on and vice-versa. This is generally done by automatic traffic signals by coloured lights in big cities like Bangalore, Bombay etc. The timing, phasing and installation of signals have to be determined by conducting a detailed traffic survey. These come under restrictive measures.

12.14 Road Junctions. The design of road junction should be done carefully to make it more safe for movement of the traffic. There are number of types of road junctions to be designed for different conditions of traffic. The factors that govern the type of road junction are as follows:

(i) Volume and type of traffic.

(ii) Number of intersecting roads.

(iii) Availability of traffic control devices.

(iv) Funds available.

The guidelines to be observed in the design of road junctions are:

(1) *Angle of Crossing:* The angle of crossing should not be acute. As far as possible the subsidiary road should be aligned to meet the main road at right angles.

(2) *Conflicting Points:* As far as possible the conflicting points should be reduced and the lines of traffic flow are made to cross at right angles. The road junctions by this way can be properly channelised to permit a smooth flow of traffic without any collision.

(3) **Entry Speed:** The design of road junction should be ingeniously done such that it should not halt the main road traffic but only allow to slow down the high entry speed to avoid accidents.

(4) **Kerbs:** These indicate the boundary between the pavement and footpaths. They help the traffic to remain in the through traffic lanes. They should have suitable heights depending upon the classes and should be clearly visible during nights.

(5) **Pedestrian Crossings:** Separate path marked with alternate black and white strip should be provided for the pedestrians at suitable distance from the junction (Zebra Crossing). In case of heavy pedestrian traffic, hand rails should be provided round the junction with openings at pedestrian crossing, and marked with flashing beacons.

(6) **Sight Distance:** At junctions, there should be a clear view across the corners from a sufficient distance so as to avoid collision of the vehicles approaching from other directions.

(7) **Grade-separator:** If the roads intersect at different levels or grades, at junction, then grade separator is provided which attains hundred percent segregation of traffic.

12.15 Types of Road Junctions. The road crossings or junctions can be divided in the following categories:

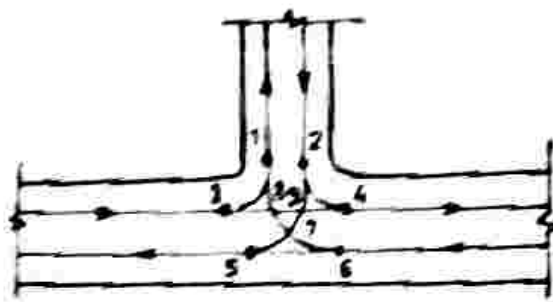
1. T-Junction
2. Y-Junction
3. Acute-angled Junction
4. Staggered Junction
5. Right-angled Junction
6. Multiple Junction
7. Grade Separators.

1. **T-Junction:** This type of T-junction is formed when a local road meets with the other local or main road at right angles. Fig. 12.7(a) shows 1 to 9 potential points of collision, or points of conflict. By widening the junction and providing a safe area for right out vehicles, the conflicting points can be greatly reduced.

This is the simplest form of junction and provides adequate sight distance and radius kerbs.

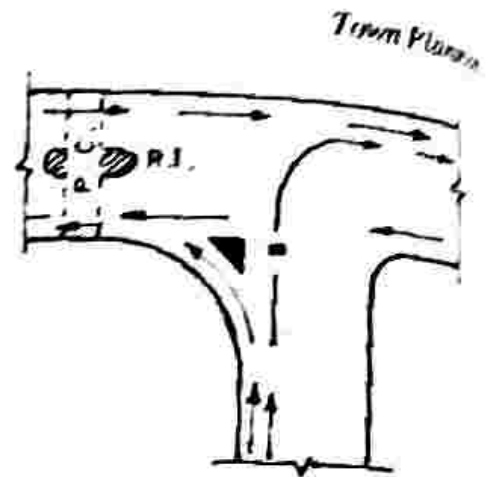
A traffic island can be provided which ensures that the traffic on local road approaches the main road at lower speed. The shape of the traffic island should be such as to allow easy access of the traffic from the main road to the local road. These traffic islands serve as shelter for pedestrians crossing (P.C.) the road. They are called as *Safety Islands or Refuse Islands (R.I.)*. These islands are provided about 20 cm higher than the road level and painted with colour to make them distinct from road pavement. The necessary footpaths, and pedestrian crossings should be provided with appropriate sizes. See Fig. 12.7 (b).

(2) **Y-Junction:** This type of junction is formed when one road meets the other at some acute angle. Fig. 12.8(a) shows the Y-junction with number of conflicting points. If there is no traffic control, these may prove to be very dangerous especially when both the roads are main roads. Fig.



Before Channelization

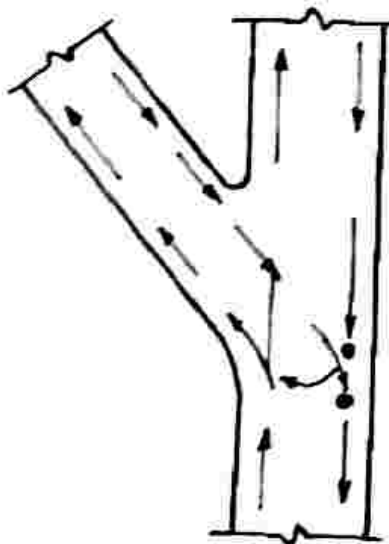
Fig. 12.7(a). T-Junction.



After Channelization

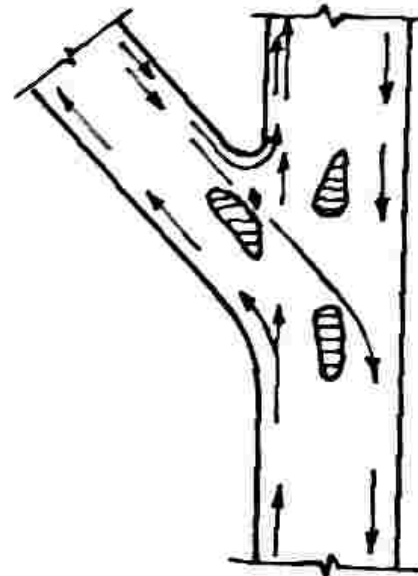
Fig. 12.7(b). T-Junction.

12.8 (b) shows improved design by necessary segregation with traffic islands of appropriate size and shape. By these arrangements the points of possible conflicts can be greatly reduced.



Before Channelization

Fig. 12.8(a). T-Junction.

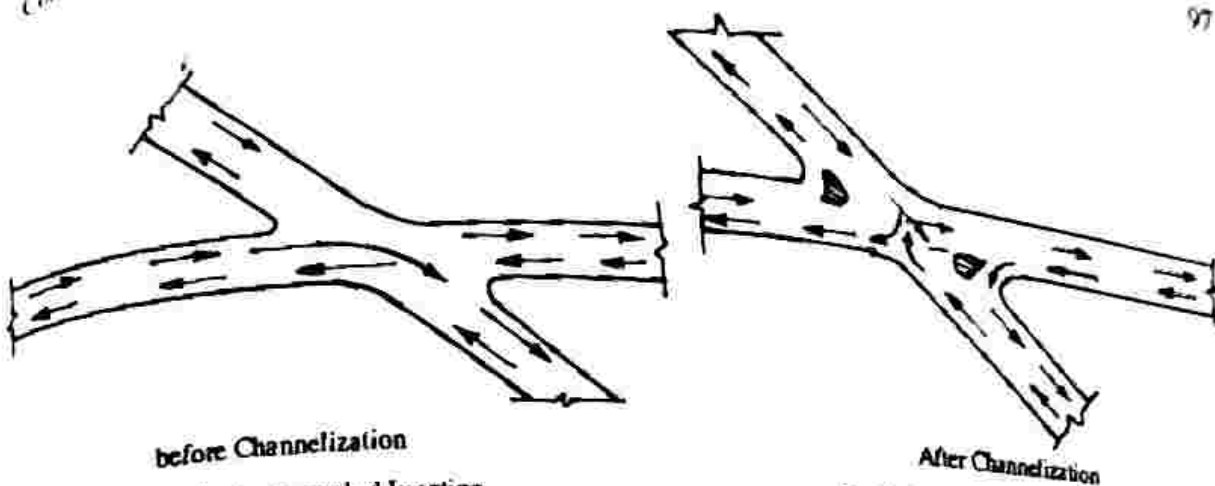


After Channelization

Fig. 12.8(b). T-Junction.

(3) *Acute-angled Junction*: This type of junction is formed when two roads cross each other at acute angle. These types of junctions do not provide sufficient sight distance and therefore should be avoided as they prove to be grave hazards to the traffic. Fig. 12.9(a) shows the main traffic desire to turn into the side road, has to make a turn which brings it into direct points of collision with two opposite lines of traffic. Fig. 12.9(b) shows the arrangement with necessary islands so that the turning traffic will be allowed to pass the signals provided at the corners so as to circumvent the islands.

(4) *Staggered Junction*: This type of junction is formed when two roads cross each other at right angles at different places. It is here necessary that the staggered roads should be of sufficient distance apart or at least 100 m apart so as to admit the crossing traffic to weave freely across the path of the opposite traffic flow.



before Channelization
Fig. 12.9(a). Acute-angled Junction.

After Channelization
Fig. 12.9(b). Acute-angled Junction.

Fig. 12.10 shows the layout of a staggered junction. The points to be noted in the design of a staggered junction are:

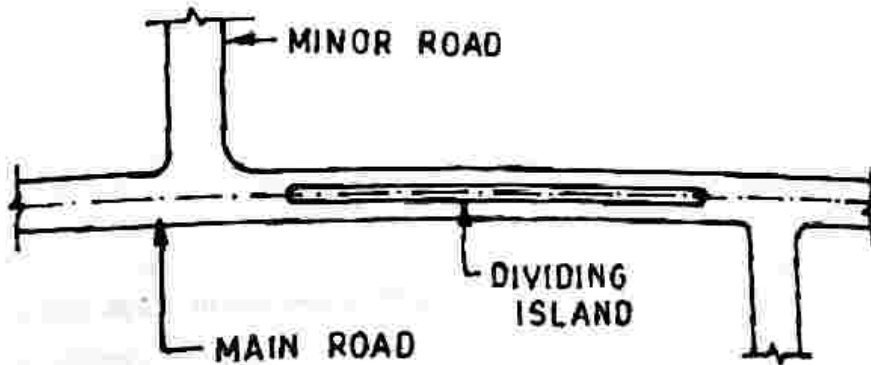


Fig. 12.10 Staggered Junction.

(i) The local road joins the other local or main road at right angles.

(ii) The stagger is to the left. The stagger to the right is preferable to the stagger to the left because in the former the traffic from the minor road would slow down at the junction and proceed across the road and turn to the right after ensuring that the road is clear. But opinion differs as to whether the stagger of the junction should be to the right or left. According to town planner G.T. Bennet, more than seventy per cent of accidents at junction are due to the vehicles turning to the right.

(5) **Right-angled Junction:** This type of junction is formed when the two roads cross each other at right angles. Fig. 12.11(a) shows the right-angled junction with as many as twenty-four conflicting points.

In this type the traffic moving in opposite direction has to make a complete right angle turn. Where space is available, the traffic is controlled by creating in the centre of the junction a dead area called a 'traffic island' or 'roundabout' around which the traffic is compelled to go clock-wise in a gyratory manner, always keeping a left hand rule, so as to avoid the chances of accidents due to short cuts. See Fig. 12.11(b). The movement of traffic flow in opposite direction is altogether eliminated.

The design factors of rotary or gyratory system are:

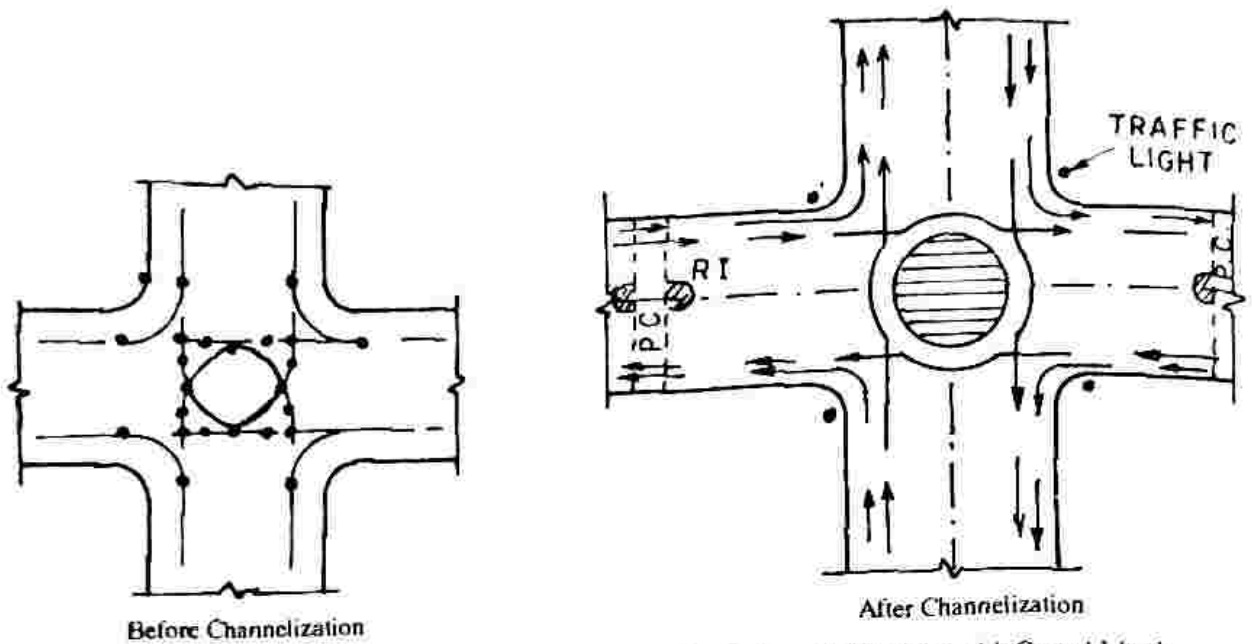


Fig. 12.11(a) Right-angled Junction.

Fig.12.11(b). Right-angled junction with Central Island.

(i) *Design Speed*: The vehicles approaching the rotary have to slow down their speeds as compared to the design speed. However, the traffic need not come to a stop before allowing the cross-traffic to pass but has to reduce the speed to a considerable extent. The speed of the traffic rotary is taken at 40 kmph and 30 kmph for rotaries in rural and urban areas respectively.

(ii) *Radii of entrance and exit curves*: For the designed speed of 40 kmph, the radius of entry curves is 20 to 35 m and for 30 kmph, 15 to 25 m.

The radii for exit curves should be one half or twice the radius of entry curves.

(iii) *Rotary Island*: The rotary islands have generally circular or elliptical, turbine and tangent shapes. See Fig.12.11(c) to (f). Its size largely depends on the volume of traffic. The radius of central islands should be 1.33 times the radius of entry curves. The island should be fenced by about 20 cm. stone kerbs painted black and white so as to make it visible both by day and night. The kerbs should be properly lighted during night.

The island may be made pleasing with a green lawn, or with ornamental features like a statue or fountain etc. However, for good visibility it should be kept open as far as possible.

(iv) *Width of the carriage-way*: The width of the carriage-way round the island should be slightly more than the average of the widths of the crossing roads.

(v) *Pedestrian traffic*: The pedestrian crossing should be provided at appropriate place with a refuge island at the centre. This is especially helpful to provide shelter or protection for the children and aged persons who do not cross the streets at one stretch. In case of large volume of pedestrian traffic, it should be controlled by human control or automatic signals to regulate the movement of pedestrians. The other provision of crossing facilities to pedestrians is by providing a sub-way and

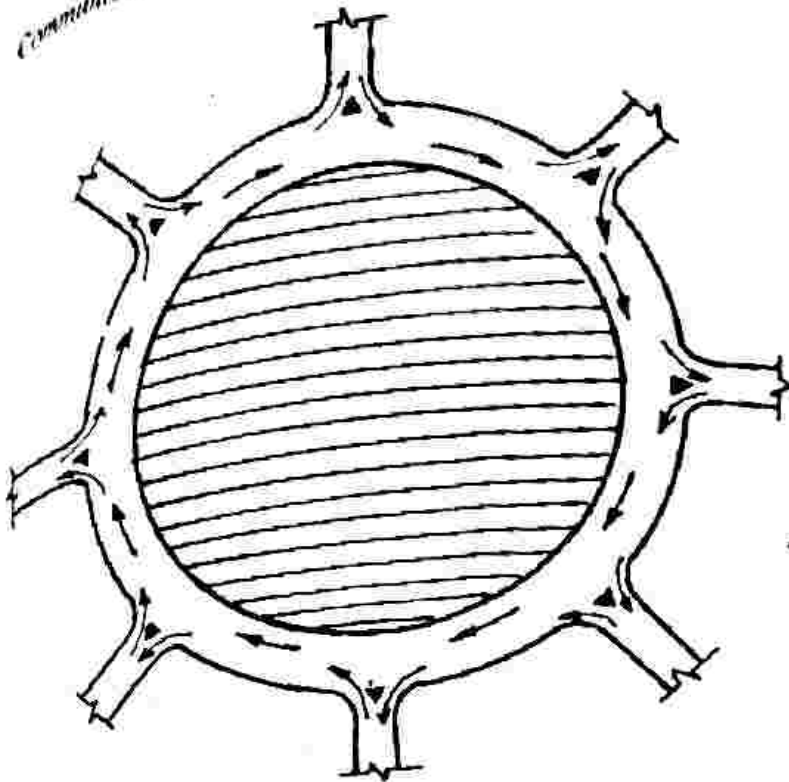


Fig.12.11(c). Circular Type.

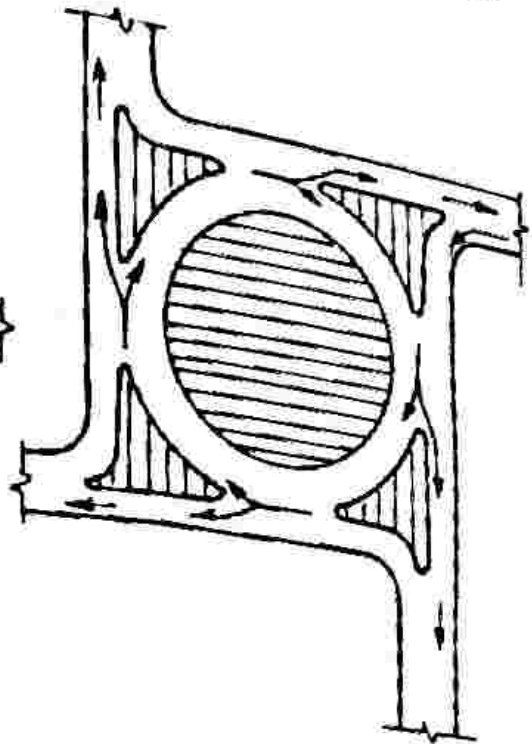


Fig.12.11(e). Turbine Type.

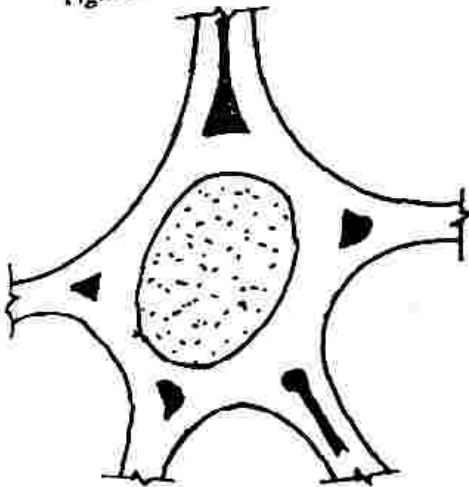


Fig.12.11(d). Elliptical Type.

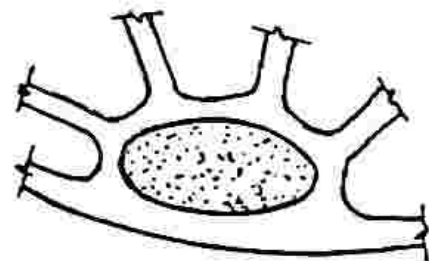


Fig.12.11(f). Tangent Type.

over-bridge. These types of provisions though costly are being provided in metropolitan cities like Bombay, such as at Victoria Terminus.

6. *Multiple Junction*: This type of junction is formed when more than two roads cross one another. See Fig. 12.12(a). They are highly undesirable and dangerous if not properly designed with provision of traffic signals.

Hence number of intersecting roads should be limited, and the junction should be laid out which will permit rotary traffic.

A large-sized island is constructed in the centre while suitable channelising is done by providing directional islands at the mouth of each road. By this method the flow of traffic can be separated to avoid congestion. Fig. 12.12(b) shows the multiple junction with six intersecting roads. All the safety devices are provided as described under right-angled junction.

7. Grade Separators: When two roads cross each other at different grades they can be separated by allowing one to pass over or under the other by means of a bridge or fly-over. This is called as Grade Separator where the two traffics cross at different levels leaving no chance for collision. When the two through roads are interconnected by link roads to help the traffic to pass through one intersecting road to the other, such grade separators are called *Interchanges*. The link roads function both ways so that all the turning traffic on the road turns left only and is entirely free from dangerous right turn. Such type of construction requires large area and therefore becomes very costly. However, these are the most efficient methods of traffic control where there is safety first and safety last.

Following are four common types of interchanges:

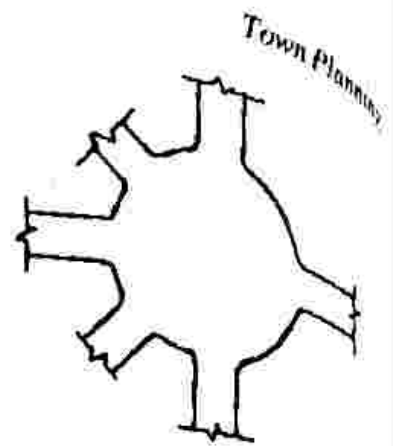
- (i) Diamond Interchange or Crossing.
- (ii) Y-type Interchange or Crossing.
- (iii) Trumpet type Interchange or Crossing.
- (iv) Clover leaf Interchange or Crossing.

(I) *Diamond Crossing*. This is the simplest form of interchange and is very much suitable for city locations.

Fig. 12.13 shows the diamond crossing where the arterial road used for fast moving traffic is taken over the bridge at the centre whereas the local road carrying the slow traffic goes underneath through the bridge. The arterial and local roads are interconnected by link roads. There are only left turns and no right turns, hence there are no chances of collision. It also helps a large volume of traffic to move smoothly without reducing their speeds.

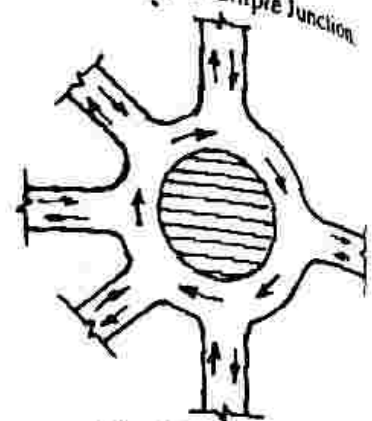
(II) *Y-type Crossing*. The shape of the interchange resembles the Y-letter and hence the name. See Fig. 12.14. It comes under three leg interchange.

(III) *Trumpet type Crossing*. This resembles a trumpet in plan and hence the name. See Fig. 12.15. The disadvantage is that the vehicles leaving the main road have to run through a small radius. This also comes under three leg interchange.



Before Channelization

Fig. 12.12(a). Multiple Junction.



After Channelization

Fig. 12.12.(b). Multiple Junction.

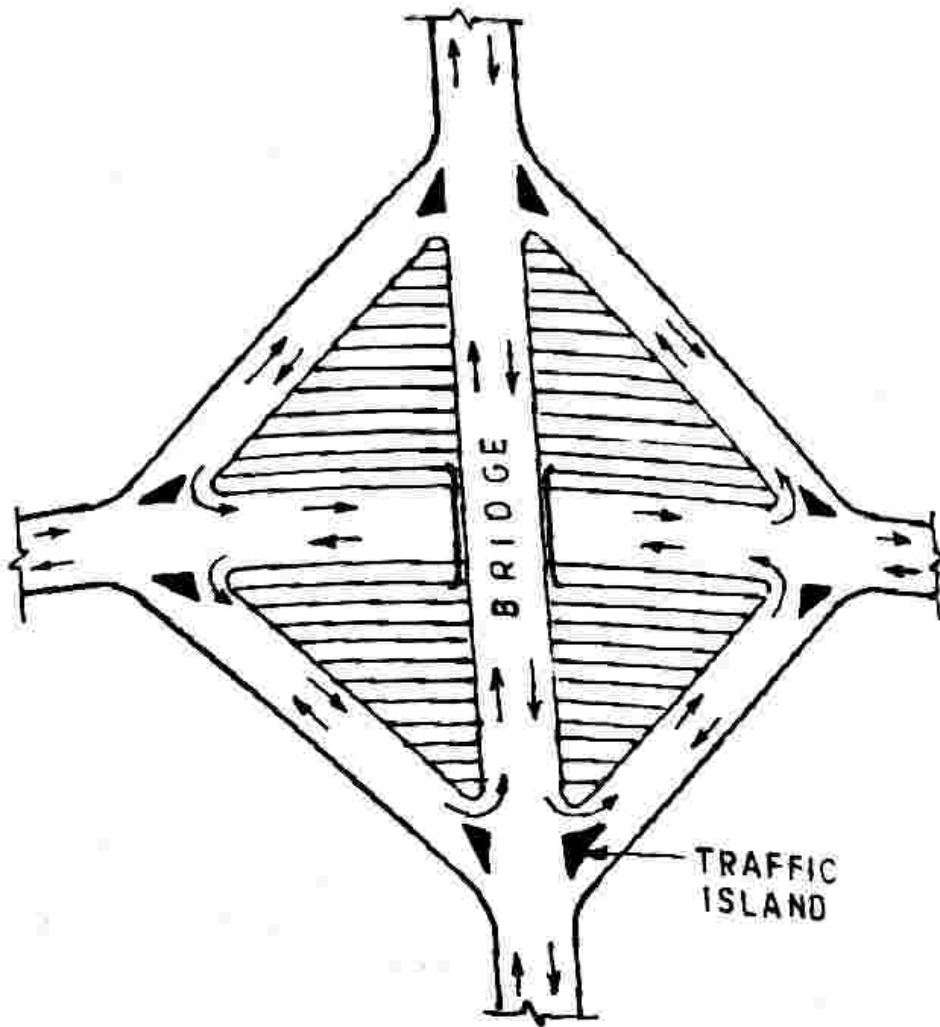


Fig. 12.13. Diamond Crossing

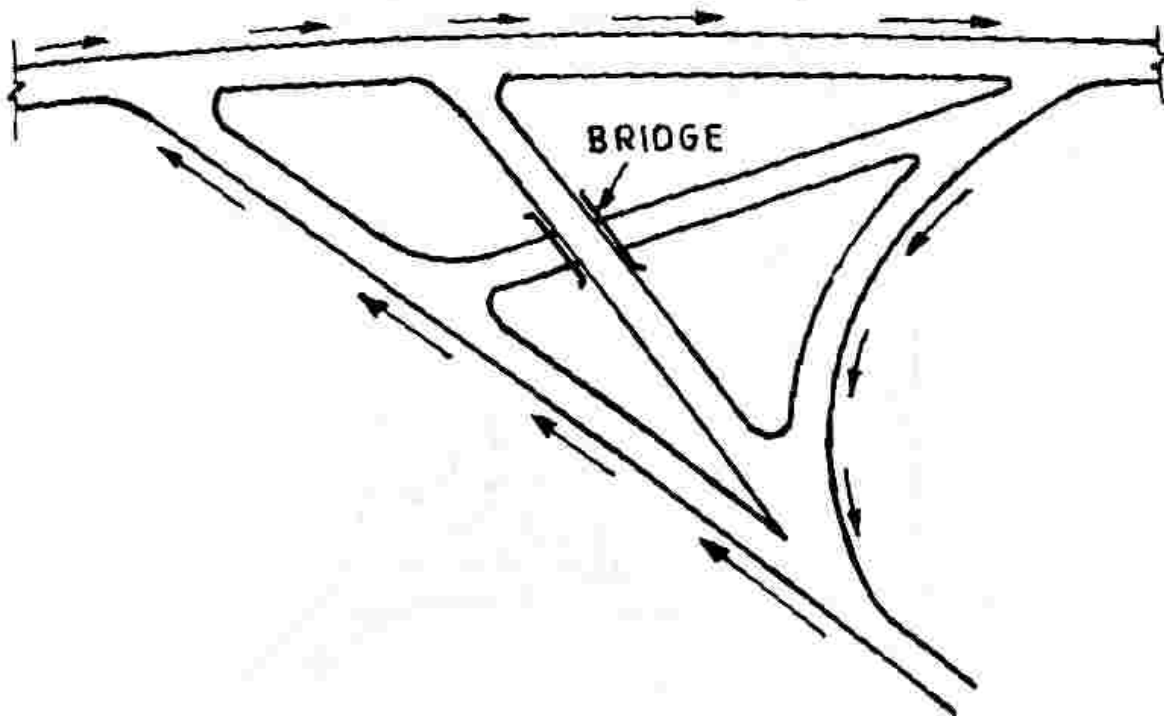


Fig.12.14. Y-Pattern.

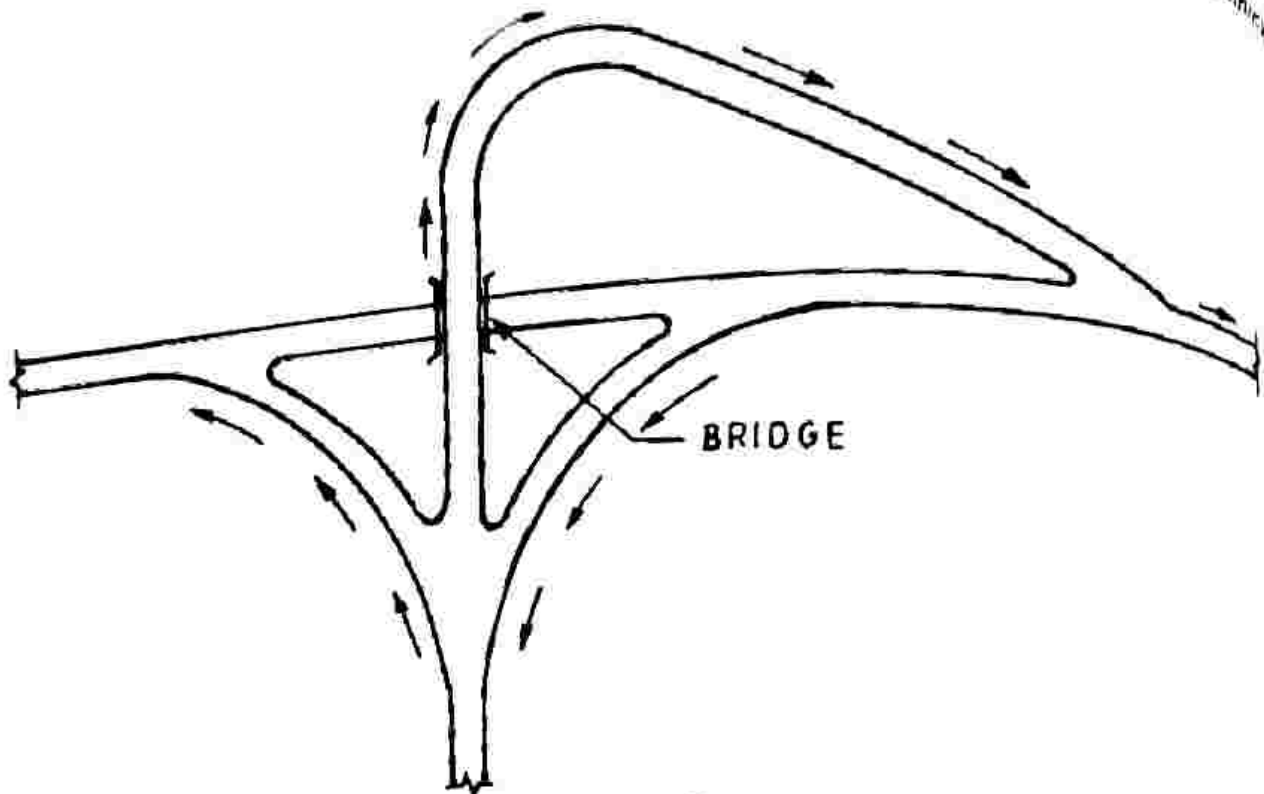


Fig.12.15. Trumpet Pattern.

(IV) *Clover-leaf crossing*: It is an improved type of diamond crossing. It was first used in America. The plan resembles the clover-leaf and hence the name. See Fig. 12.16. It comes under four leg interchange. It requires large area of land, and therefore is very costly. But it is most effective.

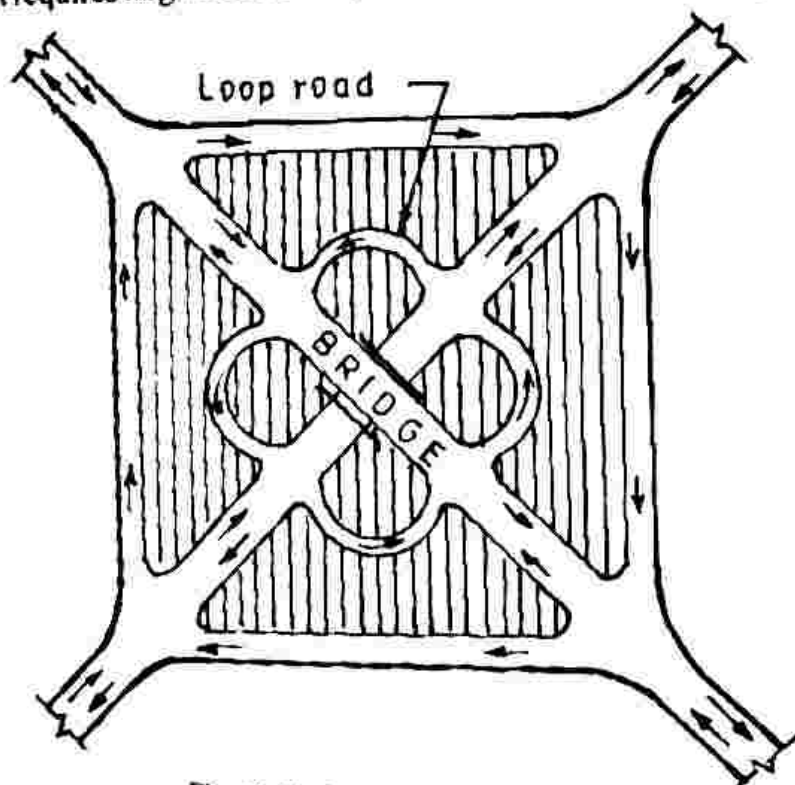


Fig. 12.16. Clover - Leaf Junction.

means of traffic control, as in this method, all the conflicting flows of traffic are avoided. The through traffic moves at its own speed. It is therefore superior to a roundabout since there is no weaving and slowing down of speed.

It is best suited for intersections carrying equal amount of traffic in all the four directions, with little turning to left or right. The two through traffic flows are separated by a fly-over or bridge. The through roads are interconnected by link roads with large radii and ring roads with small radii to provide simplest traffic manoeuvres.

12.16 Parking Facilities. It is not sufficient to provide the roads for smooth running of vehicles, but it is equally important to provide spaces for parking them.

Use of road for parking the vehicles is a common practice in the town which should not be allowed since it reduces the effective width of the road thereby causing overcrowding, congestion. It is the abuse of road, since its main function is transit of vehicles and not storage even for short time.

There are two methods of parking devices such as:

1. On-street Parking and
2. Off-street Parking

(1) *On-street Parking:* Under this we have,

(a) *Parallel Kerb Parking:* In this method the vehicles are parked along the road side kerbing, parallel to the centre line of the road.

(b) *Angle Parking:* In this case, vehicles are parked at 30°, 45° and 60° to the kerb. It is easy to park and to take off the cars but it occupies more space.

(c) *Right Angle Parking:* In this case, as the name indicates, the vehicles are parked at right angle to the kerb. It allows maximum number of vehicles to be parked.

(2) *Off-street Parking:* Here a separate space away from the kerb is provided for parking the vehicles, and is known as off-street parking. It does not produce congestion and delay as in kerb parking.

The off-street parking is provided in the following ways.

(a) *Parking areas:* It is done by providing a separate by-pass entrance and exit by the side of the road

(b) *Parking Lots:* Here parking of vehicles is done by the owners of big commercial establishments, cinema theatres for their customers in their own premises or in basement floors of the buildings.

(c) *Multi-storeyed Parking Garages:* It is adopted when the parking space is less and also very costly. It is possible to park a number of vehicles by providing multi-storeyed garages. Here the inter-floor travel facility is provided by means of elevators or ramps.

(d) *Parking Lanes:* Separate lanes are provided by the side of the main road for parking vehicles.

12.17 Traffic Control Devices. These are necessary for the following purposes:

- (i) to have a smooth movement of the traffic.

- (ii) to direct the traffic on the desired routes.
- (iii) to control the speed of the vehicles.
- (iv) to reduce traffic congestion and avoid the traffic accidents.

Following are the traffic control devices to guide the traffic:

- (a) Traffic Signs.
- (b) Traffic Signals.
- (c) Traffic Markings.

In addition, the street lights are provided to guide traffic during night.

(A) **Traffic Signs.** These include:

- (i) Regulatory or Mandatory Signs.
- (ii) Warning and Cautionary Signs.
- (iii) Informatory and Guide Signs.

(I) **Regulatory or Mandatory Signs:** These signs are provided to inform the road users about certain rules and regulation to maintain safe and smooth flow of traffic. Penalty is levied on those who violate these signs. The regulatory signs commonly used are 'Keep Left', 'Turn To Right', 'Speed Limit', 'Dead-Slow', 'Main Road Ahead' — 'No Parking' etc.

(II) **Warning and Cautionary Signs:** These signs are used to warn the road users of certain hazardous situation ahead requiring caution on their part to take desired action. The warning signs commonly used are 'Major Road Ahead', 'Cross-Road', 'Level Crossing', 'Narrow Bridge', 'Hair Pin Bend', 'Steephill', 'Pedestrian' Crossing' etc.

(III) **Informatory and Guide Signs:** These signs are used to guide road users and to give required information regarding the name of the street, direction, distances etc. The informatory signs commonly used are 'Parking Limit', 'Road Junction Approach', and route marker sign showing 'S.H.W.', meaning State High Way and 'N.H.W.' meaning National High Way.

(B) **Traffic Signals.** These are necessary to control the traffic at junctions. Usually three colours namely red, yellow, and green are used. Red indicates 'stop', yellow indicates 'impending changes' and green indicates 'movement'. There are various patterns and designs used in traffic signals. The most common type of traffic signal is the actuated or automatic time signal. The time interval in which the changes occur in signals are predetermined carefully considering the thorough study of traffic volume, and based on these the changes in lights are made automatic. It may be noted here that they do not suit to unusual conditions of long procession or large crowds, since it involves loss of time therein. Hence these could be used only where the constructive measures are not suitable and workable.

(C) **Traffic Markings.** These are the special signs used to control or regulate the traffic. These signs are made of lines, words, symbols, or reflectors on the roads, kerbs, or nearby roads. The different types of markings are classified as:

1. Pavement Markings.

2 Kerb Markings.

3 Object Markings.

4 Reflector Unit Markings.

(1) *Pavement markings*: The usual forms of pavement markings are:

- (i) Arrow markings.
- (ii) Centre line markings.
- (iii) Turn markings.
- (iv) Stop lines.
- (v) Cross-walk lines.
- (vi) No passing zone markings.
- (vii) Pedestrian Crossing markings.
- (viii) Parking space limits markings.

(2) *Kerb Markings*: These indicate the parking regulations and painted with alternate black and white lines for clear visibility from long distance.

(3) *Object Markings*: The physical obstructions which may prove hazardous to traffic are marked here. These are level crossings, narrow bridges, etc.

(4) *Reflector Unit Markings*: These help for the safe driving at night. These markers reflect yellow light giving warning to the drivers from a long distance.

12.18 Street-Lighting

(1) *Necessity of street lighting*: The street lighting is primarily intended to help the road users—pedestrians, cyclists, motorists—to see clearly the carriageway and its surroundings in darkness. A large number of road accidents and fatalities occur during nights than day driving because of the unsatisfactory lighting.

Though driving is done with the help of head-lights, it is not always possible to do so. For instance, if all the vehicles drive with full head-lights on, there will be too much glare which may cause accidents. Hence there is necessity of street lighting to illuminate the carriageway so as to minimise the use of head-lights. The street lighting improves visibility at night and helps to avoid accidents. It ensures comfort, confidence in driving, and in general improves the traffic flow conditions.

It also helps to prevent the illegal acts and theft and crime on streets.

The lighting is also more important at junctions, bridge sites, level crossings etc.

The accidents generally occur at night due to poor night visibility.

The night visibility depends upon the following factors:

- (i) Amount and distribution of the light flux from the lamp.
- (ii) Size, brightness, and colour of the object.
- (iii) Brightness of the back ground.

- (iv) Light reflecting characteristics of the road-surface.
- (v) Driver's eye-glare.
- (vi) Time available to see an object.

(II) *Design Factors of Street Lighting*: The following factors should be considered in the design of street lighting

- (i) Choice of lamps.
- (ii) Light distribution on the carriageway.
- (iii) Spacing of lighting units.
- (iv) Overhang and mounting height.
- (v) Lateral placement.
- (vi) Arrangement of lamps.

(i) *Choice of Lamps*: The usual types of street lamps are:

- (a) Tungsten filament lamps.
- (b) Tubular fluorescent lamps.
- (c) Sodium vapour lamps.
- (d) High pressure mercury vapour lamps.

The choice of lamp, its colour, size depends on the spacing and distribution of light flux on the surface of the pavement.

Tungsten filaments (bulb type) are most familiar. They have low light producing efficiency and short life. They give out almost a white light. They are suitable for residential streets and footpaths.

Tubular fluorescent lamps have long life, provide good visibility. They give out white light which is least dazzling to drivers. These are popularly used for shopping streets as they have good colour rendering properties.

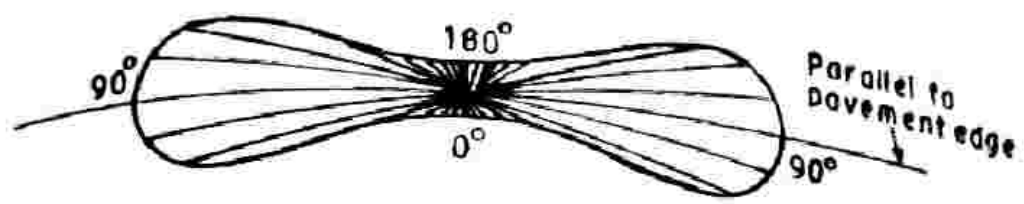
The low pressure sodium vapour lamps give a characteristic monochromatic yellow light in which no colour can be easily distinguished. As such it is unsuitable for shopping areas. However, high pressure sodium vapour lamps give out white light and illuminate all colours. They emit pleasing light and thus are popularly used for street lighting.

High pressure mercury vapour lamps have very good colour rendering properties and emit a characteristic bluish white colour which is pleasing to the eye. As such they are ideal for street lighting.

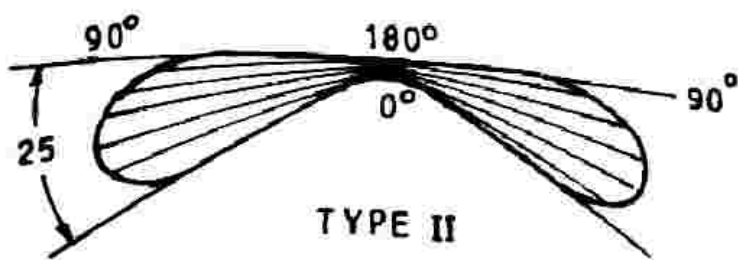
(II) *Light distribution on carriage-way*: The light distribution should be such as to produce maximum uniformity of pavement brightness. There are five types of luminaire distribution commonly adopted to meet the requirements of street lighting. See Fig. 12.17.

Type I known as two-way lateral distribution is suitable for narrow roads.

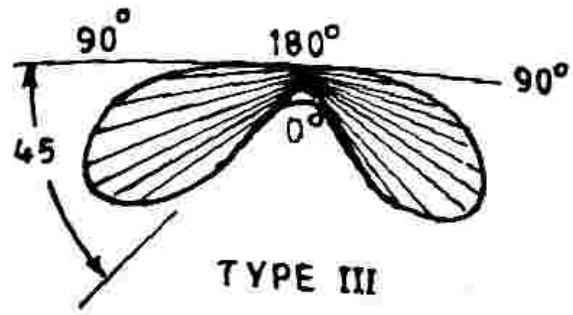
Type II known as narrow asymmetrical distribution is suitable for narrow roads.



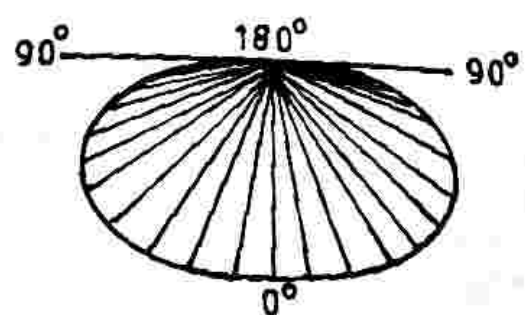
TYPE I



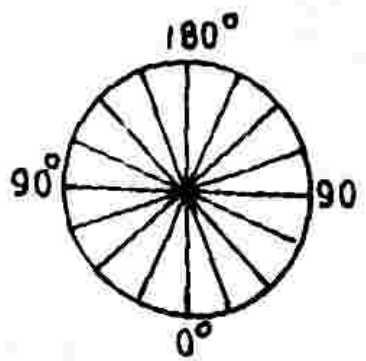
TYPE II



TYPE III



TYPE IV



TYPE V

Fig. 12.17. Types of Luminaire Distribution.

Type III known as medium width asymmetrical lateral distribution is suitable for roads with medium width.

Type IV known as wide asymmetrical lateral distribution is suitable for very wide highways.

Type V known as normal symmetrical distribution is suitable for mounting at centre of highway and at intersections.

The bright area on the carriageway depends upon the reflection properties of the street-surface, the distribution of light from lamps, the power of lamps, the height of light from the observer and the height of the observer.

The Indian Standard Institution recommends an average level of illumination of 30 lux on important urban roads carrying fast traffic and 15 lux on other main roads carrying mixed traffic, the ratio of minimum to average illumination is 0.40.

(III) *Spacing of Lighting Units*: The spacing between lamp to lamp on straight roads is generally three to five times the mounting height. The spacing of lamps on sharp curves should be closer than ordinarily used on straight roads.

The spacing of lights largely depends upon the average lux required to illuminate the pavement, the power of the lamp, pavement width, mounting height, maintenance factor etc.

(IV) *Overhang and Mounting Height*: The over-hang and mounting height governs distribution of light, shadow and glare effect from the street lamps. The Indian Road Congress (I.R.C.) recommends a minimum height of 6 m. above the pavement surface for electric power lines upto 650 volts. The effect of the overhang and mounting height on the length of the shadow is shown in Fig. 12.18. It will be observed that to minimise the length of shadow it is necessary to have higher mounting heights and necessary overhang projections.

(V) *Lateral Placement*: The street light posts should not be placed close to the pavement edge. If they are very close to carriageway, they obstruct the smooth flow of traffic.

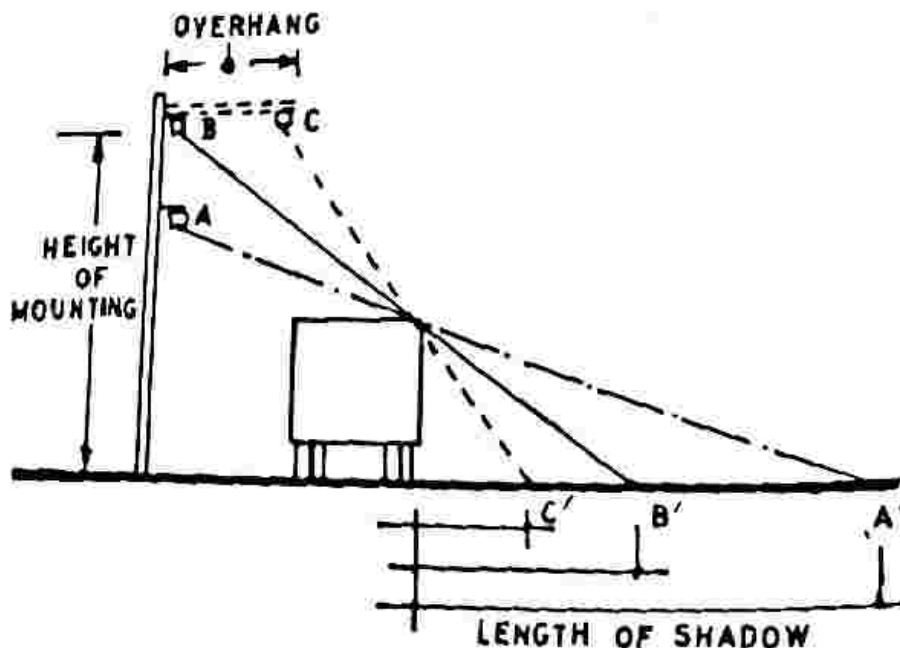


Fig 12.18. Effect of Mounting Height.

As per the Indian Road Congress, the street light posts should have the following horizontal clearance from the pavement edge.

- (i) For roads with raised kerbs (as in urban roads)
- (ii) For roads without raised kerbs (as in rural roads)

Minimum 0.3 metre and desirable 0.6 metre from the edge of raised kerb.

Minimum 1.5 metres from the edge of the carriageway, subject to a minimum of 0.5 metre from the centre of the line of the carriageway.

(VI) Arrangement of Lamps : The lamps may be arranged in the following way on straight roads

- (a) Single side system.
- (b) Staggered (both side) system.
- (c) Central system.

In single side system of lighting as shown in Fig.12.19(a), the lamps are installed on one side. It is most economical and suitable for narrow pavements with very light traffic.

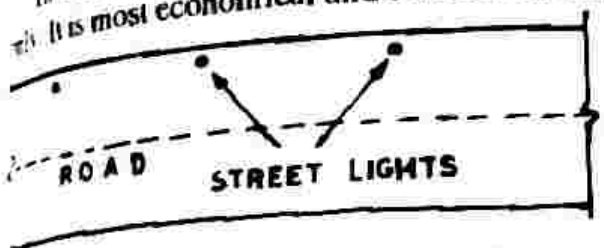


Fig.12.19 (a). Street Lights—One side.

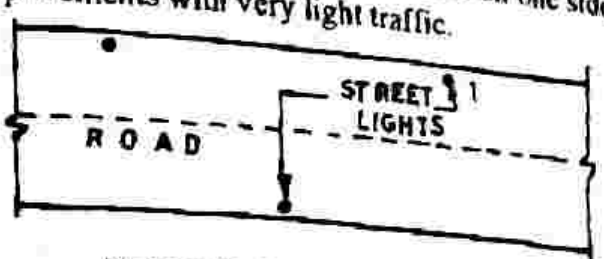


Fig.12.19(b). Street Lights—Staggered.

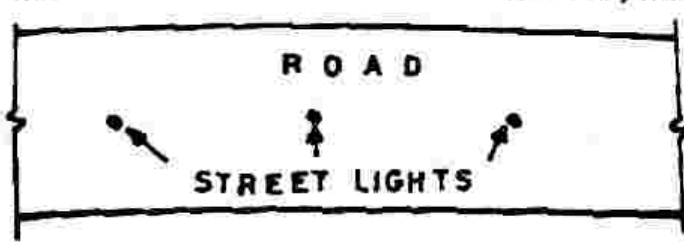


Fig.12.19(c). Street Lights—Central.

In staggered system of lighting as shown in Fig. 12.19 (b), the lamps are installed on both the sides but staggered, and are suitable for wider roads with light traffic.

In central system of lighting as shown in Fig. 12.19 (c), the lamps are installed in the centre and are suitable for three to four lanes pavements with narrow control strip and heavy traffic.

Proper care should be taken while locating lights on curves. Curves require closer spacing than the adjacent straight sections. The lights are located on the outer side of the curve for better visibility. See Fig. 12.20 (a). In case of reverse curves, it is necessary to change the location from side to side, as shown in Fig. 12.20 (b).

The lighting is more important at intersections. There are more conflicting points of pedestrian and vehicular traffic and hence more illumination is necessary at intersections. A detailed study of traffic volume, traffic flow is necessary to decide the layout of light. The lighting units should be

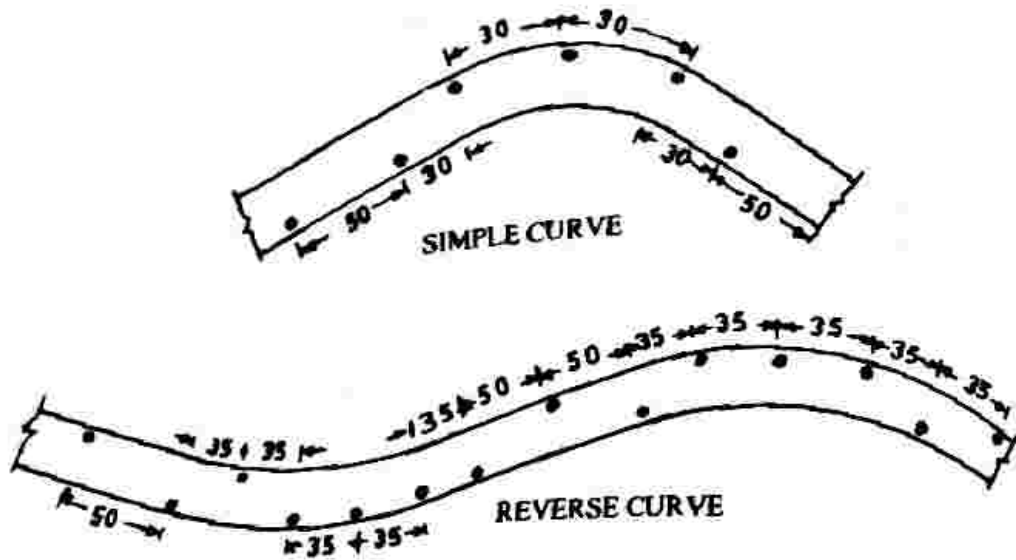


Fig.12.20(a) & (b). Lighting Layout on Horizontal Curves.

located near the channelising island, pedestrian crossing and signs. The lighting layouts for T-intersections and cross-roads are shown in Figs. 12.21(a) and (b).

Special care should be taken while locating the lighting on bridge sites, levee-crossings and tunnels.

A wide variety of ornamental lights are also available. They can be used to promote the aesthetic appearance of the surroundings. It is therefore the duty of the traffic engineer as well as the illumination engineer to provide a satisfactory arrangement of lighting so as to make the night travel not only safe but also comfortable and pleasant.

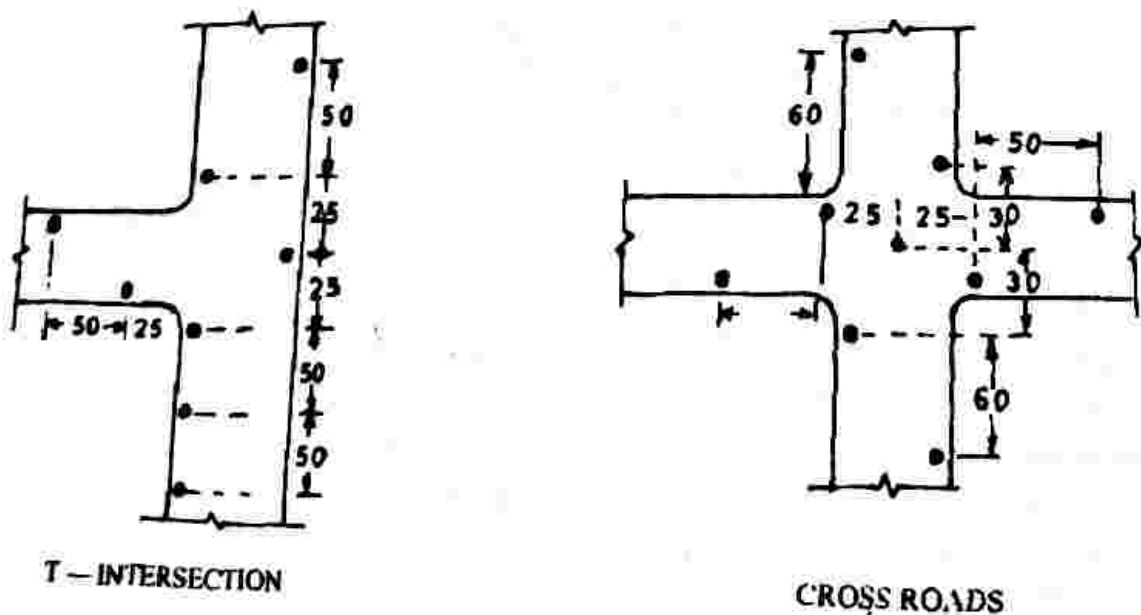


Fig.12.21 (a) & (b). Lighting Layout for Intersections.

URBAN RENEWAL AND REPLANNING THE EXISTING TOWNS

13.1 Necessity of Re-planning. Many of the existing houses have been constructed more than a hundred years ago and due to this aging process many residential and commercial buildings have deteriorated badly. These towns when built were once cheerful places with plenty of open spaces and all amenities. But very soon the picture has changed.

Excessive centralisation and activities related to industry and trade have caused tremendous growth of urban population. As a result there is acute shortage of housing, squatting on public lands, encroachment, uncontrolled settlements, increased density in built-up areas, shortage of public utilities and community facilities.

The factories have been set up in the heart of the cities. One time pleasant cheerful residential areas have been engulfed by the industrial areas. There is now noise, smoke, dust in the towns, which are more or less converting in slums.

The transportation facilities are also found to be inadequate due to limited road network. Every street has become a highway due to increased automobiles. The present communication system seems to have totally collapsed.

There is inadequacy of open spaces, parks, gardens, playgrounds, playfields and other recreational facilities.

All these and many more evils have created the blight in the cities, which have begun to suffer from neglect and decay. To prevent these it is utmost necessary to take immediate action to re-plan the existing towns and cities which have been deteriorated by the passage of time. It is also to be noted here that planning a new town on virgin land is very easy but it is too difficult to re-plan the existing town.

"Designing part of a city is more complex than putting the man on the moon," says Lawrence Halprin, an eminent architect and town planner, "On a moon shot, the goal is set. But there is little agreement as to what is the best type of city."

Each town or city has its own problems which must be properly studied before suggesting the re-planning scheme.

13.2 Object of Re-planning. The objects of replanning the existing towns are as follows:

- (1) To provide suitable means to control the future growth of the town in a co-ordinated manner.

- (2) To provide healthy environment for the economic and social welfare of the community.
- (3) To add the necessary civic aesthetics of the town.
- (4) To provide a proper arrangement of land use.
- (5) To correct the mistakes of the past and take proper precaution in the future.
- (6) To suggest a long range programme of corrective measures for the orderly growth of town in future.

13.3 Data to be Collected. For this purpose, the main data to be collected is based on civil survey and the physical conditions of the buildings are classified in three categories such as,

- (1) Sound condition.
- (2) Deteriorating condition.
- (3) Dilapidated condition.

(1) *Sound condition:* Here the buildings coming under sound condition have no defects but only need minor repairs such as new plaster work, replacing plumbing fittings, painting of wood works etc.

(2) *Deteriorating condition:* Here the buildings coming under this condition may have many defects such as cracks in the walls, cracked terrace which leaks, broken window frames, broken steps of stair-case etc.

(3) *Dilapidated condition:* Here the buildings coming under this condition have number of serious defects such as defects in walls, columns, beams etc. so that such buildings are dangerous for living. The cost for repair may amount to partial rebuilding.

The other data to be collected is the density of population, land-use, communication system, nature and type and condition of industries, parks, play-grounds, open spaces, and public utility services etc.

13.4 Urban Renewal. The blighted areas of the towns are due to civic neglect. The blight is generally formed due to those conditions brought about over a long period of obsolescence, decay, neglect and characterised by sub-standard housing, incongruous land use, lack of open spaces, parks, playfields, encroachment of industries on residential areas, congestion, inadequate communication facilities, lack of public utility services and the like.

The only solution to improve the condition of towns is to eliminate the existing and prevent the future blight in urban areas. An action to be taken to remove the blight is called urban renewal. It requires three major actions in the form of conservation, rehabilitation and redevelopment. Conservation is 'preventive medicine', Rehabilitation is 'medical treatment' and Re-development is 'surgery' on decaying parts of the town.

Conservation helps to prevent the spread of blight into decent city areas on neighbourhood basis by providing public and private facilities.

It includes the provision of parks, playfields, schools, street improvements, removal of junk yard or industrial area from residential area.

Rehabilitation is defined as the improvement of blighted neighbourhood through enforcement to reinstate owner's properties or to purchase of properties which have deteriorated beyond repair under slum clearance scheme for future provision of parks, playgrounds, shopping centres, road improvement etc.

Re-development helps to remove the buildings from blighted area which have completed their useful life and are thus beyond conservation or rehabilitation. It is therefore necessary to demolish the entire area and replan the area for completely new development. The land acquired under this category is used for rebuilding according to the detailed redevelopment plan prepared for that area. As usual, facilities like park, playfields, schools, shopping centres are also provided.

Following are the various steps to be taken for the urban renewal programme:

(1) A comprehensive plan is prepared for the over-all development of the town considering the present and future trends.

(2) A detailed civic survey of the town is conducted.

(3) Co-operation of various agencies such as individual property owners, tenants, local authority and the Government.

(4) Re-settlement of the families and business affected under urban renewal programme in other parts of the town.

(5) Rigid enforcement of various development rules and building bye-laws by the authority concerned.

(6) Provision of adequate finance to work out the programme successfully.

13.5 Advantages of Urban Renewal. Though the urban renewal is costly, it pays for itself in large measure on long-term basis for better conditions of living, improves health conditions of the citizens, reduces crime, juvenile delinquency, and increases municipal tax, revenue etc.

MASTER PLAN

14.1 Definition. For a successful town planning there must be a plan which envisages the entire town as a single unit. This is necessary to achieve overall development of the town in a co-ordinated manner. The development or expansion of a town takes a long time, and therefore, the development is required to be controlled at any time on the basis of a plan. Such a plan is called as 'Master Plan'. A master plan or a development plan is thus a blue print of the various proposals that are intended to improve the existing conditions and to control the future growth of the town in a co-ordinated manner. Such a plan must be realistic, ideal to be aimed at, preserving the individuality of the town. Since the development of the town is a lengthy process, the plan must not be rigid but elastic at the same time so as to amend it from time to time to satisfy the changing needs in the new developments. The master plan is generally prepared to improve the old conditions of the town but it is also equally necessary for the new cities to be planned and built on virgin land. Eg. New Delhi, Gandhinagar, Chandigarh, etc.

14.2 Objects of the Master Plan. Following are the main objects of the master plan:

- (1) It serves an overall picture and programme for the future development of the town.
- (2) Its purpose is to place various functions the town has to perform in such physical relation to each other as to minimise the chances of mutual conflict. It helps to bring harmony and understanding between the different groups of the people.
- (3) It stimulates wider interest in community problems and brings a well co-ordinated development.
- (4) It provides for intelligent and economic spending of the public funds as per the fixed programme for general welfare of the community.

14.3 Necessity of Master Plan. The period of 'Industrial Revolution' (1760-1820) marks an important epoch in the history of the growth of all the cities. Between the two World Wars and especially after the Second World War (1939-45), many towns and cities have been grown up haphazardly without proper planning. And the over-grown cities became a mess and a muddle with all the evils.

The industries have been set up in the heart of the cities without any consideration of transport and other utility services. The migration of rural population has caused housing shortage and increased congestion. The rapid development of transport has been found to be inadequate for the growing needs of the automobiles. It has caused over-crowding and congestion on the roads resulting

in road accidents. Industries have encroached upon the residential areas causing shortage of open and recreational areas.

In order to eradicate the evils of the ill-planned cities, there is a need of a comprehensive Master Plan for the general welfare of the citizens in respect of health, convenience and comfort.

14.4 Data to be Collected. The data and information is to be collected from various surveys such as land survey, topographical survey and especially the civic-survey as described in Art. 5.3(D). In general the data required for the preparation of master plan is as follows:

- (1) Meteorological data regarding direction, intensity of wind, temperature and rainfall.
- (2) Geological data regarding soil condition.
- (3) Mineral resources.
- (4) Places of historical, cultural and scientific importance.
- (5) Population—present and its future growth.
- (6) Economic conditions.
- (7) Trade and communication.
- (8) Water supply and drainage arrangement.
- (9) Expansion, development of environments.
- (10) Political position of the place with regard to its neighbouring area.

14.5 Maps to be Prepared. A master plan is only a key plan generally prepared on a small scale showing the broad zones and their relationship with one another. As such a number of plans are to be prepared to its supports giving every aspect of planning on a large scale. Various maps are required for the preparation of the master plan showing the details for:

- (1) Present and proposed communication.
- (2) Present and proposed open areas.
- (3) Residential areas.
- (4) Important public buildings, civic and other centres.
- (5) Public amenities.
- (6) Public utility services.
- (7) Boundary of the green belt surrounding the town.
- (8) Contour map of the whole town.
- (9) Positions of springs, rivers etc.
- (10) Open spaces, parks and playgrounds.
- (11) Types of land such as residential, agricultural and industrial etc.
- (12) Landscape features.

14.6 Stages in the Preparation of Master Plan. The replanning of an existing town is more complex than planning or designing a new town on virgin land, such as Capital towns like New Delhi, Chandigarh, Industrial town like Rourkela, Port-town, Military cantonments etc. The work of ordinary town-planner is usually restricted to replanning of an existing town and so let us see how he proceeds in preparing a Master Plan for an existing town and what features or items should receive priorities in evolving such a plan.

After taking the Government sanction to prepare the scheme, next work is to collect the data and relevant information, with the help of a comprehensive civic survey. Ref Art 5.3(D). From the data collected in the civic survey, he is in a position to make a correct diagnosis of the various ills of the town and suggest remedies for their cure.

For the collection of data for the planning scheme, the town is divided into old town and new town. In the former case, the work is tedious because the old town usually consists of narrow streets, congestion, insanitation, and un-healthy conditions etc. But in the later case, the town-planner's work is more easy which offers him almost virgin land for the application of modern methods of development and control through the provision of new network of roads, zoned areas, provision of all civic amenities etc. However care should be taken to keep the whole town, old or new alike in all aspect and finally blended skilfully so as to form inseparately interwoven structure.

Features of Master Plan: The most important features which receive the top priorities in the preparation of Master Plan are given below.

1. **Population:** The prospective population to be provided for the next thirty to fifty years should be calculated on the basis of the present population, and its rate of growth during the last three to four decades.

2. **Density:** The next task is to fix the density of population as per the required standards. The standards vary for the town centre, suburb, type of buildings, flat, etc. An average over-all density of eighty to hundred persons per acre can be allowed.

3. **Requirement of Land:** The next step is to work out the total land requirement for the anticipated population. If the population is in surplus then it has to decant and provide for it in new layouts. The planner has to calculate how many acres of land are required for the 'over-spill' population to rehabilitate them and how many acres will be required for the future growth of the town.

4. **Distribution of Land:** The total land will have to be distributed for the different uses such as

- (i) Residential
- (ii) Commercial
- (iii) Industrial
- (iv) Public and Semi-public
- (v) Open-spaces
- (vi) Communication
- (vii) Other special uses

(i) *Residential use* : The total population will have to be distributed in various zones, based on Neighbourhood planning, fixing the density which may vary from a minimum of 40-50 persons to a maximum of 100-200 persons per acre or even more. Usually the density varies from town centre, suburbs to the outer fringe areas of the town. The distribution of population from the congested areas will have also to be considered for the calculation of total residential land required.

(ii) *Commercial use* : The shopping facilities for the neighbourhoods will have to be provided. These include small shops for day-to-day purchases; shopping sub-centres for casual purchases, and shopping main-centres for special purchases. Provision will have also to be made for the wholesale trading, godowns, warehouses, cattle markets etc. at convenient places with good accesses.

(iii) *Industrial use* : The location of industry in the development plan is very important. It depends upon nearness to roads, railways, availabilities of electric power, water supply etc. The industries should be planned leeward of the town so that the smoke, dust, dangerous gases will not travel over the town. Except the service industries such as bakeries, dairies, laundries, flour mills, auto-works, the industries should be located at the outskirts of the town. A green belt should be left between the industries and other uses.

(iv) *Public and Semi Public uses* : These include schools, colleges, Govt. Offices, etc. which should be located in the convenient places to serve all the people in the unit.

(v) *Open Spaces* : These include parks, playgrounds, stadiums etc. The standards for open spaces are given separately. See Art. 9.6. According to this standard, the open space for outdoor recreational purpose should not be less than 10 hectares or 25 acres for 10,000 population.

(vi) *Communication* : The area occupied by roads, bus-stands, railways etc. come under this category. The main arterial roads should be aligned on the boundaries of the units. Each unit will be divided by sub-roads giving access to its principal parts and it will again be sub-divided into smaller groups by the local roads. The width of the roads will be proportional to the volume of the traffic. The layout of the roads, crossings, junctions should be carefully done.

(vii) *Other Special uses* : These include the refuse disposal, grave-yards, etc.

The general land use pattern for a town is given below :

	<i>Land Use Pattern</i>	<i>Percentage</i>
(a)	Residential Use	50-55
(b)	Commercial Use	2-5
(c)	Industrial Use	10-12
(d)	Public & Semi Public Uses	8-10
(e)	Open Spaces - Parks - Play grounds	10-15
(f)	Communication - Roads - Railways	15-18
(g)	Other Special Uses	About 5

The percentages given above are average figures for guidance and may vary depending upon the town. The other facilities to be provided for different population and reasonable walking distances in the unit are as under:

S. No.	Population	Provision to be made	Area required in Acres	Reasonable walking distance in metres
1	Up to 1000	(i) Tot lots	0.05	200
		(ii) Nursey school	0.5	400
2	3500 to 5000	(i) Primary school	2 to 3	400 - 600
		(ii) Play grounds	2	400 - 500
3	12000 to 15000	(i) High school	5.0	500 - 600
		(ii) Community hall	2.0	
		(iii) Shopping centre	3.0	up to 1600
		(iv) Parks	10.0	
4	40000 to 50000	(i) Library	1.0	800 - 1600
		(ii) Shopping centre	10.0	
		(iii) Health centre	5.0	
		(iv) Post & Telegraph	3.0	
		(v) Petrol pump	0.5	
		(vi) Police station	2.0	
		(vii) Fire station	2.0	
		(viii) Religious buildings	2.0	
		(ix) Cinema	2.0	

When a Master Plan for the entire town is prepared it will be observed that certain parts of the city suffer from various problems. The living conditions may not be satisfactory. There may be haphazard development and may be found to be congested and lack of open spaces, parks, playgrounds etc. The roads may be narrow. As such the improvement schemes will have to be proposed.

In the proposals, works such as road widening or re-aligning, creations of open spaces, parks, playgrounds, community facilities are taken up. The land use plan, road system and proposals for civic amenities are prepared. The improvement proposals are usually shown super-imposed on the existing land use map so as to clearly indicate which of the buildings are affected and proposed to be pulled down. Only buildings in bad or dilapidated conditions should be pulled down to make place for open spaces, public buildings, road widening etc. Alternate arrangement for accommodation for the dis-housed persons should be made in the nearby transit camps with least inconvenience.

It may be observed that the full requirements of civic amenities on the ideal basis, as mentioned in the above Table may not be fulfilled in these areas. However, at least the bare minimum requirements of the basic amenities must be provided. And the proposed scheme shall be made as practical as possible, with full support and whole hearted cooperation from the public.

The success of the Master Plan will be assessed by the functional qualities viz. Are the areas sufficient to the population? Are the housing layouts produce maximum utility, convenience and safety? Are the shopping facilities adequate? Are the schools properly distributed? Are the roads provide safety and convey traffic speedily and cheaply? Is the journey of the people from place of residence to the place of work convenient, safe and economic?

The old school of Town Planning solely concerned themselves in creating visual effects either in architectural details or town design and human needs were almost neglected with disastrous results. Hence for the success of the planning scheme the townplanner requires a functional approach to the more important sociological aspects of the town, viz. 'Folk, Place and Work'. The interim master Plan also called the Outline Development Plan is thus prepared by the Planning Authority. The statutory time limit is two years. It shall then be notified for the public comments and suggestions (Time one month) The Draft plan may be revised in the light of the public and expert comments and shall be submitted for Govt.'s sanction. (Four months from date of publication of the draft plan to be further extended by the Govt. by three months, if required). The Govt. sanctions the revised plan and appoints an arbitrator. (Twelve months) The Arbitrator after holding proceedings in respect of each plot, publishes the award and submits the detailed proposals to the higher authority such as the President of the Tribunal of Arbitration (No fixed time limit but at least twelve months for small scheme and more for longer schemes). The Tribunal shall make thorough scrutiny of Arbitrator's proposals and convey their decision (usually six months). The Arbitrator prepares the final scheme and submits to Govt. with plans through the local authority (usually six months). The local authority forwards the final scheme to the Govt. (usually three months) Govt. sanctions the final scheme after the photozinc Dept., has printed all the plans (normally nine months) after which the final scheme of Action plan comes into force (usually two months after the Govt.'s sanction). The detailed Master Plan also called the comprehensive Development Plan is duly approved and sanctioned by the Govt. then made legally bindings on all the authorities concerned, by giving it a legal status.

Lastly a financial programme is prepared to devise the ways and means for the implementation of the Master Plan according to the Schedule.

14.7 Implementation of Master Plan. The execution of master plan is carried out either by municipality or corporation. For execution a team of experts in Engineering, Architecture, Public health, Sociology, Economics, Finance etc. headed by a Town Planner is required.

After the master plan is accepted and approved by the concerned authority, the steps to be taken will be

- (1) to fix the broad policies in connection with various proposals.
- (2) to prepare the list of the urgent works according to their priorities.
- (3) to prepare the detailed estimates of work of top priority.
- (4) to prepare a financial programme. See Art. 15.12 (6) (b).

It takes many years to complete the works contemplated in the master plan. The cost is also very high amounting to several lakhs of rupees. So the expenditure will have to be distributed over several years. Moreover, several modifications will have to be made as such no final estimate is made in the initial stage.

The most important part of master plan is the reservation of land for road system, open spaces, and public amenities, which cannot be provided for at a later date. Once it is finalised, no building should be allowed to construct which will upset the street system.

The works proposed in the plan are for the prosperity of the people, hence any new proposals benefiting the public are considered periodically, usually at every period of five years.

14.8 Legal Status of Master Plan. The implementation of master plan would be possible if it is made legally binding on all the concerned authorities. Hence it should be made obligatory and give the plan the legal status to facilitate its implementation.

14.9 Co-operation. Master plan is an ideal never to be reached, but one to be aimed at. It takes one into dreamland and if the dream is to be a reality, the planner has to get full support and whole-hearted co-operation from the public. 'What makes our dreams so daring' Le Corbusier once said, 'is that they can be realised'.

PLANNING LAW AND LEGISLATION

15.1 Necessity of Planning Law and Legislation. During the last few decades there is phenomenal growth in the population in the cities and towns. There is also migration of rural population, as a result we see today overcrowding, congestion, deterioration and haphazard development in most of our cities and towns. The work involved in planning due to this enormous growth, improvements and extensions of towns, is so complex that some of the municipalities, found it difficult or are unable to carry on these works effectively.

The foremost problems these urban areas are facing are the shortage of housing, resulting in squatting on public lands, encroachment, un-controlled settlement, increased densities in built-up areas, limited road network, shortage of public utilities and community facilities etc.

As we see today the city authorities and planners are surrounded by a multitude of problems. So to tackle these problems there is necessity of planning laws and special legislation.

From among the existing legislations which are used for clearance, development and control of urban land, the more important are:

- (1) Town and Country Planning Act
- (2) Municipal Act
- (3) Development Authority Act
- (4) Improvement Trust Act
- (5) Slum Clearance Act
- (6) Land Acquisition Act
- (7) Urban land Ceiling Act
- (8) Rent Control Act
- (9) Periphery Control Act
- (10) Water and Air Pollution Act
- (11) Regulations such as
 - (i) Sub-division Regulation
 - (ii) Zoning Regulation
 - (iii) Building Bye-laws or Regulation

Under the constitution, the State Governments are the competent authorities for enacting legislation relating to Town and Country Planning Act. Hence Central Government has not enacted any legislation on these subjects so far except the Model Town Planning Act. But the Land Acquisition Act, Urban Land Ceiling Act etc. have been enacted by the Central Government.

The above legal tools are the foremost requirements in the hands of the planner and their proper use is to promote health, safety, morale and general welfare of the community.

15.2 Evolution of Planning Legislation in India. Before independence, certain planning legislations were introduced in different parts of India.

Sanitary Commission (1864) : An agency under the name of 'Sanitary Commission' charged with the responsibility of town improvement was formed in India in 1864. In the same year Sanitary Commissions were set up in Bombay, Madras and Bengal at the instance of Royal Sanitary Commission, which had been appointed by Britain in 1859, to "give advice and assistance in matters relative to public health and sanitation, to advise on the sanitary improvement of native towns and prevention and migration of epidemic diseases".

The Bombay Improvement Trust (1898): The year 1898 made another epoch in the history of town improvement (or planning as the term came in vogue later) when the first Improvement Trust was constituted in the city of Bombay, just two years before the outbreak of bubonic plague. It compelled the Government under the Improvement Trust to adopt proper measures for the removal of insanitary dwellings, overcrowding and to carry out the necessary sanitary improvements so as to secure better living conditions for the people.

Then Mysore Improvement Trust was set up in 1903 and was followed by Calcutta Improvement Trust in 1911.

The Bombay Town Planning Act (1915): The first town planning legislation was enacted in India in 1915 under the title 'Bombay Town Planning Act 1915'. It confers on the local authorities the most valuable powers, the chief of which are

- (1) to control the future growth of the town,
- (2) to prevent formation of slums to provide healthy dwellings,
- (3) to take active measures to make life more comfortable for the poor and middle class people.

In the same year well known sociologist, town planner Sir Patric Geddes (1854-1932) came to India at the invitation of Lord Pentland, the then Governor of Madras to advise the Madras Government on planning and redevelopment of old towns. He gave his expert opinion for the improvement of about eighteen cities in India. He was the first town planner to introduce the sociological concept in the town planning.

Soon after the Bombay Town Planning Act, it was followed by U.P. (1919), Madras (1920), Punjab (1922), Nagpur (1936), Bangalore (1945) and Kanpur (1945).

Bombay and Madras Acts gave powers to Municipality but others gave to Improvement Trust Acts.

When the Second World War (1939-45) took place whatever was being done in this sphere was discontinued, as a result the towns developed haphazardly without any order and control.

With the attainment of Independence in 1947, the country took the task of socio-economic development. Except the States which had enacted special Town Planning Acts, the other States had to depend on legal provisions in Corporation Acts, Municipal Acts, City Improvement Acts, for the development in Urban areas and Village Panchayat Acts for rural areas. After independence, many of the States enacted special legislations for planning and developing their areas. Such as M.P. (1948), Bihar (1951), Orissa (1956), Delhi (1957), Karnataka (1957) (amended in 1964), Maharashtra (1966), Tamilnadu (1971), W. Bengal (1979) etc. But there is no uniformity in them, since different states have different provisions.

India became Republic on 26th January 1950 providing fundamental rights to every citizen to enjoy as far as his property rights are concerned. Hence certain provisions enacted in early legislation had to be revised under the democratic set up.

Model Town Planning Act (1957): The old enactments were found to be ineffective to tackle many of the city problems. Hence it was felt necessary for a new comprehensive legislation. For this purpose the Institute of Town Planners, which was founded in 1951 in India, drafted a Model Town Planning Act in 1957 and circulated it among all the States for implementation. It was again revised by the Town and Country Planning Organisation, Government of India (the then Central Regional and Urban Planning Organisation), in consultation with the State Town Planning Departments in 1960. It provided only the basic guidance with regard to town planning legislation, leaving it to the States for implementation to satisfy their requirements.

Even after forty five years of independence, it is surprising to know that some of our States have not enacted the town planning legislation. Town planning Law and Legislation is still new to this country. Whatever may be the reason there is urgent need for a comprehensive legislation to see that the community should be beautiful as well as healthy, spacious, clean, well balanced as well as carefully controlled.

15.3 Development Control. Without control over development and use of land and building, no planning will be successful.

The objects of Development Control are as follows:

- (1) to control private development as per the required standards in relation to public health, safety and convenience.
- (2) to encourage private interest with public interest in all the aspects of development.
- (3) to prevent the conflicting demand and mis-use of land.
- (4) to control and prevent overcrowding on land.

Development Control is statutory in nature and the planning authority has the power to punish the defaulters. Different types of development control that are exercised by the planner are

- (1) Town and Country Planning Act
- (2) Zoning Regulations
- (3) Sium Clearance Act.
- (4) Building Bye-laws.
- (5) Periphery Control Act

(6) Land Acquisition Act.

A few important development controls will now be described in detail.

15.4 Building Bye-laws. There must be a law or regulation on the part of the owner while building his own house. If not, the house-owner under his 'ownership' right will construct the house which may affect the interests of others in respect of health and convenience. The landlord will take only profit into account and spend minimum amount to get maximum benefit. The builder takes everything for granted and hopes to get away with everything. Hence there must be restriction to limit the power of the builder or owner to deal with his property. This is done under Building Regulations which are a comprehensive code of Building Bye-laws.

Building regulations are one of the major methods used for the following:

(1) To control land development and to check un-authorized constructions.

(2) To limit or define the way the new structures are to be built.

(3) To specify the type of materials to be used.

(4) To provide open spaces, air breeze and afford safety against fire, noise, smoke etc.

The building regulations are generally uniform in character, covering the entire city. The regulations are drawn up by a panel of persons who are experts in different fields such as Engineering, Public Health, Law, General Administration and Town Planning. It is the Corporation or the Municipality which forms the building bye-laws as per the Corporation Act or Municipality Act. These bye-laws are generally passed by the corporators or municipal councillors and then it is finally approved by the Government, which then becomes a regulation to be enforced on all buildings, whether constructed by the Government, Local bodies or private persons, agencies etc.

To provide necessary guidance and help for the smooth working of the various authorities, the Government has published National Building Code, abbreviated to NBC, which deals with all aspects of building activities and building materials conforming to Indian Standards.

15.5 Function of Local Authority. For every construction, a building licence is required, which is given by the local authority after it is satisfied that the plan conforms to all the regulations laid down in the building bye-laws.

While submitting the plan for getting approval, the applicant has to produce the following:

- (1) Plan
- (2) Site Plan
- (3) Elevation
- (4) Section
- (5) Detailed Estimate
- (6) Details of electricity, sewerage arrangement
- (7) Ownership right.

It should also show the following:

- (1) Total area, floor area

- (2) Details of doors, windows, ventilation
- (3) Foundation details
- (4) Character such as Residential or Commercial etc.

The department checks each and every detail on the plan and defects, if any, are pointed out for compliance. Only those plans are approved which comply with the requirements of building bye-laws and licence is issued with the following conditions:

- (1) There should be no change or alteration, deviation from the sanctioned plan.
- (2) As and when required, the copy of the sanctioned building plan has to be submitted to the appropriate authority.

The completion certificate has to be obtained within one month of the completion of building construction, after which the assessment of house tax is made.

All building bye-laws are not retrospective but always prospective in nature and are applicable only from the date on which they are issued.

15.6 Provisions of Building Regulations. The regulations deal with various provisions in connection with buildings. The most important provisions are as below:

- (1) *Minimum Sizes of Plots:* The permissible sizes of plots for the family unit is as under:

Type	Dimensions in metres	Area in sq. m.
(a) Low Income Group (LIG)	9 × 15	135
	12 × 15	180
(b) Middle Income Group (MIG)	12 × 18	216
	14 × 21	294
	15 × 24	360
(c) High Income Group (HIG)	18 × 27	486
	27 × 36	972

Minimum size of dwelling, 2 living rooms, kitchen and bath. Desirable persons per room, 2 only.

(2) Marginal Spaces or Set Backs:

(a) Front and rear margin or Set-backs:

Depth of site in mtrs.	Minimum front in mtrs.	Minimum rear in mtrs.
Up to 15	1.5	1.5
15 - 18	1.5	1.8
18 - 21	3.0	1.8
21 - 24	4.0	2.0
24 - 27	4.5	2.5
27 - 30	4.5	3.0
30 - 36	6.0	4.0
Above 36	9.0	4.5

(b) Side Margins or Set Backs:

Width of site in mtrs.	Minimum left side in mtrs.	Minimum right side in mtrs.
Up to 9	1.0	1.0
9 - 12	1.25	1.75
12 - 15	1.25	3.0
15 - 21	1.75	3.5
21 - 27	3.0	4.0
27 - 30	3.0	4.5
Above 30	4.5	6.0

(3) Minimum Floor Area for Rooms: The minimum floor area for a living room, bedroom, dining room etc. should be 9 m^2 (one side being not less than 2.4 m.); kitchen, store room should be 5.4 m^2 (one side being not less than 1.8 m.)

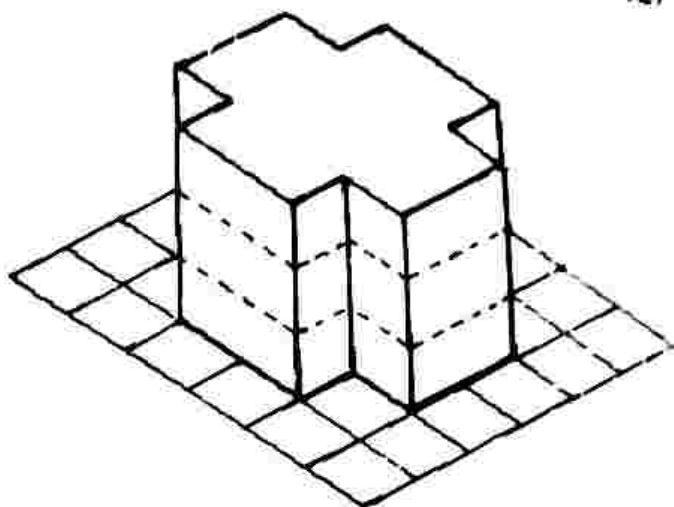
(4) **Proportion of Built-up Area to Plot Area** : The ratio of total built-up area to the plot area of the building is called Floor Space Index abbreviated to F.S.I. The F.S.I. is fixed by the local authority and is different for different areas and different buildings in the city.

The F.S.I. checks the building activity on the plot and as a consequence, it controls the density of the population. For example, if the plot area consists of 36 squares with F.S.I. as 1.00, then the maximum buildable area will be $36 \times 1 = 36$. Now if this area is to be utilised for multistoreyed building, then two floors are necessary to utilise buildable area of 18 squares, three floors to utilise 12 squares, four floors to utilise 9 squares, six floors to utilise 6 squares, and nine floors to utilise 4 squares. See Figs. 15.1(a) and (b).

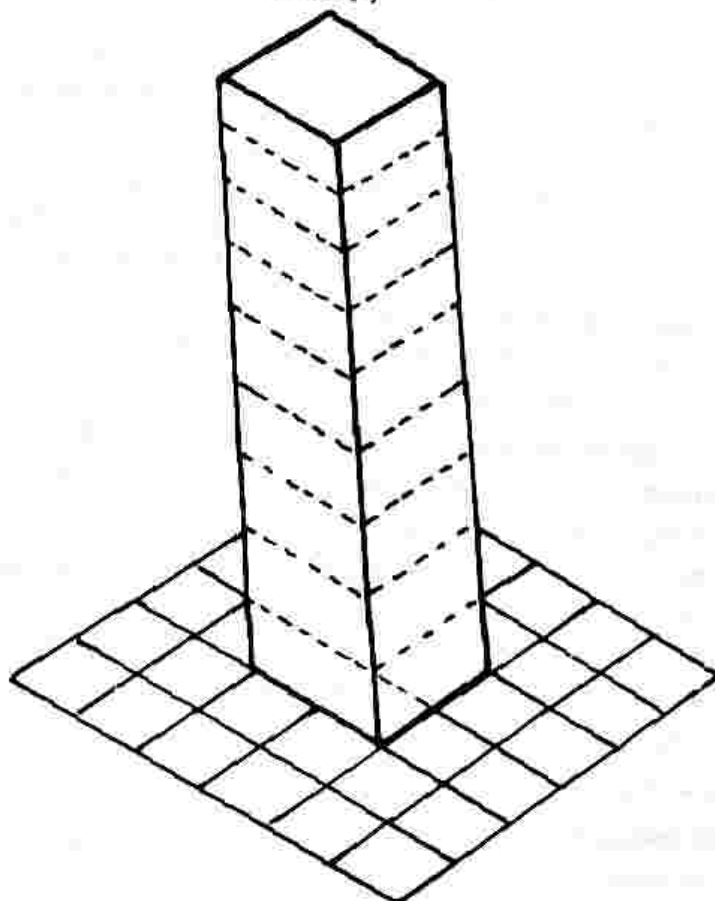
(5) **Height of Plinth** : The plinth height should be at least 45 cm above the road level or plot level whichever is higher.

(6) **Height of floors** : The clear height of living room to be not less than 3 m, for bath room, W.C. etc. to be not less than 2.5 m, for passage to be not less than 2 m.

(7) **Proportion of Window Area to Floor Area** : To secure good amount of light and ventilation, the window area should not be less than one-seventh of the floor area of the room, of which at least one side should be adjacent to open space.



Floor Space Index = 1.0
Per Floor built-Up Area = 12 Squares
(Buildable Area = $12 \times 3 = 36$ Squares)
Fig. 15.1 (a)



Per Floor built-Up = 4 Squares
(Buildable Area = $4 \times 9 = 36$ Squares)
Fig. 15.1(b)

(8) *Projections in Margins* : The projections of the following elements in margin shall be as follows

(a) Chajja or Canopy of 3 m wide and 2.5 m. above the ground level.

(b) Gallery to be not more than 1.2 m. wide at floor level.

(c) Cellar : The minimum height shall be 2.4 m., ventilation to be one-tenth of floor area.

(10) *Stair* : The minimum width of stair either provided inside or attached to the outside of the building and open to the sky shall not be less than 90 cm, with inclination to horizontal or pitch with 30° to 45°.

(11) *Compound Wall and Gate* : The height of the compound wall shall not be less than 1.5 m on road side and 1.8 m on other sides. The gate shall be of 1.2 m height and open from inwards.

(12) *Materials and Workmanship* : All the materials shall conform as per the specifications and good workmanship.

These building bye-laws regulate the construction aspect of the buildings whereas the zoning regulations control the use of land which have been already dealt in chapter 6 separately.

15.7 Land Acquisition Act. For implementation of any urban development programme, availability of land and its control are necessary. Acquisition of land for creating an adequate stock of urban land is necessary not only for future growth but also for a large number of public uses. One of the most important legal tools to acquire the land is the Land Acquisition Act of 1894. It has been subsequently amended in 1961.

The right to acquire the land by the State for the public utility has been recognized all over the world. The basic principle of this act is to give top priority to the welfare of the community and the private interests are always subordinate. The right to acquire the land is however not confiscatory in nature but imposes obligation on the part of the state to pay appropriate compensation, before acquiring the land. The basis of compensation to be paid to the owner for the loss of his property rests with the state to settle.

The main obstacle in the development work is the distribution of land into a large number of owners and the purpose of acquisition is to combine the different ownerships into one authority for the development programme.

15.8 Aims and Objects of Land Acquisition (L.A.) Act. The Act deals with the law to acquire the land for 'Public' purpose and for 'Companies', or 'Societies'. For public purpose is meant the land to be acquired to benefit a large section of the community. For companies' purpose the land is taken to mean everything in connection with land such as buildings standing on it, standing trees, etc. The act also provides the speedy method of finding compensation to be paid to acquire the land in the manner in which the land is to be acquired, norms and forms to be followed for acquisition.

15.9 Salient Features of L.A. Act. The salient features coming under various sections of L.A. Act are as given below:

Section 4(1). Publication of Preliminary Notification and Powers of Officer thereupon.

- (1) When the local Government thinks appropriate to acquire the land for public purposes, a notification to that effect is published in the Government Gazette. Such notice has also to be given in the locality.
- (2) On the publication of such notice, the officer authorised by the Government can enter upon and carry out the survey to take levels, trial pits, to ascertain whether the land is appropriate for such purpose and finally to set out boundaries of the land.
- (3) When the acquisition is for the company, the officer of such company is authorised by the Local Government or Deputy Commissioner to exercise the above powers.
- (4) The investigating officer who has been authorised to carry out the survey, shall have to complete his investigation and submit his report to the Deputy Commissioner within a period of three months or at best six months from the date of publication of preliminary notice. The Deputy Commissioner shall forward the report with his remark to the Government under sub-section (2) of Section 5A.

Section 5. Payment of Damage

The investigating officer shall pay or tender payment for the damage fee to the owner and in case of dispute as to the sufficiency of the amount so paid or tendered, the case will be referred to the Chief Revenue Officer of the District or Deputy Commissioner, whose decision shall be final.

Section 5-A. Hearing of Objection

- (1) Any person interested in the land which is needed or likely to be needed for public purpose or for a company, has to file objection against such acquisition of land on or before the date specified in the preliminary notification under section 4(1).
- (2) Every objection under sub-section (1) shall be made to Deputy Commissioner in writing who will give a hearing and after hearing the objections, he shall make a report making recommendation to the Government for decision.

Section 6. Declaration of Intended Acquisition

(1) If the local Government is satisfied after considering the report made under Section 5-A, sub-section (2), that the land is required for public purpose or any company, the declaration to that effect is made in the Government Gazette, and the Deputy Commissioner may proceed to acquire the land.

(a) Such final notification regarding the declaration of intended acquisition given under Section 6 has to be made within three years from the date of preliminary notification.

Section 9. Notice to Persons Interested

(1) The Deputy Commissioner shall then give notice to all the persons interested in the land and that the claims of compensation for the interest in such land, may be made to him.

- (2) Such notice should state
 - (i) Particulars of land.

- (ii) Nature of respective interest in land.
- (iii) Claims of compensation for such interest.

Section 11. Award by the Deputy Commissioner

On the date so fixed, the Deputy Commissioner will proceed to enquire into the claims of all persons interested in the land and then pass the award. (The total amount of compensation to be paid and its apportionment amongst the various co-sharers, is called Award.)

Section 16. Taking Possession

(1) After the award is made, under Section 11, the Deputy Commissioner may take possession of land which shall thereupon vest absolutely in the Government free from all encumbrances.

(2) The fact of such taking possession will be notified by the Deputy Commissioner in the Official Gazette and the notification will be the evidence of such fact.

Section 17. Special Powers of Taking Possession in case of Emergency

(1) In case of urgency the Government can direct the Deputy Commissioner, though no such award has been made, to take possession of any waste or available land needed for public purposes or for a company. Such land shall thereupon vest absolutely in the Government.

(Emergency cases such as (1) Sudden change in channel of navigable river, (2) Land necessary for Railway, (3) Land necessary for maintenance of traffic, (4) Land required for making ghat station or providing convenient connection to any such station, (5) Owing to breaches or damage to road etc.)

Section 18. Reference to Court

(1) Any person interested in the property who is not satisfied with the award in any respect may make a written application to the Deputy Commissioner within ninety days from the date of issue of such notice.

(2) The applicant shall state the grounds on which objection to the award is taken.

(3) The Deputy Commissioner shall make reference to court within ninety days from the date of receipt of an application under sub-section (1).

Section 23. Matters to be Considered for Determination of Compensation

(1) In determining the amount of compensation to be awarded for land acquisition, the court shall take into consideration the following:

- (a) Market value i.e. the actual use value at the time of publication of the first notification under Section 4, sub-section (1).
- (b) Compensation to be paid for standing crops, trees etc.
- (c) Compensation to be paid for the damage of the land.
- (d) Damage caused to movable or immovable property or the earnings.
- (e) Compensation for change of residence or change of occupation.

Section 24. Determination of Compensation

(1) The court after paying due consideration for the matters referred under Section 23, shall determine the amount of compensation and the orders of the court will be final and binding both on the party and the Government. The Deputy Commissioner may deposit the amount of compensation according to the Court's decision and may take possession of the land.

(2) In addition to the market value of the land as provided above, the Government has to pay an extra 15 percent on such market value on account of compulsory acquisition.

15.10 Betterment Contribution. Due to any town planning scheme, if some owners of the property are affected, then the Government has to pay a certain amount of compensation for causing damage to the owner's property. But it may so happen that some owners of the property will be benefitted due to development scheme. Such owners have to pay to the planning authority a certain amount of share in respect of increase in value of the land resulting from the execution of the development scheme. This share is known as Betterment which the Government or development authority recovers from the owners for bettering their land.

The important provision in the Town Planning Act regarding Betterment are as follows:

(1) The list of properties put to Betterment shall be published with notification and the same notices are given to the respective owners and their objections, if any, are invited.

(2) The maximum Betterment contribution shall be 50% of the increase in the value of the property resulting from the execution of the development scheme.

(3) The value of the Betterment will be fixed only after the scheme is completed.

(4) In case of dispute, the owners of the property can refer to the court or tribunal whose decision will be final.

15.11 Model Town Planning Act, 1957 (subsequently Amended in 1960). The Act was published in 1957. The Model Act deals with in regard to the constitution of planning authority for large areas of urban centres of the State. The Act contains important provisions coming under or outside municipal limits. The objective of this Act is to provide for regulation of planned growth of land use and development so as to execute the town planning scheme in the state.

The Act is necessary for the following:

(1) To create favourable conditions for planning and redevelopment of urban and rural areas to provide civic and social amenities.

(2) To prevent uncontrolled development of land.

(3) To preserve and improve the existing recreational and other facilities.

(4) To direct the future growth in a co-ordinated manner to improve health and living conditions.

(5) To provide facilities for the orderly growth of commerce and industry etc.

15.12 Salient Features of the Model Town Planning Act 1960. The Act deals with various important provisions which are as under:

(1) It provides the constitution of a State Town Planning Board to advise the State Government with regard to planning and local development and to work out a broad principle and policy for the balanced development of the State. This Board consists of the following members:

- (a) *Chairman* : The Minister in charge of Town and Country Planning.
- (b) *Vice-Chairman* : The Minister of State if any in charge of Town and Country Planning.
- (c) *The Secretary* : The Director of Town Planning.
- (d) *The Board Members* : The Secretaries to Government from Depts. of Town Planning, Finance, Health & Family Planning and Chairman of the Housing Board.
- (e) *Other Members* : Five persons nominated by State Government from among the members of the local authorities in the State and three persons nominated by the State Government.

The main functions of the Board will be:

- (i) to advise and assist the local planning authorities and the State Government in matters relating to planning, development and use of rural and urban lands in the State.
- (ii) The Board may, if required by the Government
 - (a) advise in the preparation and implementation of town planning and replanning schemes by the Local Planning Authority.
 - (b) assist, in collection, publication of bulletin on planning.
 - (c) prepare and furnish reports.
- (iii) The Board will have all such powers as may be found necessary to carry out its functions under this Act.

(2) The State Government may, by notification, declare any area in the State to be a local planning area for the purpose of this act and on such declaration this act shall apply to these areas, except the military cantonment area. Such notification shall also define the limit of the planning area.

(3) After consultation with the Board, the State Government may amalgamate or sub-divide the planning area and constitute a special planning authority or Town Improvement Board to function as Planning Authority.

(4) The Planning Authority constituted under the sub-section (2) shall consist of the following members, namely

- (a) a Chairman appointed by the State Government.
- (b) a Town Planning Officer, to be the member-secretary.
- (c) representatives of local bodies coming under the jurisdiction of their planning area, and the total number of such representatives shall not exceed five.
- (d) three other members, appointed by the State Government.

The State Government, if it feels fit, may nominate one of the members as Vice-Chairman of the Planning Authority.

(5) The State Government, by notification, shall specify the date with reference to which the present land-use has to be determined and different dates may be fixed for different areas in the State.

(6) Every Planning Authority shall prepare a Master Plan in two stages :

(a) Preparation of an Outline Development Plan or an interim master plan: Within a period of two years, the Planning Authority has to conduct the Survey and prepare outline development plan and submit the same to the Government through the Director for approval.

In case the outline development plan is not prepared by the Planning Authority within a period of two years, the State Government may authorise the Director to prepare the plan and the expenditure incurred for it is to be recovered from the Planning Authority.

(b) Preparation of a comprehensive development plan or a detailed master plan.

A comprehensive development plan will then be prepared after which the outline development plan is treated as superseded. The comprehensive development plan will be revised if found necessary at least once in five years.

The financial programme and a schedule for implementation of the proposals in the comprehensive development plan shall then be worked out. The finance can be obtained in the following ways:

- (i) Recurring Income, and
- (ii) Non-recurring Income.

(i) *Recurring Income* : It consists of

- (a) Municipal or Corporation Contribution.
- (b) Stamp Duty.
- (c) Annual Ground Rent.
- (d) Municipal and Government share.

(ii) *Non-recurring Income* : It consists of

- (a) Premium from the sale of the plots.
- (b) Betterment contribution.
- (c) Abandonment charges.

As the development scheme is laborious and time consuming, there is always a time lag in capital returns as against capital expenditure. That is why the planning authority has to go in for long-term loans, at the start and then go for short-term loans to overcome temporary setbacks.

For necessary payment of these loans, the planning authority must stick up to the financial programme as far as possible. The success of the scheme finally depends not only on the sound development but also on the ability with which the financial aspect is tackled by those who are at the helm of planning administration.

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VILLAGE PLANNING

16.1 Necessity. India is a land of villages and will continue to be so for many years to come. India is overwhelmingly rural as 80 percent of its 750 million population live in about 6 lakh villages. On an average there are about 185 villages for each town in the country. Some villages even do not have more than 500 persons inhabited in about 48 thousand villages.

There is a steady flow of rural migration into the urban areas due to the availability of better job opportunities, higher wages, proper facilities and other amusements and the towns have grown up at the expense of the villages. As a result there is over-crowding and congestion in the towns and cities.

Also due to neglect in planning, the villages which were once known for open air, breeze, beautiful natural surroundings have grown haphazardly with housing sprawling along the narrow lanes, full of dirt, filth etc. As a result, the villages are slowly deserted. The present flow of migration stream is not less than 15 to 18%.

In order to check the migration of the rural population, the living conditions of the people should be improved by providing better health, educational and employment facilities in the rural areas.

Gandhiji once said: "India lives in its myriad villages. If the village perishes, India will perish too, and as such, the very heart and soul of India cannot be neglected... The growth of cities based on exploitation of the villages is an evil thing, unfortunate for the mankind... and certainly unfortunate for India".

During the last few decades, attempt has been made at various levels to improve the living conditions of the towns and cities but no attention has been paid for the proper development of villages. Even today the living and working conditions in many of our villages are deplorable. As such to raise the general standard of living in villages, there is an urgent need of a comprehensive village planning.

16.2 Social Concept of a Village. It is a small rural unit of self-contained community living in small houses and huts etc. It is a place where the man-made surroundings have been dominated by the natural surroundings.

Generally a village has a population of not more than 5000 people, more than 75 percent of which are engaged in agricultural occupation.

16.3 Rural and Urban Differences. The rural social life in a village develops in natural surroundings whereas the urban life does so in man-made surroundings.

The main differences between the rural and urban social life are as follows:

- (1) The size of the village is very small, hardly a few sq. km. whereas the town spreads far and wide.
- (2) The density of population is very low like 50 to 100 persons/hectare whereas it is as high as 200-400 persons/hectare in towns.
- (3) Farming is the main occupational pursuit in village. Non-agricultural pursuits such as trade, commerce, industries are almost absent whereas they flourish in towns and cities.
- (4) The community in village is homogeneous whereas it is more or less heterogeneous in towns and cities.
- (5) There is more personal contact in village and good neighbourhood spirit than in towns and cities.

16.4 Social Groupings. It is seen in the village, that the habitation is in the form of groups based either on caste or trade, occupation and income. It indicates the inherent tendency to form separate groups.

16.5 Village Types. There are mainly three types as follows:

- (1) Single nucleated settlement.
- (2) Linear settlement.
- (3) Scattered settlement.

(1) *Single nucleated settlement* : Here the village develops in the form of concentric rings with nucleus as village since there is tendency of the people to keep the centre, nucleus or heart of the village as near as possible. This type of development is seen in the plain areas.

(2) *Linear settlement* : The development takes place along the length. This type of development is seen on coastal areas.

(3) *Scattered settlement* : Here the village has erratic growth, scattered here and there in an irregular way without any order. This type of development is seen in the hilly or forest areas.

16.6 Principles of Village Planning. The village planning is almost synonymous with community planning and the general principles of Town Planning can equally be applied to Village Planning, with some conditions of restrictions. However, there are certain peculiar principles to be applied to the village planning which are as under:

(1) *Location* : The best location is the availability of farm land and water. Other factors to be considered are the rainfall, wind and nature of the ground.

(2) *Communication* : The arterial road should bypass the village. It should never be taken through the village. The approach road should link the arterial road outside the village limit. The width of approach road should be at least 10 m. to 15 m. with well planted shady trees on both the sides. It should be aligned straight to make it as short as possible. The internal roads need not be straight. They can be taken along the contours. They can be taken deep in the village to provide easy access to all the individual houses. The width of the road should not be less than 7 m. Finally the village should have proper communication to the neighbouring small towns and cities such as highways and

railways. With this the villagers will be able to market his produce in time and make profits. In addition, he will be benefitted with education and medical facilities from neighbouring towns.

(3) *Village Centre* : The main centre of the community life is the hub of the village where all the public activities are centred. The hub consists of a market, chawadi, Panchayat hall, clinics, cultural centres etc. The hub should be on the central axis of the village with easy access to the approach road. The market or shopping centre may be located on the terminal of the approach road around which the community buildings like Post Office, Police Chowki, a Reading Room, Games Club may be located.

(4) *Neighbourhood Unit Planning* : A neighbourhood unit consists of a small group of houses having common utility services such as water supply, a school, a playground etc. The population of such a unit should be such as to maintain a Primary School of about 200 pupils of six to ten years of age to be distributed in four classes, each containing about 50 pupils. So far a village of say six thousand population, four such neighbourhood units may be provided and arranged around the main centre or hub of the village. The area of each neighbourhood may be about 12 hectares or 30 acres, with a gross density of about 40 to 50 persons per acre.

The schools should be located at the centre of neighbourhood so that it may be within a walkable distance from the houses of the pupils. Each school will have at least an area of 100 m × 50 m. inclusive of its playground, an open air theatre for film shows and magic lantern slides.

The grouping of the neighbourhood houses around the school, and its playground, which forms the sub-centre of each unit, is the basic principle of Neighbourhood Unit Planning. It more or less conforms to 'Reilly Plan' described under Art. 7.5.

Further care should be taken to provide plenty of open spaces for house gardens, playfields, a small park preferably with public radio etc. with other civic facilities, a place of worship, community buildings, cremation grounds etc.

16.7 Village Re-development Project. It is easier to plan a new village or town than to replan an existing one. It is seen that very rarely a town planner gets an opportunity to plan a new village, since such possibilities are very few. On the contrary there is unlimited task for redevelopment of vast number of villages which portray the pictures of squalor, dirt, filth, etc. Hence there is a need of a comprehensive development scheme. Here the hands of the town planner are tied down as he has to take into account the existing conditions of the village. He has to carry out the conservation, rehabilitation and redevelopment schemes in the best possible manner. The points to be noted in village development project are:

(i) *Socio-economic Survey* : The socio-economic or civic survey is to be carried out to know the living and economic conditions of the people, housing conditions, population, topography etc. As such it is necessary to collect data by reconnaissance survey, house-hold survey, etc. These have been briefly described under Art. 5.3. The environmental hygiene, living conditions, drinking water facilities can be studied through observation. Group discussions further help to know the opinion of the villagers.

16.8 Preparation of Development Plan (Master Plan). First of all a tentative map showing the internal road system without changing the old road system is prepared. Care should be taken not to

Village Planning

demolish a number of houses. The width of the internal roads should be 7 to 10 m. The layout of road pattern is important as it more or less defines the layout of houses.

The houses which are in good condition should not be disturbed as far as possible. Some of the houses which require minor repairs may be made good by proper improvement method. Houses which are in dilapidated conditions may be demolished for clearing the congested areas. The area so cleared can be utilised for creation of open spaces, widening of roads etc. Arrangement for rehousing for displaced families should be done before pulling down the dilapidated houses. The new houses to be built may be grouped around the open spaces maintaining the rural tradition such as cattle sheds, courtyards, grains storage etc.

The village centre consisting of Panchayat hall, clinic, etc. should be provided with easy access and should be close to the approach road.

The shops may be located near the main road. Roughly eight to ten shops per one thousand population may be provided to satisfy all the needs of the community. Gobar Gas Plants can be installed to produce cow-dung gas for lighting and cooking. The manure got from them can be utilised for kitchen gardens etc. The development plan should also include the proposals for improving the street-lighting, water supply, sanitation, hygiene of the village. Lastly scope should be given to the village industries in the form of poultry, dairy farms, weaving industries etc. to have a proper balance with agriculture. There should be adequate grazing grounds for cattles.

The development plan should be accompanied with the project report giving emphasis on the necessity of the proposed schemes.

After the plan is accepted by the local authority, a detailed programme for various developments must be prepared with priorities. The roads, drains must receive top priority, next housing and then village centre etc.

Lastly for the successful implementation of the plan, there must be whole-hearted support and co-operation between the planner and the villagers, in order to make village life as pleasant as town life.

16.9 General Principles of Rural Housing Design. The rural housing has a peculiar character of its own. As such planning and designing of the houses should suit the village life. Considering these, the National Building Organisation (NBO) has evolved a typical design of a rural house. Many Rural Housing Wings are functioning under the guidance of NBO in different States.

The design of rural house is based on functional requirements. The villager may be a well-to-do agriculturist, or a farmer, a small shopkeeper, a trader. Hence the needs of space for their living and occupation will differ from one another. As such the rural house should be designed to satisfy the following requirements:

- (1) Two living rooms, a sanitary kitchen equipped with fuel-saving hearths, such as smokeless chullas using rice husk, a bath, grain storage etc.
- (2) Verandah for relaxation of elders and for children, open space for playing etc.

(3) For occupational purpose there should be adequate space in the front for storage of raw materials for craftsmen, like potter, black-smith, carpenter, weaver etc. and arrangement for bullock-carts, cattle shed for a farmer etc. at the back with a courtyard in between them.

(4) Locally available materials may be used for construction, in the traditional way to reduce the cost to a minimum.

(5) It should be provided with drinking water by means of tube wells and dugwells. The drinking water well should be atleast 10 m to 15 m away from cess pools, latrines and should be lined all round to protect it from sources of pollution. If possible, it may be covered with concrete slab with proper openings for ventilation. Wells are the most utilitarian structures in the village. So they should have a good washing platform, a concrete trough at one corner for cattles to drink water, fix up hand pumps with taps etc. In fact it is the centre where all the village wives meet, relax and chit chat as such it almost forms a 'ladies club'. It should therefore be made attractive and pleasing. For a bigger village a small overhead tank may be provided, and taps can be installed at convenient places for taking water through pipe system.

(6) It is often seen that the waste water from kitchen and bath room is carried off by the open pipes or unlined channels which form the source of danger to the health of the society causing disease and sickness. The waste water soaks in the ground and forms a dirty pool which soon becomes the carrier of disease. It is therefore necessary to provide concrete drains and the waste should be carried to cess pool or soak pits.

(7) The rural house should also be provided with a sanitary privy which does not require water carriage system to dispose of the human waste. For a large village, community latrine may be provided with septic tank of required size.

(8) The usual practice of keeping cattle in or close to the living quarters which aggravates the insanitary conditions should be avoided. Hence cattle sheds should be located at the far end of the quarters and maintained clean with properly lined floors. Nearby a manure pit may be provided for collection of cattle waste for preparing compost.

(9) Proper storage bins either under ground or above ground should be proof against insects or pests.

The general layout of the house may be detached or semidetached according to the income group, and constructed in open landscape and natural surroundings.

16.10 Rural Housing Problem in India. India is predominantly rural and about 80 percent of the people live in rural areas of which 75 percent are engaged in agricultural profession. In view of the large population in rural areas and the agro-economy based infrastructure of the country the problem of rural housing should be given a careful thought and precedence over the urban needs. Yet the rural housing is neglected over the years. According to the Sixth Plan document, about 25 percent of rural houses are not worth living and the shortage of housing was about 18.8 million units. At present the shortage is about 20.5 million units.

As regards the situation of water supply and sanitation, it is equally alarming. The Local Self-Government viz. Village Panchayat exists only in name and practically non-existent. Most of

the rural areas have no conservancy services. The practice of keeping the cattle near the living quarters has further aggravated the insanitary conditions of the village.

It is estimated that more than 50 percent of the ruralities are poor and live below poverty line which is reflected in the environmental condition of the village. About 40 percent of the houses are made of mud, wood and thatches of different types using local materials. A large number of people live in small huts. Though Indian villages are known for open space, natural surroundings, yet a large number of villages are over-crowded, and are pictures of squalor, dirt and filth. About 40% of the population live in one room-houses, 28% in two-room houses, 13% in three-room houses and the remaining 19% live in more than three-room houses.

It is estimated that about 20% of ruralities live in pucca houses, 35% live in semi-pucca houses and 45% live in kachcha houses. The basic amenities are scarce if not absent. About 97% have no latrines and 94% have no bathrooms. Regarding the electricity, the position is not at all satisfactory. Only 40 percent of rural population has electricity. There is total lack of gas service and the people still use the traditional fuels. More than 70 per cent of the population depend on wells, ponds and lakes. The World Health Organisation (WHO) reports that "6 percent of the population had access to safe water in 1970 and 18 percent in 1975. In drought areas people had to walk 8 km and more. There were also water quality problem areas, endemic for guinea worm infestation, high fluorides and nitrates. Rural sanitation was all but neglected, the coverage rising from 1 percent in 1970 to 2 percent in 1975".

Rural housing is a totally neglected field even though India's visualisable future is predominantly rural. It made a humble beginning in the first five year plan but unfortunately it did not receive much attention in the subsequent plans. No scheme of National Housing will be complete unless it gives a thorough and comprehensive consideration to the problem of rural housing. The fundamental principle, in solving the problem of rural housing, should be based on co-relation of its cost and the income of the occupant and it must receive top priority in the rural housing scheme in a poor country like India.

16.11 Rural Housing Scheme. To tackle the problem of rural housing, a rural housing cell was created at the centre in the second five year plan period to study the various problems in the field and evolving suitable designs, layouts and methods of construction making the best use of local materials. In the third five year plan two schemes were included, one is the Village Housing and Planning and second is the House Sites for Agricultural Workers.

The Planning Commission has provided in the Sixth Plan period (1980-85) an outlay of Rs. 3500 crore for rural housing.

The Village Housing and Planning Scheme provides loan for the selected villages in groups of five to six. The implementation of layout plans and house construction are taken up in stages so that the whole village is remodelled in a period of about eight to ten years.

Under the same scheme, finance assistance in the form of loans upto Rs. 3000 per house with a rate of interest of 7 percent is given for house construction. The scheme gives preference to Harijans, agricultural workers. Till now more than eighty thousand dwelling units were constructed under this scheme.

Under House Sites for Agricultural Workers, the land for village extension was acquired and given to the landless agricultural workers. Semi-detached houses, back to back arrangement without service lanes were designed and a density of 25 to 38 houses per hectare was fixed. Sufficient width of the plots was allowed for a side passage for cattle and a depth of 27 m. was recommended for keeping the cattle shed away from the living place.

Under the 20 point programme of the Government of India, attention was paid to provide house sites for the under-privileged groups in the rural areas. Uptil now more than 70 to 80 lakh free sites are allotted. The Karnataka Government has taken up Janata Housing Scheme for the landless workers. The house consists of a hall, kitchen and bath and constructed in mud walls with split bamboo reinforcement, and covered with country tiles roofing. N.B.O. has also evolved a suitable design for economical mass housing. It has conducted a number of exhibitions on low cost housing. Many Rural Housing Wings are functioning under NBO in various states.

Now a massive housing programme is launched by the Government of Kerala. The State initiated an 'One-Lakh Housing Scheme' to the landless. This scheme envisaged to distribute about hundred houses in each of its 960 Panchayats throughout the states. It may be noted here that there was no particular Government Agency and substantial budgetary provision for the implementation of this scheme. All work was carried out by volunteers, students from Engineering Colleges and Polytechnics and Panchayat Committees. Financial assistance and material help came from industries and organisations. A number of other States are also undertaking such schemes on similar lines. 'Do-it-yourself' techniques based on self-help and mutual help can result in large amount of saving in labour cost.

With the emphasis on rural development, more attention is being paid to the rural housing. The Basic Minimum Need (BMN) programme at present will try to cover many villages. This new village movement will bring new life, hope and dignity to rural India. To achieve this goal we have to put tremendous efforts to solve the problems at the grass-root level which could be a great stride towards the development of the country.

In conclusion, it may be pointed out that the housing problem, whether Urban or Rural is a great challenge to the Government of India. To tackle the problem, Government should set up Training Centres for Labour, Research Centres and a well-knit Building Industry together with emergency measures on all fronts.

It is therefore hoped that our builders of New India will accept the challenge to provide a decent house for every family which was aimed at since independence. And the aim should be achieved, as India claims to be a Welfare State.

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